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COGNITIVE DESIGN:  
CREATING THE SETS OF CATEGORIES AND LABELS THAT STRUCTURE  
OUR SHARED EXPERIENCE

by

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and approved by

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## ABSTRACT OF THE DISSERTATION

Cognitive Design:

Creating The Sets Of Categories And Labels That

Structure Our Shared Experience

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Following in the tradition of studies of categorization in everyday life, this dissertation focuses on the specific case of *sets* of categories. The concept of the "contrast set," developed by cognitive anthropologists in the 1950s, is the central focus of analysis. Canonical examples of everyday life contrast sets include alphabets, identification numbers, standard pitches, and the elements of geographical categorizations. This dissertation focuses on the design issues surrounding the deliberate, conscious construction of such sets (rather than on contrast sets which are natural or emergent). The chapters focus respectively on the creation of contrast sets; the way contrast sets are used as labels for other contrast sets; the use of rules, principles, and set topologies in this labeling process; the standardization and institutionalization of contrast sets; the way in which people justify, legitimate, and attempt to change standardized contrast sets; and the ways people learn about unfamiliar contrast sets.

The dissertation uses the method of pattern analysis. It identifies and describes abstract social forms, gives numerous concrete examples of each form, and includes sixty images. The goal is to understand a recurrent type of human activity that affects and structures many everyday life experiences. The dissertation is practically oriented as well, and directly addresses the concerns of those responsible for designing contrast sets for public use.

# Table of Contents

<b>Abstract of the dissertation.....</b>	<b>ii</b>
<b>1 Prologue.....</b>	<b>1</b>
1.1 Introduction.....	1
1.2 Background and methods.....	4
1.3 The thematic organization of this book.....	12
1.4 Contrast sets and the lexicon.....	14
1.5 The workshop metaphor.....	17
<b>2 Contrast Sets.....</b>	<b>20</b>
2.1 The contrast set.....	21
2.2 Behind the contrast set: the domain.....	23
2.3 The spatial metaphor for the domain.....	27
2.4 Partitioning by boundary and focal point.....	32
2.5 Discerned or constructed?.....	41
2.6 Features and featurelessness.....	45
2.7 Acts of partition.....	52
2.8 Changing the domain to match the contrast set.....	59
2.9 Contrast sets in linked domains.....	71
2.10 Precision.....	78
2.11 How contrast sets fill slots.....	87
2.12 Images of contrast sets.....	91
<b>3 Labeling.....</b>	<b>96</b>
3.1 Defining labels.....	101
3.2 Labeling tools and techniques.....	107
3.3 Communicating the context of a label.....	115
3.4 The art of label display.....	122
3.5 "Just a number" and the level playing field.....	128
3.6 Norms of attention to labels.....	135
3.7 Meet John Doe: stand-ins.....	142
<b>4 Mapping.....</b>	<b>153</b>
4.1 The nature of mapping principles.....	159
4.2 Mapping in the lexicon.....	166
4.3 The design of target sets .....	170
4.4 The drawbacks of mapping.....	183
4.5 The design of contrast set topologies.....	192
4.6 Efficiency and economy in labeling.....	207
4.7 Private labels and private mappings.....	217
4.8 The case of the revolving restaurant.....	224
<b>5 Standardization.....</b>	<b>229</b>
5.1 Basic concepts of contrast set standardization.....	232
5.2 Contrast sets as social facts.....	241
5.3 Contrast sets and thought communities.....	248
5.4 Contrast sets and the sense of identity.....	253
5.5 Miscoordination.....	257
5.6 Commitment.....	262
<b>6 Justification and Change.....</b>	<b>266</b>
6.1 Objective, subjective, and intersubjective.....	266

6.2 Reification.....	268
6.3 Justifications.....	273
6.4 The dilemma of arbitrariness.....	284
6.5 Change.....	288
6.6 The standards evangelists.....	298
6.7 Creep and drift.....	302
<b>7 Socialization.....</b>	<b>306</b>
7.1 Contrast sets and external cognition.....	308
7.2 Cultural differences in contrast sets.....	313
7.3 Resocialization, or not.....	320
<b>8 Conclusion.....</b>	<b>329</b>
8.1 Form, not content.....	329
8.2 Cognitive design.....	333
8.3 The importance of contrast set design.....	336
<b>List of Examples.....</b>	<b>338</b>
<b>Image Credits.....</b>	<b>348</b>
<b>Bibliography.....</b>	<b>350</b>

# 1 Prologue

## 1.1 Introduction

Think of how you organize the collections of things in your home. How do you arrange your music collection, the books on your bookshelves, the food in your fridge and pantry, and the clothing in your dressers and closets?

I think that all of us have regular principles for organizing such collections. Usually this involves sorting them into groups or categories, and keeping everything in each group together. Thus we have a sock drawer, and an underwear drawer, and a rack for our shoes, and a closet where shirts hang on hangers. We can arrange our music into jazz, classical, rock, and world music, and we may keep novels on one shelf, travel books on another, and cookbooks all together in our kitchen.

There are always alternative ways to sort. I have a bookshelf which is divided into the three categories of "books I like," "books that are OK," and "books that I would be happy to get rid of." A restaurant I know in Prague has a purely decorative bookshelf, where the books are sorted by color. Some used book stores sort by type of binding. At scholarly conferences, one encounters books sorted by publisher.

Sometimes things fall in between categories. Is this red, or orange? Hardcover or softcover? Is this rock, or world music? Or both, and what then? Should this go with the shirts I hang up, or the shirts I keep in the drawer? These ambiguous cases remind us that our classifications are imperfect. Encountered in a bad mood, such ambiguity can nearly make us swear off using any kind of sorting system at all.

If we have something that can be arranged in a more or less linear order, a whole new range of possibilities opens up. Instead of grouping our books into categories, we can sort them sequentially. We can arrange books by size, or alphabetically by author's last name, or by Library of Congress call number. We can organize our CDs by title, or by the last time we listened to them.

Whatever organizing principle we use varies in its "shareability" with other people. Some organizing principles are practically innate and inescapable, such as the segregation of trash in a taboo location. Others are based on widely standardized knowledge that other people immediately understand, such as alphabetical order. Others are more idiosyncratic but easily explainable, such as the organization of most peoples' pantry shelves. Some, though, are so deeply based on subjective experience that they are impenetrable to outsiders.

Thus, for example, the Library of Congress system for arranging books is a widely shared standard, as is the expectation that in an unfamiliar American kitchen you may well find eggs in the refrigerator door, vegetables in the lower bins and the garbage under the sink. Your friends may not know which is your sock drawer, but they can guess that you probably have one, instead of mixing socks with, say, belts. Anyone familiar with alphabetical order, and with the way music stores sort titles, can easily grasp how you organize your CDs if you have them grouped by genre or sorted alphabetically by artist. No one else, however, can easily know which books you like best, or what music you played most recently.

Once an organizing principle is set, it makes good sense to follow it. And especially if other people are sharing your stuff — say, if you are managing a store or a library — it is essential that your users understand your organizing principles, or at least have the opportunity to learn them, since if users know how things are organized, they waste less time looking for them. Even if your organizing principle is known only to you, you still want to follow it, so that you (as user) can retrieve something tomorrow that you put away last month — not by remembering it specifically, but by remembering the principle. It is such a bother when things get lost in the system — misshelved in a bookstore or library, or just a sock that found its way into the pajamas drawer — and it reminds us how helpful category

systems are. (Is it just me that feels a pang of guilt in the supermarket when I put that unneeded extra can of peeled tomatoes back on the peanut butter shelf, because I am in too much of a hurry to find the canned tomato section again?)

Think of the last time you moved into a new house or apartment. When you stocked the pantry for the first time, you were (perhaps without much deliberate reflection) designing a partitioning system for the domain of food, so that a bag of pasta now belongs on one shelf and a can of artichoke hearts on another. Meanwhile, you were (perhaps unconsciously) coming up with names for each of the rooms in your home. Ideally, you want everyone in the household to agree on these partitioning principles and names. In defining the class of provisions that belong on a particular shelf, or the name of a room, your role is that of a cognitive designer: someone who creates the terms in which an entire group of people will think.

This book is about that process of cognitive design, and more specifically, about the cases where we design *sets of categories and labels*, a set being a collection of two or more things. Designing and labeling sets of categories is something that humans do not only in organizing our music collection or our kitchen shelves, but also when we divide Africa into countries or a book into chapters, assign area codes to telephone lines, number the spaces in a parking lot or the highway system of an entire country, come up with a conventional way of measuring speed, design a set of banknotes, organize a supermarket, create a set of size grades for apples or T-shirts, or invent an alphabet.

By focusing on *sets of categories*, this study distinguishes itself from scholarly works on the more general phenomenon of categorization. Scholars from several disciplines have studied categorization very intensively over the past few decades. Many interesting and important books have appeared. While categorization scholarship has developed the term "contrast set" to label the phenomenon of sets of categories within a particular semantic domain, few scholars have lingered long over this concept. Most studies of categorization mention sets of categories only in passing (if at all). This book is different: it brings the idea of a set of categories or labels into the spotlight.

This book also focuses particularly on contrast sets that have been *deliberately* created by human beings, rather than on those that have emerged in a tacit or unplanned fashion. It focuses on the design choices involved in making these sets, rather than the way they are stored or represented in our minds.

Chapters 2 through 4 discuss the more linguistic and semantic aspect of creating contrast sets: respectively, partitioning domains, labeling those partitions, and developing systematic labeling principles. Chapters 5 through 7 discuss the way in which contrast sets become norms and conventions to which an entire community or society is committed. Chapter 5 focuses on the basic steps in the standardization of contrast sets, chapter 6 on people's beliefs about why particular contrast sets became norms, and chapter 7 on the process of socialization and resocialization for those who are "strangers" to a particular contrast set. The theme of "cognitive design," the idea that human beings like you and me created and continue to create our cognitive conventions, will run throughout the book, and I will return more specifically to it at the end.

## 1.2 Background and methods

For the past sixteen years I have worked each summer in the travel industry, first writing travel guidebooks, then guiding group tours, and also planning group tours. I have had the chance to travel a lot myself and also to watch many other people travel. This book was written in Reykjavík, Iceland, where I have lived since 2001. I have also lived or spent extended time in Rochester (N.Y.), Boston, California, New Jersey, Seattle, Britain, Russia, China, and New Zealand. Many of the examples in this book come from these experiences, and I would have had a harder time writing the book without them.

As an undergraduate in college, I knew already that I was interested in the themes covered in this book. At the time I felt that linguistics was the best match for them. During my four years in a linguistics department, from 1988 to 1992, the pendulum had swung towards formalist and "innatist" approaches to linguistics, inspired by Chomsky and evolutionary psychology. This style of linguistics was a poor fit with my interests in

standardization, writing systems, planning, and what many linguists at the time might have thought of as "all that social and cultural stuff."

However, I did manage to be allowed to earn credits studying type design, writing systems, and language standardization, as well as individual languages such as Icelandic, German, Polish and Chinese. In a writing class, I wrote a paper on the development of the American telephone area code system, a paper which is an ancestor of this book's sections on labeling and mapping. For one semester I worked for the sociologist Stanley Lieberman on the study of first-naming practices that was eventually published as *A matter of taste*.<sup>1</sup> I also worked as a researcher and editor for the *Let's Go* travel guidebooks, where in between my regular work I concerned myself with questions like how to typeset non-Roman scripts and how to refer to telephone numbers in a standard way.

After spending one semester in a graduate program in linguistics, I decided that it would be easier to stay true to my interests by studying under Eviatar Zerubavel in the Rutgers sociology department. While I was skeptical that sociology could be an ideal home for my concerns, I was attracted by the unusual mixture of expertise in standardization and semiotics among the "cognitive sociologists" at Rutgers. Indeed, cognitive sociology has helped me find theories and contexts in which the interests that I brought from linguistics have more meaning.

I still find the study of language thrilling, and I feel that those who call themselves linguists should embrace the widest possible definition of their field rather than excluding subject after subject as "not really about language proper." The more linguistics excludes, the smaller the range of phenomena it is able to explain, and the less interesting it becomes. Linguistics would do well to embrace the flexibility of a discipline like sociology.

Although this book is a study in the sociology of cognition, I have deliberately tried to take a perspective in it that I would call "general social-scientific." The analytical lens used in chapters two through four borrows heavily from semantics, semiotics, pragmatics, and the

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<sup>1</sup> Stanley Lieberman, *A matter of taste: how names, fashions, and culture change* (New Haven: Yale University Press, 2000).

anthropology of language and communication. Chapters five through seven rely more on perspectives borrowed from sociology, economics, and the history of technology. The book also borrows lenses from the worlds of cognitive science, philosophy, planning, and design. In dealing with a topic that involves both cognition and planning, this book resembles many works on language planning: indeed the division between chapters 2-4 and chapters 5-7 corresponds roughly to the distinction that language planning scholars draw between "corpus planning" (planning the internal design of a norm) and "status planning" (planning the social status of a norm; see section 5.1).

The most common way of writing about contrast sets, or about any cognitive convention or social norm or standard, is to tell the history of an individual norm. Middleton's book on the history of the thermometer and the temperature scale and Georges Ifrah's book on the history of numbers are fine examples.<sup>2</sup> Focusing one's attention topically, on a single norm, is immediately appealing to readers' natural curiosity about the origin of norms. One can write such a history with a greater or lesser degree of sociological, historical, or technological sophistication. In 1984 Otis Dudley Duncan lamented that the scholarly world was still lacking studies of standardization (and particularly measurement) which were as broad and as sociologically informed as they could be.<sup>3</sup>

There has been much progress since Duncan made this comment, but there are still many topics left to explore. Scholarly books on standards continue to come out — on, for example, the history and anthropology of numbers, the seven-day week, and the fixing of the standard meter.<sup>4</sup> Meanwhile, trade publishers have brought out a series of popular and

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<sup>2</sup> W. E. Knowles Middleton, *A history of the thermometer and its use in meteorology* (Baltimore: Johns Hopkins Press, 1966); Georges Ifrah, *The universal history of numbers: from prehistory to the invention of the computer* (New York: John Wiley & Sons, 2000).

<sup>3</sup> Otis Dudley Duncan, *Notes on social measurement: historical and critical* (New York: Russell Sage Foundation, 1984), p. 13. More recently, Wendy Nelson Espeland and Mitchell L. Stevens in "Commensuration as a social process," *Annual Review of Sociology* 24 (1998): 313-343, have also called for more attention to measurement, although they are more specifically interested in those cases where a single measure is applied to diverse domains.

<sup>4</sup> Georges Ifrah, *The universal history of numbers: from prehistory to the invention of the computer* (New York: John Wiley & Sons, 2000); Thomas Crump, *The anthropology of numbers* (Cambridge: Cambridge University Press, 1990); Eviatar Zerubavel, *The seven day circle: the history and meaning of the week* (New York: Free Press, 1985); Ken Alder, *The measure of all things: the seven-year odyssey and hidden error that transformed the world* (New York: Free Press, 2002).

semipopular books on standards and on the microhistory of science and technology in general, perhaps encouraged by the success of Dava Sobel's *Longitude*.<sup>5</sup> We can now read for pleasure about the development of musical temperament, the standardization of the meter, and the poetic beauty of the Beaufort scale<sup>6</sup> — as well as the history of European porcelain manufacture, the role of the codfish in exploration and discovery, the importance of salt and pencils, and many other such fundamental topics that have been retrieved from the historical rubbish heap of everyday life and served up in attractive and entertaining formats.

Still, there are many standards which lack good histories, and I myself expected that, if I were to write a book-length study in this area, I would focus on a single case of cognitive standardization. There are many fine candidates. For example, we lack a good history of the Unicode worldwide computer character set standard. Duncan called for a study of pitch standardization. The politically delicate topic of geographical boundaries is worth much more exploration. And someone ought to research out the *real* story of the worldwide development of the typewriter keyboard and report back to us on it.

One can, of course, use methods other than historical analysis to study individual cognitive conventions and standards. As a graduate student, I used logistic regression to analyze worldwide changes in the rule of the road, and qualitative interviews to learn about pitch standardization and the experience of having absolute ("perfect") pitch.

What I was encouraged and ultimately convinced to do, though, was to write an overview of certain theoretical principles which apply to many cases of cognitive standardization. After all, as I was reminded, even the most successful studies of single contrast sets (or single standards or conventions) give off the slightly dusty air of the collector and have the slightly auxiliary flavor of numismatic or onomastic research. So I have focused analytically on the general theme of the contrast set, and have presented it as an

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<sup>5</sup> Dava Sobel, *Longitude: the true story of a lone genius who solved the greatest scientific problem of his time* (New York: Walker, 1995).

<sup>6</sup> Stuart Isacoff, *Temperament: the idea that solved music's greatest riddle* (New York: Alfred A. Knopf, 2001); Denis Guedj, *The measure of the world: a novel* (Chicago: University of Chicago Press, 2001); Scott Huler, *Defining the wind: the Beaufort scales, and how a nineteenth-century admiral turned science into poetry* (New York: Crown, 2004).

abstract topic that is relevant to dozens of areas of human social endeavor dispersed over fields like communication, education, science, architecture, and design.

Choosing this route meant accepting much more imperfection than I ideally wanted. This book covers a lot of ground and borrows from many different fields and disciplines. Nobody could possibly be an expert on all of the examples, concepts, and themes mentioned. There was never any chance of my fully "succeeding" at the project.<sup>7</sup> I cannot ever be comprehensive. I have to admit, as Duncan did in his book on measurement, that what you are reading here is at some level just "notes."<sup>8</sup>

Surely I do a few themes and examples an injustice through my amateurish treatment of them. But I have tried to be expert in, at least, the way I have linked examples and patterns from many different intellectual areas which "belong" to many different scholarly disciplines. For example, I have used the example of musical pitch standardization at a number of points in the book. I would never try to pass this book off as a significant contribution to the history of pitch standardization. Rather, this book's value is that it links the analytical structure of pitch standardization to that of analogous phenomena from completely different areas of everyday life (such as clothing sizing), thus placing pitch standardization's particularities in a much more general context.

The method used here is the theme-driven analysis of everyday life examples. While quite different from the quantitative, qualitative or even historical methods most common in the social sciences, this is a method which all linguists know and use, and which now has a tradition of its own in sociology.<sup>9</sup> In this sort of scholarly work, the contribution to

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<sup>7</sup>I sympathize with Georges Ifrah's comments in the preface to his *Universal history of numbers*, p. xix: "What I had set out to do was manifestly mad. The topic sat at the junction of all fields of knowledge and constituted an immense universe of human intellectual evolution. It covered a field so rich and huge that no single person could hope to grasp it alone." Ifrah's book is much more ambitious than this one, but some of the same issues apply. I wish that Ifrah had read, for example, Erving Goffman, whose work might have reassured him that the ubiquity of a topic is not a barrier to a concise and interesting treatment of it.

<sup>8</sup>Duncan, *Notes on social measurement*, p. 13.

<sup>9</sup>Two classic examples of such studies are Eviatar Zerubavel, *The fine line: making distinctions in everyday life* (New York: Free Press, 1991); Erving Goffman, *The presentation of self in everyday life* (Garden City, N.Y.: Doubleday, 1959). For commentary on the methodology specifically, see Eviatar Zerubavel, "If Simmel were a fieldworker: on formal sociological theory and analytical field research," *Symbolic Interaction* 3, 2 (1980): 25-33, and Eviatar Zerubavel, "Generally speaking: the logics and

knowledge lies in the way the examples are decontextualized and reassembled to demonstrate a pattern and thus a certain analytic point about society.<sup>10</sup> Rather than being convinced by correlation coefficients and levels of significance, the reader must be convinced by the author's skill at marshaling analytically comparable phenomena from diverse areas of daily life and explaining them in a way that the reader finds persuasive — just as a linguist demonstrates patterns in language by marshaling enough data to allow the reader to see the formal similarity of disparate examples.

The success of this method hinges on the way the examples are gathered. Since the data are everywhere, the researcher must look at the everyday world with notepad in hand, voraciously observing and analyzing, with their attention tuned to a particular theme. Their choice of examples will always be open to the charge of selectivity, but a sufficiently broad and compelling range of examples makes it likely that the pattern observed is genuine and important.

The focus on themes and patterns links this book to the tradition of *formal sociology*, a method of analysis generally traced to Georg Simmel.<sup>11</sup> In this book, the social form under investigation is that of contrast sets and contrast set design. Social forms are patterns of social interaction viewed as independent of their specific instantiations, and as divorced from any particular place or time. For example, from the concrete phenomena of dinner parties, school cafeterias, restaurants, breakfast noodle shops, and takeout pizza shops, we might focus on the relationship between those who prepare food and those who eat it, or on the process of people eating together. These two forms or patterns manifest themselves in each of the concrete situations involved. Although Simmel's conceptualization of social form is not fully exact, the common feature of sociology in the formal or Simmelian tradition is that it

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mechanics of social pattern analysis," paper presented at the annual meeting of the American Sociological Association, San Francisco, August 2004. See also Kristen Purcell, "Leveling the playing field: constructing parity in the modern world" (Ph.D. dissertation, Rutgers University, 2001), pp. 7-9.

<sup>10</sup> On decontextualization, see Eviatar Zerubavel, *Time maps: collective memory and the social shape of the past* (Chicago: University of Chicago Press, 2003), pp. 8-10.

<sup>11</sup> Georg Simmel, "The problem of sociology," in *Georg Simmel on individuality and social forms*, edited by Donald N. Levine, pp. 23-35 (Chicago: University of Chicago Press, 1971 [1908]). For a brief critical summary of the idea of social forms, see Lewis A. Coser, *Masters of sociological thought* (2nd ed., New York: Harcourt Brace Jovanovich, 1977), pp. 179-182.

picks out abstract similarities between diverse concrete contexts, which might not be immediately obvious to those focused on the analysis of one single concrete phenomenon at a time.

This book's use of examples collected from a wide range of spheres of daily life also links it to the rich social-science tradition of studying the "cement" of society and the rules of everyday life. I have chosen throughout to highlight the mundane<sup>12</sup> rather than the extraordinary in our world. I have focused throughout on the "socially standardized and standardizing, 'seen but unnoticed,' expected, background features of everyday scenes."<sup>13</sup> Typical of studies of everyday life is that everyone is already familiar with what you are talking about, but has never thought about it carefully before. Like Erving Goffman, my goal is to succeed not by having "brought new facts to light or revealed information which was previously unknown, but [rather by having] made clear what was previously unclear, pointed to the significance of things which had been regarded as of little or no consequence, and disentangled what was previously an indiscriminate muddle."<sup>14</sup>

I have tried to write with the expectation that my readers, if they are specialists in one area I cover, will be beginners in others. Thus I have tried to reference easily accessible and introductory discussions of the topics I touch on, for those interested in further reading. These references are in footnotes and also in the example list at the end of the book.

I have also tried to make this book accessible to the enquiring lay reader. It is my perhaps naive hope that the book might interest anyone who is professionally concerned with the phenomena that I most frequently use as examples, and that they may thereby discover how their area of concern can be analytically tied to many others. I am thinking here of type designers, usability designers, graphic and "information" designers, architects, urban planners, tourism officials, travel guidebook editors, transport managers, wayfinding specialists, standards administrators, coinage administrators, telephone numbering plan

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<sup>12</sup> See Wayne H. Brekhus, "A mundane manifesto," *Journal of mundane behavior* 1 (2000), at <http://www.mundanebehavior.org/issues/v1n1/brekhus.htm>.

<sup>13</sup> Harold Garfinkel, *Studies in ethnomethodology* (Englewood Cliffs, N.J.: Prentice-Hall, 1967), p. 36.

<sup>14</sup> Tom Burns, *Erving Goffman* (London: Routledge, 1992), p. 6.

administrators, public administrators in general, database designers, reading teachers, anyone involved with musical notation and pitch, linguists and anthropologists who are involved in language planning activities, and the historians of topics such as the alphabet or the metric system. All these people are either creators, consumers, or chroniclers of conventional contrast sets. I particularly hope that this book might encourage and help the authors of histories of specific contrast sets and standards to place them in a sociological and formal context.

While I have mainly taken an objective and descriptive approach, I have not shied away from making value judgements about different contrast set design options when they flow naturally out of my analysis. The line between prescription and description is very thin, and this is particularly true when the subject is planning and design.<sup>15</sup> When I prescribe, I do so with full awareness that my prescriptive statements' value are limited by my own knowledge and by the the social and technical conditions of the years 2003 to 2005.

Despite my willingness to prescribe, this is not a how-to book on information design along the lines of those put out by Edward Tufte or the Society for Environmental Graphic Design (among many others).<sup>16</sup> Rather it is an exposition of the linguistic and sociological principles which underlie the practical act of designing contrast sets. Most information design books talk about how to arrange images on paper — I focus instead about how to arrange concepts before they ever get onto paper. I have very little experience in the craftsmanship of information design, but I *can* illuminate the underlying principles of contrast set design in a way that craftsmen might not have the patience for.

An important inspiration for this book has been a modest and light-hearted sense of injustice. We often background everyday categorization and labeling conventions, rarely making them a lengthy focus of discourse (see further section 6.2). Linguists, for example,

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<sup>15</sup> See Einar Haugen, "Linguistics and language planning," in his *The ecology of language: essays by Einar Haugen*, pp. 159-190 (Stanford: Stanford University Press, 1972), pp. 159-161.

<sup>16</sup> See, for example, Edward Tufte, *Envisioning information* (Cheshire, Conn.: Graphics Press, 1990), and *The visual display of quantitative information* (Cheshire, Conn.: Graphics Press, 1983); Gail Deibler Finke, *You are here: graphics that direct, explain, & entertain* (Cincinnati: ST Publications, 1999); *Elements & total concept of urban signage design* (Tokyo: Graphic-sha, 1989).

tend to dismiss writing systems as derivative phenomena and their study as an endeavor of marginal scholarly value. Social scientists' concrete examples of social facts and institutions (to take just one theoretical concept) often tend towards grand, barely definable phenomena like "science" and "capitalism" instead of very simple and graspable things like the typewriter keyboard or the Fahrenheit scale.<sup>17</sup> In 1993, I worked as a computer programmer on a project directed by Western economists trying to privatize Russian government holdings. The prevailing view was that if free markets could only be created, new social norms and institutions would arise automatically and spontaneously, which implies that considering the details of such norms would be a waste of time.<sup>18</sup> I watched this dogmatic conviction get in the way of sensible progress in the management of crucial practical public administration issues like telephone renumbering, taxi fare regulation, and the reliability of the Russian postal system.<sup>19</sup>

The media frequently mention contrast sets — briefly and breezily. The weekly *Economist* magazine sometimes recognizes their importance, but rarely goes into depth. Almost never do the media convey the message that people have written about them seriously. My distinct sense is that standardized contrast sets matter a lot in peoples' daily lives, but rarely enjoy our focused attention. For the next couple hundred pages at least, I'd like to let them take the center stage they deserve.

## 1.3 The thematic organization of this book

You may think of this book as having two *general themes* (which run throughout the book) and four *chapter contexts* (which are associated with particular chapters).

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<sup>17</sup> See, for example, Douglass C. North, *Institutions, institutional change and economic performance* (Cambridge: Cambridge University Press, 1990).

<sup>18</sup> See Peter Reddaway and Dmitri Glinski, *The tragedy of Russia's reforms: market bolshevism against democracy* (Washington: United States Institute of Peace, 2001), p. 302. (There are several other books on the same events.)

<sup>19</sup> Similarly, one of the unforeseen problems that Iraqis faced after the American occupation in 2003 was a shortage of small banknotes so severe that a single 10,000 dinar note was "worth" only 7,500 dinars of small bills. See Edmund L. Andrews, "Iraqis scramble for scarce small bills," *New York Times*, 21 June 2003, p. A10.

The two general themes are *contrast sets* and *design*. This book focuses on the intersection of these two themes. Most fundamentally, this book is about contrast sets. It basically provides a definition of them and a description of the way they are used. The book narrows this field by focusing on the *design* of contrast sets (and of things connected to them).

The four chapter contexts are linguistic categorization (chapter 2); semiotics and signification (chapters 3-4); standardization and convention (chapters 5-6); and socialization (chapter 7).

The four chapter contexts give us different angles from which to view the themes of contrast sets and design. In each case, I try to introduce the essential concepts of the chapter context and refer to the major existing literature on it. However, my purpose is never to give an exhaustive overview of the chapter context, but rather to give just enough information to allow me to explain how that context intersects with the world of contrast sets and contrast set design.

My main goal has been to apply the existing theories in these four contexts to the example of contrast set design. In each of the four contexts, previous scholarship has generally overlooked contrast sets and set design. In some cases, though, I have tried to amplify or extend the existing theory, based on the evidence and examples I introduce from the area of contrast sets and set design.

I also sometimes illustrate the chapter context with examples that do not have to do with contrast sets (for example, lexical and onomastic examples in chapters 2-4, and examples of standardization in chapters 5-7). I do this when these examples help explain the theory of the chapter context in a particularly effective way. This also serves as a reminder that there is *much* more to each chapter context than contrast sets. Contrast sets are only one example of classification, of labeling and mapping, of standardization, and of primary and cross-cultural socialization.

A helpful metaphor for the book might be to imagine that the two general themes are like a cruise ship, and the four chapter contexts are the islands that it stops at. Only part of

the life of the island is displayed in the interaction between the cruise passengers and the locals. There is much more to the island than just what one can see from the pier — hinterlands, private life, and its history and future. There are also islands that the cruise does not visit — the cruise operator could only fit four into the schedule.

The design of contrast sets is one example of the much more general, indeed utterly unencompassable phenomenon of *cognitive design*. I use the term "cognitive design" to mean the design of institutions, tools, procedures, and environments in whose terms people are supposed to think, or which presuppose a certain way of thinking. I never really address the entire potential breadth of this field, but the conclusion tries to open the themes of the book in that direction.

## 1.4 Contrast sets and the lexicon

Ferdinand de Saussure proposed that the study of language was only one part of a much more general "science which studies the role of signs as part of social life."<sup>20</sup> Scholars in the field of semiotics have been working since in the direction of carrying out Saussure's vision.<sup>21</sup> This book is, in part, intended as a contribution to this project.

In focusing on contrast sets, I have, as Saussure suggested, deliberately decided to explore a part of the world of signs which sits just outside the realm of language and the lexicon. The lexicon is the collection of words in a language, and in this section I begin to discuss the relationship between contrast sets and the lexicon, and to clarify the considerable differences between them.

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<sup>20</sup> Ferdinand de Saussure, *Course in general linguistics*, trans. Roy Harris (London: Duckworth, 1983 [1916]), p. [33].

<sup>21</sup> Winfried Nöth's *Handbook of semiotics* (Bloomington: Indiana University Press, 1990) is a tremendously wide-ranging and erudite encyclopedia of semiotic scholarship and a great resource for further thought on the themes treated in this book.

Contrast sets and the lexicon have in common not only that they both signify and represent, but that both categorize reality and that both are social norms. Both contrast sets and the lexicon partition semantic domains into concepts and label them with words or other signs. And both contrast sets and the lexicon are social facts that involve conventionalized and standardized coordination throughout society.

But it is quite difficult to construct theories or scientific generalizations which hold across the awesome vastness and complexity of a language's lexicon. On the contrary, a relatively simple model of classification, labeling, conventionalization and socialization suffices to discuss contrast sets. This model, which has been called the "coding model,"<sup>22</sup> indeed underlies the theory of the partitioning and labeling of domains laid out in chapters 2 and 3. It falls woefully short as a theory of the lexicon. Although it is easy and attractive to think of the lexicon as a sort of wire-mesh colander or printer's type-case in which all of our perceptions flow through or are sorted into different squares of a giant "matrix of perception"<sup>23</sup> — those squares corresponding to all the concepts and words in our language — those who have hoped to reduce the lexicon to a few simple models have usually failed. John Lyons comments that "Most authors who have written recently on the subject of semantic fields [i.e., domains] have conceded that the majority of lexical fields are not so neatly structured or as clearly separated one from another as [some people] originally suggested."<sup>24</sup> Umberto Eco has described how many people (most famously, John Wilkins) have been tripped up by this same hope that the lexicon would be more simply structured.<sup>25</sup> In fact, the lexicon is too complicated to be easily sorted into neatly ordered little boxes. It is a haunted-house of gray areas, unexpected turns and passageways, incomplete parallelisms, and other such problems.

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<sup>22</sup> See Nikolas Coupland and Adam Jaworski, "Code," in *The Routledge companion to semiotics and linguistics*, edited by Paul Cobley, pp. 170-172 (London: Routledge, 2001), and Umberto Eco, *A theory of semiotics* (Bloomington: Indiana University Press, 1976), pp. 36-38 (definition of code) and 48-150 (theory of coding).

<sup>23</sup> This metaphor is from Ernst Pawel, *The nightmare of reason: a life of Franz Kafka* (London: Collins Harvill, 1988), p. 22.

<sup>24</sup> John Lyons, *Semantics* (Cambridge: Cambridge University Press, 1977), 1: 267.

<sup>25</sup> Umberto Eco, *The search for the perfect language* (Oxford: Blackwell, 1995), pp. 238-259; see also Eco, *A theory of semiotics*, pp. 75-76.

The contrast sets that I discuss in this book almost make metaphors of matrices or sorting-boxes literal. Contrast sets have simpler structures than the lexicon. Their members' attributes vary along a restricted set of dimensions — sometimes along a single scale. There are often clear gaps between the different members of a contrast set. They thus make for a more encompassable and less controversial topic of study. And since the design of contrast sets is much more under human control than the design of the lexicon, studying contrast sets has considerable practical as well as scholarly value.

Despite the differences between contrast sets and the lexicon, I will often refer to parallel literature on the lexicon when I am discussing the relevance to contrast sets of a concept that has already been applied to language. The lexicon thereby assumes the role of the ogre in the basement throughout the book: it is always vaguely present, and I briefly unlock the unruly language beast from its cage when I can use a lexical example to illustrate a point in an especially effective way. I give the literature on language planning special attention, since language planning (unlike most of linguistics) explicitly concerns itself with matters of cognitive design.

Throughout this book, the reader might want to keep in mind that some scholars have suggested that the lexicon is the only semiotic system that is of any more than trivial interest, which would imply that that studying contrast sets is a pointless, inconsequential endeavor. Roland Barthes stated this position quite strongly:

Saussure, followed in this by the main semiologists, thought that linguistics merely formed a part of the general science of signs. Now it is far from certain that in the social life of today there are to be found any extensive systems of signs outside human language. Semiology has so far concerned itself with codes of no more than slight interest, such as the Highway Code; the moment we go on to systems where the sociological significance is more than superficial, we are once more confronted with language.<sup>26</sup>

This statement implies that the only semiotic system of any sociological significance is language itself. While the reader will have to be the ultimate judge of whether there exist semiotic systems besides language which are of considerable sociological interest, this book is intended as good evidence that there are. Indeed, I would suggest that contrast sets

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<sup>26</sup> Roland Barthes, *Elements of semiology* (New York: Hill and Wang, 1968), pp. 9-10.

illustrate certain principles of categorization and signification in a much more clear and effective way than does the lexicon.

Some might argue that it is too easy, indeed a sort of cop-out, to lay out the rather simple theory behind contrast sets rather than engaging the complexity of the lexicon. Similarly, the reasoning behind Barthes' comment may have been "since the lexicon is so complicated, it must be sociologically significant, and since those other semiotic systems are so simple, they must not be significant." I would argue that the internal complexity of the system has nothing really to do with its social significance. Contrast sets can be very simple and very socially significant at the same time. And as a relatively understudied part of the world of signs, one book on contrast sets perhaps adds more value than one more book on the lexicon, and brings us one step closer to making Saussure's vision a reality.

## 1.5 The workshop metaphor

Imagine a workshop which makes wooden furniture, such as chairs and tables. The workshop has workers, who design and make the furniture, and customers, who buy it. Raw materials (like pine or maple), tools, and supplies (like screws and glue) come into the workshop. The workers' labor transforms these raw materials into saleable products. The nature of the raw materials constrains, to some extent, the nature of the products (one can do things with pine that one cannot do with maple or with steel, and vice versa). The traditions of the workshop, and the traditional needs of its customers, also dictate how the raw material is worked. Only a limited number of the possible products that could be made from them are actually created. To explain why the workshop produces the products it does, one must tell both the story of the raw materials, and of the workshop itself.

This book uses a "workshop" metaphor to structure its explanation of contrast set design.<sup>27</sup> The creation of a contrast set (or the way it is labeled or ordered) is seen as a process of working raw material, in only one of the many possible ways it could be worked. The raw material involved is what I will call "domains," and the fundamental nature of each

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<sup>27</sup> In a similar way, Alessandro Duranti uses a canvas-and-paint metaphor for language in *Linguistic anthropology* (Cambridge: Cambridge University Press, 1997), p. 334.

domain at the point when it "arrives" in the workshop places limitations on the type of contrast set that can be created in that domain. Within the bounds of those constraints, the ultimate decision about how to shape a contrast set is up to those who staff the workshop (the contrast set designers), and those "customers" who judge their products (the users who choose whether to actually use a contrast set or not).

The organization of a collection of books or music, the creation of geographical categories, the numbering of a highway system, the size grading of apples, the invention of an alphabet, and the rest of the examples of contrast set design dealt with in this book can all, in slightly different ways, be fit into the metaphor of the workshop. This way of seeing contrast sets looks at them as constructions which are built by humans working within the limits of the raw material we are given, the goals which we are trying to achieve, and the traditions of construction that we already know. Although it is not quite the same thing as "social constructionism," it does emphasize the human role in the authorship of the world.

At the same time, this book does try to discover something about the contents of our toolkit, and about the raw material that we have to work with. The building blocks of contrast sets — such as perceptual and sensory domains, the ability to categorize and to label, ordering, spatial metaphor, and boundaries and focal points, as well as the basic patterns of standardization and institutionalization in societies — seem to be inescapable facts about how the natural world and our cognitive relation to it work. Thus our investigation of contrast sets can indeed allow us to deduce something about the properties of the natural world.

This book does not, however, assume that everything about how contrast sets work can be predicted from an understanding of the natural world and the natural constraints on our cognitive apparatus. Quite the opposite. The perspective that I assume is that human ingenuity, and the cooperative creation of norms and social conventions, is part of the story of who we are and the shared cognitive world we have built. In architecture, in literature, in our cognitive life and I would say in language to a great extent as well, we design the world

with a limited toolkit but a fairly open-ended set of possibilities.<sup>28</sup> We design the world, and choose what is possible, at the same time as our choices are constrained by our environment and our biological endowment.<sup>29</sup> Just as the characteristics of pine, or teak, or birch, only constrain, and do not determine, the furniture that can be made from them, most familiar contrast sets are conventional norms rather than performances from a universal inner script.

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<sup>28</sup>Note that some linguists prefer to evaluate whether a sentence is *normal* or not rather than whether it is *grammatical* or not. See, for example, D. Alan Cruse, *Lexical semantics* (Cambridge: Cambridge University Press, 1986), pp. 11-12.

<sup>29</sup>This perspective is worked out at greater length by Michael Tomasello, *The cultural origins of human cognition* (Cambridge: Harvard University Press, 1999), p. 11, and in section 2.0 of Stephen C. Levinson, "Language and mind: let's get the issues straight!", in *Language in mind: advances in the study of language and thought*, edited by Dedre Gentner and Susan Goldin-Meadow, pp. 25-46 (Cambridge: MIT Press, 2003).

## 2 Contrast Sets

Everybody who has taught or taken a class has at some point struggled with the issue of grading.<sup>1</sup> There are, of course, plenty of schools and even universities which refuse to sort their students into discrete categories of achievement and pride themselves on issuing only written evaluations. But most schools in the world seem to have decided that grading is practical, even if it demands evil compromises, approximations, and oversimplifications. The grade-point average calculated at the end of a term is usually a mean which can have a practically infinite number of values. But the grade for each individual piece of work is usually chosen from a small set of perhaps no more than a dozen possibilities. These might be called A, A-, B+, B (and so forth), or Exceptional, High Pass, Pass, and Fail, or 5, 4, 3, 2, and 1. Both the categories and the labels vary from one system to another, but the common theme is that teachers have to choose one and only one of these categories for each piece of work. Most teachers, once they have gotten the hang of the system, stop asking why it is the way it is and just use it.

This book asks why, and asks why for all kinds of conventional sets, not just grading systems. When and why were these sets created? Who chose the divisions, and were these divisions natural or conventional? How are they labeled? How and why are these systems perpetuated? Why do they sometimes vary from place to place?

This chapter focuses on the semantic question of how the entities and categories in a contrast set are created. Because creating contrast sets involves acts of categorization and partition, this chapter builds on existing studies of categorization in the social sciences and especially in cognitive science and linguistics. Much of that literature focuses on the nature of categories that already exist in the mind. This chapter is different from most in its focus on the process of creating and designing new sets of categories, although Nelson Goodman's

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<sup>1</sup>A starting point for the study of grading conventions is Mark W. Durm, "An A is not an A is not an A: A history of grading," *Educational Forum* 57 (1993): 294–297. See also Marita Moll, "The history of grading in three minutes," Canadian Teachers' Foundation press release, 30 July 1998, <http://www.ctf-fce.ca/en/press/1998/PR30.HTM> (December 2004).

outline of a "theory of notation" is one item in the existing literature that does takes an approach relatively close to that in this chapter.<sup>2</sup>

## 2.1 The contrast set



Image 2.1 (001)

Image 2.1 shows one octave from a piano keyboard. There are twelve keys in each octave. When trying to understand categorization it is good to try to think of things without their usual labels, so imagine labeling the keys with the numbers 1 through 12. Each key is different; the key labeled 1 does not give the same sound as the key labeled 3. Each note has also a sort of equivalence to all the others; all twelve keys are all passable examples of the concept "piano key." So it is possible to use the expression "key #1 and other piano keys," and equally well, to substitute any of the other eleven keys in place of key #1 in this expression.

Image 2.2 shows a number of other similar sets. Thus we have the different numerals in the Maya writing system, the different states of Australia, the months of the year, a collection of different fruits, the keys on a calculator keyboard, the letters of the alphabet, and the grades in a typical American grading system. Common to each of these sets is a general notion, and various examples of it. The general notions are numerals, states, months, fruits, keys, letters, and grades. These general notions have been called *hyperonyms* or *superordinate terms*. The examples of these general notions are specific, individual numerals, states, months, fruits, keys, letters, or grades. These

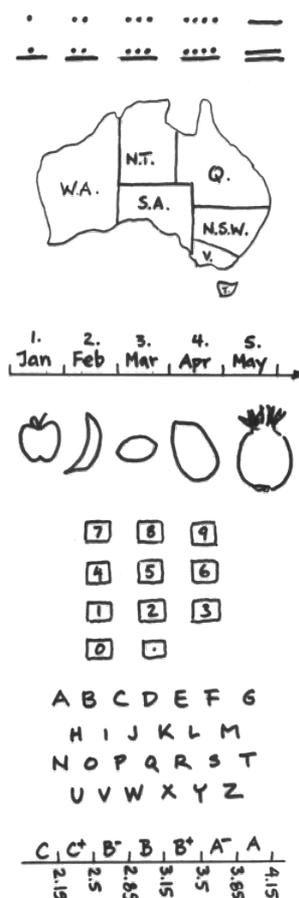


Image 2.2 (027)

<sup>2</sup> Nelson Goodman, *Languages of art: an approach to a theory of symbols* (London: Oxford University Press, 1969 [1968]), chapter IV ("The theory of notation," pp. 127-173). I would sooner call his chapter a theory of partitioning than of notation.

examples can be called *hyponyms* or *subordinate* terms.<sup>3</sup> A good test of whether two things have a subordinate-superordinate relationship is to ask whether one can use them in an expression of the form *X and other Ys*, such as "key #1 and other piano keys," "Queensland and other states," "mangoes and other fruits," "8 and other integers," or "B+ and other grades."<sup>4</sup>

**Examples of the "X and other Ys" formula**

the eighth floor and other floors of a building  
*m* and other letters of the alphabet  
 C sharp and other notes on the musical scale  
 440 hertz and other audible pitches  
 my parking space and all the other parking spaces in the lot  
 section 23D and all the other sections of the parking lot  
 my parking space and all the other parking spaces in section 23D  
 30° south 150° east and other geographical points within Australia  
 Bolivia and other countries in the world  
 35 kilometers per hour and other speeds  
 the sound of a trombone and other musical timbres  
 cream cheese and other dairy products  
 limes and other fruits  
 halibut and other fish  
 Jan and other speakers of Scandinavian languages  
 Jan and other speakers of Norwegian  
 Norwegian and other Scandinavian languages  
 Norwegian and other Indo-European languages

Since the 1950s a special term has been used in semantics and linguistic anthropology for the set of hyponyms "under" a given hyperonym: a *contrast set*. Charles Frake is responsible for the classic description of the contrast set — or at least one that is clearly written and has been read by thousands of students.<sup>5</sup> Frake demonstrated the principles of the contrast set using the set of sandwiches, whose *members* include hamburgers, cheeseburgers, hot dogs, and ham-and-cheese sandwiches.

Contrast sets are the main theme of this book, but I focus on particular types of contrast sets. I am most interested in contrast sets which are artificial rather than natural, consciously created rather than emergent, created as ensembles rather than piecemeal, and at least potentially redesignable rather than fixed for all time. For example, I will be much more interested in "B+ and other grades" and "C# and other piano keys" than in "hamburgers and other sandwiches" or "running and other actions."

<sup>3</sup> On hyponyms and hyperonyms see D. A. Cruse, *Lexical semantics* (Cambridge: Cambridge University Press, 1986), pp. 88-92; John Lyons, *Semantics* (Cambridge: Cambridge University Press, 1977), 1: 291-295.

<sup>4</sup> On this formula see Cruse, *Lexical semantics*, p. 91, and Lyons, *Semantics*, 1: 292-293.

<sup>5</sup> Charles O. Frake, "The ethnographic study of cognitive systems," in Stephen A. Tyler, ed., *Cognitive anthropology* (New York: Holt, Rinehart, and Winston, 1969 [1962]), pp. 28-41. See also Lyons, *Semantics*, 1: 287-290, and Doede Nauta, *The meaning of information* (The Hague: Mouton, 1972), pp. 179-180.

The term "contrast set" carries within it the reminder that all members of the set belong together — they are a *set* — but they are all distinct from each other — they *contrast*. To define any member of the set, using the superordinate term as a base, you need to highlight that contrast by writing the definition to exclude all the other members of the set. But you do not need to say anything about anything that is not a member of the set. As Frake put it, "In writing rules for classifying hamburgers I must say something about hot dogs, whereas I can ignore rainbows."<sup>6</sup>

The members of a contrast set contrast, but at the same time they fulfill the same role. We express this by saying that the relation between members of a contrast set is *paradigmatic*. Within the same syntactic construction, one can at least conceive of substituting one member of a set of paradigmatically related entities for another: thus a grade report showing that you got a B+ could equally well (if you had performed differently) read A, B-, or C+ in place of B+.<sup>7</sup> (See further section 2.11.)

We usually give the members of a contrast set *names* or *labels*, which are the subject of chapters 3 and 4. The first three piano keys in the octave, for example, are often labeled C, C#, and D. But each member of the set exists prior to and separately from its label. So it is possible to refer to the key called D not by its label, but by saying that "it is the white key in between the group of 2 black keys on the piano." When thinking about the creation of contrast sets, it often helps to try to think of them in this sort of pre-labeled state.

## 2.2 Behind the contrast set: the domain

It is usually possible to think of the members of a contrast set as distributed throughout some kind of literal or metaphorical *space*, which existed before the set itself came into being, and in which each member of the contrast set occupies a particular place. Thus the fifty American states divide up the land-mass of the United States just as the twelve months divide up the time-span of the year. A, A-, B+, B, and the other student grades divide

<sup>6</sup> Frake, "The ethnographic study of cognitive systems," p. 33.

<sup>7</sup> On paradigms see Lyons, *Semantics*, vol. 1, pp. 240-243; Alessandro Duranti, *Linguistic anthropology* (Cambridge: Cambridge University Press, 1997), pp. 164-166; Ferdinand de Saussure, *Course in general linguistics* (Roy Harris, trans., London: Duckworth, 1983), pp. [170]-[175].

up the entire universe of possible student performance. Piano keys divide up the piano keyboard, while each of the set of musical pitches that they produce occupies a particular spot in the range of audible frequency. Our terms for colors occupy particular points in the field of possible colors, and each parking space occupies a particular spot in the parking lot.

It is hard to choose what word to use to label this space that lurks behind the contrast set.<sup>8</sup> So far I have used *space*, *universe*, *mass*, *span*, *field*, and *range* to convey the sense of this concept. Two different traditions in twentieth-century linguistics have used this idea. Their terminology differs. The first tradition, more European and philosophically oriented, preferred the term *semantic field*.<sup>9</sup> The more recent, more Californian tradition of cognitive linguistics uses the term *domain*,<sup>10</sup> which I have chosen for this book too.

I use the word *instantiation* to describe these individual points within the domain.<sup>11</sup> The process of creating a contrast set in a given domain involves organizing those instantiations into different categories. There are several distinct methods of doing this, which are described in more detail below.

The relationship between contrast sets and their members parallels that between domains and their instantiations. In both cases the *X and other Ys* formula applies, and domains can be considered hyperonyms and their instantiations hyponyms. (Indeed, as I explain below, a contrast set can itself be thought of as a particular type of domain, and its

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<sup>8</sup> For example, Geoffrey C. Bowker and Susan Leigh Star in *Sorting things out: classification and its consequences* (Cambridge: MIT Press, 1999), pp. 10-11 struggled with what to call the idea of the domain without any clear resolution. They variously use the terms *world*, *any object addressed by the system*, and *the world it [a contrast set] describes*.

<sup>9</sup> On this first tradition of semantic field theory see John Lyons, *Semantics* (Cambridge: Cambridge University Press, 1977), vol. 1, ch. 8 (pp. 230-269); Richard E. Grandy, "In defense of semantic fields," in *New directions in semantics*, edited by Ernest Lepore, pp. 259-280 (London: Academic Press, 1987); Eva Feder Kittay, *Metaphor: its cognitive force and linguistic structure* (Oxford: Clarendon Press, 1987), ch. 6 ("Semantic field theory," pp. 214-257); Adrienne Lehrer, *Semantic fields and lexical structure* (Amsterdam: North-Holland, 1974), esp. ch. 2 ("Semantic fields," pp. 15-45); Stephen Ullmann, *The principles of semantics* (2nd ed., Oxford: Basil Blackwell, 1957), pp. 152-170, 309-313.

<sup>10</sup> John R. Taylor, who also uses the word *domain*, defines it at length on pages 84-85 of *Linguistic categorization: prototypes in linguistic theory* (2nd ed., Oxford: Clarendon Press, 1995). A fuller account (which is referenced by Taylor as his source for the term) is Ronald Langacker, *Foundations of cognitive grammar* (Stanford: Stanford University Press, 1987-1991), 1: 147-154 (section 4.1, "Types of domains"). In chapter 7 of Taylor's new textbook *Cognitive grammar* (Oxford: Oxford University Press, 2002), which I have not fully been able to review, he appears to use a somewhat different terminology.

<sup>11</sup> On the idea of instantiations see Langacker, *Foundations of cognitive grammar*, 2: 55-64 (sections 2.2.1-2.2.3).

members as instantiations of that domain; but the converse is not true, so that not all domains can be thought of as contrast sets.)

These pairs of terms — contrast set and contrast set member, domain and instantiation, hyperonym and hyponym — are themselves examples of the somewhat broader and very fundamental semantic notion of, on the one hand, an abstract "thing" or "category," and, on the other, the various real-life entities which can count as an example of that thing. A diverse selection of terminology for this pair of notions is available to us, of which Charles Sanders Peirce's "type" and "token" are probably the best known pair.<sup>12</sup> Rudolf Carnap used "design" and "event,"<sup>13</sup> Douglas Hofstadter prefers "class" and "instance,"<sup>14</sup> and scholars of database design have used "entity type" and "entity occurrence."<sup>15</sup>

A key difference between contrast sets and domains is that, while contrast sets always consist of distinct entities, many domains (such as those involving time and space) are *continuous*. In a continuous domain there are an infinite number of points,<sup>16</sup> and it is possible to mathematically pinpoint each of those points using a scale or a coordinate system. Thus the landmass of Australia can be considered a domain, the infinite number of points in Australia are all its instantiations, and Australia's internal borders partition the domain into a contrast set of seven different territories and tell us which instantiations belong to which member of the contrast set. Or, consider the year a domain. The infinite number of moments within a year are instantiations, and the "boundaries" between the months create a contrast set which separates those instantiations into twelve distinct groups.

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<sup>12</sup> Charles Sanders Peirce, *The collected papers of Charles Sanders Peirce* (Cambridge: Harvard University Press, 1933), volume 4, section 537.

<sup>13</sup> Rudolf Carnap, *Introduction to semantics and formalization of logic* (Cambridge: Harvard University Press, 1959), pp. 5-8.

<sup>14</sup> Douglas R. Hofstadter, *Gödel, Escher, Bach: an eternal golden braid* (New York: Basic Books, 1979), pp. 351-354.

<sup>15</sup> Thomas Connolly and Carolyn Begg, *Database systems: a practical approach to design, implementation, and management* (3rd edition, Harlow, Essex: Pearson Education, 2002), pp. 331-332.

<sup>16</sup> Nauta, in *The meaning of information*, p. 180, argues that the idea of a continuous domain with an infinite number of points is actually a mathematical idealization and "should be conceived of as just a way of expressing that the nuances in question have a fine structure that surpasses man's discrimination capacity."

However, I also use the term *domain* to refer to collections of entities — of individual things — which lack the simple continuity of space or time. The entities in these collections are distinct, are usually finite in number, and do not shade into each other to form a continuum. Examples of such collections are all the books or CDs on your shelves, all the sheep in New Zealand, all the pieces of fruit in the supermarket, or all the students in a class. I call these *collective domains* and use the word *instantiation* for the individual entities within the collection when I am talking about the collection as a domain. (But they may also be thought of as the members of a contrast set, and I do in fact present them that way at times.) Creating a *new* contrast set within a collective domain involves, of course, sorting all of these instantiations into different categories. For example, the collective domain of New Zealand citizens could be sorted according to whether they were born on the North Island, the South Island, or elsewhere. Or, if an earthquake mixed up all the fruit in the supermarket, you could easily sort it back into order, helped by the fact that different fruits are naturally distinct from one another, and that ambiguous hybrids do not usually make it into the store. In either case, the result of the sorting process is a collective domain which has been sifted through the matrix of a particular contrast set so that each instantiation is associated with a single member of that set (as long as one manages to handle any ambiguous cases). A slightly different example is the scene when Harry Potter arrives at the mythical Hogwarts School of Witchcraft and Wizardry. His very first experience, before even eating, is the sorting ceremony where each new student is assigned to one of the four houses of Gryffindor, Hufflepuff, Ravenclaw, and Slytherin.<sup>17</sup> In this case, the instantiations of the collective domain (the students) do not already possess the characteristics that they are sorted on; instilling those characteristics in them is rather a part of the partitioning process.

With the addition of the concepts of *domain* and *instantiation* to our arsenal, we may fine-tune the *X and other Ys* formula so that it better captures the crucial elements of any given hyponym-hyperonym relation. One can rewrite the term *Y* as "*Ps in Q*", yielding *X and other Ps in Q*, where *P* is the name for a type of instantiation within the domain *Q*, and *X* is

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<sup>17</sup>J. K. Rowling, *Harry Potter and the philosopher's stone* (London: Bloomsbury, 1997), chapter 7.

an example of such an instantiation.<sup>18</sup> Fitting a hyponym-hyperonym relation into this formula does not mean coming up with one unique, correct, analysis of that relation, but is simply a shorthand means of expressing or representing one distinct way of thinking about that relation (some such way of thinking is usually present in any given analytical "take"). Thus we can emphasize how a contrast set partitions a continuous domain by thinking about "Belgium and other countries in Europe" or "B+ and other levels of student performance," but we may equally well emphasize how the same contrast set forms a collective domain by discussing "Belgium and other members of the European Union" or "B+ and other grades in the standard American grading system." Meanwhile we may emphasize the individual instantiations in a continuous domain by discussing, for example, "30° south 150° east and other geographical points within Australia," or the individual instantiations in a collective domain by referring to "this mango and all the other individual fruits in the supermarket produce section."

The concept of a *taxonomy* builds on the concept of the domain. In taxonomies, some members of a contrast set are themselves domains which "govern" contrast sets of their own. Thus New York is not only one of the fifty states of the USA, it is itself divided into sixty-two counties, which are themselves each subdivided into towns. "Swede" is not only one of the different classifications of "Scandinavian"; the set of Swedes is itself a collective domain which could be divided into contrast sets of different kinds of Swedes. This hierarchy of contrast sets is the defining feature of a taxonomy.<sup>19</sup> Taxonomies favor specific labeling styles, which are discussed in chapters 3 and 4.

## 2.3 The spatial metaphor for the domain

Some domains are actual, physical spaces, like Australia or a parking lot. In these cases it is not metaphorical at all to use the language of spatial relations to describe them.

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<sup>18</sup> In this formula, *P* and *Q* correspond respectively to the terms *attribute* and *domain* in the relational database model. See Connolly and Begg, *Database systems*, p. 72.

<sup>19</sup> On the idea of taxonomy see Fraake, "The ethnographic study of cognitive systems," pp. 33-36; the extended discussion by Cruse, *Lexical semantics*, pp. 136-196 (who distinguishes between taxonomies, meronymies, and "non-branching hierarchies"); Paul Kay, "Taxonomy and semantic contrast," *Language* 47 (1971): 866-887.

But we also speak, for example, of all the points "within" the domain of color, and we might talk about two people whose Norwegian dialects are very "close" to each other. This comes so naturally to us that we barely notice that the domain of color does not really occupy a space (although it comes close to it when we see a rainbow or the spectrum projected by a prism) and that the "closeness" of dialects has to do with something other than their physical location in terms of latitude and longitude. When we talk about non-spatial domains in spatial terms, our language is actually mediated through a spatial metaphor. This spatial metaphor also extends to contrast sets which are formed out of that domain.

These spatial metaphors are common in everyday speech, and they are well-known to scholars. Indeed, there is wide agreement not only that we use spatial language as a basis for reasoning and thinking about non-spatial domains, but that it is difficult or impossible to think about many non-spatial domains *without* a spatial metaphor.<sup>20</sup> This book takes it for granted that the same analytical language can be used to generalize about both literally spatial and metaphorically spatial domains, so it is best to lay the facts about the metaphor out clearly on the table.

Each spatial metaphor for a domain has a particular structure or topology. (Literally spatial domains have particular topologies too.) The most common domain topologies are linear and circular, but there are also planes, dyads, matrices, solids, tree-forms, networks, and multidimensional spaces. There can easily be more than one possible metaphorical topology for any contrast set. For example, we can conceive of the seven days of the week or the twelve hours on the clock face as a linear sequence with a definite beginning and end, or as a circular sequence that "wraps around."<sup>21</sup>

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<sup>20</sup> For more on the spatial metaphor of the domain see Eviatar Zerubavel, *The fine line: making distinctions in everyday life* (New York: Free Press, 1991), pp. 15-18; Taylor, *Linguistic categorization*, pp. 84-85; Ray Jackendoff, "Semantics and cognition," in *The handbook of contemporary semantic theory*, edited by Shalom Lappin, pp. 539-559 (Oxford: Blackwell, 1996), section 9 (pp. 554-557); the discussion of "spatial thinking about nonspatial matters" in Alexander W. Siegel and Sheldon H. White, "The development of spatial representations of large-scale environments," *Advances in child development and behavior* 10 (1975): 9-55, pp. 47-48; and Barbara Tversky, "Remembering spaces," in *The Oxford handbook of memory*, edited by Endel Tulving and Fergus I. M. Craik, pp. 363-378 (Oxford: Oxford University Press, 2000), p. 364. In studies of metaphor, spatial metaphors are often lumped under the title "States Are Locations."

<sup>21</sup> On linear and circular conceptions of time see Eviatar Zerubavel, *The seven day circle: the history and meaning of the week* (New York: Free Press, 1985), pp. 83-86.

Contrast sets and domains that easily admit of a linear topology include time, number,<sup>22</sup> pitch and audible frequency, color, and many measurement standards including mass, distance, and temperature as well as grading standards like those for eggs, students, and military personnel.<sup>23</sup> In some atypical contrast sets which consist of only two items (such as left and right or clockwise and counterclockwise), the sense of a line or scale disappears leaving one with only the contrast between the two poles. These sets can be called binary or dyadic rather than linear.

Circular metaphors are common for time (months in the year, days in the week, and hours in the day), color (since the two ends of the spectrum can be joined), and pitch names (which cycle with every octave or as part of the "circle of fifths").<sup>24</sup> Actually, any finite linear domain or contrast set can be forced into a circular form.<sup>25</sup> A number of domains and contrast sets have a literally circular form, such as compass direction, time zones, and the set of constellations used in astrology.

Literally planar domains include parking lots and two-dimensional geographical space. The Munsell color chart (used, for example, to illustrate the diagrams in Berlin and Kay's *Basic color terms*) is a planar metaphor for the domain of color.

Three-dimensional or solid topologies describe actual spaces in which the vertical element is important (such as a tall building), as well as metaphorical spaces such as the color solid (yet another way of representing the domain of color). And there is no reason why domains cannot be metaphorically modeled in more than three dimensions (difficult material for a mental image, but easy enough to conceptualize mathematically).

Spatial metaphors based on simple linear, planar, or three-dimensional topologies are relatively simple to apply, and it takes little mental stretching to manipulate them. These

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<sup>22</sup> On the linear metaphors behind number and basic arithmetic see George Lakoff and Rafael E. Núñez, *Where mathematics comes from: how the embodied mind brings mathematics into being* (New York: Basic Books, 2000), pp. 71-73.

<sup>23</sup> On linear metaphors for sets of terms which differ in degree of a certain quality see Cruse, *Lexical semantics*, pp. 187-189, 192-195.

<sup>24</sup> On circular domains in general see Cruse, *Lexical semantics*, pp. 189-191.

<sup>25</sup> See the numerous examples of circularly presented contrast sets illustrated in Jessica Helfand, *Reinventing the wheel* (New York: Princeton Architectural Press, 2002).

topologies can be applied to domains where all the instantiations of the domain uniformly possess a scalable quality (or qualities) so that each instantiation of the domain can be pinpointed mathematically by a value on the scale (or set of values on multiple scales). We can easily visualize scales in space (most of us explicitly learned to do so in algebra class and commanded the technique intuitively long before), so we can easily visualize scalable domains.

There are also many domains which are difficult to describe in terms of one, two, or three dimensions but for which spatial notions of "closeness" and "boundaries" still seem to make sense. In these cases, applying a spatial metaphor is more of a stretch, but still a reasonable one.

For example, in the case of collective domains like a book or music collection, there is no real space behind the set of entities — they are just a bunch of things. Still, though, we can speak of passing "from" jazz "through" bop "to" rock, of two books being in the same "area," or of Episcopalians being "close" to Anglicans without having to explain ourselves at length. We can make it easier to discuss "closeness" or "internal boundaries" in a collective domain if we project it into some  $n$ -dimensional space, which we can do by focusing on selected attributes of each entity and graphing them accordingly. Thus we can only think of true "boundaries" between the different sections of our music collection if we have focused on some sortable or scalable aspect of each entity in the collection, such as media, size, artist's name, date, genre, and so forth. Similarly, the existence of a conventional order for the letters of the alphabet makes it easy to use a linear metaphor for them. So when we use a spatial metaphor for domains composed of entities alone, we are often not only speaking metaphorically, but also assuming the use of some sort of conventional organizing principle that grants the domain a topology and shape.

A slightly different method can be used with the elements of biological classifications. Fruit, for example, presents itself as a multitude of disconnected species such as apples, gooseberries, rambutans, and black sapotes. We can certainly expect to be understood if we say that apples are relatively "close" to being pears. But it is difficult to come up with a simple

spatial metaphor which allows us to project the different species of fruit into space and imagine this visually. However, the more complex visual metaphor of a "family tree" perhaps does a good job of capturing the difference in the degree of relationship between, say, apples and pears, versus apples and rambutans.<sup>26</sup> Similarly, linguists have for decades had to decide whether the best way to visually represent the relationships within a family of languages is with a tree chart or with a two-dimensional isogloss map, both of which misrepresent reality in different ways.<sup>27</sup>

In other cases of collective domains and contrast sets, the spatial metaphor applies much more loosely because one cannot easily project the domain into a manageable number of dimensions. It is, for example, very difficult to imagine a topology for the domain behind the contrast set of all potential letterforms and graphic symbols (punctuation, numerals, and so forth). The concept of domain still seems to be valid (the *X and other Ys* test makes sense — the letter *A* and other graphic forms — and one can easily imagine points in the domain which have not been conventionalized), as does the idea of a spatial metaphor (it seems to make sense to say that the comma is "close" to being a period). However, coming up with a set of measurable, spatially projectable attributes of each letterform is unworkable. Many letterforms are characterized not only by their degree of a particular quality but by whether they possess it at all; in other words, not every member of the set can be measured in the same terms. Douglas Hofstadter came up against this problem when he attempted to draw a map of his intellectual interests,<sup>28</sup> and spatial metaphors of the lexicon or of the World Wide Web seem to founder on the same issue. That does not, however, stop us from discussing such domains in spatial terms.

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<sup>26</sup> On tree metaphors for distance see Eviatar Zerubavel, *Time maps: collective memory and the social shape of the past* (Chicago: University of Chicago Press, 2003), pp. 63-81.

<sup>27</sup> A classic discussion of tree and "wave" diagrams is Leonard Bloomfield, *Language* (London: George Allen & Unwin, 1935 [1933]), section 18.10 (pp. 311-318). An entry point into more recent debate on the issue is Robert L. Rankin, "The comparative method," pp. 183-212 of Brian D. Joseph and Richard D. Janda, ed., *The handbook of historical linguistics* (Malden, Mass.: Blackwell, 2003), section 3 (pp. 185-86).

<sup>28</sup> Hofstadter, *Gödel, Escher, Bach*, p. 370.

## 2.4 Partitioning by boundary and focal point

When people are asked to think about the ways we create contrast sets within domains, the first style of partitioning they think of is usually partitioning by boundary, and the first examples they think of are usually things like the fifty American states or the twelve months of the year. Partition by boundary involves laying down linear divisions in a two-dimensional domain or cut points in a one-dimensional domain, and considering each distinct "area" between those boundaries as a set member. In a collective domain, boundaries are not laid down in the domain itself but rather act on selected attributes of each of the entities in the domain.

Fixing *focal points*<sup>29</sup> is another way of partitioning a domain into a contrast set, by building up each member of the set around a specific point in the domain. Typically, each focal point is a prototype<sup>30</sup> or best example of the member of the contrast set that it is associated with. This point often represents the most typical or salient instantiation within that contrast set member. When the members of a contrast set formed by focal point usually have clearly defined prototypes, they may lack clearly defined boundaries.



Image 2.3 (050)

Creating contrast sets by focal point is what we do in large parking lots when we put signs on lampposts to help people remember where they parked their cars. Image 2.3, a photograph of the smoking area in the train station of Shizuoka, Japan, is another good example of a category created by focal point in

<sup>29</sup> My choice of the term *focal point* is inspired by Thomas C. Schelling, *The strategy of conflict* (Cambridge: Harvard University Press, 1960), pp. 54-58. Schelling used focal point to mean a point within a domain which constitutes the solution to a coordination problem (particularly for problems whose solution can be arbitrarily chosen since solving the problem is more important than the nature of the solution). I use focal point to mean a point within a domain which constitutes a member of a contrast set formed out of that domain. My use of the term is thus closer to the meaning of "prototype" in linguistic categorization, but focal points in my terms are also often focal points in Schelling's terms.

<sup>30</sup> For an introduction to the concept of "prototype" in linguistic categorization see Taylor, *Linguistic categorization*, pp. 38-90.

two dimensional space. (An aquarium marks the focal point of the smoking area, and also gives smokers something to look at.) When an ice-cream maker chooses exactly which 52 flavors they will have on sale in their store, they are also creating focal points, in a continuum of possible flavors which has a much more complex metaphorical topology; similarly, the choice of the symbols of our alphabet, or any other writing system, involves a choice of focal points out of the virtually infinite variation of possible two-dimensional graphic symbols. In a simple linear topology, the set of standard pitches used in Western music is created out of the one-dimensional domain of audible frequency: the first focal point is laid down, by conventional agreement, at 440 Hz (which we label as A above middle C), and the conventions of equal temperament fix the focal points of all the other standard pitches relative to this fundamental focal point.<sup>31</sup>

A collective domain for which it is difficult to imagine a continuous topology (and which therefore cannot be partitioned easily by boundary) may be partitioned by grouping all the entities in the domain around focal points or prototypes. Thus supermarkets put apples, pears, lemons, and bananas with other apples, pears, lemons, and bananas, and may well then put the lemons near the limes, oranges, and grapefruits. Meanwhile, birdwatchers anxious to identify the bird they just saw can check in a book to see which known species it seems most like.

Contrast set members created by focal point tend to be relatively flexible. That means that we do not have to have an instantiation that is *exactly* right, *exactly* on prototype, in order to be able to consider it a good representative of the contrast set member. We do, however, have to get *near enough*, and how near is a matter of judgement. 439 Hz is near enough to 440 to count as a decent example of A above middle C, but since the next standard focal point below 440 is 415 Hz, 425 Hz would be an unacceptably ambiguous A. The smokers in the Japanese photograph did not feel that they had to press right up against the bullseye center of the smoking area, but none of them chose to stand far away over by the

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<sup>31</sup> For a short but fine analytical discussion of tuning and temperament see Crump, *The anthropology of numbers*, p. 105-107.

platform edge. You can hear your favorite station even if your radio is not tuned to the very center of its transmission frequency. A capital *A* can still be a capital *A* even if the vertical strokes do not quite meet at the top. If a recipe calls for one cup of flour, it is not necessary to level the flour precisely in order to bake a successful cake, but using half a cup would not do. And there are many types of chocolate ice cream. I will use the term *tolerance* to refer to this (variable) degree of flexibility around a prototype.<sup>32</sup> Within this tolerance, we conventionally consider specific instantiations of a domain equivalent, substitutable, or within a threshold degree of similarity to each other. Those designers who oversee the display of contrast sets, such as signage or type designers, must have a feel for the tolerance of any focal points involved.<sup>33</sup>

In contrast, contrast sets which are defined by boundaries can be made to behave in an intolerant, on-and-off, disjunct and mutually exclusive fashion where it is always very clear whether a given instantiation of the domain is an example of a particular member of a contrast set. In these cases, one speaks less often of "good" or "bad" examples. Thus we can say exactly where Czechia begins and Slovakia ends. (In fact, though, even the members of contrast sets defined by boundary may contain focal points, or things like them; thus the capital cities of Czechia and Slovakia respectively are focal points of a sort.)

We can borrow the prefix *allo-* from linguistics (which uses terms such as *allophone* and *allomorph* to describe different versions of the same phoneme or morpheme) and use the term *allovariants* to refer to instantiations whose differences we overlook because we have lumped them under the same contrast set member.<sup>34</sup>

A special way of using boundaries to create a contrast set in a domain is the creation of a *scale unit*,<sup>35</sup> such as "one degree Celsius" in the domain of temperature or "one mile per

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<sup>32</sup>The term "tolerance" is widely used in this sense in engineering. One linguist has suggested the terms "pragmatic slack" and "pragmatic halo" for a version of this concept in a slightly different context; see Peter Lasersohn, "Pragmatic halos," *Language* 75 (1999): 522-551.

<sup>33</sup>For an example of design advice intended specifically to sensitize readers to prototype tolerance, see Otl Aicher and Martin Krampen, *Zeichensysteme der visuellen Kommunikation: Handbuch für Designer, Architekten, Planer, Organisatoren* (Stuttgart: Alexander Koch, 1977), pp. 9-10.

<sup>34</sup>On allovariation see Zerubavel, *The fine line*, p. 16.

<sup>35</sup>There is a vast literature on scaling and measurement and on the history of individual scales. A basic introductory text is Warren S. Torgerson, *Theory and methods of scaling* (New York: John Wiley &

hour" in the domain of speed. While this may seem, at first glance, to have only a little in common with other methods of set creation, there are extensive formal similarities between the creation of scale units and other types of partitioning, involving issues of labeling, naturalness, iconicity, and precision. Scale units are consciously designed, and they fulfill the *X and other Ys* test, so that we can speak of "plus six and other degrees of temperature in the Celsius scale" or "one hundred baht and other amounts of money in the Thai monetary system." One can create scale units only in linear domains. To create a scale unit, one settles conventionally on a specific range of that domain which constitutes the base unit of the scale — for example, how much "one degree Celsius" will actually be. However, scale units are, as partitions of domains go, particularly artificial, and interpreting scales as contrast sets does occasionally feel somewhat forced (see further section 2.6).

No review of boundary and focal-point partitioning would be complete without mentioning that there is a long debate in linguistics and cognitive science about whether human minds represent the meaning of concepts in a bounded and essentialist, or focal and prototypical fashion — or both.<sup>36</sup> Regardless of the true nature of human conceptual storage, at a practical level we can create categories using either approach — and we do.<sup>37</sup> There are, however, specific tradeoffs involved in the choice between boundary and focal-point approaches.

There are times when we need clear boundaries between contrast set members. For instance, the rules of student grading pretty much force teachers to assign student work to one category or another. Computers, in particular, tend to cope better with disjunct category

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Sons, 1958), chapter 2 ("The Nature of Measurement", pp. 13-40). Sociological approaches to measurement include Otis Dudley Duncan, *Notes on social measurement: historical and critical* (New York: Russell Sage Foundation, 1984) and Witold Kula, *Measures and men* (Princeton: Princeton University Press, 1986 [1970]); on the idea of the scale unit specifically also see Crump, *The anthropology of numbers*, pp. 76-78. For a review of theories of measurement, see José A. Díez, "A hundred years of numbers. An historical introduction to measurement theory," *Studies in History and Philosophy of Science* 28 (1997): 167-181, 237-265.

<sup>36</sup> Eric Margolis and Stephen Laurence, ed., *Concepts: core readings* (Cambridge: MIT Press, 1999), is a collection of key articles, with a good introductory chapter, that makes an excellent introduction to this debate. Another good summary is Taylor, *Linguistic categorization*, chapters 2-3 (pp. 21-58).

<sup>37</sup> Paul Starr also makes this point in "Social categories and claims in the liberal state," *Social research* 59 (1992): 263-295, p. 280.

systems where there is no ambiguity at all, and interacting with computer programs often requires precise clarity: after all, get one letter wrong in an Internet address or filename and you might as well have typed something entirely different. And most geographical taxonomies demand hard boundaries, so that it is clear where, say, Thailand ends and Cambodia begins. This style of categorization is sometimes called the classical or Aristotelian approach. A hard-boundary approach to creating contrast sets is useful in any context which requires an unambiguous answer to the question of what contrast set a particular instantiation belongs to.<sup>38</sup>

Unfortunately the laying down of strict boundaries results over and over in what we could call the *categorical paradox*, where two instantiations on either "side" of a boundary are closer to each other than two instantiations at opposite "ends" of a single member of the contrast set.<sup>39</sup> Thus when converting the four-point grading system common in American universities into letter grades — as professors commonly do when averaging grades at the end of the semester — a 3.17 and a 3.49 might earn you a B whereas a 3.51 would get you a B+, despite being only one-sixteenth as different from 3.49 as 3.17 is. A Polish writer speaks of how, in the divided political atmosphere of 1954, Warsaw felt closer to Beijing than to Vienna or to West Berlin.<sup>40</sup> In a case like the Auschwitz "selection," where concentration camp arrivals were partitioned between forced labor and the gas chambers, the categorical paradox involved was not simply a matter of Bs and B-pluses but of life and death.

The advantage of focal-point approaches is that the transition between contrast set members may be left fuzzy, so that there is no absolute point at which an instantiation stops belonging with that contrast set member and starts belonging with another. Transitional instantiations which are ambiguous between two contrast set members may possibly be considered to belong to both. Although such an approach can be maddeningly irresolute, it can also have great practical and moral advantages if a designer sees reason to avoid allowing

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<sup>38</sup> Again, Paul Starr makes this same point in "Social categories and claims in the liberal state," p. 280.

<sup>39</sup> On the categorical paradox see Zerubavel, *The fine line*, pp. 24-32.

<sup>40</sup> Jan Kott, *Still alive: an autobiographical essay* (New Haven: Yale University Press, 1994), p. 213.

the composition of a contrast set to conclusively dictate the way an instantiation should be treated, preferring to explicitly assign final judgement on such matters to the contrast set's users.

The tradeoff between the two partitioning styles is that the classical approach is usually more practical, but the focal point approach is usually more honest. A contrast set designer needs to keep in mind that if contrast sets are created around focal points, serious questions of how to deal with ambiguity may arise. But when contrast sets are created by boundary, challenges to the fairness and appropriateness of the system will always arise in cases where a categorical paradox has been created.<sup>41</sup>



Image 2.4 (076)

In either case, one needs to be prepared to take the consequences. Many legal and political conflicts in society are fights about the design and interpretation of contrast sets: arguments about what member of a set a particular instantiation belongs or belonged to ("I was in the intersection *before* the light turned red, Officer"); struggles

between a "hard" and "fuzzy" interpretation of a boundary ("Hungarians in Slovakia are Slovak citizens, but shouldn't they have the right to primary education in their own language?"); uncertainty over the degree of tolerance around a prototype (do you have to stop at the blue stop sign in Image 2.4?); disagreement about the assumption of disjunctness between the contrast sets in a domain ("But I am Asian *and* Hispanic! Should I mark both, or 'Other'?"); or complaints that a contrast set does not exhaustively partition a domain ("My category isn't listed and there's no 'Other' for me to mark"). Particular social groups may have an interest in particular ways of partitioning a domain. The choices one faces in creating a contrast set have real political consequences. A careful contrast set designer thinks through what those consequences will be.

<sup>41</sup> A recent newspaper article tells the story of a group of artists who have set themselves the task of challenging international boundaries and other conventional contrast sets: Elizabeth Bard, "How to cross borders: social or otherwise," *New York Times*, 27 October 2004.

## Transformations

Characterizing any given contrast set or domain with the terminology and analysis I give requires answering several different questions. Is it a contrast set or a domain? A continuous or collective domain? Does it involve categorization by boundary or by focal point? Is its topology linear, planar, or something else? There often appears to be more than one right answer to such questions, for the reason that it is very easy to transform contrast sets and domains from one type to another. These transformations do not generally change the entities or instantiations themselves, but rather the way we think of them, the context we view them in, or the role or function they play. For example, the members of a contrast set may have boundaries and focal points at the same time.

The same collection of entities can constitute both a contrast set and a collective domain, depending on whether it is looked at as material that is *already* organized into a set of entities, or that *can* be partitioned further. For example, the letters of the English alphabet are a contrast set formed out of the domain of potential letterform, whose instantiations are individual shapes. But they can also be seen as a set of twenty-six entities ripe for further partitioning, in which case they take on the role of a collective domain, which might be grouped (for example) into a contrast set consisting of two members, "vowels" and "consonants."

This means that creation of any contrast set by any means creates a new collection of entities which may take on the role of a collective domain. In this process, the members of a contrast set are no longer the products of partition, but are reanalyzed as primitives in a domain consisting of the collection of the members of the set (no longer paying attention to the fact that those members were created by partitioning a more fundamental domain). This new collection of entities can itself, if we wish, be grouped into contrast sets. Thus the seven days of the week can be thought of as a contrast set formed out of the continuous domain of time, whose instantiations are individual moments, but they can also be seen as a set of seven entities (Monday and the other days of the week), in the process disregarding the fact that

Monday is made up of an infinite number of individual moments in time. This collective domain of seven entities could then be partitioned (for example) into a contrast set consisting of two members, "weekdays" and "weekend days," in which case the entities being grouped would be days (like Monday or Saturday), not individual moments in time. (Equally well and simultaneously, though, one could consider "weekday time" and "weekend time" as direct partitions of the domain of time, whose instantiations *are* individual moments.)

Conversely, one can say that the instantiations of any collective domain form a contrast set. Thus while our first instinct might be to consider a flock of geese or the collection of people living on Barbados as a collective domain, we can also see it as a contrast set by emphasizing the individuality of each of its members.

An entity may be an instantiation of several different domains at the same time, or a member of several different contrast sets at the same time, especially within a taxonomy. Thus Monday is one of the days of the week at the same time as it is one of the weekdays, A is a vowel at the same time as it is a letter of the alphabet, C is a white key at the same time as it is one of the keys in the piano octave, and the city of New Brunswick is in Middlesex County, New Jersey, U.S.A.

The definition of a scale unit tends to induce focal points along that scale, even though scale units are precisely bounded regions. For example, standards of measurement or value often give rise to focal points in a linear continuum. The creators of the euro (the European currency) chose to have coins and bills of denominations 1, 2, 5, 10, 20, 50 cents, 1, 2, 5, 10, 20, 50, 100, 200, and 500 euros. These focal points are a joint product of the size of the scale unit and the convention of base-10 numbering, and it is these amounts — not, for example, 25 cents or 47 euros — that have now become standard reference points in peoples' minds all over Europe. In the American scale of liquid measurement, one often sees measuring devices and recipe instructions phrased in whole multiples, or quarters or halves, of standard units such as teaspoons, tablespoons, ounces, and cups, while we rarely see references to, say,  $1/6$  of a cup, let alone  $13/79$  of a cup. (For more similar examples, see section 2.8.)

We often change our view of a collective domain after coming up with a standard way to order or present the entities in the collection (a process discussed in full in section 4.5). The positioning of the elements of our writing system in a linear or two-dimensional topology (by means of alphabetical order and keyboard layout respectively) are the most familiar examples. These representations create a new domain for a set of entities that may, as in the case of letterform, have been created out of a domain with an entirely different topology. Within the new domain, one can discuss spatial relations quasi-continuous terms, recognizing the existence of contiguous units like "ABCDEF" or "QWERTYUIOP" and being able to say that "A is next to B" or that one goes "over W in proceeding from Q to E."

The grouping of a collection of entities, though it is often thought of as a physical sorting process, often depends instead on the creation of abstract boundaries or focal points in the domain of an attribute in whose terms each entity is measured, so that the partition of a collective domain actually proceeds via the partition of a "proxy" continuous domain. Consider the size and quality grading of eggs, or apples, or other kinds of food. We visualize this as physically moving eggs into bins labeled with the names of the members of a contrast set like "Medium," "Large," "Extra Large," and "Jumbo." However, we cannot do this without defining certain measurable attributes of an egg as relevant, and choosing precise points within this new (and continuous) domain of measurement to break the categories at; what we have really done is to partition the domain of "egg size" with boundaries which unambiguously define what a "Jumbo" egg is. Another example, in which our assumptions typically work in reverse, is that while we normally think of the classification of telephone code areas as a partitioning of two-dimensional space by boundary (as the map in the front of the telephone book suggests), if we step in closer we see that in practice the crucial act of classifying is the assignment of each individual customer telephone line to a particular area code (a process of grouping a collection of entities). The same is true for the division of North American commercial radio station call names into three zones beginning with W, K, and C; the act of individual assignment coexists with a sense of the location of the boundaries of the zone.

These two examples are meant to draw attention to the way that we often switch back and forth between a discontinuous view of the individuality of the entities which form a collection, and a continuous view of a domain in which those entities can be measured. If each entity has a measurable attribute in domain  $X$  (say, eggs in the domain of egg size or radio stations in the domain of North America), the "granularity" of each entity can be made to recede from our view. The salience of the entities as a collection of individuals starts to give way to an image of the domain  $X$ , in which boundaries or focal points create a partition. (It may be that when the number of entities in a collection is large, one is more likely to focus on continuous attribute domains rather than on the entities as individuals.)

This relationship between a collective domain of entities, and the continuous domain of values of an attribute of those entities, is a special case of the phenomenon of linked domains, which are discussed in detail in section 2.9. When two domains are linked, a partition in one domain induces a partition in another domain (which may be of another type). For example, the collection of people who live in Europe is a collective domain, while the landmass of Europe is a two-dimensional continuous domain, but since every member of the first domain (more or less) lives at one point in the second domain, the domains are linked. A partition in either domain induces a de facto partition in the other; if we divide Europe into two parts, one north of the fifty-fifth parallel and one south, we induce a partition in the set of European residents as well.

## 2.5 Discerned or constructed?

Are contrast sets created by human beings, or delivered to us by the natural world? The debate is very old and much ink has been spilled over it. The issue is usually phrased as a puzzle — whether the "categories" of the world exist "out there" in the domain, or only once we "see" and create them. The implication is that only one of these answers could be true.

There are dozens of scholars lined up on both sides of the debate — or at least, scholars tend to emphasize one side or another at a time. For example, on the "constructed" side of the argument, Benedict Anderson has convinced many scholars to believe that all

"communities" are "imagined," Eviatar Zerubavel titles a section "The Social Construction of Discontinuity," and Claude Lévi-Strauss tells us that humans have an inner drive to classify the world, a "demand for order" which gives classifying "a value of its own" — but that the contrast sets we make in response to these drives are conventions that could have been chosen differently.<sup>42</sup> On the "discerned" side of the debate, Karl Deutsch emphasizes the natural and circumstantial constraints on the formation of human communities, Brent Berlin observes that in the area of plant and animal taxonomy, humans "do not construct order, they discern it," and Paul Kay and Willard Kempton caution against falling for the idea that human systems of partitioning a domain "vary without constraint."<sup>43</sup>

In keeping with the practical and functional approach of this book, the point of view taken here is that within the context of set design, the puzzle metaphor for this question is inappropriate, neither the "constructed" nor "discerned" views is universally correct, and trying to "resolve" the debate between them is pointless. The degree of "constructedness" versus "discernedness" varies from contrast set to contrast set. There are, simply put, some domains in which we discern sets and others in which we create them. Many domains arrive only partly determined, with a certain amount of *wiggle room* — incompleteness which leaves the final partitioning up to the designer.<sup>44</sup>

Some contrast sets are *relatively* more universal and objective and "discerned," such as the difference between humans and orangutans or men and women, or the different floors of a skyscraper. Others are *relatively* more individual and subjective and "constructed," such as the distinction within the domain of the books I own between the books I like, the books I don't mind, and the books I want to get rid of.

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<sup>42</sup> Benedict Anderson, *Imagined communities: reflections on the origin and spread of nationalism* (Rev. ed., London: Verso, 1991); Zerubavel, *The fine line*, pp. 74-75; Claude Lévi-Strauss, *The savage mind* (Chicago: University of Chicago Press, 1966), pp. 9-10.

<sup>43</sup> Karl Deutsch, *Nationalism and social communication* (2d ed., Cambridge: MIT Press, 1966), pp. 78-79; Brent Berlin, *Ethnobiological classification* (Princeton: Princeton University Press, 1992), p. 8; Paul Kay and Willett Kempton, "What is the Sapir-Whorf hypothesis?" *American Anthropologist* 86 (1984): 65-79, p. 66.

<sup>44</sup> This "both-and" position is defended at length, in a related arena, by Rebecca Bryant, *Discovery and decision: exploring the metaphysics and epistemology of scientific classification* (London: Associated University Presses, 2000), who argues that "classification involves ... both discovery *and* decision making" (p. 116).

And most contrast sets are to some degree *social* and *intersubjective* — that is, shaped by a community rather than by nature or an individual. For example, the boundaries between neighboring counties in a featureless landscape in America's Midwest did not exist before the surveyors and settlers arrived in the 1800s, and we would forget them quickly without the county offices, mapmakers, and "Welcome To" signs which perpetuate these partitions. Even those contrast sets which appear very universal can be spotlighted or highlighted differently by different communities, so that the difference between men and women or humans and orangutans may matter more or less in different times and places. Even those contrast sets which appear very individual may be influenced by socially conventional tastes, so that you can predict to some extent what books I like by knowing what community I belong to.

Although Midwestern American county boundaries were deliberately and consciously laid out, other partitioning systems constructed by particular social groups arise without any deliberate design of the set as a whole. For example, although the sets of local supermarket chains, commercial automobile manufacturers, national flags and fonts on my computer form contrast sets, they were not deliberately constructed as a complete ensemble. The term *emergent* describes such contrast sets. They were created by human beings, but through the aggregation of many individual decisions, not a conscious strategy of set design. The different types of sandwiches that Frake discussed are another example of an emergent contrast set. Like many lexical distinctions, this contrast set is largely conventional and social, but it was created and maintained by the collective, tacit action of millions of people — not by a sandwich definition reformer, a government sandwich standardization committee, or a company that gained a monopoly on world sandwich production and forced us all to think in terms of its focal sandwich types. (On emergent standards, see section 5.1.)

There are no universal answers to the questions of whether a given contrast set was "constructed" or "discerned." The degree of influence that we have over the process of contrast set construction varies from contrast set to contrast set, and also depends on the

breadth of our conception of who "we" are. We have to answer these questions on a case-by-case basis taking into account the individual circumstances of each contrast set.

Because this is a book about set *design*, and design is an activity where human beings consciously shape something beyond themselves, I do not spend very much time discussing the origin of those sets in which one cannot trace much deliberate human authorship or constructedness. For example, the set of focal points in the domain of color is certainly not very plannable or designable, and is apparently to a large extent naturally determined by the physiology of the human eye,<sup>45</sup> and the cultural variation in color terms is more of an emergent phenomenon than a consciously planned one. The set of basic color categories is a good and interesting example of a contrast set, but a practical design problem it is not (although there are other color-related sets that are plannable, such as those chosen by crayon manufacturers). Emergent and naturally determined sets may be theoretically interesting, but the only practically designable aspect of them is (sometimes) the way they are labeled. There is little point in discussing how to design things that we have no control over whatsoever.

But there are many, many other contrast sets whose human authorship is unambiguous (even if the degree of that authorship is less than full), whose form can be modified (or could have been), and whose creators are identifiable. There are also plenty of contrast sets which have not yet been created but will be. It is the process of constructing these contrast sets that this book aims to discuss in a scholarly and practically useful way.

In doing so, this book focuses on what happens to domains once they "arrive" into the workshop from the natural or external world, and come into the hands of a cognitive designer who will partition, shape, and order them. If contrast sets were always "discerned," the cognitive designer would not have any choices about what to do with a domain once it

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<sup>45</sup> Universal color clustering tendencies were posited by Brent Berlin and Paul Kay, *Basic color terms* (Berkeley: University of California Press, 1969) and demonstrated in Paul Kay and Terry Regier, "Resolving the question of color naming universals," *Proceedings of the National Academy of Sciences* 100 (2003): 9085-9089. The argument that these clusters correspond to physiological constraints is set forth classically in Paul Kay and Chad K. McDaniel, "The linguistic significance of the meanings of basic color terms," *Language* 54 (1978): 610-646, also reprinted in Alex Byrne and David R. Hilbert, ed., *Readings on color* (Cambridge: MIT Press, 1997), 2: 399-441. This hypothesis is still somewhat controversial, but it seems that the controversy has to do with the degree of determination involved.

arrived in this metaphorical workshop but would simply follow the nature of the material. In fact, though, the workshop is the scene of constant choice about how to act within the wiggle room that the nature of a domain allows, and it is that process which I focus on.

That does not mean I am not interested in the nature of the raw material. Indeed, in defining terms like *boundary*, *focal point*, *scale unit*, and *superordinate*, I put forth hypotheses of a sort. These are analytic hypotheses — claims to have perceived fundamental building blocks of the contrast sets that we use in society, building blocks which can be used to understand the process of set formation in any given domain. By trying to identify the building blocks of contrast sets, my goal is not so much to put forth a theory of what a contrast set "really" is. I do not view contrast sets like some syntacticians think of sentences, whose "true reality" is the diagram we draw to analyze them, or like physicists think of chemicals or materials, whose "true reality" is their molecular or atomic structure. A domain is a sort of raw material, an unplowed field, or an opportunity, and these building blocks are a sort of tool kit by which people and societies make use of this material. This book investigates less the unchanging nature of reality, than how we choose to change and shape it.

## 2.6 Features and featurelessness

At the moment when a domain arrives into the workshop from the natural or external world, and comes into the hands of those who will work with it further, it has a certain degree of internal diversity and natural partitioning. Some domains arrive with sets, or at least distinctions, already built into them. Others come to us without any differentiation whatsoever.

The differentiation that exists may be stark and obvious, or it may require some work to discern. Imagine being handed three sheets of paper. One is entirely blank. Another is covered with vaguely perceptible but not immediately identifiable figures. A third is ruled into numbered squares. The contrast between these three images is the same as the contrast between a domain which arrives on our doorstep completely featureless, with considerable

(but as yet undiscerned) internal differentiation, or with a plainly obvious preexisting set of partitions (labeled to boot).

The color spectrum as it appears to someone with normal vision, or a completed multi-story building as an interior designer first perceives it, are domains which arrive with robust internal differentiation. So are the letters of the alphabet as they present themselves to a child learner, as well as the streets and houses in an urban landscape, which are clearly distinct entities and different from one another. The domains of height, temperature measurement, or wind speed have considerably fewer features (though they still have some). The radio spectrum, before stations began to broadcast in it, was homogenous and featureless, as is the sort of landscape that one sees at sea or in the polar regions.<sup>46</sup> In such domains, one point looks exactly like another, and it is only with the help of scales and measuring devices (latitude and longitude and a GPS receiver, for example) that we can introduce some sort of differentiation into what we see. In these domains the creation of contrast sets is a particularly artificial and conventional act.

Domains with a low degree of internal differentiation can be called "featureless" domains. The words "feature," "featureless," and "featurelessness," with their geographical flavor, are quite appropriate tags for the idea of an undifferentiated domain. Domains are spaces, or at least metaphorical spaces, so we can liken an unpartitioned but internally diverse domain to an unknown but internally diverse landscape. Just as explorers may perceive and name the salient features in a landscape, set designers may discern the preexisting groups, focal points, and boundaries — the metaphorical peaks and valleys — in a domain. Once discerned, these features can be labeled. Indeed, sometimes we know what has been discerned only by checking to see what has been named.

Very often, speaking of "the degree of internal differentiation of a domain" simply means saying how easily human perceptual abilities can sense the variation in the domain. In some domains it is easier to sense differences than in others. (Ability in a particular domain

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<sup>46</sup> For another example, see the Ziggy cartoon reproduced on p. 223 of Marvin Levine, "You-are-here maps: psychological considerations," *Environment and Behavior* 14 (1982): 221-237.

also varies from person to person, depending both on natural ability and on training. Some people, for example, can remember and reproduce particular musical pitches, but most can say little more about two randomly presented pitches than that one is "higher" than the other. Most people in industrial western countries learn to tell the difference between the letters of the alphabet, but not all. Without training, our ability to partition a domain is often limited to the ability to perceive a polarity and to perceive relative position along that polarity.)

Some scales are so poorly differentiated that even with training, humans make very little progress beyond the ability to order instantiations in terms of "more" or "less." (Compare how while driving across a featureless, unfamiliar, or darkened landscape on a monotonous expressway, one cannot always say where one is, but one does know one is proceeding in the direction of one's destination.) A fine example of this is the domain of the speed of moving objects. While we humans can look at two moving objects and say that one is going faster than the next, we are terrible at saying (for example) that one is going X kilometers per hour and the other Y. This seems so obvious that we do not find it remarkable. But think again: why should it be the case that we can quite confidently look at two pieces of colored paper and say that one is red and the other is green, but we are virtually helpless in the domain of speed? Why is it that if we were called into court to testify about a hit-and-run accident, we could say fairly precisely what color the car was but only very vaguely what speed it was going at? Why is it that while (for example) we can learn to distinguish unfamiliar birds, tastes, or alphabets, and sometimes even pitches, we cannot learn to distinguish different speeds?

The reason is that there are no natural peaks and valleys in the domain of speed which register in our minds. It is, for human beings at least, an especially featureless domain. There are no natural borders or focal points. Unlike with color, the structure of our perceptual apparatus give no focal points in that domain to hang any natural sense of contrast onto. And experience does not differentiate the domain any further. We need instruments, such as speedometers and radar guns, to measure speed and to "see" or

"elaborate" the differences between different speeds. Tellingly, the contrast set that we divide the universe of speed into is entirely an artificial one, based on multiples of conventional units, like kilometers per hour or meters per second.

Another interesting example is the domain of wind speed, which has a little bit more natural diversity. We can use the degree of discomfort or property damage different wind speeds cause to lend the different parts of the domain character, contrast, and identity. Indeed, prose descriptions of the perceptual effects of wind speed are the basis of the categories in the Beaufort scale of wind measurement.<sup>47</sup> With some practice, one can begin to be able to "place" one's perceptual experience of the wind at a particular point in the scale of wind speed even without a wind meter — though perhaps not with the precision that we use in, say, telling the letter *i* from the letter *j*. Thus, weather station manager Grímur Gíslason from Blönduós in northern Iceland, finally retiring at the age of 92, is quoted as saying: "I always say I've never used a wind meter. I just use my nose. One develops a feeling for this. For example, it was never Force 8 in October, except once, late in the month."<sup>48</sup> However, his pride and the journalist's attention show how uncommon the ability is. The domain of temperature also has natural, perceptible focal points such as the freezing point of water or the point at which we can be comfortable in only a T-shirt. But we still cannot "see" the members of a more precise contrast set such as the Fahrenheit scale without a thermometer. One cannot tell, and probably cannot learn to tell, *exactly* what temperature it is on the Fahrenheit scale to the nearest degree.

Many scholars have hoped to be able to measure the degree of internal differentiation in a given domain. One possible focus of measurement would be to characterize the overall homogeneity of an entire domain, just as one can say that a landscape is relatively monotonous or not, or that the domain of the speed of moving objects is featureless, but that

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<sup>47</sup> For a popular treatment of the Beaufort scale see Scott Huler, *Defining the wind: the Beaufort scales, and how a nineteenth-century admiral turned science into poetry* (New York: Crown, 2004).

<sup>48</sup> "Ég segi alltaf að ég hafi aldrei haft vindmæli. Ég hef sagst taka vindinn á nefinu á mér. Maður hefur tilfinningu fyrir þessu. Það var til dæmis aldrei hvasst í október, nema einu sinni, seint í mánuðinum." — From "Tek vindinn á nefinu á mér," *Fréttablaðið* (Reykjavík), 2 November 2003, p. 4. My translation.

of temperature or wind speed slightly less so. Another desirable mathematical measure would rate the similarity between any two different instantiations of a domain, by saying that, for example, the Portuguese are linguistically more similar to the Spanish than either are to the Moroccans. A third goal would be to be able to mathematically define which instantiations of a domain are most salient and stand out most as potential focal points or cut points in a domain, so that a classically proportioned red bell pepper rates higher than a "misshapen" one. Such measurements would have practical value for contrast set designers, because they would suggest how to group instantiations, draw boundaries, and put breaks in domains.

All of these measurement challenges have proven unexpectedly difficult. The degree of differentiation in a domain is still most often subjectively judged, and finding the partitions and breaking points in a domain usually remains more designer's art than science. There are, however, some basic mathematical strategies that one can follow.<sup>49</sup>

The simplest is to measure all the instantiations of a domain in terms of one or more continuous measures, graph all the resulting points, and use the graph as a visual guide to grouping the instantiations according to the way the dots cluster. It is difficult to make such judgements visually in three dimensions and almost impossible in four or more, but the process of multidimensional scaling can help reduce multiple qualities to a two-dimensional scale or at least a scale with fewer dimensions than the original.<sup>50</sup>

Measuring the degree of distinctiveness of two instantiations is particularly challenging when the domain they belong to does not have an obvious underlying scale. We all know that E and F are more similar than E and O, but how can we capture that difference in some mathematical or systematic way? A feature or componential analysis of each instantiation creates a scale by summing a series of (usually) binary oppositions, which rate each instantiation in terms of the presence or absence of a certain feature. Thus, linguists

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<sup>49</sup> A good but now out-of-date review article is Robert R. Sokal, "Classification: purposes, principles, progress, prospects," *Science* 185 (1974): 1115-1123.

<sup>50</sup> On multidimensional scaling see Zerubavel, *The fine line*, p. 129n91; also Torgerson, *Theory and methods of scaling*, pp. 37-40.

generally group speech sounds in terms of "distinctive features," while historical linguists have sometimes used a controversial procedure called lexicostatistics to measure the relatedness of languages. This technique samples a standard set of 200 meanings from each language, sees which are cognates and which are not, and from these results works out a crude mathematical measure of similarity.<sup>51</sup>

Another method, which avoids the creation of scales, is to ask a large number of people to subjectively rate the similarity of particular pairs or the fitness of any particular instantiation as a representative of a superordinate category, as Brent Berlin and Paul Kay did with color<sup>52</sup> and Eleanor Rosch did with different types of furniture.<sup>53</sup> One can also measure how often two entities get confused with each other. Roger Shepard developed mathematical techniques to derive spatial representations from such similarity judgements and confusion frequencies, a method somewhat akin to multidimensional scaling in its ability to make data easier to visualize.<sup>54</sup>

A dialectologist's isogloss map may help us to "see" the boundaries between two languages in space — say, Polish and Ukrainian<sup>55</sup> — by visually representing the "border" as a thick bundle of lines on the map, just as more closely grouped lines on a contour map show where elevations rapidly change between regions of flatness and homogeneity. An isogloss map by itself does not establish a mathematical scale on which we can measure "how Polish" or "how Ukrainian" any particular person's speech is, though we could artificially construct

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<sup>51</sup> For an overview and bibliography on lexicostatistics, see Paul Black and Joseph Kruskal, "Comparative lexicostatistics: a brief history and bibliography of key works," [www.ntu.edu.au/education/langs/ielex/bibliog.html](http://www.ntu.edu.au/education/langs/ielex/bibliog.html) (October 2003); for a sharp and concise critique of the method see Lyle Campbell, *Historical linguistics: an introduction* (Edinburgh: Edinburgh University Press, 1998), pp. 177-186.

<sup>52</sup> Brent Berlin and Paul Kay, *Basic color terms: their universality and evolution* (Berkeley: University of California Press, 1969).

<sup>53</sup> See Taylor, *Linguistic categorization*, pp. 43-44.

<sup>54</sup> For a nontechnical discussion see Roger N. Shepard, "A funny thing happened on the way to the formulation: how I came to frame mental laws in abstract spaces," in *Psychologists defying the crowd: stories of those who battled the establishment and won*, edited by Robert J. Sternberg, pp. 215-237 (Washington: American Psychological Association, 2003), p. 226.

<sup>55</sup> A classic discussion of dialect geography is Bloomfield, *Language*, chapter 19 (pp. 321-345); sample isogloss maps are illustrated on pp. 316 and 326.

such a scale out of the dialect features that the isoglosses track, and even try to use it to set precise grouping boundaries.

The nature of the spatial metaphor in which one grounds one's definition of similarity is an important consideration when evaluating measurement techniques. Tree metaphors of domains, for example, cannot easily be mapped into two dimensions, suggest a somewhat different metaphorical vocabulary of distance and closeness, and demand special techniques for the measuring of similarity.<sup>56</sup>

All these methods are time-consuming and mathematically complex. Most contrast set design proceeds without using them. Many fine scholars have neither the patience nor the aptitude to apply them. Thus sociolinguist Heinz Kloss, after introducing the concept of the natural distance between two standard languages, confessed that he had no answers to the question of how to measure it.<sup>57</sup> Brent Berlin created an interesting diagrammatical technique to convey a rough sense of the degree of distinctiveness of biological taxa, but complains that "no quantitative scale has been developed in terms of which perceptual distance can be given a numeric value."<sup>58</sup>

One case where mathematical techniques of judging and ensuring similarity have been used to help create the members of a consciously designed contrast set is in drug naming, where confusion between one entity and another can have serious consequences.<sup>59</sup> However, in many other domains, the complexity of measurement is so great that designers prefer to use their own eye, experience, and intuitive feel to partition a domain. Although this might seem like a less "objective" way to proceed, in fact the mathematical measurement of similarity within a domain is not entirely objective either since it depends on which qualities we select to measure. If a designer's intuitive sense of the optimum partition of a domain is able to take multiple factors and qualities into account at the same time, it may actually be

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<sup>56</sup> On measuring distance in tree structures see James E. Corter, *Tree models of similarity and association* (Thousand Oaks, California: Sage Publications, 1996).

<sup>57</sup> Heinz Kloss, *Die Entwicklung neuer germanischer Kultursprachen seit 1800* (2nd ed., Düsseldorf: Pädagogischer Verlag Schwann, 1978), p. 63 ff. ("Wie mißt man den Abstand?").

<sup>58</sup> Berlin, *Ethnobiological classification*, pp. 36-51, esp. p. 49.

<sup>59</sup> Bruce L. Lambert, "Computer assisted decision analysis in drug naming," [http://www.hc-sc.gc.ca/hpfb-dgpsa/bgtd-dpbtg/b\\_lambert\\_e.html](http://www.hc-sc.gc.ca/hpfb-dgpsa/bgtd-dpbtg/b_lambert_e.html) (March 2004).

more useful than any mathematical strategy. The next section explores some of the decisions the designer must make during the process of partition.

## 2.7 Acts of partition

The central act of creating a contrast set is the designer's decision to partition a domain in a particular way. This section focuses on four different aspects of the partitioning process: taking account of natural differentiation in the domain, choosing between boundary and focal point approaches to partition, deciding where to place those boundaries or focal points, and choosing the "perceptual focus" of a partition.

In domains which arrive with a high degree of internal diversity and variation, but without absolutely specified breaking points, the designer's task is often to decide which preexisting partitions to focus on (rather than to create them from scratch). In such cases, there is still quite a bit of room for arbitrary, conventional choice, because there are many different ways of focusing on what divisions are most salient in a given landscape. Like cookbook recipes, preexisting partitions are not always strict and precise, but can also be loose guidelines of which you need to follow only the broad outlines. Thus, for example, the creation of telephone code areas generally attempts to keep single cities, towns, and other aggregations of people together in a single code area, but this is not an absolute requirement.

In relatively featureless and homogenous domains, the designer's task is more often to create partitions from scratch which may have no basis in the domain. These partitions may be arbitrary and conventional. Thus, for example, the eighteenth- and nineteenth-century division of the American frontier into a grid system, taking little account of the landscape or any other preexisting features, is an example of partitioning without regard to the "pre-arrival" differentiation of the domain. World time zones are clearly inspired by the 24-hour timekeeping system, and the twelve-month system by the cycles of the moon, but both of these classifications by boundary also have a strongly conventional aspect. So do other many geographical classifications such as the boundaries between voting districts, between lots in a new development, or between many of the countries in Africa.

In continuous domains, the designer must choose between boundary and focal-point methods of partitioning. For example, imagine that you have to divide a cafe (or any other spatial domain) into smoking and non-smoking areas. You can define the areas by boundary (with a real or imaginary line on the floor) or by focal point (as in the Japanese train station photo); you can also use a third strategy, grouping entities in a linked collective domain (by designating certain tables or rooms in a restaurant as smoking or non). Similarly, color is a domain where we can, if we choose, classify by boundary (metaphorically taking a knife to the color solid or the planar topology of a Munsell chart), by focal point (by defining a best exemplar of each color), or by grouping a linked collection of entities (say, the different colors that the crayon box presents us with or that the houses in our town are painted).

The advantages and disadvantages of boundary and focal-point partitioning are discussed in section 2.4. Consider, as a real-life example, the structure of the contrast sets that we use to communicate location within a city. Japan uses a very straightforward boundary-based partitioning style, with urban areas divided into city blocks (*banchi* 番地). Each block has a number, and the houses within each block have their own series of numbers in turn. A corollary of this system is a lessened focus on streets and other transport corridors which often lack names.<sup>60</sup> A somewhat similar system was also used, exceptionally, in at least one medieval European town.<sup>61</sup> Europeans and Americans, meanwhile, have created in each of their cities a contrast set of "streets" partitioned, by boundary, out of the domain of all of the transit corridors in the city.<sup>62</sup> These streets are named, and the set of houses along a given street are numbered to form a further level of the taxonomy (even buildings that do not directly front on a street are assigned to a street by the numbering system). In everyday

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<sup>60</sup> On the closely connected issue of marking corridors versus marking destinations in wayfinding signage, see Phil Baines and Catherine Dixon, *Signs: lettering in the environment* (London: Lawrence King, 2003), p. 46.

<sup>61</sup> This was Mannheim (Germany). See Pierre Lavedan, "Préface," in *Les numérotages des maisons de Paris du XV<sup>e</sup> siècle à nos jours*, by Jeanne Pronteau (Paris: Ville de Paris, Commission des Travaux Historiques, 1966), p. 10.

<sup>62</sup> The partition of this domain mainly follows natural breaks, with acute angles signifying the boundary between two entities, although Europeans often partition single corridors into two "streets," so that Canongate and High Street in Edinburgh are "different" even though a pedestrian or driver notices no break as they proceed over the dividing point between the two.

practice, however, people commonly express location without using these reference systems, simply saying that a destination is "near" a particular landmark. And in some cases, a quasi-standardized set of focal points within a city exists, so that in Venice, natives often give wayfinding references from the nearest church. (The finite contrast set of Venetian churches and their locations is one of the easiest reference systems to master in a city whose land corridors have little salience.<sup>63</sup>) Similarly, residents of Florence used to give references in terms of focal points around the city, until the introduction of street names in 1785 and house numbers in 1808 marked a shift to standard European path-based reference.<sup>64</sup>

Once the method of partition is settled on and natural divisions in the domain taken into account, the designer may have a lot of freedom to choose the boundaries or focal points in the domain. Consider, for example, the fact that nothing precisely determined the placement of the boundaries between Hungary and Romania (at the Treaty of Trianon in 1919), between the months of the year (which could well differ from the current system in number and length), between the time zones in the United States, or between the different privilege levels of a frequent flyer program I belong to (which is divided into Bronze, Silver, and Gold depending on the number of miles flown). Consider as well the question of which day (such as January 1 or March 25) we should consider the beginning of a year. Even when there are preexisting breaks in the domain, they may still permit the designer a considerable amount of wiggle room to make an entirely conventional decision.



Image 2.5 (054)

When simple scalable domains of measurement are partitioned into contrast sets, the crucial conventional choice is the size of the unit. Thus the Fahrenheit and Celsius scales measure the same concept, but the size of each degree is different. The same is true for the measurement of distance (in inches or centimeters) or speed (in miles per hour or

<sup>63</sup> According to Dominic Beddow, *The illustrated Venice map* (London: Magnetic North/Draughtsman, 1997) there are 75 squares in Venice named after (presumably adjacent) parish churches.

<sup>64</sup> Kevin Lynch, *The image of the city* (Cambridge: Technology Press and Harvard University Press, 1960), p. 130.

kilometers per hour). Grading systems for students vary similarly in the number and size of the units. In designing relief maps cartographers must choose what cutpoints to use in dividing the continuous domain of altitude into different categories,<sup>65</sup> and indeed they face the same problem when defining any other system of "isolines" (e.g. of temperature or barometric pressure).<sup>66</sup> In all these examples the size of the units is fairly arbitrary and conventional and bears little relationship to any "natural" breaks in the domain (although the Fahrenheit and Celsius scales are both based on the use of relatively round numbers of units — 180 and 100 — to partition the space in between two natural focal points, the freezing and boiling points of water).<sup>67</sup> Similarly, the numerical heat intensity scale (0 to 5) on the electric oven controls in Image 2.5 is basically arbitrary and idiosyncratic and not correlated with any preexisting, objective or intersubjective features in the domain of heat intensity (the scale for my new rangetop runs from zero to three, not five). Although the choice of a scale unit may seem to be a fairly innocuous matter of convention, it can have real consequences, as I noted on a recent plane trip. The airline accepted multiple currencies, but not wanting to deal with coins smaller than certain units, priced its drinks at rounded-off levels: one pound, one euro, or one dollar got you a non-alcoholic beverage. This meant that a can of soda cost almost twice as much in British currency than in American — due entirely to the variation in the size of conventional scale units.<sup>68</sup>

In domains that involve focal points, the designer's task is to choose where those focal points are located. Thus Western musicians' fairly recent decision to standardize twelve equally spaced pitches per octave off a base of 440 Hz,<sup>69</sup> Turks' convention of distinguishing between dotted *i* and undotted *ı* (symbols whose differences, in handwriting at least, English-

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<sup>65</sup> Eduard Imhof, *Cartographic relief presentation* (Berlin: Walter de Gruyter, 1982 [1965]), chapter 8, section B ("The vertical intervals between contour lines," pp. 113-126).

<sup>66</sup> On the history of the concept of isoline see Arthur H. Robinson, *Early thematic mapping in the history of cartography* (Chicago: University of Chicago Press, 1982), pp. 46, 49, 60, 84-85, 210.

<sup>67</sup> W.E. Knowles Middleton, *A history of the thermometer and its use in meteorology* (Baltimore: Johns Hopkins Press, 1966).

<sup>68</sup> Noted on an Icelandair flight in spring 2004.

<sup>69</sup> See Llewellyn Southworth Lloyd, "Standard pitch," *Grove's dictionary of music and musicians*, 5th ed. (1954), 6: 788-803.

speakers would tend to ignore), and the Icelandic dairy industry's convention of producing one only kind of milk "between" whole and skim, with a fat percentage of 1.5% (instead of the dual focal points of 1% and 2% typical in the United States), are all choices of a set of focal points within a relatively featureless domain and could easily have been designed otherwise. Likert scales, so widely used in survey research, saddle respondents with the sometimes difficult task of deciding that their feelings about a particular subject are most similar to one of an arbitrary number of focal points, thus likening, for example, their degree of job satisfaction to one of the five prototypes {very satisfied, satisfied, neither satisfied nor dissatisfied, dissatisfied, very dissatisfied}.

Underlying the issues of partitioning style and partition location is the designer's choice of a *perceptual focus* of partition within the domain. By perceptual focus of partition I mean something quite different from focal point: a focus of attention on an attribute of the instantiations of the domain whose differences are considered a reasonable basis for creating a partition. Sometimes the focus is obvious from the nature of the task, but very often it is not.

Consider, as an analogy, the way we tend to perceive or pick out only a subset of the features in a landscape. After all, many cultures name valleys before slopes and mountain peaks before saddles, and an explorer is more likely to focus on fords or portages depending on whether they are traveling by foot (and thus more interested in passages from land to land) or by canoe (water to water).

Two of the best examples of focus in deliberate partitioning are highly political ones. In the United States, many legislative districts are redesigned after every census, and the question of what basis to use in determining them has been extremely controversial. Districts must be contiguous. Within that constraint, the choice is of whether to define a district so that geographical population aggregations stay together; so that people with similar socioeconomic characteristics stay together; or so that people who tend to vote for a particular political party stay together. While my first instinct is to say that the first method is the most "natural," it is possible to argue that other methods are equally so, and indeed

many districts now have extraordinarily contorted shapes on the map. The verb *gerrymander* refers to the act of defining voting districts in a way which is in the political interest of specific groups.<sup>70</sup> The example of racial classification in America is also a question of what salient natural features in a domain should be picked out as a basis for practical classification. Although on the face of it, racial classification appears to be about defining boundaries or focal points in the domain of skin color and other physical features, the debate about whether "Hispanic" is a valid racial classification points up the fact that no one is really sure whether race should be about physical features or ethnic origins. These examples remind us that the creation of contrast sets is not simply a trivial matter of convention but can also have tremendous political ramifications.<sup>71</sup>

Or take, for example, expressways. Americans label expressway exits. Israelis label intersections rather than exits.<sup>72</sup> In America the intersection of two expressways has two labels (the exit numbers off each expressway respectively), but in Israel it has only one (the intersection name). This means that the labeling used for American expressway systems refers to contrast sets consisting of all the exits off a given expressway. But Israeli expressway labeling refers to a contrast set consisting of all the expressway intersections in the country. This shows a slightly different perceptual focus on what is most salient about a highway system. The same issue comes up in the question of whether those subway "stations" where it is possible to connect between two different lines should receive two names (for the stations on each line) or one name (reflecting the ability to connect). The Moscow subway system resolves this with one name at some intersections (e.g. Paveletskaya) and with two names at others (e.g. Krasnopresnenskaya/Barrikadnaya).

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<sup>70</sup> A recent treatment of gerrymandering is Mark Monmonier, *Bushmanders & bullwinkles: how politicians manipulate electronic maps and census data to win elections* (Chicago: University of Chicago Press, 2001).

<sup>71</sup> On this theme see Paul Starr, "Social categories and claims in the liberal state," *Social research* 59 (1992): 263-295, pp. 274-278.

<sup>72</sup> See *Atlas ha-zahav: kol ha-kvishim veva-rehovot be-Israel* [The golden atlas: all Israel's roads and streets] (4th ed., Tel Aviv: Mapa, 2004). In fact, Israelis do sometimes label exits, and Americans do sometimes label intersections in exceptional circumstances. (An intersection in Rochester, N.Y. which was notorious for traffic jams and complicated lane changes until it was reconstructed in the late 1980s is still referred to, except in the most formal registers, as the "Can of Worms.") It is not an either-or decision: Germans label both exits (with numbers) and major intersections (with names).

Shifting perceptual focus causes similarity judgements to shift in many other everyday-life domains. In partitioning the alphabet, we can foreground the similarity between *A* and *a* (they are the "same letter") or between *A* and *B* (they are both upper case). In music, we can foreground the similarity between *A* above middle *C* and *A* below middle *C* (they are the "same note") or between *A* above middle *C* and *B* above middle *C* (they are in the same octave). In thinking about political boundaries, we can focus on the similarity between Turkish Cyprus and Turkey proper (they are the "same country") or between Turkish Cyprus and Greek Cyprus (they are on the same island). In organizing the ice cream shelf in the supermarket, one can focus on the similarity between low-fat vanilla and all-natural vanilla (they are the same flavor) or between all-natural vanilla and all-natural chocolate (they are both all-natural).

Indeed, the decision to partition a continuous domain by boundary, focal point, or by reference to a linked collective domain can be seen as a type of perceptual focusing. Thus, in the example of location reference within a city, the contrast between the focal-point technique of using a nearby landmark and the boundary technique of defining streets or city blocks involves differing styles of focusing — on churches, corridors, or city blocks — as seed material for creating contrast sets.

A final issue is whether a partition should be exhaustive or not. One can always create an "other" category, which is a sort of extra category for those instantiations of a domain which do not fit with the "regular" members of the contrast set. Some might consider the creation of "other" categories a cop-out. Indeed, new hires at the McKinsey business consultancy firm are drilled in the company dogma of creating "MECE" or "mutually exclusive, collectively exhaustive" partitions, with no less than three and no more than five members, in their reports and analyses.<sup>73</sup> However, "other" categories can also serve as safety valves in the many cases in which an instantiation of a domain does not easily fit into an

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<sup>73</sup> Ethan M. Rasiel, *The McKinsey way: using the techniques of the world's top strategic consultants to help you and your business* (New York: McGraw-Hill, 1999). On the principle, see Barbara Minto, *The Minto pyramid principle: logic in writing, thinking, and problem solving* (London: Minto International, 1996), p. 80.

accepted or convenient partition of that domain. Some may feel that "other" categories thereby reduce the analytical power or statistical validity of a set of distinctions, but others might say that one sometimes wants to highlight just the most important categorical distinctions in a domain, or that the frequent use of an "other" category is a useful red flag that calls attention to the problematicity of a partition meant to be exhaustive.

The multitude of design options available reminds us that there are usually many ways of creating contrast sets out of any given domain, and that designers must therefore prepare themselves for criticism of their choices. Though the raw material may be universal, and the designers individual, the normative traditions of the contrast set design workshop are profoundly social.<sup>74</sup> Some partitioning choices are "natural," and some are the product of particular designers' individual character, but many are determined by community standards which vary from place to place, from time to time, from culture to culture, and from subculture to subculture.

## 2.8 Changing the domain to match the contrast set

If a set designer creates partitions within a domain that are not fully supported by the natural features within the domain, the set designer may choose to artificially intensify and strengthen the apparent naturalness of these partitions and to make them more distinct or salient. Alternatively, the set designer may also try to smooth out certain internal distinctions within a domain, removing features or obscuring distinctions that the designer considers inconvenient. Here the role of the designer and the workshop goes beyond the creation of a set of categories, to the attempt to modify the way people perceive the domain. In some cases, the designer is not personally in charge of changing the domain to match the contrast set, but only puts in motion a process that others complete.

Perhaps the most obvious way of making the domain match the contrast set is to mark newly created partition lines. The lane markings on roads, the yellow line we wait

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<sup>74</sup> For an exposition of this point with reference to the more general phenomenon of categorization see Zerubavel, *The fine line*, pp. 61-70.



Image 2.6 (077)

behind at passport control, and the cordons that mark the line up to the airport check-in counter were all placed in a landscape that did not naturally have these boundaries. Immigration formalities, welcome signs, and other trappings of crossing a political border, the airplane pilot's announcement of the new local time when we cross from one time zone to another, and graduation ceremonies are examples of "rites of passage" that lend reality to a distinction that may have little natural foundation.<sup>75</sup> Image 2.6, showing two views of the same bicycle lane near Ernst-Reuter-Platz in Berlin, demonstrates how paint and color were used to intensify the reality of a category that was not fully specified by the natural landscape.<sup>76</sup> Eviatar Zerubavel has collected a number of similar examples of "polarization" and the construction of discontinuity in a domain.<sup>77</sup>

In other contrast sets (particularly those formed by focal point, where there are no partition lines to mark), the designer may strengthen the identity and distinctiveness of particular set members so that they stand out better against the others. There are many such cases in the domain of letterform. Thus the crosses that computer programmers put on their zeroes to distinguish them from Os, or the way we might emphasize the points of the Z in the call number PZ3 to make it clear we do not mean P23, involve developing and extending the distinctiveness between two members of a contrast set (*O* and *o* or *Z* and *z*) in a way that adds something extra to our everyday, unmarked, conception of these entities.<sup>78</sup> (Indeed,

<sup>75</sup> On rites of passage see Zerubavel, *The fine line*, pp. 18-20; Arnold Van Gennep, *The rites of passage* (Chicago: University of Chicago Press, 1960 [1908]).

<sup>76</sup> For further examples of lane and pavement markings see Phil Baines and Catherine Dixon, *Signs: lettering in the environment* (London: Lawrence King, 2003), pp. 62-65.

<sup>77</sup> Zerubavel, *The fine line*, pp. 39-47, 74-80.

<sup>78</sup> In writing systems there are many other examples of conventionalized categories which, because they "approach each other" too often, have to be deliberately "polarized" and distinguished from each other. In Europe, where the handwritten form of the numeral 1 "approaches" the form of a 7, one outfits the 7 with a cross to make up for its lack of Abstand from the 1. The Cyrillic letters *ш* and *т* (equivalent to Roman *sh* and *t*) are quite distinct in normal printed form, but are more similar in italics (*u, m*) and practically identical in handwriting where they are typically made more distinctive by adding a bar below (*u*) or above (*m*) the letter. Similarly, in cases where we are not sure of the original vertical orientation of what we are reading, we add underlines so that we can properly interpret the difference between the numbers 6 and 9. The general idea is that we may exaggerate or even add characteristic

zeroes and Os seem ill designed for the purpose of being distinct, but they are so entrenched in tradition that we prefer to strengthen their distinctiveness in contexts where they might be confused, rather than redesigning them altogether.)

We see the same pattern in the development of standard languages. A particular person's speech forms an instantiation within the domain of all the languages which people speak.<sup>79</sup> When we deem certain varieties of speech as "standard" — standard Polish, for example — we choose one usually idealized instantiation in this domain as a focal point. The location of this focal point normally has some degree of conventionality, and the boundaries surrounding the other instantiations of the domain that we might group with it are normally to some degree ambiguous. Thus what we consider "Polish" is an aggregation of speech acts which are grammatically similar enough to allow us to lump them in a single category around the focal point of standard Polish. Just as we consider only musical pitches that are at or near the focal point of a standard category to be "well-tuned," we think of dialects of Polish that are "close" to the standard as "normal" Polish. At its limits, Polish shades into what is normally called Belarussian, Ukrainian, or Slovak instead.

Some standard languages — Norwegian, Danish, and Swedish are good examples — are so similar that there seems to be little natural reason to recognize them as separate focal points within the domain. Indeed, it would have been perfectly possible to establish one single standard written language in Scandinavia rather than three. Instead, as part of the development of three distinctive senses of national identity, a deliberate process of strengthening magnified the differences that did exist between them, and outfitted each of the three standards with distinctive spelling, lexicon, grammar, literary traditions, vocabulary, and even alphabetical orders. For example, deliberate efforts eliminated Danicisms from the two competing versions of standard Norwegian.<sup>80</sup>

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features of a letter, or of any other member of a contrast set, when we are afraid it might be mistaken for another.

<sup>79</sup> Dafydd Gibbon has used the term "language variety space" to metaphorically envision the domain of all the different versions of language that a particular group of people speak. See <http://coral.lili.uni-bielefeld.de/Classes/Winter96/Dialects/dialects/node29.html> (March 2004).

<sup>80</sup> Einar Haugen, "Language planning in modern Norway," pp. 134-136, and "The Scandinavian languages as cultural artifacts," pp. 280-282, both in *The ecology of language: essays by Einar*

Sociolinguist Heinz Kloss, writing about these processes of language standardization, developed a pair of concepts and terms which are applicable to many more domains than simply that of language.<sup>81</sup> Both in German and English, Kloss referred to the natural differentiation between two languages such as Polish and Slovak as their *Abstand* (distance, spacing, or offset) and the process of deliberately intensifying or strengthening that differentiation as *Ausbau*. One can loosely translate Kloss's *Ausbau* as "strengthening" or "intensifying."<sup>82</sup> Kloss used these terms as adjectives to characterize particular standard languages as "Abstand languages" (those whose identity was naturally distinct from the time it entered the workshop) and "Ausbau languages" (those whose identity was created through conscious and deliberate effort).

Of the many other examples of strengthening and *Ausbau* in language standardization, consider the deliberate development of Urdu and Hindi as separate standards after 1837 (when Urdu replaced Persian in the administration of northern India) and 1947 (when Pakistan became independent),<sup>83</sup> and of Serbian and Croatian after 1991. Note that there are also plenty of examples where strengthening failed to occur or to succeed: the descendants of Scots speakers in southern Scotland, and Occitan speakers in southern France, now generally read, write, and indeed speak standard English and French, since the effort to establish a fully functional separate standard did not take root.

The development of standards of measurement provides many good examples of strengthening. Many domains of measurement have an internal diversity that is quite difficult for humans to perceive, and in these domains the creation of contrast sets is a particularly artificial and conventional act due entirely to the efforts of the workshop. It is thus only the markings on thermometers or speedometers that suggest to us that the contrast

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*Haugen* (Stanford: Stanford University Press, 1972).

<sup>81</sup> Heinz Kloss, "'Abstand languages' and 'Ausbau languages,'" *Anthropological linguistics* 9,7 (1967): 29-41; Kloss, *Die Entwicklung neuer germanischer Kultursprachen seit 1800*, pp. 23-30.

<sup>82</sup> In German the word *Ausbau* most commonly refers to the completion of part of the interior of a building, such as the "finishing" of an unfinished basement or garage, but it may also mean something closer to "elaboration," "extension," or "development."

<sup>83</sup> See Christopher R. King, *One language, two scripts: the Hindi movement in nineteenth century North India* (Bombay: Oxford University Press, 1994), pp. 7-11.

sets used in temperature and speed measurement are really real. The difference between, say, medium-large, large and jumbo eggs might be difficult to perceive if they were not sold in differently colored, labeled, and priced boxes which occupy different bins in the supermarket.

Strengthening is particularly difficult in measurement domains such as speed, because contrast sets formed by scale units have very weak boundaries (in fact they can only barely be considered contrast sets at all). We can, of course, measure the speeds of passing cars in kilometers an hour, round off to the nearest whole number (as the actual speeds range along the infinity of points in the continuum), and consider that we are sorting the passing cars into groups of all cars going at 78, 79, 80, 81, 82 kilometers per hour and so forth. But the cars going 78 kilometers per hour have precious little in common with each other, and very little less in common with those going 79. It takes a great deal of strengthening and support for this set of measurement categories — public consciousness-raising, signposting, speeding-ticket-issuance, and even sometimes the installation of speed limiters or alarms or tachographs — to get people to treat the idea of 81 kilometers per hour as "illegal" in a way that 79 is not. (Even where this is done the authorities typically give a little bit of leeway in their interpretations when it comes to making an official decision to write someone a ticket.) It is hard to get people to see the world in terms of a contrast set which has so little relation to natural features in the domain, just as it is hard to judge one's level of drunkenness in terms of the measuring scales used by the law and the police without the help provided by rules of thumb that use familiar entities such as a single beer or a glass of wine.

Instead of trying to intensify boundaries, an alternative strengthening strategy for contrast sets is to try to draw attention away from anything which might potentially call into question previously made partitions. Consider, for example, the stigmatization of a "transitional" dialect that is halfway in between, say, Polish and Belarussian.<sup>84</sup> Instead of

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<sup>84</sup> See the ironic discussion of "Polesian" identity in Anne Applebaum, *Between east and west: across the borderlands of Europe* (New York: Pantheon, 1994), pp. 181-183.

exaggerating the typical by strengthening focal points and boundaries, this reverse strategy taboos the liminal and ambiguous areas in between the prototypes of the members of a contrast set.<sup>85</sup>

In all these cases of strengthening, the goal is to get people to focus on each instantiation's position in a contrast set, rather than its position in the domain. If a consciously created contrast set is to succeed, its users must be made more aware of an instantiation's taxonomic status within the set than its location within the domain (in the terms used in section 3.5, they must understand it structurally rather than descriptively). As Anne Applebaum explains, having national borders means getting villagers to say "We are Polish" or "We are Ukrainian" rather than just saying "We are from *here*."<sup>86</sup> In the same way, an instrument such as the piano, which is only able to produce a fixed set of standardized pitches, removes the performer's ability to keep in mind the rest of the spectrum of pitches, since they fall in between the standard foci.

Of course, just as we can introduce or exaggerate distinctions in a domain which arrive with little internal differentiation, we can also try to ignore or smooth over distinctions within a domain when those distinctions are inconvenient for some reason — most commonly, because they cut across a region of the domain that we have defined as constituting a single contrast set member. This is a frequent strategy in dealing with the domain of ethnicity in imperial and other multi-ethnic political entities such as Austria-Hungary, the Soviet Union, Yugoslavia, or Iraq.<sup>87</sup>

The process of strengthening is something that takes place within a society, not within nature. The effects of strengthening could disappear and be forgotten should the

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<sup>85</sup> On the stigmatization of liminality as a polarization strategy see Zerubavel, *The fine line*, pp. 45, 72-74.

<sup>86</sup> Applebaum, *Between east and west*, pp. xi-xii. Note that in some Slavic languages it is particularly easy to focus on the locale within the domain, as these languages have deictic attributive adjectives that translate into English roughly as "here-ish" and "us-ish," and can syntactically substitute for adjectives of national identity such as "Polish."

<sup>87</sup> One discussion of this phenomenon (though certainly not the most in-depth one or the last word on the subject) is in Hans Magnus Enzensberger, *Civil wars: from L.A. to Bosnia* (New York: New Press, 1994), pp. 107-108, 134. On the general phenomenon of "ignoring intracluster differences," see Zerubavel, *The fine line*, pp. 16-17.

society, and the world within which it exists, disappear. However, strengthening accumulates in a domain, so that strengthening that took place in a society ancestral to our own may now appear external, with Norwegian now seeming as natural a category as German. The fascinating thing, then, about how domains are reworked to match the contrast sets created in them is that the actions of the workshop change the way that the domain and the natural world present themselves to future designers.<sup>88</sup> Contrast sets are examples of phenomena which "bite back,"<sup>89</sup> in that structure affects human agents, who in turn affect that structure.<sup>90</sup> Contrast sets are derivative representations of a reality that we then use them to change.

Regardless of whether it is selected out of natural variation or created through strengthening, easily perceivable differentiation within a given domain is important and useful. It allows us to manipulate and work with the contrast sets that we create in that domain, and thus to do things like read, play music, and do arithmetic. The easier it is to see the difference between the members of a contrast set in a domain, the higher the likelihood that a human being will be able to train themselves to classify an instantiation of that domain under one of the members of that contrast set, without having to use special instrumentation or other outside devices to intensify meager contrasts. It is precisely the distinctiveness of the letters of the alphabet, and our ability to perceive that distinctiveness, that allows us to learn to read. It is precisely the distinctiveness of the different standard pitches based on A=440, and the fact that well-tuned musical instruments produce and present a featured landscape of sound consisting of these standardized pitches and not the intervening, tabooed, nonfocal

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<sup>88</sup> Lest the reader think this is a statement in support of the Sapir-Whorf hypothesis, let me clarify. The Sapir-Whorf hypothesis is that the structure of a grammar and lexicon unconsciously affects the way people think about the world (see Kay and Kempton, "What is the Sapir-Whorf hypothesis?", p. 66). My point (a less controversial one, I think) is that we use the structure of deliberately created contrast sets to change our experience of the domains in which they were created.

<sup>89</sup> On the idea of technologies which change the terms of the world they were built for, see Edward Tenner's two books *Why things bite back: technology and the revenge of unintended consequences* (New York: Knopf, 1996) and *Our own devices: the past and future of body technology* (New York: Alfred A. Knopf, 2003).

<sup>90</sup> For a readable, recent summary of the two-way interaction between structure and agency see William H. Sewell, Jr., "A theory of structure: duality, agency, and transformation," *American Journal of Sociology* 98 (1992): 1-29.

ones, that allows some people to develop absolute pitch.<sup>91</sup> To those of us who do not have absolute pitch, the domain of pitch is one in which we can only perhaps tell that pitches are "higher" or "lower" than one another. The domain of pitch is a good example of how, without the ability to perceive the features in a domain, we are as helpless as an illiterate person trying to read the newspaper.

## How contrast sets change the "presentation" of a domain

You have probably heard the truism that there is very little blue food. It is an example of how, in any given context, we do not experience all instantiations of a domain with equal frequency. Some instantiations present themselves more often than others. Red and brown show up on our plate more often than blue. By instantiations "presenting themselves," I mean that they make an appearance in the world that human beings can perceive. When *x* and the other letters of the alphabet appear in the newspaper, they are also "presenting themselves." The letter *x* is one conventionalized focal point in the continuous domain of graphic form. There is a huge, multidimensional, basically infinite range of potential letterforms in the world, most of which we do not see. We have settled on only a few of these instantiations as ones which our society will recognize as "letters."



Image 2.7 (008)

Designing a contrast set  
in a given domain can actually  
change the way that the

instantiations of that domain present to us. This occurs particularly when the *production or creation* of those instantiations is under our control, and particularly in contrast sets formed by focal point where we cannot experience an "overview" of all the points in the domain at

<sup>91</sup> Absolute pitch "must be *learned* from exposure to music containing fixed pitches," say Richard Parncutt and Daniel J. Levitin, "Absolute pitch," in *New Grove dictionary of music and musicians*, edited by Stanley Sadie, 1: 37-39 (2nd ed., London: Macmillan, 2001). Though I have never seen the truth of this statement explicitly demonstrated, recent work on absolute pitch has confirmed other hypotheses that would seem to be logically dependent on it, so it is very difficult to imagine that it could be untrue. Also see Daniel J. Levitin, "Absolute pitch: self-reference and human memory," *International journal of computing anticipatory systems* 4 (1999): 255-266, section 2.1; and Daniel J. Levitin, "Memory for musical attributes," in *Music, cognition and computerized sound: an introduction to psychoacoustics*, edited by P. R. Cook, pp. 209-227 (Cambridge: MIT Press, 1999), section 17.9.

one time. Thus the standardization of musical pitch, or of the forms of the alphabet, makes it less likely that we will produce and thus experience pitches or letterforms which are "in between" those we have designated as standard focal points. Only in spheres like doodling and graphic design do we produce letterlike symbols that are not letters. If a string ensemble is in tune and using standard tonality, they will normally choose to produce instantiations of the domain of pitch which are close to those focal points, and we will never hear frequencies very far from those that are deemed focal. Image 2.7 shows an idealized view of the distribution of frequencies produced by a string ensemble tuned to A=440 Hz.<sup>92</sup> Indeed, such widespread clumping around standardized instantiations helps people to perceive the identity of contrast set members and thus, for example, to learn to read, or to develop absolute pitch.

It is important to emphasize that this process takes place when contrast sets standardize our behavior as *producers* of the instantiations of a domain. In a store, where human beings are in charge of setting prices, the vast majority of them may be 1/100 or 5/100 less than a full major monetary division (e.g. \$1.99). Consider as well how hotels structure their renovation budgets around whether it will lift them up into the next "star" category or not.

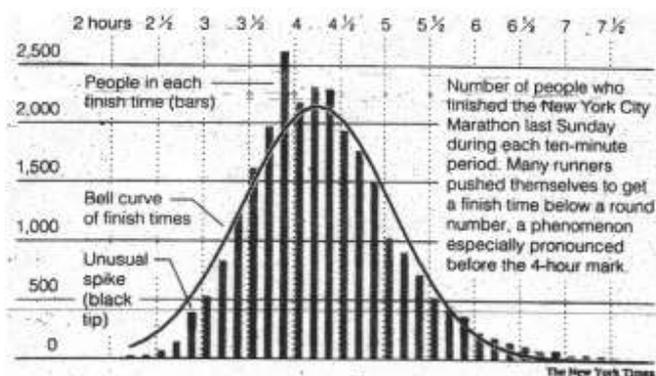


Image 2.8 (060)

If human beings are not in charge or not fully in charge of producing the instantiations of that domain, conventional focal points will not be able to influence the presentation of the domain, or at least not as much. For example, the results

from the New York Marathon in Image 2.8 show spikes in the normal distribution of finishing times at just *under* 3, 3 1/2, 4, 4 1/2, and 5 hours, showing how people set their goals

<sup>92</sup> Successive frequencies in equal temperament are related by ratio (the twelfth root of two), which is why the intervals between the standard focal points widen towards the right on the chart.

relative to these purely mathematical and conventional boundaries: "a 4:02 runner pushes for a 3:57; a 5:03 is pulled by 4:58."<sup>93</sup> This effect, though significant, was rather weak, since people are not fully in control of their exact finishing time in a race. (The longstanding question of whether people have the ability to postpone their deaths until just after a birthday or major holiday is similar, with birthdays serving as a sort of boundary in the domain of the year.<sup>94</sup>)

Changes in the presentation of a domain often have the effect of tabooing the instantiations that are liminal, non-focal, or "in between" those that we have conventionally designated. This tabooing or polarizing process strengthens a contrast set by drawing users' general attention away from those instantiations which are most threatening to it. This is why we consider pitches of 425 Hz "out of tune," and why teachers mark down penmanship students for "improperly" formed letters. We do this partly because we want to instill the conventional focal points we have formed in these domains into the heads of those we are socializing. If we do it well enough, they will come to share the taboo, and to forget the conventionality of the contrast set.

The full range of the domain behind such reinforced focal points and fortified boundaries is still available to us should we choose to see it, use it, or imagine it.<sup>95</sup> Periodically, and not without some effort, we rediscover the marginal, the liminal, and the tabooed spaces in between our focal points, and at the same time realize the conventionality of our contrast sets. We can always find a tailor to make our clothing in sizes other than small, medium, and large, we can ask at a restaurant for a non-standard portion size as a favor, and listening to an elephant call or to birdsong acquaints us with beings who do not respect humans' socially conventional focal points of pitch. In the world of letterform, Douglas Hofstadter has shown that "no letter is an island" and that one can easily draw

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<sup>93</sup> Hubert B. Herring, "Mind over muscle," *New York Times*, 19 November 1995, section 4, p. 2. The original data is available at <http://www.nycmarathon.org> (March 2004).

<sup>94</sup> A special collection of articles on this question, including a review of past research, appears in *Psychosomatic Medicine* 66 (2004): 372-386.

<sup>95</sup> For a demonstration of the ability to see "past" conventional breaks in the partition of the domain of color see Kay and Kempton, "What is the Sapir-Whorf hypothesis?", pp. 73-74.

liminal, ambiguous letterforms: *A* can merge into *H*, or *h* into *k*,<sup>96</sup> and it is possible to read the same handwritten scrawl as either *month* or *mouth*.<sup>97</sup> Such ambiguous instantiations of a domain can be assigned to either of two members of a contrast set depending on "how we look at them," just as we can interpret the outline of a Necker cube as pointing in either direction.

There are also a number of domains which are not subject to this strengthening effect. In these domains, despite the construction of conventional contrast sets, all instantiations continue to present themselves to us (in certain contexts) with the same or at most only partly reduced frequency. Thus, even though there are focal points of color (and these do influence what colors the Crayola crayon company chooses to produce for their smallest, 8-color crayon sets), out in the "real world" we still commonly see many instantiations of color that are not near these focal points — outside the context of food, of course. In domains such as the speed of cars, the unit measurement of speed in kilometers or miles per hour creates such a weak contrast set that it does not cause a "digital" representation of speeds of exactly (say) 32, 33, and 34 miles or kilometers per hour; the speeds of cars continue to vary in an analog way along every point in the entire continuum. (Of course, the speed limit on the expressway surely causes the distribution of the points at which people drive to bunch together at somewhere in the neighborhood of that limit.)

However, even in continuous domains in which we have defined a mathematical scale, we tend to focus on round numbers in that scale as breaking points or significant milestones, although we know they are totally artificial. Thus we might say "I'll stop after we've gotten to 300 kilometers" or "I missed being born in the 1960s by two weeks," or write books about "fifteenth-century Italy." No matter how many times we were told that the

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<sup>96</sup> Donald E. Knuth, "The concept of a Meta-Font," *Visible Language* 16 (1982): 3-27; Knuth, "Lessons learned from Metafont," *Visible Language* 19 (1985): 34-53; Douglas R. Hofstadter, "Meta-Font, metamathematics, and metaphysics: comments on Donald Knuth's 'The concept of a Meta-Font,'" *Visible Language* 16 (1982): 309-338, esp. p. 331; Hofstadter, *Metamagical themas: questing for the essence of mind and pattern* (New York: Basic Books, 1985), pp. 243-244. See also Geoffrey Sampson, "Is roman type an open-ended system? A response to Douglas Hofstadter," *Visible Language* 17 (1983): 410-412; Hofstadter's reply to Sampson, *Visible Language* 17 (1983): 413-416, and Johanna Drucker, *The alphabetic labyrinth* (London: Thames & Hudson, 1995), p. 282.

<sup>97</sup> For more similar examples see Goodman, *Languages of art*, pp. 137-139.

twenty-first century actually began on January 1, 2001, we all agreed that "the fun is when the calendar goes from one-nine-nine-nine to two-zero-zero-zero."<sup>98</sup> The publicity surrounding the breaking of the four-minute mile is another example of the feeling that there is a real difference between things on one side of such points and the other.



Image 2.9 (049)

Sometimes we playfully make reference to the fact that we have conventionally limited the presentation of certain domains, by making reference to the instantiations that we

have excluded. A musician may play a deliberately out-of-tune note for comic effect.

Comedian John Cleese is noted for his ability to speak in nonsense syllables.<sup>99</sup> Image 2.9 shows a motif used on the plastic bags given out by Hugendubel, a major German bookstore chain. The shapes look like they *could* be members of the contrast set of standard letterforms, but on closer inspection, we see they are not — they are nothing more than "phantom members." Consider as well the psychedelic song from the *Easy Rider* soundtrack which speaks of a forest where the leaves of the trees break the light into colors "that no one knows the names of."<sup>100</sup> The theme here is the persistent human fantasy that, like straying into Shangri-La, we might someday discover yet another member of a familiar contrast set — a city, or planet, or color that is part of a set we already are familiar with, but which we did not know about before.<sup>101</sup> In domains which are not exhaustively partitioned, we may actually be able to make such dreams come true by, for example, creating a totally new flavor of ice cream or designing the graphic symbol for a new currency such as the euro. But in completely partitioned domains which we can envision in their entirety, we can only fantasize about new contrast set members, imagining the experience of someday discovering

<sup>98</sup> Edwin McDowell, "Dec. 31, 1999: Dressed up, but with no place to go?", *New York Times*, 18 December 1995, p. A1.

<sup>99</sup> John Cleese, interview with Terry Gross on National Public Radio, 1990, <http://www.npr.org/rundowns/rundown.php?prgId=13&prgDate=29-Jun-2001> (October 2004).

<sup>100</sup> The Byrds, "Wasn't born to follow," from *The notorious Byrd brothers* (New York: Columbia Records, 1968).

<sup>101</sup> For a literary example of this fantasy see H. P. Lovecraft, "The color out of space," in *The annotated H. P. Lovecraft*, pp. 57-100 (New York: Dell, 1997).

on the map a hidden kingdom in a remote mountain valley, or another European country that we never noticed before.

Discussing the topic of strengthening brings up the opposition of "digital" and "analog," which has a tremendously long history in measurement, electronics, computing, philosophy, and the social sciences as well.<sup>102</sup> The creation of contrast sets, particularly by boundary, can be thought of as shaping a domain's continuous, analog variation into a set of discrete, digital categories. Increasing digitization lends an increasingly "jerky," "convulsive," and "staccato"<sup>103</sup> feeling to our images of motion through a domain, in which there is more and more contrast between the experience of the borders between contrast set members and the spaces in between those borders. Thus progressing through an unpartitioned, fully analog continuum feels like driving along a smooth expressway, crossing the weak boundaries created by scale units feels like driving over warning strips, crossing pitch foci as one moves through the domain of audible frequency feels like driving over speed bumps, and traveling through a maximally digitized domain might be likened to running hurdles in a foot race. Meanwhile, the metaphor of the "basin of attraction," frequently used in the discussion of digital phenomena, represents the strengthening process by suggesting a visual image in which instantiations "migrate" away from the boundaries and towards the focal point of a contrast set member.

## 2.9 Contrast sets in linked domains

Creating a contrast set becomes more complicated when one finds that one is creating a set not just in one domain, but also in another, through links that connect the instantiations of one domain to the instantiations of the other domain. One's best efforts at creating a partition that makes sense in one domain may completely fail to accord with the natural breaks in domains it is linked to.

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<sup>102</sup> For a useful multidisciplinary review of the history of the digital/analog opposition, see Ellie Epp, "The analog/digital distinction in the philosophy of mind," M.A. thesis, Simon Fraser University, 1993 (available at <http://www.sfu.ca/~elfreda/theory/analog/analogo.html>). See also Zerubavel, *The fine line*, pp. 34, 60, 134n2; Anthony Wilden, *The rules are no game* (London: Routledge and Kegan Paul, 1987), pp. 222-225.

<sup>103</sup> These terms come from Zerubavel, *The fine line*, pp. 34, 70.

An easy place to see this happen is in the problem of grading students' scores on a "curve" (which often means simply that the professor is reserving for themselves the determination of the connection between performance and grading label). Say that there are fifty students, and that their "raw" scores are numerical and *could* theoretically range from 0 to 100, though in practice they actually range from 40 to 98. Say then that each student must be assigned a grade from the seven-member set {A, B+, B, C+, C, D, F} — note that some universities, such as Rutgers, do not have "minus" grades. How should one proceed? One could divide the range from 0 to 100 into seven parts, label each part with one of the seven grades, and give every student the grade of that part of the range that their raw score falls into. Or, one could plot the distribution of the raw scores and notice a clump of scores around 95 (call those As) and another clump around 88 (call those B-pluses). The first approach is a partition of the quasi-continuous range of raw scores; the second is a partition of the collection of students. Each student is linked to a particular point on that range; to put it another way, the domain of students is linked to the domain of raw scores.

The first approach would cause problems if (say) you chose a cut point of 70 for one of the partitions, but found that there was a clump of scores at 69.5, 70, 70, 70.5, 71, 71, 71.5, and 72 (with the nearest scores on either side of the clump being 62 and 77). Shouldn't all the students in this clump receive the same score? Shouldn't one try to avoid creating categorical paradoxes?

But the second approach might also cause problems if there was one student with a score of 92 who could not easily be lumped with the 95-clump or the 88-clump. The first approach involves creating boundaries in the continuous domain, and fails to take account of clumps of entities in the collective domain. The second approach involves recognizing clumps of entities in the collective domain, and fails to take account of the vast range of potential values in the continuous domain. Each approach is grounded in one domain but fails in the other.

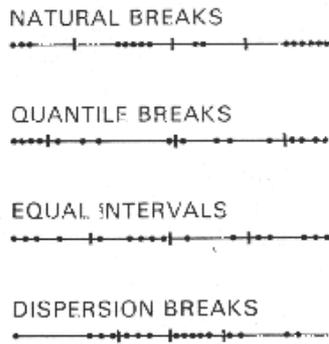


Image 2.10 (017)

The chart in Image 2.10, designed by cartographer Mark Monmonier, graphically illustrates these problems.<sup>104</sup> It shows four different ways in which one can choose to partition a pair of linked collective and continuous domains. The two strategies discussed in the previous paragraph are equivalent to the "equal intervals" and "natural breaks" strategies in the chart. "Quantile breaks" involve a partition

of the collection of entities, set in rank order, into equally-sized groups — regardless of their closeness in the continuous domain, thus risking falling afoul of the categorical paradox.

"Dispersion breaks" use mean and standard deviation values to inspire a partition.

Cartographers have long struggled with this issue in the design of the intervals used in choropleth maps, which define hard boundaries and leave cartographers particularly open to charges of miscategorization.<sup>105</sup> The assignment of differently-sized point symbols or fonts to towns and cities of different sizes creates a similar challenge. In both cases the problems surface because one wants the colors or symbols derived from one's categorization of a scale to echo the similarity relations one feels exist within the collection of entities.

Indeed, we have a naive tendency to expect partitions in one domain to carry over to linked domains. In a classic traveler's cognitive slip, classification in a key domain is assumed to penetrate to all linked domains, so that "even the sheep seem Moroccan, even the volcanoes seem Indonesian,"<sup>106</sup> and one expects *everything* about France to be different because France is not England. As well, we tend to expect a kind of "transitivity" in which

<sup>104</sup> Mark Monmonier, *Maps, distortion, and meaning* (Washington: Association of American Geographers, 1977), p. 26. Reprinted with permission.

<sup>105</sup> A choropleth map takes a preexisting geographical contrast set (usually defined by political boundaries), each of whose elements has a value in some scalar domain. A partition then simultaneously divides the scalar domain and groups the entities of the linked geographical contrast set. A color or shade is assigned to each group and a map created which shows each entity in the geographical contrast set in the color or shade of the group it belongs to. For a discussion of the problem, see Mark Monmonier, *How to lie with maps* (Chicago: University of Chicago Press, 1991), pp. 40-42, 129-134; also Arthur H. Robinson, *Early thematic mapping in the history of cartography* (Chicago: University of Chicago Press, 1982), pp. 111-112, 199-200.

<sup>106</sup> Clifford Geertz, *After the fact: two countries, four decades, one anthropologist* (Cambridge: Harvard University Press, 1995), p. 22. For more similar examples, see Zerubavel, *The fine line*, p. 28.

oppositions in one domain carry over as well. This type of overgeneralization is also responsible for our expectation that Bostonians would be more likely to support the Red Sox over the Yankees, as well as travelers' common fear that they will become the target of resentment for their government's policies even if they disagree with them, and politicians' assumption that if the opposition supports a bill, that they should probably find some reason to be against it. After all, people tend to be interested in statistical correlations, and to look for correspondence in structural contrasts across domains, so that one expects that the divisions between the shelves in a friend's bookcase or pantry might well correspond to divisions in the domains of their books or provisions. It might be possible to relate this tendency to the principle of "cognitive economy" (see section 4.6).

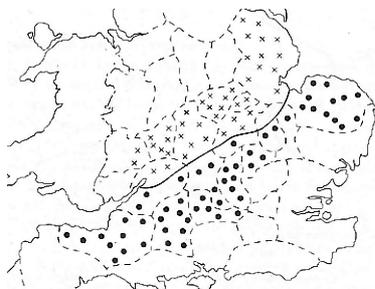


Image 2.11 (007)

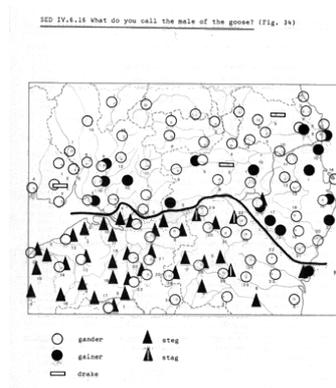


Image 2.12 (006)

However, the two isogloss charts illustrated here show that reality is more complex, and that the natural features of one domain do not always carry over to linked domains. Both charts are based on dialect studies which surveyed people — the instantiations of a collective domain.

Each instantiation was grouped: in Image 2.11 according to what vowel they use in the word *cut*, and in Image 2.12 according to what word they use for a male goose. A symbolic label was applied to each group. Since each instantiation was tied to a particular place (of residence), the label associated with its group membership could be plotted on a two-dimensional map. The question is then: can the two dimensions of the map be

partitioned according to the group membership of the entities plotted on it? More precisely phrased, the question is about the nature of this partition — how "neat" will it be? Can partitions within a continuous domain be made to correspond to the way that entities tied to particular points of that domain are grouped? The answer to this question is "not necessarily." Image 2.11 (designed to illustrate the discussion of dialect geography in an introductory textbook) shows an almost idealized example of geographical segmentation in

which all the entities in each of the two geographical categories have the same group membership in the linked collective domain. Rarely in real life do we see such neat and perfect divisions. Image 2.12, from a dialectologist's survey of the Scottish-English linguistic border, is much more typical. The black isogloss line is an approximation, which conveys a very general sense of difference accurately, but which does not allow us to accurately infer each entity's group membership in the linked domain. Image 2.11 is entirely "consolidated," and drawing the boundary is no more difficult than dividing white from red in the Polish flag; the bottom chart is "fragmented," and partitioning it is like trying to draw a single boundary between black and white squares on a chessboard. We all know, or should know, that we cannot assume correlations and correspondences across domains in the real world: for example, if you sort your e-mail messages by date, they will no longer be in order by sender. Linked domains are like multiple columns in a database which belong to the same database "tuple" or relation: there *may* be correlations between the columns, but you cannot assume that as a fact.

One of the weightiest and most complex real-world applications of the problem of linked domains has been in the political partition of the world into countries. Historically speaking, this partition is more emergent than planned, but it has also been the subject of conscious design at certain times and places (for example, in central Europe after World War I). This partition involves, at minimum, two domains: a collection of entities (people) and a two-dimensional geographical domain (the landmass of the earth). But the collection of people also has other qualities — in particular, each person's mother tongue can be located at a particular point in the domain of language. Each person can also be located in various other cultural domains, such as religion, diet, or dress, while geographical domains are also riven by other frontiers, such as mountain ranges and coastlines.

Political partitioners using language as an organizing principle typically hope that a partition by language, translated into geographical terms, will result in a geographical partition that does a reasonable job of minimizing the length of the borders between the members of the contrast set created. Political partitioners using geography as an organizing

principle typically hope that a partition by geography, translated into linguistic terms, will result in the creation of viable and unified linguistic communities that promote efficient public administration.

Unfortunately there is rarely a perfect relationship between geographical and linguistic consolidation. Linguistic classifications, projected into geographical space, generally scatter enclaves and fragments across the map. After all, the dialect spoken in a city may be closer to that of another city than to that of the nearby countryside, just as neighboring black squares on a chessboard will always have a white square in between. Similarly, geographically based classifications, which take no account of cultural differentiation, may well cut natural linguistic communities in half. Two entities that are similar in one domain may not be in another. A partition which makes sense in one of these domains, when transposed into another domain which is organized according to different attributes and qualities, will not necessarily result in a simple or efficient partitioning of that second domain.

Despite these problems, we have collectively created a contrast set consisting of nearly two hundred first-level geographical partitions of the landmass of the world, which we use on an everyday practical basis. Some of these partitions (Iceland, for example) transpose well into cultural domains. Others do not. Some partitions are still controversial. We ought not to expect that a perfect transposition can ever exist. Even if one did, we can be sure it might deliberately be ignored for reasons of realpolitik or political expedience. However, it is important to have a clear grasp of the necessary compromises involved in such partitions.

Note that our political creations can influence the presentation of domains *linked* to the one they partition, by creating "refugees," "exiles," and "irredentists" (terms which presuppose a geographical contrast set), and stimulating immigration that increases the linguistic or cultural homogeneity of geographically created entities, similar to the way that defragmenting a hard disk drive clumps together all the used sectors of the drive. For example, Hungary has become more Hungarian and Romania more Romanian since their creation in current form after World War I, as the ethnic minorities in each country have left

for those nation-states where their language is the majority standard. Anne Applebaum writes about how two adjacent villages, both in Poland before World War II, were split between Belarus and Lithuania afterwards; slowly but surely, the two villages diverged in everyday attributes such as the language villagers spoke, where they shop, what television they watch, and which authority does road maintenance on either side of the border.<sup>107</sup> As Thomas Schelling demonstrated in investigating neighborhood segregation,<sup>108</sup> consciousness of a partition in a literally spatial domain can change peoples' choice of instantiations within that domain. More generally, a partition in one domain can induce a partition in domains linked to it.

Before leaving the example of geopolitical contrast sets, it would be only fair to mention that there are even more complexities involved in it. I have only laid out the very basics of the problem. I have presented it in a structural, static way, but one must also take into account that many people are multicultural and multilingual, and that language exists not only as knowledge in the head but as individual acts at particular moments in time. In addition, cultural variables can be mapped to geographical focal points, such as national capitals, and larger political entities were in earlier times more often defined by focal point (with fuzzy boundaries) than by boundary.<sup>109</sup> Also, in geographical domains, transport corridors such as roads and rail lines, as well as institutional relationships between producers and purchasers, bind different parts of that domain together in ways that can be inconvenient to cut. I could also explain in detail how the choice of "perceptual focus" in partitioning (see section 2.7) can be thought of as a choice of which of a set of linked domains to prioritize as a basis for partition. Overall, though, I think that the vocabulary of domains

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<sup>107</sup> Applebaum, *Between east and west*, p. 94.

<sup>108</sup> Thomas C. Schelling, "Dynamic models of segregation," *Journal of mathematical sociology* 1 (1971): 143-186. For a recent summary see among others Philip Ball, *Critical mass: how one thing leads to another* (London: William Heinemann, 2004), pp. 383-396.

<sup>109</sup> In the medieval world, it seems that large-scale political categorization was often (but not always) relatively more defined by focal point than by boundary, but that at the micro level, boundaries were routinely used to demarcate villages, parishes, and agricultural land. See Daniel Abulafia, "Seven types of ambiguity, c. 1100-c. 1500," in *Medieval frontiers: concepts and practices*, edited by Daniel Abulafia and Nora Berend, pp. 1-34 (Aldershot: Ashgate, 2002), p. 15, and Ronnie Ellenblum, "Were there borders and borderlines in the Middle Ages? The example of the Latin Kingdom of Jerusalem," pp. 105-119 in the same volume, pp. 110-111.

and contrast sets could be much more widely used in discussions about geographical boundaries, and it would be interesting to see this issue explored in much greater depth.

## 2.10 Precision

Finding our bus in the gigantic car park at Pryca was supposed to be easy. Each small section of the car park was signposted with a different animal. So if you parked in, say, the elephant section, which had a silhouette of an elephant on the sign, you knew you'd find it among the hippos and lions, just like the eagle was near the duck and toucan, etc., etc. The only problem was that the car park was so vast that they had to use many animals, and they ran out of ones that look completely different. You may be able to tell the difference between the silhouette of a spiny-tailed bandicoot and a blue-nosed armadillo at 40 paces, but I can't. So I always made sure we parked in the shadow of an unmistakable animal, like a giraffe.<sup>110</sup>

The former motorcoach tour guide whose memoir is quoted above is complaining about a situation where there was insufficient contrast between the members of a contrast set. In this case, the contrast set of animals was being used as a set of labels. It seems the number of labels needed was fairly large and hence so was the number of animals. Indeed, their number perhaps started to exceed the number of animals that people are easily able to distinguish. When choosing the members of a contrast set one wants to pick distinct, salient entities that people are easily able to keep apart — not armadillos and bandicoots, whose profiles people may not be able to recognize.

Within a given context, systems of classification usually have a lower limit on the size of the units which they recognize. We distinguish red and blue, but not scarlet and crimson. We think of both Chihuahuas and St. Bernards as dogs even though they appear as different as wolves and foxes. We consider South Africans, Scots, and Canadians as speakers of "English" even though the Englishes they speak are not the same. We speak of our trip to "India" or "Italy" even though we may only have been to Rajasthan or Rome. Because the town is the smallest political division in New Jersey, residents of different parts of Piscataway have the same mayor, even though equally distant residents of Piscataway and Bound Brook have different mayors.

The challenge for the designer of a contrast set is to help users find an appropriate level of precision in the division of a domain. In choosing how finely to partition the domain,

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<sup>110</sup> Brian Thacker, *Rule no. 5: no sex on the bus* (Sydney: Allen & Unwin, 2001), pp. 213-214.

designers must decide what degrees of difference between instantiations they should take account of, and what they should ignore. Stopping points built into the design of a contrast set have a powerful effect on users' choice of a level of precision (for example, though we *could* discuss time in terms of 45-second chunks, we tend to use the convention of 60-second-long minutes). Since the level of precision appropriate for one context may not work in another, designers may want to recognize several different levels of precision in their partitions, thus effectively creating a taxonomy (such as days, hours, minutes, and seconds). The term *granularity* can be used to refer to the size of the smallest unit deemed significant in a given context. The finest level of the taxonomy might correspond to the least effective difference<sup>111</sup> between the instantiations in the domain — that is, the smallest difference that really matters.

In contrast sets defined by focal point, the issue of precision is connected to the concept of tolerance around the focal point of each contrast set member. In general, the finer the degree of precision, the smaller the tolerance around a focal point. At a basic level of color categorization, for example, where we distinguish "red" from "blue," scarlet and crimson fall within a tolerable distance of our prototype of the color "red," but we can also imagine moving down to a finer level of color differentiation where the terms "scarlet" and "crimson" would have prototypical focal points of their own.

The definition of a scale unit suggests a particular level of granularity and set of stopping points within a domain. Thus the use of the Celsius scale in European television weather reports strongly encourages that all temperature figures be "rounded" to the "nearest" full degree, suggesting that "8 degrees Celsius" is something significantly different than "9 degrees Celsius" whereas "8.1" and "8.2" are just allovariants of "8". However, mathematical scales are open to the possibility of capturing differences in a domain that are below the granularity of the unit. We have conventional ways of symbolizing fractional value by using decimal points and numerators and denominators ("8.63", "8<sup>5</sup>/<sub>8</sub>"). But whether we

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<sup>111</sup> This term is borrowed from Edward Tufte, *Visual explanations: images and quantities, evidence and narrative* (Cheshire, Connecticut: Graphics Press, 1997), chapter 4 (pp. 73-77).

use them is optional, and indeed, rounding conventions in timekeeping or retail sales are agreements about how far to go in taking account of these small differences.

Contrast set designers face a tradeoff between the costs and the benefits of precision. Precision is valuable up to a certain point, after which it becomes wasteful. Precision is what allows us to build accurate machinery, express complex and nuanced meanings, produce useful maps, and coordinate our plans with others. But it costs us time and effort to measure precisely, to produce rulers with accurate fine spacing marks, or to remember to take into account the difference between a dotted and an undotted *i*. One wants instantiations that are significantly different to belong to distinct contrast set members. But at the same time, one does not want to institutionally recognize differences that are barely perceptible. In public situations people expect the members of a contrast set to make neither too fine nor too coarse distinctions but rather the distinctions that are relevant. There is an economy of our attention and people expect it to be used thriftily.

This realization has been a cornerstone of the discussion of precision in linguistics and philosophy. H. P. Grice expressed it as the Maxim of Quantity: "1. Make your contribution to the conversation as informative as necessary. 2. Do not make your contribution to the conversation more informative than necessary."<sup>112</sup> From this principle one can derive the idea that the level of precision used in a given context must be relevant to the needs of the discourse, and that inside that level of precision one has license to be vague.<sup>113</sup> Thus, we give ourselves license to lie a little bit, and to simplify "minor" details, as long as we "present the *essential* on the scale on which we are working."<sup>114</sup>

The problem is that imprecision at one level becomes untruth at a finer level. Since our ability to represent analog domains in terms of discrete contrast sets is limited by the granularity of the set, such representations will never be perfectly *true* at all potential levels

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<sup>112</sup> H. P. Grice, *Studies in the way of words* (Cambridge: Harvard University Press, 1989), pp. 33-34; H. P. Grice, "Logic and conversation," in *Speech acts*, edited by Peter Cole and Jerry L. Morgan, pp. 41-58 (New York: Academic Press, 1975).

<sup>113</sup> On the concept of relevance see Deirdre Wilson and Dan Sperber, "Truthfulness and relevance," *Mind* 111 (2002): 583-632. See also the discussion of a "functionally determined lower limit to specificity" in Cruse, *Lexical semantics*, pp. 153-155.

<sup>114</sup> Mircea Eliade, *Journal II, 1957-1969* (Chicago: University of Chicago Press, 1989), p. 202.

of precision. (Mark Monmonier had this fact in mind when he ironically titled a book *How to lie with maps*.<sup>115</sup>) To accept a conventional standard of precision is, then, to tacitly agree not to accuse contrast set users and other representers of being unfaithful to the things that they are trying to represent — at least, not at a level below the granularity of the representative process. In America, the standardization of the penny as the smallest coin allows a storekeeper to be confident that if they compute seven percent sales tax on a ninety-nine cent sale, a customer will not protest when they are charged \$1.06 instead of \$1.0593.

In fact, similar questions of precision arise not just in contrast sets, but in any human activity where one kind of information is projected onto or represented by another. Other real-life situations where we project one set of information onto another in a way that calls for a particular level of precision include the creation of maps and narratives, the reproduction of images, and the design and use of collections of terms. The Borges story about the cartographers who made a "map of the Empire which was the size of the Empire, and which coincided point for point with it"<sup>116</sup> shows how ubiquitous these situations of representation are, by pointing out the absurdity of any representational process which does *not* involve a certain degree of simplification and approximation.

In certain contexts (such as in choosing a lower limit of monetary value), the members of a social group have settled on a single shared level of precision, for which we can use the term *standard of precision*.<sup>117</sup> Standards of precision are conventional guidelines for what level of precision is appropriate in a given everyday life context. They are sometimes formally specified, and sometimes not; they can be rough, flexible guidelines, or very exact specifications. But when a standard of precision exists, we expect people to take the trouble to follow it. Within a single domain, the standards of precision can vary from context to

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<sup>115</sup> Mark Monmonier, *How to lie with maps* (Chicago: University of Chicago Press, 1991). See especially chapter 3 ("Map generalization," pp. 25-42).

<sup>116</sup> Jorge Luis Borges, *Collected fictions* (New York: Viking Penguin, 1998), p. 325.

<sup>117</sup> This term has been previously used by David Lewis, "Scorekeeping in a language game," in *Philosophical papers*, 1: 233-249 (New York: Oxford University Press, 1983-1986 [1979]), p. 245. Wilson and Sperber, in "Truthfulness and relevance," suggest that Lewis's concept of standard of precision can be replaced by the more flexible concept of relevance. I propose that there is a need for both concepts and that standards of precision may be considered conventionalized judgements of relevance.

context. Thus a different level of precision is required when timing the length you clocked on your last work shift (which you might measure to the nearest quarter hour) and your finishing time in the hundred-yard dash (which might be measured to a hundredth of a second). And, when asked the time of day, a large number of people who wear digital watches go to the extra effort of rounding off to the nearest five minutes rather than simply reading off the already precise-to-the-minute digital display.<sup>118</sup>

Many domains exhibit a default level of precision that we expect unless we are told otherwise. Thus we might use the same men's room sign to signify both a men's room with one urinal and one with ten. The size of a men's room is largely irrelevant to our interest in finding it, we do not normally expect others to give much attention to the domain of the size of men's rooms, and thus we do not partition and label them in a way that reflects the attribute of size. Similarly, if we are looking for wing A of a building, we are likely to assume that a sign reading *A* refers to our destination, even though the *A* in this case is in italics. These standards of precision are not natural or universal, but we learn them from our experience of the world. We can call the distinction between "mens' room and womens' room" and "A and other letters of the alphabet" a *basic level* of precision, working from the idea of basic-level categories in linguistic categorization.<sup>119</sup> Below the basic level of precision, people consider distinctions to be *technical* (too specific to make much of an effort to capture). Thus the distinction between different types of mens' rooms or different types of *As* is, in the examples given, technical, not basic.

As, however, people do not lead only "everyday" lives but also use and make technical distinctions in certain contexts, it is important to have technical distinctions available to us without forcing them on everyone all the time. While most people would find it odd to hear someone observe at a garden party that the wind was coming from the west-northwest, the same observation would be entirely appropriate in a meteorological office where wind direction is described with a higher degree of precision. In algebraic formulas, we might

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<sup>118</sup> Jean-Baptiste Van Der Henst, Laure Carles, and Dan Sperber, "Truthfulness and relevance in telling the time," *Mind and Language* 17 (2002): 457-466.

<sup>119</sup> For a summary of basic level categories, see Taylor, *Linguistic categorization*, pp. 46-51.

consider the forms *y*, *y*, and *Y* equivalent in some contexts, and pay attention to the differences between them in other contexts. This need for flexibility is a good reason for contrast set designers to consider partitioning a domain in multiple "layers." That may mean creating a taxonomy with different levels, so that it is possible to choose a level of the taxonomy that corresponds to the level of precision that is appropriate for the context at hand. One may say, then, that something happened in the United States, in New York State, in Monroe County, or in Rochester. One may discuss "A, B, C, and other letters of the alphabet" or "A, A, a, a and other types of As." In written Japanese, *dakuon* diacritical markings (which mark voiced versions of unvoiced consonants) do not have any affect on alphabetical order, so that と 'to' and ど 'do' are alphabetized together, effectively creating two levels of precision in the Japanese syllabaries; similarly, accented and unaccented letter pairs such as *a* and *á* are lumped together in certain Icelandic dictionaries, and not in others. Consider as well how many writing systems typically choose not to indicate certain features of spoken language (tone in Chinese Pinyin, vowels in Arabic and Hebrew) but can do so optionally, for example in texts for children or foreign learners. In other cases, having multiple layers means being able to choose between quite different sets of focal points which partition the same domain at different levels of precision, so that the sets {N, W}, {N, NW, W}, {N, NNW, NW, WNW, W}, and {270, 271 ... 360} partition the north-western quarter of the compass by focal point at four distinct levels of precision.

Just as our everyday, "basic" level of precision is widely shared and assumed throughout a whole society or thought community, it can also change from community to community. In Hungarian, there is a distinction between the letters *o*, *ó*, *ö*, and *ő* whereas in German handwriting, any *o* with a mark over it is likely to be taken to represent an *ö* (German does not use *ó* or *ő*). Visitors to Florence (Italy) who are trying to find a street address must take account not only of the house numbers, but of whether they are written in red or black. Russians have basic level terms for two different kinds of what we call "blue" and Hungarians more or less do the same with what we call "red." Different musical

traditions prefer to partition the octave into five, seven, or twelve divisions or even into so-called microtones.

A standard of precision can be challenged in two ways: by saying it requires too much exactness, and by saying that it is not precise enough. We can think of a person (or a situation) who makes the first type of challenge as an *approximator* and a person who makes the second type of challenge as a *hairsplitter*. As an example of approximating, consider those situations that force people to ignore important distinctions in their regular orthography for technical reasons. For example, Icelanders generally conflate the letters *d* and *ð* as *d*, *t* and *þ* as *t*, and *a* and *á* as *a* when writing cell phone text messages, not by choice but since most phones do not support *ð* and *þ* and it requires bothersome extra keystrokes to write *á*. Similarly, a Swedish company posts a notice on its website explaining that the e-mail address of each employee is simply "firstname.lastname", except that one must "round off" *å*, *ä*, and *ö* to *a*, *a*, and *o*.<sup>120</sup> Both examples show a more precise contrast set being approximated by a "restricted" or "generalized" version which is less precise.

Hairsplitting challenges to a standard of precision claim draw our attention to features in a domain that are not reflected in the construction of a contrast set. Statements of the form "There is x and then there is x'" (such as "There is first class and then there is *first class*") tell us that a particular contrast set member warrants further conventional partitioning. Author Vladimir Nabokov, who had a keen interest in sets and classification, once told his annotator that

I am therefore puzzled and distressed by the significance you lend to the general idea of "red" in my book. When the intellect limits itself to the general notion, or primitive notion, of a certain color it deprives the senses of its shades ... For me, the shades, or rather colors, of, say, a fox, a ruby, a carrot, a pink rose, a dark cherry, a flushed cheek, are as different as blue is from green or the royal purple of blood from the English sense of violet blue. I think your students, your readers, should be taught to see things, to discriminate between visual shades as the author does, and not to lump them under such arbitrary labels as "red" (using it, moreover, as a sexual symbol ...)<sup>121</sup>

When people are confronted by others who disregard small differences that they consider important, they often find it insulting or disappointing. Hungarians put in a

<sup>120</sup> "Kontakta SvD," [http://www.svd.se/dynamiskt/omsvd/did\\_5454742.asp](http://www.svd.se/dynamiskt/omsvd/did_5454742.asp) (May 2004).

<sup>121</sup> Vladimir Nabokov, *The annotated Lolita* (New York, McGraw-Hill, 1970), p. 362.

situation which does not distinguish between *o*, *ó*, *ö*, and *ǰ* may feel that they have been shown a lack of respect, while an American newspaper article which renders the Icelandic girls' name Þorbjörg as Þorbjorg<sup>122</sup> provokes a small sigh of resignation from those who know the difference between *Þ* and *P* and between *ö* and *o*. Consider, as well, an American, the brother of a former co-worker of mine, whose parents named him Søren (as in Kierkegaard) but who was forced by the conventions of written language in America to go by Soren. Reports from Norway are that parents, eager to help their children avoid this sort of minor indignity, are avoiding first names that include the typically Norwegian letters *å*, *æ*, and *ø*, which do not fit into the system of significant distinctions supported by the least-common-denominator lingua franca of the Roman alphabet.<sup>123</sup>

In certain domains, when levels of precision are defined too finely, one runs the risk that users will make too much of the categorical difference between two instantiations which are actually quite similar. Consider the Doonesbury cartoon where the head of Nike denies that the company hires 13-year-old Asian workers. "The 13 thing is a total media fabrication," he says; they are actually 14.<sup>124</sup> The humor here plays on the question of the lack of formal agreement in society about what degree of transmission error is significant enough to render inaccurate a message that conveys a certain position in a domain. Is a claim of importance based on someone being 13 years old rendered completely invalid if the actual age turns out to be 14, or simply diminished? The fact that the year is a basic-level unit of age measurement gives the head of Nike an opening to shift the focus of the debate from the fairness of the practice to the issue of the accuracy of the claim, but doing so makes us laugh since we know that 14-year-olds are only slightly poorer examples of "underage labor" than 13-year-olds. To take another example, consider that in Russia in the summer of 1992, a kopek was worth less than a hundredth of a U.S. cent and kopek coins were in short supply. One day at a state-run store, I bought a subsidized loaf of bread priced at eight rubles forty-

<sup>122</sup> Jason George, "In Iceland, freeze frame takes on new meaning," *New York Times*, 4 November 2004, p. B1.

<sup>123</sup> Þráinn Bertelsson, "Alþjóðleg mannanöfn," *Frettablaðið* (Reykjavík), 17 November 2003, p. 32.

<sup>124</sup> Garry Trudeau, *Doonesbury*, original release date 14 October 1997.

seven kopeks and presented the cashier with eight rubles and a fifty-kopek coin. Trained to be exact, she adamantly refused to "keep the change," creating an absurdist situation as I and the line of disgruntled customers behind me waited for her to search through the bottom of her cash drawer for three kopeks.

Designers should keep in mind that people and machines differ in their ability to disambiguate. Computers and other machines cannot use contextual clues outside of the artificial framework of their own competence to disambiguate, but they can perceive very small degrees of difference which humans have trouble seeing so long as they are "told" where to look. Human beings, meanwhile, constantly mix up their scrawled 1s and Is and Os and Os, and have difficulty telling the sounds of *s* and *f* apart on the telephone. This is why telephone reservationists have to spend so much time repeating the letters and numbers on airline ticket record locator codes like ERQ2SM or Z1DLW9, and why early computer displays which were limited in their rendering resolution distinguished between the letter O and the number 0 by putting a slash across the latter. Although these figures are completely distinct in the code in which the computer represents them, humans easily confuse their names and shapes.


 A handwritten seven-character code 'A1X0987' where the '1' is a vertical stroke and the '0' is a circle with a diagonal slash through it.

Image 2.13 (040)

A designer who is planning a numbering system whose elements frequently need to be transmitted visually or through speech might be well advised to use a reduced symbol set with fewer potentially confusable elements, or to separate and thus contextualize the use of letters and numbers. Thus the airline Iceland Express uses only numeric booking references (such as 208783). "Hollis," the database of the Harvard University libraries, for some years identified each record with a seven-letter code which was always three letters plus four numbers (ABC1234, for example), so that even a beginning user could see that the Hollis number in Image 2.13 contains neither the numeral 1 nor the letter O. Although this limitation of form reduced the capacity of a seven-symbol ID tag from  $36^7$  to  $26^3 \times 10^4$ , it freed users from having to make similarity judgements between forms which are difficult to keep apart.

Precision is a fascinating theme which cuts through almost every domain of daily life. Although philosophers of language have considered it in some detail, social scientists and scholars of everyday life have not. Despite tantalizing book titles like "The values of precision," and many references to standards of precision in specific contexts, when I wrote a graduate term paper about standards of precision in 1997, I could not find any previous treatments of the topic as a practical, mundane social form. I hope that this brief discussion might encourage someone to explore precision in everyday life in greater depth.

## 2.11 How contrast sets fill slots

Particular discourse contexts often create "slots" which are designed to be filled by the members of one particular contrast set. Contrast sets thus act as sets of the arguments or variables that can be "taken" by a particular formula in everyday life. As examples of how everyday life formulas "call" the members of contrast sets as arguments, consider how the different slots in a cognitive schema,<sup>125</sup> the attributes of objects in object-oriented computer programming, or the elements of relationships in entity-relationship database modeling<sup>126</sup> may each be filled only from a particular set of hyponyms. For example, your credit card expiration date is a two-slot schema whose arguments are the two contrast sets of month and year numbers. In the lexicon, compare how only a limited class of words can fill a particular role (such as the object of a particular verb) in a sentence.

Thinking in the opposite direction, given a particular contrast set, there are many different types of slots that its members can fill. Take, for example, the domain of standard languages, and the element "Vietnamese" within the contrast set formed by partitioning that domain. It is possible to *be* a native speaker of Vietnamese, to *be in* an environment where most people speak Vietnamese, or to be *speaking with* a native speaker of Vietnamese. Or, take the days of the week. It is possible that it *is* Monday, or that it is not Monday but you are *thinking about* Mondays in general, or that it is not Monday but you are *making an*

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<sup>125</sup> For an introduction to schemas and scenarios see Roy D'Andrade, *The development of cognitive anthropology* (Cambridge: Cambridge University Press, 1995).

<sup>126</sup> See Connolly and Begg, *Database systems*, section 11.1.

*appointment for* next Monday. Similarly, you can be geographically *in* telephone area code 315, or *calling from* 315, or *calling someone who lives in* 315, or simply *focusing on* that part of your work that deals with area code 315. You can *be on* the red team, or *cheering for* the red team, or *wearing* a red sweater, or *on vacation on* red days. You can be *listening to* an A flat, or *playing one on* the piano, or *seeing one written out on* a score, or *singing one and knowing you next need to sing a* B. Consider, as well, domains of measurement: when you drive, you *are going* at a particular speed, and the temperature outside *is* at a certain level, and that carton of eggs you are holding *occupies* a particular position in the domain of standardized egg sizes. Databases and other collections of entities work the same way: if, for example, you have just given your ticket record locator to the airline telephone representative, you *are* the person identified with the entity referred to by that locator, while the representative is simply *thinking about* your record (as opposed to the other records in the database), and about you as its holder (as opposed to all the other people in the world).

All of the italicized words in the preceding paragraph are verbs, while all of the consciously created contrast sets referred to involve nouns. When asking what kind of slot the members of a contrast set belong in, one is therefore asking what *context of activity* provides an option to choose between the different members of the contrast set. What is the action schema in which the contrast matters?

In each case, there is a human actor or user in the picture as well. At any given moment, the context of activity associates that user with a particular member of the set chosen to fill a slot. This relationship may be different in nature but it always involves some type of tie or focus. As we pass through the course of the day we enter and then leave dozens of such contrast set relationships, so that I am currently in room number 505 in the building I work in, but an hour from now I no longer will be.

The fact that, in a particular context, one member of a contrast set and not the others fills a slot, creates a special link or affinity between the human beings in that context, and the selected member of the set. To say that "I am in Lisbon (and not Larnaca)," or that "I am Asian (and not a Pacific Islander)," or that "I am processing *this* item in the inventory, not

*that one,*" or that "it is 1989, and not 1988" is to attribute to oneself a particular location with a contrast set, and with that, a particular identity that is defined against the other members of the set. These acts of definition of a user's place are important, because some ways of referring to locations in contrast sets and domains assume that the user's location is known and understood. Linguists call this phenomenon of context-dependent reference *deixis* (the adjectival form of the word is *deictic*).<sup>127</sup> Words like "here," "there," "me," "you," "now," "then," "next," "last," "left," and "right" cannot be definitively interpreted without knowing the position and identity of the speaker in a given domain.

The most classic deictic settings are literally spatial. In many cases the user is actually physically inside the domain and inside one of the members of the contrast set. This is most obviously true of geographical domains and their contrast sets. That means not only administrative contrast sets like countries, counties, school districts, voting districts and the like, but also sets like the rooms or floors of a building, or telephone and postal coding areas. Being inside the contrast set lends a certain flavor to the user's relationship to it; the domain becomes identical with the user's physical environment, rather than being an abstract idea.

In other cases, the user is not literally "in" the domain, but rather has a special relationship with one part of the domain at a time that they are holding, looking at, focusing on, paying attention to, thinking about, surrounded by, connected to, or dealing with.

Users of a domain often have the choice to discuss that domain in one of two ways: a deictic way that can only be interpreted with knowledge of our position in the domain, or a non-deictic way which is independent of such knowledge. The most common terms for this distinction are "relative" and "absolute" respectively, but other pairs are commonly used including the more technical terms "egocentric" and "allocentric."<sup>128</sup> The choice of absolute or

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<sup>127</sup> See Charles J. Fillmore, *Lectures on deixis* (Stanford, California: Center for the Study of Language and Information, 1997), esp. pp. 59-75; Stephen C. Levinson, *Pragmatics* (Cambridge: Cambridge University Press, 1983), ch. 2 (pp. 54-96). Czechs may be familiar with the Jára Cimrman skit in which Cimrman teaches his students how to use the telephone, explaining that they should not answer with (for example) "Smith here," but rather "Smith *there*," because they need to keep the perspective of the caller in mind.

<sup>128</sup> See Tversky, "Remembering spaces," p. 364-365 on terminology; for more on the allocentric-egocentric contrast see Stephen C. Levinson, "Language and space," *Annual Review of Anthropology* 25 (1996): 353-382. Roger M. Downs and David Stea use "state description" and "process description"

relative reference is most typically a conventional design choice made in the assignment of labels to a preexisting contrast set (see section 3.3). However, the issue also comes up in the design of contrast sets themselves in a few cases, where the actual partition of a domain may take place in different ways depending on the position of the user. Thus we often express direction absolutely and non-deictically in terms of the four focal points of north, south, east and west, or by using the convention of a circle divided into 360 degrees with 0 as north; these directions are grounded in a shared theory of the shape of the earth. But if we are on a ship we may prefer to express direction relatively and deictically using the bearing-based terms fore, aft, starboard and port, and if we are a guide on a bus we may communicate relative directions with our group in terms of a clock face where the front of the bus points towards 12:00 and the rear towards 6:00.<sup>129</sup> Thus, if you are piloting a ship with a bearing of 90 degrees, both "go east" and "go forward" are commands with the same practical meaning that rely on different conceptions of the structure of the domain.

In dreams, our sense of our relationship to a contrast set may be disrupted or perturbed, and dreams may loosen the conditions that a schema normally places on the type of contrast set that can fill a certain slot. For example, we may imagine ourselves "in" something that we normally cannot be in. In Nicholson Baker's novel *The everlasting story of Nory*, he tells us about Nory's dream "of being chased *through* various shades of colors by a queen who was determined to cut off her arm for a punishment."<sup>130</sup> It seems that Nory is running through something like the color spectrum projected into space, and thus that the dream reinterprets the domain of color as something with an actual spatial existence. This is not such a huge leap, since the spatial metaphor suggests that *any* domain is something that we could possibly imagine ourselves going *through*.

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for a similar opposition in *Maps in minds: reflections on cognitive mapping* (New York: Harper & Row, 1977), pp. 43-47.

<sup>129</sup> On the partition of the domain of direction generally, see Edwin Hutchins, *Cognition in the wild* (Cambridge: MIT Press, 1995), and Levinson, "Language and space."

<sup>130</sup> Nicholson Baker, *The everlasting story of Nory: a novel* (London: Vintage, 1999), p. 15. My emphasis.

## 2.12 Images of contrast sets

We very often create conventional derivative representations, usually visual or visualizable images, of a contrast set. An image usually takes a form that is the same or similar to the topology (literal or metaphorical) of the contrast set, but this is a matter of inspiration, not determination. Such images may be entirely mental, existing only in the mind of a person or a group, but they may alternatively or at the same time be real and physical, like a map. They are durable, whether in our minds or in the world, and we use them as tools to allow us to think about the contrast sets they represent.

The most familiar images of contrast sets are the ordinary physical representations of them that we work with every day. For example, the piano keys, the musical staff, or the keys or strings of any other instrument are physical representations of the contrast set of standard pitches. The alphabet, written out in ABC order, is a conventional way of representing the contrast set we have picked out of the domain of letterform. The speedometer in your car is an image of the contrast set of speeds, while the diagram on the bulb of a stick-shift lever is an image of the contrast set of gears in the transmission. A political map of the seven divisions of Australia is an image of that contrast set (a physical map of Australia is more an image of the underlying domain). Similarly, a diagram or chart may show all the stops along a subway line. A simple number line is an image of the contrast set of integers, while calendars, appointment books, and employee shift plans physically represent months, dates, days of the week, and hours of the day.

When these images are shared throughout a community, they are necessarily conventionalized, so that not all of the many possible images that could be shared actually are. The alphabet, for example, frequently presents itself sequentially, beginning with A, B, and C, even though there are other ways it can be visualized. But ABC order is so deeply ingrained in us that we have difficulty thinking of the alphabet in any other way and may indeed rarely think of the alphabet *without* seeing this image. Certainly we find it hard to say the alphabet backwards, or in any other sequential order, though many people can manage to

reproduce the layout of a typewriter keyboard. (For more on ordering standards, see section 4.5.)

Images of contrast sets generally not only approximate the topology and replicate the conventional order of a contrast set, but also highlight particular members of the set which are "marked" or which serve as particularly important focal or anchor points. Some members of a contrast set may be "regular" or "normal" while others are special in some way. (The classic example is of "default" weekdays and "marked" weekend days.)<sup>131</sup> In other cases, a particular contrast set member forms a dividing point, focal point, or anchor point, or simply stands out in some other way. Thus my calendar marks Sundays in red, some appointment books allot less space to weekend days, two dots mark out "north" on my compass (making it easier to align the needle), and in most stick-shift cars reverse gear is marked by a special location or shifting strategy.

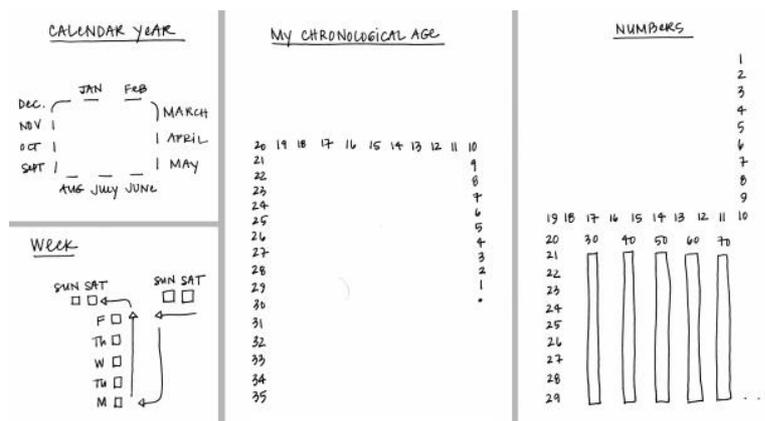


Image 2.14 (075)

Some images of contrast sets are *not* shared, indeed they are entirely personal. Though personal, these private contrast set images still normally bear some relation to the shared image or the natural topology of the contrast set.<sup>132</sup> The most

commonly reported versions of these images are of numerals and various calendrical contrast sets, but they have also been reported for the contrast sets of the alphabet and for

<sup>131</sup> On markedness within the week specifically, see Eviatar Zerubavel, *The seven day circle: the history and meaning of the week* (New York: Free Press, 1985), pp. 107-129. For a review of the idea of markedness, see Edwin L. Battistella, *The logic of markedness* (New York: Oxford University Press, 1996). Markedness has been defined in several ways. I use "unmarked" in a sense close to Roman Jakobson's, to describe those members of a contrast set or structural opposition which are "default" or "normal." See also Linda R. Waugh, "Marked and unmarked: a choice between unequals in semiotic structure," *Semiotica* 38 (1982): 299-318; Wayne H. Brekhus, "A sociology of the unmarked: redirecting our focus," *Sociological Theory* 16 (1998): 34-51.

<sup>132</sup> Kevin Lynch makes a similar point about individual and shared images of domains (specifically, cities) in *Image of the city*, p. 46.

height, weight, and temperature measurement.<sup>133</sup> They are typically durable, life-long images that their possessors automatically use to "locate" a particular member of the contrast set, and, perhaps, to amplify their sense of that member's distinct identity by assigning it a particular spot on the image. Image 2.14 illustrates four such private images which a former college classmate of mine possesses.

One study estimates that 14% of the population have (like my classmate) a private visual image of the contrast set of integers (called a *number form*). Typically, they visualize the numbers along a line which takes a particular form in space, usually twisting or bending at the important turning points in the sequence, and receding or becoming indistinct as the numbers rise.<sup>134</sup>

Some people also form powerful and permanent private images of temporal contrast sets. For example, the year might be represented as a circle or a triangle with a particular orientation in space and with each of the months located at a particular point; these images are often called calendar forms. Someone with a form for the year or the week who is thinking about (say) "April" or "Tuesday" will simultaneously, automatically, and only half-consciously visualize the corresponding point on their year- or week-form.

Such private images do reflect the naturally determined and socially conventional aspects of the contrast set formed out of a given domain. Number forms represent the sequence of integers in a linear fashion, and although the line is not geometrically straight, it usually bends at socially conventional points, in other words at multiples of ten in our base-ten societies. Images of the year are often cyclic. In Image 2.14, the week is, as one would expect, seven days long with a two-day weekend (although it proceeds from right to left, which seems unconventional in an English-speaking world). The image of "my chronological

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<sup>133</sup> Richard E. Cytowic, *Synesthesia: a union of the senses* (2d ed., Cambridge: MIT Press, 2002), pp. 179-205.

<sup>134</sup> For a general introduction to number forms see Brian Butterworth, *The mathematical brain* (London: Macmillan, 2000), pp. 235-240, 308-309, and the references therein. Also see Xavier Seron, Mauro Pesenti, Marie-Pascal Noël, Gérard Deloche, and Jacques-André Cornet, "Images of numbers, or 'When 98 is upper left and 6 sky blue,'" *Cognition* 44 (1992): 159-196. For a perspective from educational psychology, see Noel D. Thomas, Joanne T. Mulligan, and Gerald A. Goldin, "Children's representation and structural development of the counting sequence 1-100," *Journal of Mathematical Behavior* 21 (2002): 117-133.

age" in the picture does not include numbers below zero or over two hundred, and similarly, we expect that a subjective image of human height measurement would show typical human values, like 5 feet 5 inches, not 9 feet 9 inches. Such images are tied to the conventional contrast set formed within a given domain, not to the domain directly; thus a form based on feet and inches would not be transferable over to metric units.

Those of us who do not possess such images typically find the experience of them somewhat difficult to grasp. Private images are also difficult to study, because, like mental maps, they cannot be seen, only elicited.<sup>135</sup> Researchers have dealt with this problem by using methodologies that rely on observations of consistencies from person to person in the nature of the phenomenon, consistencies from time to time in a person's own reports of their images, and objective studies of the unconscious effects of such images. Although no one really understands why some people have private images of contrast sets and others do not, after well over a hundred years of research on them, it is clear that they are a bona fide phenomenon. I would add that they are specifically dependent on the conventional creation of contrast sets in certain particularly basic and fundamental domains.

An open research question is whether the ability to create or manipulate images of contrast sets (and domains) plays any role in various mundane human abilities and talents. Maps and visual images, models, or representations of a domain are very powerful tools, since, like a landscape or photograph, humans can think about many parts of them at once instead of bit by bit. As economists or physicists know, diagrams "automatically support a large number of perceptual inferences, which are extremely easy for humans."<sup>136</sup> The "method of loci" used in medieval memory techniques improves recall by projecting each element of a sequence into an imaginary physical space.<sup>137</sup> Some argue that images, landscapes, and diagrams can in fact be what permits an understanding of and feel for a

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<sup>135</sup> See Passini, *Wayfinding in architecture*, pp. 34-35.

<sup>136</sup> Jill H. Larkin and Herbert A. Simon, "Why a diagram is (sometimes) worth ten thousand words," *Cognitive Science* 11 (1987): 65-99, p. 98. The same point is made by Daniel R. Headrick, *When information came of age: technologies of knowledge in the age of reason and revolution, 1700-1850* (Oxford: Oxford University Press, 2000), p. 125.

<sup>137</sup> See Frances Yates, *The art of memory* (London: Routledge and Kegan Paul, 1966), p. 2.

contrast set or domain.<sup>138</sup> A calendar form concretizes into physical space the abstract difference between, say, "June" and "August," and a number form concretizes the ability to say that eight minus six is less than nine minus six. The case of a person with terrible arithmetic trouble who turned out to have a number form with the number 5 mistakenly listed twice suggests that a faulty understanding of a contrast set can be the result of a faulty image of it.<sup>139</sup> The strongest hypothesis one could put forth would be that everyone who really is able to work with a contrast set or domain has some sort of image of it, even if they are barely aware of what that image looks like.

Since the topology and form of public images of contrast sets seems to have some effect on the way that people internally conceptualize those sets, design choices for public images of contrast sets are important not just on independent aesthetic grounds but also because they will affect the way that countless people conceptualize the set. For example, the way stations are listed on subway signposts and route maps suggest spatial metaphors and images for the set of stations on a given line. The ring motifs of the Moscow metro and London Underground maps have become cultural icons, despite their cartographic inaccuracies.<sup>140</sup> Any designer who is responsible for creating a shared image of a set should know that their choices will end up not just on walls and signboards but also in the minds of many, many individual people.

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<sup>138</sup> See Kevin Dann, *Bright colors falsely seen: synaesthesia and the search for transcendental knowledge* (New Haven: Yale University Press, 1998), pp. 81-82, 84-85.

<sup>139</sup> Butterworth, *The mathematical brain*, pp. 308-309.

<sup>140</sup> See Ken Garland, *Mr Beck's underground map* (Harrow Weald, Middlesex: Capital Transport, 1994), and the critique of the London underground map in Paul Mijksenaar, *Visual function: an introduction to information design* (New York: Princeton Architectural Press, 1997), p. 6.

## 3 Labeling

Imagine that you lost your cat, or left your best hat at the opera coat check, or left an envelope with your two-hundred dollar cash bonus in it by the photocopier at work. If you then saw a "Cat Found" sign on a telephone pole or a "Money Found" sign on the bulletin board and called the number on it, or if you went back to the opera to ask about your hat, you would probably be asked to identify what you lost. How else, given the millions of cats and hats and envelopes in the world, would anyone be sure it was yours unless you could agree on the existence of some identifying mark? You would have to say that the cat was a black female with a white spot on the chest and a tear at the inside base of the right ear; the hat was brown with a white band and size 7; and that the envelope was a small-size security envelope with four fifty-dollar bills in it.

Your job would be much easier if your cat had a collar with a local police ID number on it; if you had sewn a name tag into the lining of your hat; or if the envelope had your Social Security number on it. Each of these systems would have tagged your property with a more or less unique identifier that would set it off unambiguously from other cats, hats, and envelopes. It would be much easier to identify your cat if you knew her number.

The fundamental issue here is the social problem of distinguishing between virtually identical members of sets. While we usually think of the numbering of things as something modern, associated with increasing bureaucratization and standardization, it is really something that has been around for centuries. The first person in the ancient Near East who gave instructions along the lines of "insert Tab A into Slot B,"<sup>1</sup> and indeed the first person who thought up writing and numerals as ways of symbolizing sound and number, were creating systems of signification using the same principles as assigning vehicle identification

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<sup>1</sup> See Michael Patrick O'Connor, "The alphabet as a technology," in *The world's writing systems*, edited by Peter T. Daniels and William Bright (New York: Oxford University Press, 1996), p. 791.

numbers or zip codes. Just as we do today, they came up with labels to identify the different elements of a preexisting contrast set.<sup>2</sup>

To appreciate the centrality of labeling to daily life, think of what would happen if the identification systems that we take for granted suddenly disappeared. For example, imagine what the world would be like without page numbers. Although we would still be able to write books, in indexes and citations we would have to refer people to particular pages by *describing* the identity of that page. The first few entries of an index might read:

**Aardvark**, picture of  
     about halfway through the book in the upper right-hand corner  
**Abacus**  
     discussed two pages before the aardvark picture  
**Acrobats**, training of  
     near the end of the first chapter starting on the bottom of the page  
     with the line drawings

Indeed, this is exactly what at least used to happen on the island of Saipan in the Northern Mariana Islands. "Up Navy Hill, left by the broken pump, the white house across from the basketball court" is an example of how the local pizza deliveryman referred to destinations on an island with no house numbers or street names. This type of identification worked just fine when Saipan had only a few hundred people. By 1999, when it had 70,000 residents, addresses on Saipan had become a public issue, especially because the development of an addressing plan had been stalled for more than ten years.<sup>3</sup>

Or consider what would happen if none of the multiple, nearly identical-looking checkin desks, boarding gates, and baggage carousels at a large airport were identified with names and numbers. Knowing (and mostly likely forgetting soon after) that you must check in at counters 35-38, proceed to gate D13, and retrieve your baggage from carousel B is essential to a successful trip.<sup>4</sup> Imagine if none of these labels were posted, forcing travelers to ask the airport staff to point to their check-in counter, gate, and baggage carousel.

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<sup>2</sup> A similar point is made by Alessandro Duranti in *Linguistic anthropology* (Cambridge: Cambridge University Press, 1997), p. 33.

<sup>3</sup> Seth Faison, "Saipan journal: palm trees and sun (and who needs an address?)" *New York Times*, 22 February 1999, p. A4.

<sup>4</sup> See Nirmal Kishnani, "Evaluation of the wayfinding system at Stansted Airport," in *Visual information for everyday use: design and research perspectives*, edited by Harm J. G. Zwaga, Theo Boersema, and Henriëtte C. M. Hoonhout, pp. 257-265 (London: Taylor and Francis, 1999).

It is not always worth giving a formal label to every member of a contrast set. Not all deliberately designed contrast sets are labeled, and a lack of labels does not necessarily render a contrast set unusable. For example, yellow or white lines often mark off one parking space from the next in a garage, creating clearly different entities, but whether to number or label the spaces is a separate choice. Sometimes we do and sometimes we do not. In small parking lots, it is usually enough to remember that one parked "a few spaces from the left in the row by the tree," but those of us who have lost our car in a large parking lot know that sometimes it would be nice to be able to know that we parked in, say, space A-150.



Image 3.1 (029)

The issue is ease of reference. We start to label contrast sets when the bother of labeling becomes less than the bother of getting one contrast set member confused with the next. A label is like a handle: it gives us something simple, concise, and graspable to metaphorically hold onto when we are thinking about a particular member of a contrast set. It offers a sure and easy strategy for telling the members of a contrast set apart and being able to say which is which — for example, which floor of an eighty-floor skyscraper we are on (or were on, or will be on), or which of a flock of ducks migrates to a particular place in the winter (with the help of the green identification bands in Image 3.1). And labels are at least designed to be shared by an entire community of thinkers, such as office workers or wildlife researchers. The fact that people have died unnecessarily when ambulance crews have been unable to figure out where to find them,<sup>5</sup> and that the main impetus for creating house numbers in a community sometimes comes from the fire

<sup>5</sup> Romedi Passini, *Wayfinding in architecture* (New York: Van Nostrand Reinhold, 1984), p. 21.

department,<sup>6</sup> shows how important it is to agree on a common way to label the environment we live in.

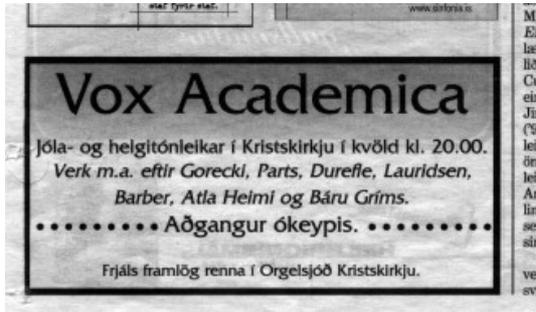


Image 3.2 (030)

In any given society, one can trace the historical circumstances that led to the creation, popularization, or demise of various labeling systems. As long as peoples' own "instinctive" sense of the identities within a set of things suffices,<sup>7</sup> formal labels need not be introduced. In

a small and homogenous society people expect others to know where things are, so that in 2003 in Reykjavík many entertainment advertisements in the newspaper neglected to list the street address of the venue (Image 3.2 shows an example), while New Zealanders still did not use postal codes on their mail. The title of the Saipan article mentioned above shows that those of us who have gotten used to such labeling systems find it shocking that some others live happily without them.

Labels become worthwhile when informal knowledge systems break down or no longer suffice. This can happen when a domain grows too large and complex for a single person to be able to maintain a sufficiently detailed subjective image of it. The Saipan example shows that such labeling tools often arise at points where societies are moving from village-style organization to a more anonymous life where people expect to be able to conduct impersonal encounters according to shared rules. Informal knowledge systems can also cease to suffice when there is a change in the average level of familiarity with a contrast set in a way that becomes problematic for all concerned — for example, if tourism brings a wave of visitors into town who, disoriented and guideless, are trying to find the lodgings that they have booked. (Similarly, *you* may know that you need to swivel your kitchen faucet left for

<sup>6</sup> See, for example, Brewster Fire & Rescue, "Can we find you?" [http://www.town.brewster.ma.us/brewfire/can\\_we\\_find\\_you.htm](http://www.town.brewster.ma.us/brewfire/can_we_find_you.htm) (January 2005). This is also true in New Zealand, where in March 2003 a resident along a rural road near Moetapu Bay in the Marlborough Sounds region explained to me how house numbers had only been put up when the local fire department insisted.

<sup>7</sup> I am still searching for studies which discuss how people remember the identity of different contrast set members (say, streets) without a labeling system.

hot water and right for cold, but your guests may not.) The introduction of centralized systems of taxation or conscription, in which those managing the system have no contact with those who it enumerates, has sometimes been a reason for the introduction of formal labels (for example, house-numbering in the Austro-Hungarian empire<sup>8</sup>). Overall, the more people live in diverse and populous communities, the more they interact with people they neither know nor see regularly, and the more that information is processed with procedures (whether electronic or human) that cannot match the richness-of-field of normal human attention, the more we need formal label systems and other types of institutionalized coordination to be able to operate in the world.

The following quote (from a historical novel about the village of Nuoro in Sardinia) shows that people raised under a system where informal knowledge sufficed can feel quite troubled by the introduction of labels:

They have given names to the streets. These are written in blue on white ceramic plaques with a thin blue line around the edge ... I am sure that Don Priamo would have disapproved of them. "What do you need plaques for," he would have told the council in memorable words, "when everyone knows where they have to go?"<sup>9</sup>

When a labeling system is introduced, not everyone will necessarily use it. There are plenty of cities in the world where street names and house numbers officially exist, but are rarely used, and where city maps are rarely sold. The following quote from a travel writer points to cultural differences in label usage between different groups of residents in Ashgabat, Turkmenistan:

... the Turkmens were a nomadic, tribal people, who still wore traditional costumes and didn't know the names of streets, perhaps because knowing street names requires an abstract and impersonal knowledge that is not based on habit. The people I met who knew one street from another were usually Russian hotel clerks, Armenian cab drivers, Azeri merchants, and so on — the urbanized foreigners.<sup>10</sup>

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<sup>8</sup> Anton Tantner, "Galerie der Hausnummern," <http://homepage.univie.ac.at/anton.tantner/hausnummern/index.html> (January 2005).

<sup>9</sup> Salvatore Satta, *The day of judgment* (London: Harvill, 1987), p. 89.

<sup>10</sup> Robert D. Kaplan, *Eastward to Tartary* (New York: Vintage, 2001), p. 298. We know what he means by saying that "knowing street names requires an abstract and impersonal knowledge that is not based on habit" but it would be more accurate to say that knowing street names permits coordination between people who do not share common experiences. And it is not only the urbanized foreigners who "know one street from another," i.e., who can perceive the contrast set; Turkmens surely know one street from another too. What the urbanized foreigners know is the labeling system; here Kaplan is confusing contrast with labeling.

Labeling systems, once developed, may also be destroyed. In 1993 in Tirana, Albania, two years after a fairly destructive revolution, my experience of trying to take public transport was that nothing was labeled. Pre-revolution regularities had been swept away. One had to know by experience, or ask somebody, where buses stopped and where they were going.

### 3.1 Defining labels

When a contrast set is used to identify and refer to the members of another contrast set, I call it a *label set* and its members *labels*. The relationship between label sets and contrast sets is an instance of the most fundamental semiotic relationship, that between the signifier and the signified.<sup>11</sup> A signifier that refers to a concept is not properly a label, in my terms, unless it is part of a label set. Letters, numerals, and colors are the most commonly used material for label sets.

While all sorts of signifiers can be grouped into sets, I focus on those label sets which were consciously designed, and whose passage through the workshop can be traced, not those (such as many proper names, not to mention the lexicon) which arose in an emergent fashion without conscious and deliberate planning. Also, just as with contrast sets, my primary interest is in those labels which were designed *as a set* and are maintained as such, and not in those human-designed signifiers which incidentally came to form a set without conscious design, like trademarks or the names of major car makes. Note that I do include in my scope those consciously designed label sets (such as identification numbers) which are applied to naturally distinct contrast sets (such as people or animals). In such cases the role of the workshop is to attach labels to each of the naturally distinct entities in a preexisting collective domain.

These definitions restrict my focus in this book to a particular kind of signification. One could, if one wished, use the word "label" to refer to any signifier that is attached to any signified, including all of the lexicon. For example, we could say that we "label" actions with

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<sup>11</sup> Ferdinand de Saussure, *Course in general linguistics* (London: Duckworth, 1983 [1916]), pp. [97]-[99].

words like "to run," prepositional relations with words like "under," people with proper names, and telephone lines with telephone numbers. But my focus in this book is on cases which are like the last of these examples (the case of telephone numbers). I do not hesitate to use signifiers outside this restricted focus to illustrate a point, taking advantage of their similarities to labels. But (unless otherwise indicated) I reserve the noun "label," and usually the verb as well, to refer to the limited circle of signifiers that includes numerals, letters, colors, symbols, Braille dots, and the like, rather than words or names which contrast primarily in the domain of spoken language. Occasionally, for variety, I will substitute for the term "label" an alternative, basically synonymous term, such as *tag*, *code*, *identifier*, or *ID*.

Some peoples' first reaction to the subject of labels is to try to trivialize them by saying that labels have only an auxiliary role in society, and that letters, numerals, and the other things that labels consist of are purely conventional signs that probably never existed before a few thousand years ago (whereas language and naming are much older and deeper phenomena). This is surely accurate, but it does not make labels trivial. Labels are ubiquitous in society, and regardless of the historical or evolutionary shallowness of letters and numbers as a phenomenon, mastering the instrumental uses they are put to is essential to participating in social life. Finding shared ways to label things is one of the means by which it becomes possible to communicate with other people. Numbers, letters, colors, and other types of labeling, just like words and names, contribute to peoples' ability to create in others' minds the same understandings that occur in their own.<sup>12</sup> They involve a grand act of social coordination. They depend on a compact between their everyday users, the people who came up with them, and, in cases like street names, those who are officially responsible for displaying them.

Aside from their ubiquity and essentialness, labels are also interesting *because* they are an explicitly planned form of symbolic communication. The labels for (say) the set of wings of a building are truly *human*-authored place names — deliberately and consciously

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<sup>12</sup> See George Herbert Mead, *Mind, self, and society: from the standpoint of a social behaviorist* (Chicago: University of Chicago Press, 1934), p. 47.

designed by designers who we can identify. They can easily be changed and indeed often are changed. (The names of mountains, rivers, cities and towns are frequently so ancient that we do not know who chose them or why, and changing such names is always difficult and often unthinkable.) From the point of view of the study of language and communication, one of the interesting things about labels is to see what sort of symbolic communication emerges when it is possible to systematically and deliberately design and plan it. The distinction between emergent and planned coordination is discussed in more detail in section 5.1.

Labels are not spoken words. This is yet another difference between labels and other signifiers like personal names, place names, and the words in the lexicon. Names — even those deliberately created to label the members of a contrast set, such as {white, black, Asian, Hispanic, Native American} — remain fundamentally spoken words, which may or may not have a written existence. Labels are "basically written but may be pronounced," whereas words and names are "basically spoken but may be noted down."<sup>13</sup> Though labels can often be read off, they usually do not have their own "pronunciation," and reading them off usually means simply reciting the names of their component symbols. They are most commonly a *visible* rather than an audible form of signification.

Accordingly, while the controversial aspect of words and names is usually how they should be written down — that is, transformed from spoken to visual symbols according to an accepted orthography — the opposite issue of translating visual contrast into auditory contrast is more likely to become a problem with labels. Thus the alpha-bravo system of letter spelling, and the "S as in Sam" formula used by airline reservationists to distinguish S and F or M and N in giving customers booking reference numbers (like "QXRS8F") over the phone, fulfill the function of coping verbally with a signification system designed to be visually distinctive. Since there are too many characters in written Chinese to have a name for each one and since some spoken Chinese syllables are labeled by several different characters, Chinese cope with the same problem by using the "*x-y de y*" formula which

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<sup>13</sup>These terms come from Fred W. Householder, *Linguistic speculations* (Cambridge: Cambridge University Press, 1971), p. 250.

defines character *y* by citing a context (*x-y*) in which it commonly appears and which the person at the other end of the line can be expected to know.<sup>14</sup> We face a similar problem with Internet domain names. Those domain names which are obviously the written form of words or proper names can easily be spoken, but those which are definitely not words have to be read off, and reading off such labels is not always conducive to preserving the visual distinctiveness that is essential to their referential function. Consider, for example, the pause that Minnesota Public Radio announcers have to put into the recitation of their web site address (*mpr.org*) to underscore that its *m* is real, not just an *n* (as in *npr.org*) that has assimilated to a following *p*.

The scholarly literature on onomastics, or the study of names, reflects the distinction between labels and names by basically ignoring labels as a field of investigation. A recent, comprehensive, three-volume encyclopedia of naming research includes nothing on labels except for one article on street names. It gives no direct theoretical or descriptive treatment of numbering systems or other similar identification systems.<sup>15</sup> Similarly, a recent general introduction to onomastics, daring and progressive in many respects, goes no further afield from the canon than a consideration of streetnames and a discussion of the reuse of personal names to label commercial goods styles (such as the labels for lines of furniture used by IKEA).<sup>16</sup> Even when a class of things are commonly labeled as well as named, it usually does not catch onomasts' attention: thus a recent onomastics collection of some quality contains an article on the naming of houses and another on the naming of vehicles and airplanes,

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<sup>14</sup>The syllable *de* in Mandarin Chinese is a genitive suffix, so that *x-y de y* literally means *x-y's y* and can be more loosely translated "*y as in x-y*," just as we use "*S as in Sam*" in English. For those unfamiliar with Chinese spelling communication methods, let me give an example. My university roommate in Beijing in 1992, a native of the city, had the relatively unusual last name of Mǐn, which is represented by the character 闵. He often had to communicate or "spell" this character over the phone to people unfamiliar with it. The character is formed from two common radicals: 阝, which in isolation stands for the syllable *mén*, and 文, which stands for the syllable *wén*. He would start off "spelling" his name by saying *yige mén, yige wén* ("a mén and a wén"). If this did not work, he would use the *x-y de y* system, defining *mén* as *kāimén de mén*; *kāimén* is a common word meaning "to open" which the person at the other end of the line could be expected to know how to spell. His saying *kāimén de mén* was like an English speaker saying "o as in open."

<sup>15</sup>Ernst Eichler et al., ed., *Namenforschung: ein internationales Handbuch zur Onomastik* (3 vols., Berlin: Walter de Gruyter, 1995-1996).

<sup>16</sup>Gerhard Koss, *Namenforschung: eine Einführung in die Onomastik* (Germanistische Arbeitshefte, no. 34; Tübingen: Max Niemeyer, 1990), pp. 89-96, 101-106.

neither of which appears to even mention the everyday phenomenon of *numbering* these same entities.<sup>17</sup> In general, onomastics rarely discusses the process of creating or designing names, tending rather to focus on names which were created far back in time (especially town names, river names, and mountain names), and individually instead of as part of a set. Street names have both label and name-like features and do show up in the onomastics literature now and then, but scholars of geographic names consider them peripheral and usually omit them in placename studies.<sup>18</sup> (Among the label-like features of street names are that they are more human-authored than other placenames, do not always consist of words, and refer to bounded, limited, and somewhat artificial contrast sets.)

Linguistics and semiotics also has surprisingly little to say about labels. Semiotic theory is important for understanding labels, but semioticians typically study more complex and opaque systems of signification, although a few contributions to what I would call a theory of labels are referenced under the heading of "code" in Winfried Nöth's massive encyclopedia of semiotics.<sup>19</sup> (They deal, however, with different themes than does this chapter.) In linguistics proper, where the study of writing systems is considered marginal, it is no surprise that labels are never discussed directly. The typical linguist's attitude towards written phenomena has been summed up as that "language is basically speech and writing is of no theoretical interest,"<sup>20</sup> and Leonard Bloomfield famously remarked that writing was "merely a way of recording language by means of visible marks."<sup>21</sup> Although, as Einar Haugen puts it, "the aggressively pejorative form of this statement is understandable in the light of Bloomfield's didactic purpose,"<sup>22</sup> such negativity has an effect. If the alphabet is of no theoretical interest, surely its use as a labeling tool is utterly trivial.

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<sup>17</sup> Ritva Liisa Pitkänen and Kaija Mallat, ed., *You name it: perspectives on onomastic research* (Helsinki: Finnish Literature Society, 1997).

<sup>18</sup> See Fred Tarpley, "Street names as signposts of world cultures," in *Namenforschung: ein internationales Handbuch zur Onomastik*, edited by Ernst Eichler et al., pp. 1481-1499 (3 vols., Berlin: Walter de Gruyter, 1995-1996), p. 1482.

<sup>19</sup> Winfried Nöth, *Handbook of semiotics* (Bloomington: Indiana University Press, 1990), pp. 206-220, esp. 217-220.

<sup>20</sup> Fred W. Householder, review of *Language and its structure* by Ronald Langacker, *Language* 45 (1969): 886-897, p. 886.

<sup>21</sup> Leonard Bloomfield, *Language* (London: George Allen & Unwin, 1935 [1933]), p. 21.

<sup>22</sup> Haugen, "Linguistics and language planning," p. 163.

There is an existing literature on labels, but it is much more dispersed than that on contrast sets. References to labeling are scattered through the literature on computer science, database management, graphic design, wayfinding, social anthropology, cognitive psychology, measurement, information theory, mathematics, and the history of technology, and on the various concrete contexts in which labels are used (such as musical notation and subway design). Very often, discussions of labeling are conflated with discussions of partitioning and the creation of contrast sets. Contrast sets and labels also surface as occasional preoccupations in fiction, for example in the work of Jorge Luis Borges.<sup>23</sup>

But no scholar, as far as I can tell, has directly discussed the particular intersection of mundane, everyday phenomena that I treat in this chapter. The closest approaches to a discussion of labels as I define them have perhaps been by Michael Patrick O'Connor and Thomas Crump, who have discussed the way that the alphabet and the numerals respectively have been put to use to label other sets of things.<sup>24</sup> In a footnote, Crump comes close to my definition of labels, mentioning the use of "ordinal numbers in cultures which require the specific identification of the different members of certain recognized classes, which may vary from the days in a year, through the inhabitants of a city, the pages of a book [sic] to the postal districts in a given country."<sup>25</sup>

Another relatively close approach is in the theory of database design in computer science, which puts forth what amounts to a fairly comprehensive model of the process of creating and labeling contrast sets. Both of the two classic models of database design — the relational model and the entity-relationship model — are explicitly designed to link contrast set members (or instantiations of domains) to one another.<sup>26</sup> The two models have slightly

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<sup>23</sup>Two Borges stories with particular contrast set preoccupations are "A survey of the works of Herbert Quain" (pp. 107-111) and "The library of Babel" (pp. 112-118) in Jorge Luis Borges, *Collected fictions* (New York: Viking Penguin, 1998).

<sup>24</sup>M. O'Connor, "The alphabet as a technology," in *The world's writing systems* (New York: Oxford University Press, 1996), p. 791; Thomas Crump, *The anthropology of numbers* (Cambridge: Cambridge University Press, 1990), pp. 38-39.

<sup>25</sup>Crump, *The anthropology of numbers*, p. 39n.

<sup>26</sup>See Thomas Connolly and Carolyn Begg, *Database systems: a practical approach to design, implementation, and management* (3rd edition, Harlow, Essex: Pearson Education, 2002), pp. 72-79 (on the relational model), 331-339 (on the entity-relationship model). The two models derive from two classic articles: E. F. Codd, "A relational model of data for large shared data banks," *Communications*

different strengths and use slightly differing terminology. Both, however, generally involve linkages between at least two different domains or sets of possible values, which one can think of as occupying different columns in a database matrix. One of the domains of any database (usually called the primary key) is generally more fundamental than the others, and the instantiations from that domain are usually listed in the first column of the matrix; they may be thought of as the "independent variable" or as the "source" contrast set which is then labeled by the values in the other domains. For example, a database might contain the name, address, and phone number of all the students at a university; the name of the student would likely be the primary key, and their address and phone number the secondary attributes. Each horizontal row in the database (what we popularly call a "record") contains one instantiation of the primary-key database, plus the instantiations it is linked to in all the other domains of the database: for example, one student's name, their address, and their phone number. The data in a single such horizontal row is called a "tuple." Databases organized according to the entity-relationship model allow the user to encode further "relationships" which specify the different domains or columns which fill slots in a particular action or interaction. For example, a phone call from a customer might constitute a relationship linking a customer number, a phone representative's name, the date and time of the call, and the customer's order number. These relationships are roughly equivalent to the scripts, scenarios, image schemas and action schemas postulated by cognitive scientists and discussed in section 2.11.

## 3.2 Labeling tools and techniques

We label, in my sense of the term, when we use the members of a contrast set to tag or identify the members of another contrast set. Normally, each label is linked, or set in correspondence, with a member of the contrast set being tagged. Thus each duck in a flock may be labeled with a code number that is printed on the band on their leg; one code number is linked to one duck. Similarly, one can label subway lines with colors, North American radio

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*of the ACM* 13, 6 (1970): 377-387; and Peter Pin-Shan Chen, "The entity-relationship model — toward a unified view of data," *ACM Transactions on Database Systems* 1 (1976): 9-36.

stations with call letters, parts of books with page or chapter numbers, or parking spaces with painted numbers. These linkages may have to be learned individually (as in the case of subway lines and radio stations), or they may be predictable according to a rule (as with page numbers, which rise as one gets towards the end of a book).

The relationship between contrast sets and label sets has certain special features not shared by all signifier-signified relationships. Prominent among these features is the fact that it involves a linkage not just between one signified and one signifier, but from a *set* of signifieds to a set of signifiers. The relation between the word "desk" and the piece of furniture behind which I sit is a signified-signifier relationship, but neither the word "desk" nor my desk are members of any well-delineated contrast set. In contrast, the label "24" for a bus route and the actual route itself are members of the contrast sets of bus route numbers and routes respectively, and their relation is thus not only one of signification but also of labeling. Musicians use the label set {A, A flat, B ...} to identify the members of the contrast set of standardized musical pitches. Cartographers use label sets of visually contrasting symbols to label different types of roadways (highways, through roads, regular streets, pedestrian zones) or different features on a city map (hospitals, train stations, hotels, museums). The International Organization for Standardization's ISO 3166 standard is a set of agreed-upon numeric and alphabetic labels for the contrast set of countries and political units that partition the landmass of the world. The elements of a writing system, such as the individual letters of the English alphabet, the symbols used in linguists' International Phonetic Alphabet, or the syllabic signs in Japanese, are label sets which are mapped to contrast sets in the domain of speech sounds — or at least were so mapped at some point.<sup>27</sup>

Since label sets are basically contrast sets which have been specially designed or adapted for the purpose of tagging other contrast sets — so that labeling is a function that

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<sup>27</sup> The elements of a writing system may over time lose their precise linkage to the contrast set they once straightforwardly labeled, as they have in English, where the relation between sound and spelling is not always direct. The labels used in writing systems thus retain a certain degree of utility even when they stop functioning as "true" labels and lose their clear one-to-one linkage to the contrast set. The tendency for these links to lose clarity over time does not, in my view, mean that writing systems are any poorer an example of labeling.

certain contrast sets take on, not something embedded in the nature of the set — it is perfectly possible to attach labels to labels. The letters of the alphabet are labels, but they may themselves be labeled by letter-names (ay, bee, see, etc.) or by a transliteration scheme (say, a set of rules for mapping Cyrillic words into Roman script). Indeed, the crucial difference between transliteration and transcription is that in transliteration, labels label other labels, while in transcription, labels label contrast sets formed out of the domain of spoken sounds.<sup>28</sup> (The difference between ciphers and codes can be described in a somewhat parallel way.) Indeed, in theory, any two contrast sets can be linked so that the members of one correspond to the members of another. (It can sometimes even be a little unclear which set is taking the "labeler" role and which set the "labeled" role.)

At the risk of introducing unnecessary complexity, it is worth mentioning briefly that the instantiations of a domain, or indeed the entire infinite continuum of a domain, can also take on a signifying role. For example, a mood ring purports to show how you feel by displaying one point out of a smooth continuum of colors. Although I focus primarily in this chapter on linkages using contrast sets as tools, I will not hesitate to mention certain examples of domains as signifying tools as well.

Not all contrast sets are equally well suited to the labeling role and to serving as the "matter"<sup>29</sup> that actually carries out the act of signification. The most common visual material out of which we make labels are the elements of our writing system (letters and numerals). The alphabet and the numerals were originally developed as a tool for tagging sound and numerosity. By giving these graphic contrast sets a broader labeling role, we are using the alphabet and the numerals "as a technology"<sup>30</sup> instead of for their original purpose of representing language and number.

While letters and numerals are pretty much equally capable of serving as labels, numerals are perhaps a more canonical way of distinguishing things than are alphabetic

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<sup>28</sup> Hans H. Wellisch, *The conversion of scripts, its nature, history, and utilization* (New York: Wiley, 1978), pp. 23-36.

<sup>29</sup> The term "matter" comes from Roland Barthes, *Elements of semiology* (New York: Hill and Wang, 1968), p. 34.

<sup>30</sup> O'Connor, "The alphabet as a technology."

symbols. This is evident from the fact that we often refer to "numbering systems" but rarely to "lettering systems," and from the frequent slip of the tongue whereby people refer to something as (for example) "number A." (Of course, we often combine letters and numbers — paper size "A4", for example — as part of multi-level taxonomic labeling strategies.)

## Numerals as labels

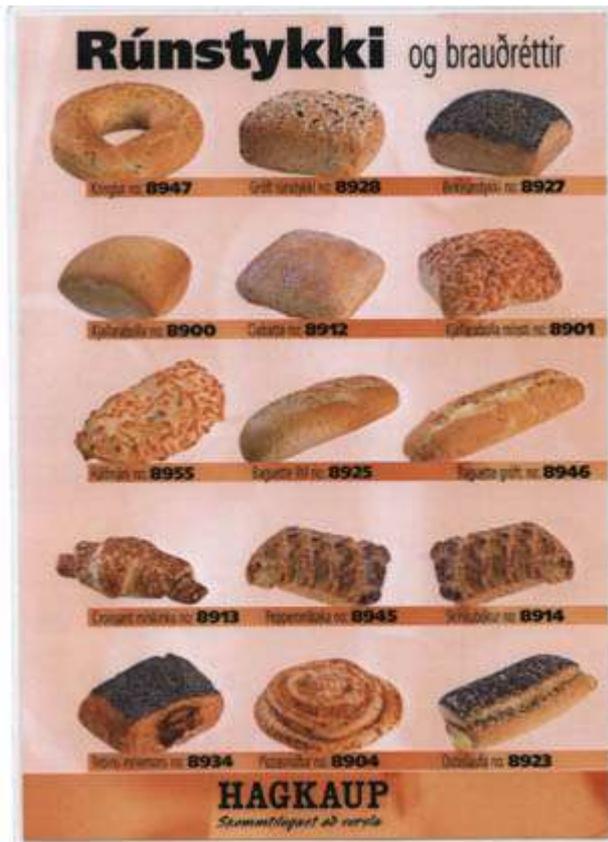


Image 3.3 (063)

It is worth going into detail for a moment about the way numerals have come to be used as labels. Numerals are one of the most fundamental labeling tools that we have. Scholars of numbers suggest that what the outside world delivers to the workshop is nothing more than the raw idea of number or numerosity — the fundamental distinction between singleness, twoness, threeness, and so on as far up in the set of positive integers as we can manage.<sup>31</sup> The collection of these different sizes of groups forms a contrast set ("oneness, twoness, threeness and other integral amounts"). This contrast set is slightly mind-boggling in its fundamentalness. Try to think of it without thinking of its graphic and linguistic labels such as 3 and "three" (fighting the fact that, as Thomas Crump says, "one's intuition revolts against the idea"<sup>32</sup>).

To this contrast set we applied another set, one which we had constructed ourselves instead of taken from the natural world: namely, the set of graphic forms starting with {1, 2,

<sup>31</sup> On the set of integers see Bertrand Russell, *Introduction to mathematical philosophy* (London: George, Allen & Unwin, 1919), pp. 1-19. Also see Crump, *The anthropology of numbers*, pp. 6-11.

<sup>32</sup> Crump, *The anthropology of numbers*, p. 32.

3 ...}. We set these contrast sets into relationship with one another, so that 1 corresponded to the idea of oneness, 2 to twoness, and so forth. It is this relationship which transformed those ten graphic forms from simply a contrast set of focal points in the domain of graphic form into labels which we call *numerals*. We must not forget to acknowledge that an important part of this labeling convention was the choice of a conventional cyclical stopping point, or *base*, within the contrast set of integers.<sup>33</sup> We use 10 today, but could have used 12, or any other amount that would limit the number of labels we need to a reasonable and convenient amount. Along with a base, we also came up with a label for zero.

These tools — a base, a limited set of numeral labels, and the label for zero combined with the invention of the place-notation system — allowed us to develop a label set which can be linked not just to the first few integers {1, 2, 3, 4, 5, 6, 7, 8, 9} but rather as many as we choose: {10, 11, 12 ...}. This set of *composite* numerals is formed by combinations of the set of single numerals, but it is a distinct set of its own. Like the integers it corresponds to, it is an unbounded, potentially infinite set, which makes it particularly suitable as a label set for contrast sets with an uncertain number of members. It is this set of numeric labels which we most often use to label all sorts of other contrast sets besides the integers: for example, the years since 1 A.D., the set of people boarding a plane (say, in the order that they received their boarding pass), the set of countries in the world (according to their ISO 3166 number), the houses on my street, or the different types of rolls and pastries in Image 3.3. (Note that the idea of using spoken words for larger numbers, such as "eleven" or "seventy-three," is not necessarily of any greater antiquity than the idea of using visual symbols, such as 11 and 73; in fact, some scholars believe that visual representations of number antedate aural representations.<sup>34</sup>)

There is, therefore, quite a bit inside the "black box" of the process that we use when we label things by number. When we number the people who are boarding a plane, using

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<sup>33</sup> On the idea of base see Georges Ifrah, *The universal history of numbers: from prehistory to the invention of the computer* (New York: John Wiley & Sons, 2000), pp. 23-46; Crump, *The anthropology of numbers*, pp. 33-46; James R. Hurford, *Language and number: the emergence of a cognitive system* (Oxford: Basil Blackwell, 1987).

<sup>34</sup> Crump, *The anthropology of numbers*, p. 41.

numeric labels to identify the contrast set of passengers, not only are the numeric labels themselves a contrast set which is taking on a labeling role: this contrast set was originally developed as a set of labels for yet another contrast set (the class of positive integers), by forming it according to the combining principles of the base and place-notation system from another contrast set in the domain of graphic form (the ten numerals from 1 through 9 plus 0). The ten numerals, in turn, function independently as labels for the set of integers from zero to one less than the conventional base.

### Color and other labeling sets



Image 3.4 (069)

Color is also an effective labeling technology, especially when we use it to tag the members of relatively small contrast sets. Thus color is a main distinguishing feature of traffic lights, customs lanes at airports (red if you have something to declare, green if you don't), different paths or tracks in museums and parks (group visitors to Plitvice park in Croatia follow the grey square), harp strings (Cs are red, Fs black, and all other strings are white), temporary subgroupings within a class at school (for example, the Red Team and the Blue Team in a game), the different lines of a transport system, the different floors of a building,<sup>35</sup> different sports teams, different political groups, and the different categories (of, say, elevation or mean annual temperature) shown on maps. When Soviet Russia instituted a five-day week from 1929 to 1931, each of the days was color-coded, workers' days off were staggered, and people were encouraged to have visiting cards printed in the color of their day off so that it would be easy to see who one shared one's free time with.<sup>36</sup> The convenience of color as a

<sup>35</sup> For design advice on color coding and wayfinding in architectural settings see Paul Arthur and Romedi Passini, *Wayfinding: people, signs and architecture* (New York: McGraw-Hill, 1992), pp. 16, 177-178; Spencer and Reynolds, *Directional signing and labeling in libraries and museums*, pp. 40-42.

<sup>36</sup> Leo Gruliov, "Significant Russian approval," *Journal of calendar reform*, September 1953, p. 104n.

labeling system for small sets is responsible for the popularity of keys whose shape allows them to be outfitted with a colored plastic jacket, as in Image 3.4.<sup>37</sup>



Image 3.5 (019)

While color can be a very attractive labeling tool, it also has distinct disadvantages. It is technically more challenging to render the distinction between colors than numerals or letterforms, although in recent years the greatly reduced costs of color printing have made it less of an extravagance to use color as a label.<sup>38</sup> Another disadvantage is the surprisingly large number of people (men especially) who are "color blind," or, to be more accurate, who have variant color vision abilities.<sup>39</sup> Since not everyone perceives color in exactly the same way, color labels need to be supplemented with other labeling devices (which is why not just the color but also the position of traffic lights is standardized, and why many multi-line public transport systems, such as the Copenhagen suburban train system in Image 3.5, use line letters, numbers, or names in addition to color). Another limitation is that humans do not easily perceive and remember fine distinctions in the domain of color, and can thus use only a relatively small number of color labels at a time. It would not be very useful, at least not for identification purposes, to label a set of a hundred classrooms with a hundred different colors, and unlike the case of numerals, we do not have a system of recombining the elements of a small contrast set of colors to create a larger set of distinctions.

Beyond letters, numbers, and colors, there are many other visual ways to conventionally symbolize discrete distinctions between the members of a contrast set. For

<sup>37</sup> On the classification of keys see Christena E. Nippert-Eng, *Home and work: negotiating boundaries through everyday life* (Chicago: University of Chicago Press, 1996), pp. 48-50.

<sup>38</sup> Paul Mijksenaar, "Maps as public graphics: about science and craft, curiosity and passion," in *Visual information for everyday use: design and research perspectives*, edited by Harm J. G. Zwaga, Theo Boersema, and Henriëtte C. M. Hoonhout, pp. 211-223 (London: Taylor and Francis, 1999), pp. 214-215; Mark Monmonier, *How to lie with maps* (Chicago: University of Chicago Press, 1991), p. 147.

<sup>39</sup> An excellent introduction to color blindness is chapter 10 ("Color vision variations," pp. 411-484) in Peter K. Kaiser and Robert M. Boynton, *Human color vision* (2nd ed., Washington: Optical Society of America, 1996). On color as a labeling device, see also Edward Tufte, *Envisioning information* (Cheshire, Conn.: Graphics Press, 1990), chapter 5 ("Color and information," pp. 81-95).

example, maps use differences in line width and color to symbolize different categories of roadways, military symbols set off the army from the navy and privates from sergeants and generals, and weather symbols (smiling sunny faces, clouds with drops, and so forth) tell us what things will be like outdoors (there is more discussion of these "graphical variables" in section 4.3). Differences in pavement color or composition distinguish the street from the sidewalk, bicycle lanes from pedestrian lanes, and public from private space.

Practically any contrasting set of shapes can be used as visual labels. Think, for example, of the vast variety of symbols used to distinguish the mens' and womens' rooms, or of the standardized label sets used in highway and urban signage, or the somewhat more open-ended set used in train stations, airports, and so on. Parking garages often use animal signs or other contrasting shapes to label different levels or areas in the lot. At least through 2000, public buses in Warsaw (Poland) required that passengers punch their ticket in a small device on board; the punch pins in every bus were set to create a slightly different pattern, so that inspectors could be sure from the punch pattern that you had not punched your ticket hours before in another bus.

Nonvisual labels exist too. Standardized tactile and audible contrast sets (Braille and Morse code) can be used to label the same set of distinctions as the graphic elements of our writing system. Or consider distinctive telephone ringing signals (of the type where each person in an office is assigned a different ring). A hotel I know in Kraków, Poland uses a room card key system where if you have correctly inserted the key, you are rewarded both visually and audibly with green flashes *and* a pleasant peeping sound; if not, you get a steady red light and a subtle alarm-like tone. However, since we do not share contrast sets of sound, taste, or smell in as precisely coordinated a way as we do visual and spatial contrast sets, the usefulness of nonvisual contrasts (with the notable exception of spoken words) as labels is somewhat limited.

The key, of course, is that the elements of a set must really contrast to be used as effective labels. As the tour guide's critique of the parking lot's animal-label navigation

system showed (in section 2.10), poorly differentiated label sets whose elements are difficult to distinguish and remember are always unwelcome.

### 3.3 Communicating the context of a label

In order for a label to be understood, not only must the label be communicated but the nature of the set it refers to must also be made clear. This is particularly important because the same label set may be reused over and over, in different contexts, to label different contrast sets. This context-dependence highlights how the use of labels requires common agreement not only on the meaning of the label but also on the context and framing of the discourse.

If a label set is linked to multiple contrast sets, the same element of the label set may have multiple meanings in these multiple contrast sets, despite functioning as a unique identifier relative to each individual contrast set. Such labels are "multivalent" (the term proceeds from the idea that a label indicates a particular "value" within the contrast set to which it is mapped).<sup>40</sup> Examples of this contextual dependence abound. For example, "CO" means Continental Airlines in the airline labeling world, Colombia in the world of ISO-3166 country codes and Internet domains, Colorado in the world of American postal zip codes, and undoubtedly many other things in many other different contexts. It is useless to refer to a musical composition as number 100 unless you know you are talking about "opus," "Köchel," or "BWV" numbers. Similarly, it is not very helpful to tell someone to call phone

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<sup>40</sup> My use of the term "multivalence" comes from the use of the term "bivalence" to describe the way that some graphic symbols in the Roman alphabet also occur (often mapped to a different sound) in the Cyrillic alphabet; see Laurie Beth Feldman and Dragana Barac-Cikoja, "Serbo-Croatian: a biscriptal language," in *The world's writing systems*, edited by Peter T. Daniels and William Bright, pp. 769-772 (New York: Oxford University Press, 1996). This is a slightly different phenomenon than the one discussed in the text, involving the same graphic form having value in different label sets, rather than the same label set having value when applied to different contrast sets. For example, "CAMOBAP" is an example of a sequence of symbols which, since it has at least potential value in both Cyrillic and Roman, gives no formal clue to its proper interpretation; if you know it is Cyrillic you will read it off as *samovar*. Students of Russian are all familiar with the lame joke about going out for a bite to eat at the *pektopa* (as one would pronounce the Russian word *PECTOPAH*, meaning restaurant and pronounced *restoran*, if it was written in Roman instead of Cyrillic). In the pre-Unicode era, the designer of the now-defunct Web site of the Estonian ferry company Estline ([www.estline.ee](http://www.estline.ee)) took advantage of this bivalence by using the word *Pyckuu*, coded in the Roman alphabet but readable as *Ruskii* in Cyrillic, to indicate the link to the Russian-language version of a site, thus not having to worry about whether the reader had Cyrillic installed on their computer.

number 987-6543 unless the geographical location of the number is clear to both people involved. The same sequence in the Roman alphabet can take on quite a different meaning if one knows it is in Finnish or Malay instead of English. The Thai writing system helpfully indicates the tone of each syllable using a set of four diacritical marks, but (unlike the Pinyin system for Mandarin Chinese) the linkage between tone mark and tone is not direct; there are several different types of syllables in Thai, and the same tone mark denotes entirely different tones in the context of different types of syllables.

In fact, a label set is often assigned to a contrast set for a temporary purpose, so that the mapping between the label set and contrast set may be forgotten directly afterwards. For example, in putting together the American "Stor-All" brand of cardboard storage boxes one must learn to follow the manufacturer's identification of four different flaps as A, B, C, and D. However, we are free to forget the connection between these tags and their referents as soon as we finish putting the box together, and we may re-use these letters in a completely different label system an hour later. It seems that labels are more often used in this way than words and names, whose referents we usually at least try to keep stable.

It is quite common for a label to have different meanings at different levels of a taxonomy — for example, in telephone numbering or the hierarchy of year, month, and date. The different levels of the taxonomy "count" as different contexts for a label set. Thus if (as Europeans commonly do) we cite dates in the day-month-year format where January 10, 2000 becomes 10.01.00, the label "05" in this system could mean May, the 5th day of the month, or 2005, depending on where it appeared in the hierarchy. Unless the sequence of contrast sets being referred to is made clear in series of this sort, they cannot be properly interpreted. If someone tells me that my credit card expires on "05-06," I cannot tell you whether that means May 2006 or June 2005 unless I know which label refers to the month and which to the date.

From the design point of view, multivalence, context-dependence, and the reusability of labels simply means that label designers need to make sure users know what contrast set (or level of a label taxonomy) the label is referring to. One must know not only what element

of a contrast set each labels refers to, but what contrast set is being labeled to being with. If you see a big sign saying "2" at the airport, is it telling you something about baggage claim 2, gate 2, terminal 2, level 2, or check-in counter 2?

There are many ways to communicate this kind of context, but they all involve coming up with some sort of sign for the superordinate concept, the hyperonym of all the contrast set members, or the contrast set as a whole. We can use the term *superordinate sign* for this type of context designation (if several contrast sets together constitute the members of a superordinate contrast set in a taxonomy, their superordinate signs together constitute a *superordinate label set*). Computer scientists might think here of the very similar concept of "data type." The consistent use of a superordinate sign conveys a clear message that all of the labels so marked belong together as equal members of a set which passes the *X and other Ys* test.

In public settings such as train stations and airports, the typical design strategy is to give all signs referring to the same contrast set a graphic identity which may involve the typeface, color, layout, size, or placement of the signs. If there is space, a word such as "Platform" also serves as a verbal superordinate sign. The result is that the look of labeling signage varies from contrast set to contrast set. For example, the use of a consistent design for train platform numbers helps confirm that a sign reading "1" is a platform number which contrasts with other platform numbers such as "2a" and "13" (and not, say, a sign for ticket window number 1). The use of standardized station name signs helps train passengers understand that a sign reading, say, "Haarlem Spaarnwoude" is a station name which contrasts with other station names like "Amsterdam Sloterdijk" (and is not, say, an advertisement for a local savings bank). Distinctive signage for things like "WC" and "Exit" helps one figure out that these are not the names of platforms or destination stations, but rather help you find the bathroom or your way out of the building. On city streets, public transport signs usually show by means of some sort of symbol whether the listed route numbers are buses, trams, or something else; the signs themselves use a standard format and

are regularly renovated, which provides assurance that a bus will actually come.<sup>41</sup> Similarly, conventions of placement encourage us to guess that the insignia on a policeman's sleeve or above a military officer's breast pocket, even if we do not understand their precise meaning, tell us something about their bearer's rank and experience.

In written language, we often conventionally create specific symbols to serve as superordinate signs. When we write £10, €10, 10:00, 10% and 10°, the symbols £ € : % ° tell us that we are dealing respectively with ten pounds, ten euros, ten o'clock, ten percent, and ten degrees. Within the taxonomy of worldwide telephone numbers, we have a number of strategies for indicating the particular contrast set that a number we cite belongs to: a "+" indicates that what follows is a country code, a 0 in most countries with area codes (or a 1 in North America) indicates that an area code follows, an "x" in America or a "-" in Europe indicates an extension number within a building or company, and no prefix indicates the default, usually a local number.

Quite often, however, no specific superordinate signs are given in a particular context where contrast sets are being labeled. In these cases one relies on the user to bridge the inferential gap. In some cases, a user's knowledge of the nature of the contrast set being labeled, or of the constraints on the potential form of the labels for it, can help the user pinpoint the contrast set that a particular label is referring to. If one knows that the sequence of labels "30.01.99" refers to a date, simply knowing something about the nature of the contrast sets being labeled helps you be sure that January 30th is the date in question, even if you did not previously know that day-month-year order was being used. A label such as "BLAHBLAH.EXE" is immediately recognizable by anyone who used IBM compatible computers in the 1980s and 1990s by its capital letters, eight-letter filename, three-letter extension, and separating dot. Regular users of American libraries know that "DK123.L45" is likely to be a call number for a book. Compare, as well, the related way in which many Northern European countries create and enforce official lists of accepted boys' and girls'

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<sup>41</sup> For examples, see Phil Baines and Catherine Dixon, *Signs: lettering in the environment* (London: Lawrence King, 2003), pp. 75-79.

names, which allows one to tell with considerable assurance both that one is dealing with a given name, and whether its holder is male or female.

The context-dependence of labels can sometimes create considerable efficiencies, by allowing us to signal only the terminal, contrasting portion of the label if its context is indubitably clear. As Charles Frake put it: "Taxonomies make possible a regulation of the amount of information communicated about an object in a given situation."<sup>42</sup> For example, if the country code and area code are already clear, you can cite your telephone number at somewhat less length. I remember being puzzled as a child when, on a visit to friends of my parents, the father of the family asked his son to make a telephone call and told him the number, which was only four digits long (not seven); my parents explained to me that it was a small town, and everyone in the town had the same first three digits of their phone number. Similarly, not including the name of the country in the address of a letter I am sending suggests that the letter will not be crossing national boundaries. Old family letters addressed to my grandfather read simply "James Watson, 161 N. Cortez St., City." Although dropping city, state, and zip code in this way is frowned upon in America today, you might doubt my sanity if I included "Earth" as part of the address on a letter — not because it would be strictly incorrect, but rather because it is a safely assumable and thus omittable context. Assuming taxonomic context in the presentation of a label often contributes to the readability of a label. Edward Tufte shows the dramatic difference in readability between a schedule of frequent trains which assumes the hour number and a schedule which does not.<sup>43</sup> However, the value of context-assumption in citing a series of page numbers (for example, by writing 297-99 or 297-9 instead of 297-299) is more dubious, because the reader may not have enough reason to feel secure in their assumption that context-assumption has taken place (297-9 could also refer to item 9 on page 297).

In most cases the members of a label set are tied to the members of a contrast set in an "absolute" way, which never varies and is not dependent on the user's current location in

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<sup>42</sup> Charles O. Frake, "The ethnographic study of cognitive systems," in *Cognitive anthropology*, edited by Stephen A. Tyler (New York: Holt, Rinehart, and Winston, 1969 [1962]), p. 34.

<sup>43</sup> Tufte, *Envisioning information*, pp. 47-48.

that same contrast set. Thus "NY" refers to New York State within the domain of American states regardless of whether you are in Albany, Alabama, Albania or Antarctica. But there are other contrast sets whose members' absolute location can be calculated from a label only if you know the user's location in that same contrast set. This is the phenomenon of deixis, which was introduced briefly in discussing contrast set creation (see section 2.11 and the references cited there). Thus "A flat (above middle C)" is an absolute label for a particular standardized pitch, but the same pitch could also be called by the relative labels "mi" or "so" (or alternatively, III or V) if we knew that the user was "located" in the reference key of E or D flat respectively. Similarly, the dialing sequence that you follow to reach a telephone number varies depend on your location, so that while a telephone number beginning with the country code is an absolute label, a dialing sequence is effectively a relative label for that same subscriber line. In a similar way, cartographers have a special word for placenames used by people who live outside the place being referred to ("exonyms").<sup>44</sup> Designers who choose to use a label system involving egocentric, relative reference should do their best to convey the location of the user or "ego" in the contrast set. Otherwise, there is no way to interpret a relative reference; there is no way to know what "mi" or "so" refers unless you know where "do" is at the moment.



Image 3.6 (031)

Very often one can choose among several different sets of label sets which can each be mapped to the same contrast set. Thus Roman numerals, Arabic numerals, and a myriad of other congruent collections of ten signs are different ways of rendering the contrast set that we can also refer to with the words "zero" through "nine."<sup>45</sup> Similarly, it is equally possible to render the discrete differences usually labeled by the

<sup>44</sup> For references on the subject of exonyms, see C. R. Perkins, and R. B. Parry, ed., *Information sources in cartography* (London: Bowker-Saur, 1990), pp. 399-400, 406-408.

<sup>45</sup> For more examples of ways of rendering this set, see Ifrah, *The universal history of numbers*.

twenty-six letters of the English alphabet in Braille, typing, handwriting, uppercase, lowercase, italics, Morse code, semaphore, finger-spelling, or any number of different computer character codes.<sup>46</sup> The contrast between the twelve standard notes of the Western temperament system may be labeled with absolute note names such as A'' and C#' or relative names such as do, re, mi or I, IV, V, with exact frequency numbers such as 415 Hz, by the location of a dot on a standard musical staff, by marking one key on an image of a piano keyboard, by Braille musical notation, by the contrast of different fingering charts for the guitar, or by any of the various algorithms by which computers store music. Similarly, the twelve months of the year may be labeled with names such as January, February, and March, or with numbers like 1, 2, 3, through 12. In baseball scoring, there are at least five different graphic labeling conventions for the contrast set {single, double, triple, home run}.<sup>47</sup> Any pair of label sets which can be mapped to the same contrast set will have a certain degree of congruence and isomorphism; they may be alike in number, partitioning locations, metaphoric topology, functional origin, or in the way they themselves are labeled. For example, although Scandinavians number floors of residential buildings with Arabic numerals while Hungarians use Roman numerals, the two strategies share the same structure, topology, and functional origin, and they are read off in the same way (one, two, three, and so on up).



Image 3.7 (032)

In certain cases, two label sets for the same contrast set may be used simultaneously to fulfill different functions. Thus the playing cards in Image 3.7 use two different rendering styles for the same two contrast sets (card and suit), allowing both blind and sighted people to play together. Meanwhile, the tag from a frying pan at the IKEA housewares

chain in Image 3.6 labels the pan with a "frontstage" name (STEKA) that is easy for

<sup>46</sup> For some example illustrations, see Otl Aicher and Martin Krampen, *Zeichensysteme der visuellen Kommunikation: Handbuch für Designer, Architekten, Planer, Organisatoren* (Stuttgart: Alexander Koch, 1977), p. 16.

<sup>47</sup> Paul Dickson, *The joy of keeping score: how scoring the game has influenced and enhanced the history of baseball* (New York: Walker, 1996), pp. 20-21.

customers to remember, a bar code that is easy for cashiers to scan, and a less user-friendly "backstage" numerical code (962.258.00), which clerks can presumably use to find the product in their inventory database.

### 3.4 The art of label display

In order to recognize a member of a contrast set by its label, one must see that set member associated with that label. In cases of primary socialization to very fundamental labels like the alphabet and numerals, a teacher may actively drill the association into us by making the sound [b] and explaining that it is represented by the letter *b*, or showing a picture of three things and explaining that this quantity can be labeled by the word "three" or the symbol 3. In everyday adult life, however, it is the art of label display which help us make the connection between set member and label, and which gives us a handle for referring to the sense of being somewhere and the feeling of "here-ness" associated with a particular member of a contrast set.

What I am referring to is that fact that in everyday life, many contrast set members "wear" a "nametag." A nametag is simply a label which appears on or in proximity to the contrast set member, and says to the user "You are *here*, this is how 'here' is labeled, and if you were somewhere else you would see a different nametag." Thus the "view" from aisle 5a of the supermarket is different than that from aisle 6a, and the labels are conveniently in your field of vision if you are in either of those two aisles and looking for a way of tagging the view that you see. The number by the door of your house is a simple example of a nametag or you-are-here mark, but that same number in your listing in the telephone book is not a nametag because it is no longer physically associated with your house.

In order to understand the function of nametags, remember (from section 2.11) that action schemas describe the relationship between a user and a slot that can be filled by any member of a particular contrast set, that the user has a special relationship with the member of a contrast set that is filling that slot at a particular time, and that the user's view or

experience of the world varies slightly depending on which member of the contrast set that is. By "view," I mean a set of impressions and sensory inputs which is specific to the relationship with one member of a contrast set; the term "view" comes from the literature on our experience of literally spatial domains.<sup>48</sup> After all, as the spatial metaphor helps us see, knowing which member of a contrast set you are experiencing is quite similar to being able to say (by one of various methods) which part of a literally spatial domain you are in at the moment. (Note that one can also talk of views that are specific to particular points in a domain, instead of members of a contrast set. Thus, one of the main design recommendations in the scholarly literature on everyday you-are-here maps is to make them correspond as closely as possible to the view that the user experiences in the location where the map is placed.<sup>49</sup>)



Image 3.8 (055)

Knowing "where" you are within a contrast set, and how that set member is labeled, is very important in everyday life. For example, you might want to know which bus you are on, what month and day of the week it is, what airport terminal your plane is arriving at, what speed you are going at, what house number you are staying at, what gear your car (or your bicycle) is in, what tram stop this is, what note you are playing, what the number of this telephone is (so someone can call you back on it), whether that other army officer is your superior or subordinate, or what is the value of the coin in your hand. If you

<sup>48</sup>The idea of "view" comes from Benjamin Kuipers, "The cognitive map: could it have been any other way?" in *Spatial orientation: theory, research, and application*, edited by Herbert L. Pick, Jr. and Linda P. Acredolo, pp. 344-359 (New York: Plenum Press, 1983), p. 353. Also see Kuipers, "Modeling spatial knowledge," *Cognitive Science* 2 (1978): 129-153. The idea of "view" is also closely related to geographers' explanations of what conveys a sense of place; see, for example, Roger M. Downs and David Stea, *Maps in minds: reflections on cognitive mapping* (New York: Harper & Row, 1977), pp. 107-123.

<sup>49</sup>On you-are-here maps see Michael J. O'Neill, "Theory and research in design of 'you are here' maps," in *Visual information for everyday use: design and research perspectives*, edited by Harm J. G. Zwaga, Theo Boersema, and Henriëtte C. M. Hoonhout, pp. 225-238 (London: Taylor and Francis, 1999); Marvin Levine, "You-are-here maps: psychological considerations," *Environment and behavior* 14 (1982): 221-237; Marvin Levine, Iris Marchon, and Gerard Hanley, "The placement and misplacement of you-are-here maps," *Environment and behavior* 16 (1984):139-157.

are moving from place to place, the decisions you take in order to get to your goal depend on where you are starting from, so you need to know where you are in order to know how to act. If you need to get to gate C19 at the airport, it makes a difference whether you are in terminal A or B, or already in C, and if your destination is the 6th floor, it may help to know whether the main entrance you just came in through is on the ground, first or second floor.<sup>50</sup> Even if you are not trying to find your way, the decisions you make in daily life depend on where you are in various contrast sets, so that you may choose to make a telephone call differently depending on whether the system defines it as "local" or "long-distance," an American police officer may behave quite differently once they cross the county or state line, smokers need to know when they are in the smoking area, and a tourist may take a very different attitude towards marijuana use depending on whether they are in Amsterdam or Singapore.

It is thus crucial that these set members be labeled in an easily perceptible way. Fortunately, the label on the outside of a public bus (and ideally the inside too) tells you that you are in a vehicle traveling on route 362, not 236; the calendar on the wall tells you that it is December and not January; the calculator screen gives you feedback that tells you that you really did just press the "5" key; when you go up or down a level on the escalators in a department store, signs usually remind you which level you have arrived at; and a sign on the door tells you that you have found the classroom number you are looking for. Similarly, we try to label water faucets so that we know which is hot and which is cold; most telephones at least used to have a little slot intended to hold a slip of paper listing their number; in some countries, it is customary for the called party to answer a phone call by stating their telephone number; piano players can visually confirm what key they are pressing; and (for example) the Indonesian 100-rupiah coin is helpfully labeled "100 rupiah." In featureless landscapes where the views associated with two different contrast set members are practically indistinguishable (for example, just on either side of the border between two American states as one drives through them on an expressway), nametags and signals of

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<sup>50</sup> See the discussion of floor numbering in Arthur and Passini, *Wayfinding*, pp. 193-195, and in Spencer and Reynolds, *Directional signing and labeling in libraries and museums*, pp. 22-23.

passage such as "Welcome To" signs may be the only thing that allows you to figure out which member of the contrast set you are currently in.

Besides letting people know how what they are seeing is labeled, nametags make the use of labels more practical in the communication of directions. It is pointless, or at least much less useful, to give directions in terms of a label which is not displayed on its referent. For example, as a travel guidebook writer covering Albania in 1993, the fact that there were no streetname signs in Tirana made it much less helpful to the reader for me to mention the fact that an establishment was on a street called Rruga Myslim Shyri. In contrast, telling an employee to deliver a package to a particular street and house number, or making a mental note that shelled walnuts are in aisle 3 at the supermarket, are ways of communicating the identity of a contrast set member by means of a conventional label. A nametag lets someone who is looking for that particular label know that they have found the right member of the contrast set. Another, underestimated function of nametags is to tell people who are looking for a differently labeled contrast set member that this is not it. Thus, if you know you are looking for room B201, a sign for room B214 tells you that you are in the wrong place.

There is an entire art to the placement of nametags in the built environment,<sup>51</sup> much of it surrounding the fact that they need to fulfill not only their semantic identifying function but also be easy for users to see. Nametags can be bigger or smaller. They can be illuminated or not. (Major streets are labeled with illuminated signs in Palo Alto, but not in Reykjavík.) They can, and generally should, be standardized through the use of a superordinate sign, so that all the signs which label a particular type of entity are similar, and one knows from the design of the sign what kind of thing it is labeling. Thus house numbers are often displayed in a standard form in European cities,<sup>52</sup> with this standard form serving as a superordinate sign that tells us it shows a house number and not some other kind of number. There is, meanwhile, little or no such standardization in America (where missing or hard-to-see house numbers often create anxiety about whether one has found the right building).

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<sup>51</sup> Spencer and Reynolds, *Directional signing and labeling in libraries and museums*, pp. 48-50.

<sup>52</sup> See the examples in Tantner, "Galerie der Hausnummern."

When riding on public transport in an unfamiliar environment, the problem of picking out your stop from among the limited set of all the stops made by the bus forms a classic problem of matching a label (the stop name) to a view of a contrast set member (what things look like at the stop). Even if you are familiar with the "view" of your intended stop, it is particularly difficult to recognize that it is "the next stop" (and thus that you should press the stop button) when you cannot see it yet, especially if you are on a bus that does not stop at all potential stops (which makes it hard to be sure whether you have yet passed the stop before yours). It is possible to ask the driver for help, but drivers are sometimes not supposed to speak to passengers, or do not share a common language with them. It is possible to follow along on a map (either one's own or the one provided in the bus or tram), but this requires a lot of attention and the map must be detailed. Designers can help by labeling each stop and posting nametags, so that passengers have direct access to the labels for each stop, without someone else's assistance. These nametags may take the form of driver announcements, signs at each stop, or a display in the car listing the name of the upcoming stop. Labeling the stops on a route reinforces the sense that they form a defined contrast set, which adds to the passenger's cognitive tranquility by giving them a sense that the set of stops is bounded and catalogued. Subway and tram networks generally tend to be better set up for matching than bus networks, and to have a clearer sense of stops as a contrast set, probably because of the greater physical commitment to the location of each stop.

When displaying a label which refers to something at the terminal level of a taxonomy, and which is composed of the successive labels for each level of the taxonomy, it is helpful when possible to make the divisions between the levels of the taxonomy part of the display. Consider, for example, how we generally put spaces or other dividers in between the significant parts of a phone number. Similarly, Paul Arthur and Romedi Passini advise against assuming that people will be able to analyze the taxonomic structure of a building room number such as "505" (the number of my office, which is on the fifth floor).<sup>53</sup> They would approve of the label on the outside of my door, which reads "5 05". The space between

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<sup>53</sup> Arthur and Passini, *Wayfinding*, p. 193.

the floor number and the room number helps reinforce users' sense of the taxonomic levels of the label system.

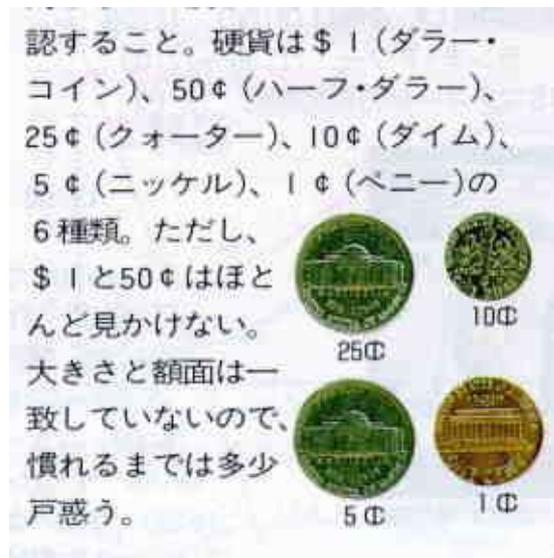


Image 3.9 (022)

Unfortunately, the goal of telling users where they are within any given contrast set frequently fails. Consider that the United States is one of the few countries whose coins show no visible numerical indications of their value. (The penny and nickel do show the *words* "one" and "five," but the dime does not display the word "ten.") Strangers to the American coin system, especially if they do not read English, have a harder time learning the value of each coin than

strangers in (say) the euro zone, because they require explicit input from a source external to the coin itself. Image 3.9 shows a guidebook doing its best to teach travelers the connection between coin and value in America. Unfortunately, the guidebook authors seem to have had a little trouble straightening out the mapping themselves. Similarly, the unfortunately common practice in scholarly book publishing of keying endnotes to the chapter number, rather than the page number, ignores the fact that readers often do not know the number of the chapter they are in (and have to do quite a bit of page flipping to find it).<sup>54</sup> Page numbers, whose nametags are always readily available in the corner of the book's regular visual field, are a better keying device. To take one more example, I remember once trying to buy a pair of long underwear in a department store in Munich. I figured out what floor it was on, but first had to use the bathroom on the top floor. I then got mixed up finding the floor, because the floor number signs were not easily visible to those coming off the down escalators. When I finally found the long underwear, I realized that I had no idea what size I might need in the local system, and that, of course, in the case of underwear, propriety does not permit one to

<sup>54</sup> For an example of a book reviewer complaining about this practice, see Edith A. Moravcsik, review of *The logic of markedness* by Edwin L. Battistella, *Journal of Linguistics* 34 (1998): 501-505, p. 504.

try on a pair to learn the relation between oneself and one's size label by trial and error. Moving out of the realm of contrast sets, it is (as some designers have pointed out) unfortunately quite possible and common in everyday wayfinding to have a clear idea of where you are going, and then to arrive at the right place (whether that be a home, a restaurant, a small village, a subway station, or an airport departure gate), but to have no sense of confirmation from the environment that you have indeed done so.<sup>55</sup> Usually we rely on a sign, a house number, or something that tells us a building's function (its shape or design, the goods on display in the window, the kinds of cars parked in the parking lot, the pile of raw materials next to it) to confirm that we have arrived where we wanted to be. Still, all of us have probably had the experience of looking for a building, having a reasonable sense of how it might be labeled, and standing outside it, but hesitating for lack of a nametag or other signal confirming that it is in fact our destination — for example, looking for a house number which is nowhere marked on the house itself.

### 3.5 "Just a number" and the level playing field



Image 3.10 (021)

A common critique of certain labels, and of the process of creating contrast sets, is that they reduce individuals — whether these are people, books, trains, or parked cars — to "just a number." Indeed, being just a number is a symptom of impersonality, insensitivity, inhuman scale, and many other supposed ills of modern society.

Practically speaking, labels (instead of names) are often applied to contrast sets of people and animals which form large and bureaucratically managed groups, such as soldiers, inmates, subscribers, customers, and herds of sheep or cows. In all of these cases, to those doing the numbering, the individual identity and experience of those numbered is not particularly important, but ease of reference is. The controversial aspect of such numbering

<sup>55</sup> On this issue see Mijksenaar, *Visual function*, pp. 8-10; Arthur and Passini, *Wayfinding*, pp. 15-16.

comes out in the emotion with which a survivor of Auschwitz, or the director of a home for chimpanzees freed from biomedical experimentation, displays a tattooed identification number dating from the survivor's or chimpanzee's incarceration.<sup>56</sup> The number speaks of a moral code grossly different from that now enjoyed by the survivor or the freed chimpanzee. Seeing how an individual's identity can be totally effaced by their group membership drives home the reminder that the people who we sometimes see as objects in our work are conscious experiencers of the world.

In the reverse of this phenomenon, we sometimes, exceptionally, name things that are typically just labeled, such as houses, airplanes, cars, and boats. Predictably, this adds a sense of familiarity and homeyness to the thing that is named.

We expect people to follow social norms about when it is appropriate to label someone and when it is appropriate to use their name. Sometimes, we get these norms mixed up. A newspaper article tells the story of Truman Bradley from Boulder, Colorado, whose parents received a letter offering "congratulations on 987-65-4321's admission to Arizona State University!"<sup>57</sup> Perhaps his Social Security number was just mistyped into the "name" field of the admissions database. Although an admissions office might well sort applicant files by Social Security number behind closed doors, in addressing correspondence outwards the norm is to "rehumanize" the person by using their name. Similarly, the existence of several different types of labels for the same entity, as in the example of IKEA products, is usually accompanied by rules for using certain labels in certain contexts. We might refer to the same TV or radio station by labels like "96.5" (its frequency) or "WCMF" (its call letters), by a name such as "the Discovery Channel," or by describing its format as "classic rock" or "talk." In general, the more vivid styles are generally used in informal and personal contexts and the more numeric labels in technical and impersonal contexts.

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<sup>56</sup> For an example of this kind of indignation see Roger Fouts, *Next of kin: what chimpanzees have taught me about who we are* (New York: William Morrow, 1997), p. 281.

<sup>57</sup> Tom Kuntz, "Congrats! You're a big number on campus!" *New York Times*, 21 March 1999, section 4, page 2. (987-65-4321 is a pseudonymous number.)

Identification numbers by themselves say little about the "soft" nature of what they identify. Labels only convey something about the things they label if they are related by an iconic mapping principle (see chapter 4), where each label reflects something about each contrast set member. Even in iconic mappings, this reflection is not usually very robust. The only clue that American Social Security numbers give to the myriad features which make up the true identity of a person is that one can tell from the first three numbers which state the label was issued in. When we use these "more organized ways of referring to our environment — by coordinates, numbering systems, or abstract names" we sometimes regret having foregone other labeling systems which "vivify" the world around us and "add to the depth and poetry of human experience."<sup>58</sup> Thus we can understand the feeling of regret when the reduction of library catalog entries to strings of computer characters, coded without nuance into 256 categories, eliminated the nonalphanumeric clues to the nature of a book conveyed by the typeface, wear, and annotations of a card-catalog card. We can understand this even if we consider the computerization of card catalogs to be worthwhile on balance.<sup>59</sup>

Similarly, considering both  $x$  and  $q$  as members of the set of English consonants makes them seem just as central and common as  $h$  or  $p$ . A student identification number conveys nothing about the student's height or academic record, nor whether they are a part-time or full-time student. Uniformly assigning non-iconic three-letter identification codes to airports all over the world masks the differences in size and centrality between airports such as ORD (Chicago's huge O'Hare Airport), and VEY (the airfield on Iceland's Westmann Islands, which has one terminal building and much shorter runways).

However, deindividualization is sometimes carried out deliberately and considered to be socially beneficial. Arranging entities into a contrast set, and then reducing each member to "just a number," smooths out the individual differences between each entity (especially if the labeling strategy used is relatively non-iconic). It creates equivalence and a "level playing

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<sup>58</sup> Lynch, *The image of the city*, pp. 127-128.

<sup>59</sup> See the essay on library card catalogs in Nicholson Baker, *The size of thoughts: essays and other lumber* (New York: Random House, 1996), originally published as "Discards," *The New Yorker*, 4 April 1994.

field" between things that are very different but, some feel, deserve to be treated in the same way.<sup>60</sup> The practice of numbering the French *départements* creates a sense of equality between administrative divisions regardless of whether they are Breton, Basque, Provencal, "typically" French, or even overseas. When we see a police mug shot of a famous person such as Michael Jackson or Martha Stewart, the booking number in the photograph attracts our attention because it symbolizes the fact that the wheels of justice will, at least in theory, consider them no more above the law than any other citizen. Meanwhile, someone whose equal status is in doubt may be thrilled beyond words by the chance to be "just a number." The proudest moment of a new member of a contrast set may be when they get the label that says that they really belong (for example, a newly minted dentist who has just received their numbered license to practice). As Slovenia progressed towards independence from 1989 to 1991, every new label that showed Slovenia's membership in the contrast set of independent political entities was applauded, whether that meant the assignment of ISO 3166 codes or the informal sprouting of white oval car bumper stickers carrying a "SLO" label (in the now-abandoned national car labeling format that was standard in Europe at the time).<sup>61</sup> In this case, a label legitimates the contrast set membership of the thing they label, ceremonially "recognizing certain distinctions while ignoring others"<sup>62</sup> and entrenching the leveling effect of membership in a contrast set.

The simultaneous existence of both positive and negative aspects of leveling explains why many acts of contrast set creation and labeling are contested and controversial, with one side generally emphasizing the fairness of leveling and the other emphasizing the way that it ignores individual differences.

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<sup>60</sup>On the idea of the "level playing field" see Kristen Purcell, "In a league of their own: mental leveling and the creation of social comparability in sport," *Sociological Forum* 11 (1996): 435-456, and Purcell, "Leveling the playing field: constructing parity in the modern world," Ph.D. dissertation, Rutgers University, 2001. On the idea of comparing the unlike, see also Wendy Nelson Espeland and Mitchell L. Stevens, "Commensuration as a social process," *Annual Review of Sociology* 24 (1998): 313-343.

<sup>61</sup>See Naško Križnar, "Visual symbols of national identity: Slovene bumper stickers and the collective unconscious," *Visual sociology* 8 (1993): 58-63.

<sup>62</sup>Duranti, *Linguistic anthropology*, pp. 124-125; see also p. 15. Here, the distinction recognized is that Slovenia and (for example) Spain are independent countries and Alaska is not; a distinction ignored is that Spain and Alaska are large territories and Slovenia is quite small.

I propose that contrast sets and labels give rise to an opposition between what I will call *structural* and *descriptive* knowledge of the members of a set.<sup>63</sup> Structural knowledge emphasizes the place of the entity in the set (and possibly in a taxonomy). Descriptive knowledge emphasizes the "feel" of an entity, the "view" associated with being "in" it, or the attributes that contribute to its sense of identity. Take, for example, the street in Reykjavík called Öldugata, which I walk along to reach downtown from my office. Structural knowledge about Öldugata would include the fact that Bárugata, Ránargata, and Vesturgata parallel it and are similarly laid out, that Ægisgata is a street which crosses all four of these streets, that all these streets are in postal code 101 and that the house numbers on Öldugata run from  $x$  to  $y$ . Descriptive knowledge about Öldugata might include a story about its history, a memory of how the street smells, a photograph of the view looking down it, or my awareness of the fact that it is a quiet enough street to walk down the middle of it on days when the sidewalks are very icy.

Just as leveling and labeling have advantages and disadvantages, so does a focus on structural and descriptive knowledge. One scholar suggests that focusing on a particular geographical location's place in the "colored polygons" of our geopolitical taxonomy contributes to the "obscuring" of the "political and economic ... cultural, social, and psychological" individuality of that location,<sup>64</sup> and undoubtedly, thinking structurally about a contrast set created by boundary gives rise to many categorical paradoxes. Structural

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<sup>63</sup> For a fine literary example of this distinction, see Antoine de Saint-Exupéry, *The little prince* (Harcourt, 2000 [1943]), p. 10. I have not yet found this exact distinction made in existing scholarly literature, despite many close approaches, and many discussions of the distinction's consequences. It is related to, but not identical with the distinction between metrical and topological perception of space, on which see Eviatar Zerubavel, *The fine line: making distinctions in everyday life* (New York: Free Press, 1991), p. 24. Neither does it quite correspond to the opposition between taxon and locale knowledge hypothesized by John O'Keefe and Lynn Nadel in *The hippocampus as a cognitive map* (Oxford: Clarendon Press, 1978; available online at <http://www.cognitivemap.com>, January 2005). The taxon-locale distinction has, nevertheless, often been misinterpreted as identical with the structural-descriptive distinction: for an example, see Dave Woodcock, "Learning chemistry: the importance of imagination," unpublished handout, Department of Chemistry, Okanagan University College, British Columbia, 1995 (available at <http://people.ouc.bc.ca/woodcock/probsol/imagine.html>, January 2005).

<sup>64</sup> Clifford Geertz, *After the fact: two countries, four decades, one anthropologist* (Cambridge: Harvard University Press, 1995), p. 22; Geertz, "Primordial loyalties and standing entities: anthropological reflections on the politics of identity," Collegium Budapest Public Lectures #7 (1994), p. 9, <http://www.colbud.hu/main/PubArchive/PL/PL07-Geertz.pdf> (February 2005).

knowledge is typically thought of as more "rational" and descriptive knowledge more "intuitive," a polarity which can be mapped into value terms in either of the two obvious ways. Among the writers who emphasize the value of descriptive over structural thinking, Benedict Anderson makes it seem like geographical and social-group categorization in Thailand and Malaysia was an evil imposed by the rationalist colonial powers on the spiritual colonized peoples,<sup>65</sup> while Jonathan Kozol rails against educational concepts such as "unit," "sub-topic," "credit hour," and "area of concentration" which are based on contrast sets, arguing that they deprive us of our sense of solidarity, wholeness, community, and individual coherence.<sup>66</sup>

An example which can easily be argued in both ways is the perhaps increasingly common practice in scholarly bibliographies of using only the initials of given names, which obscures authors' gender and also eliminates their first name as a source of descriptive information about them. Some presumably applaud this as an effort to make gender irrelevant to the advancement of science. Others surely rue the fact that this style obscures the individuality of the author and makes it more difficult to imagine who they are or were. One can imagine that scholars from particular disciplines might be more likely to sympathize with one of these arguments or the other.

A culturally entrenched practice under which people seem quite happy to be "just a number" is the common tradition in Bali and Italy of using numbers as names for sons. In Bali, a family's first four sons are commonly named Wayan, Nyoman, Made, and Ketut.<sup>67</sup> In Italy, one frequently finds Primo, Secondo, and Terzo; ironically, the best known example is Primo Levi, a man best known for writing about the horrors of concentration camps. This practice challenges the common assumption, implicit in Anderson's and Kozol's criticisms, that numbering and labeling is a phenomenon of evil, rational "modernity."<sup>68</sup>

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<sup>65</sup> Benedict Anderson, *Imagined communities: reflections on the origin and spread of nationalism* (Revised edition, London: Verso, 1991), pp. 163-178, 184-185.

<sup>66</sup> Jonathan Kozol, *The night is dark and I am far from home* (Revised edition, New York: Touchstone, 1990), pp. 56-59.

<sup>67</sup> On the Balinese case see Crump, *The anthropology of numbers*, p. 68.

<sup>68</sup> Note also that it uses a clear iconic principle (younger sons receive a higher number), and that it shows how people often allow themselves to be guided by a very fundamental social convention like

Practically speaking, bureaucracies, which may deal with millions of people, and computer programs, whose discriminatory capacities are limited, truly benefit from leveling, the creation of comparability, and the elimination of the individual features of each entity from the system. After all, prose descriptions and "fuzzy" distinctions are usually of little help in finding something in a database. For computers and bureaucracies, impersonal labels create precise contrast, and thus *increased* individuality in the units they represent, by making it possible to rely on the ability to focus precisely and unambiguously on the situation of a single individual. Creating comparability in a contrast set and labeling the members systematically helps avoid getting distracted by extraneous similarities, such as that 123-456-789 and 987-654-321 are both tall red-haired women with glasses. It ignores each entity's position in any domains not iconically reflected by the label itself. It also aids in treating things objectively, without personal prejudices and supposedly unwarranted sympathy — just as maps of South Vietnam used by American aerial bombing missions in the early 1970s listed coordinates but not place names in order to keep the crew's task "impersonal."<sup>69</sup>

Overall, there are both pluses and minuses to leveling a contrast set and creating an even playing field. It is the set designer's job to weigh the consequences of their decision. Labeling does not always imply leveling, because designers can choose an iconic labeling principle which reflects some distinctive attribute of the contrast set members. However, such principles have only limited power to convey distinctions within a contrast set because they cannot encode the variation in more than a few attributes of the contrast set members at a time.

Even in a highly levelled set, designers are sometimes in circumstances where they have the opportunity to convey a fair amount of distinctiveness "on top" of a highly levelled system. For example, maps often list the members of the set of the stops along a public transport route with a sense of complete equivalence and equality, which rightly conveys the

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numeral labels in making difficult, relatively arbitrary choices like that of naming one's children (see further section 6.4).

<sup>69</sup>Downs and Stea, *Maps in minds*, p. 44.

fact that the bus will stop at each one. But, of course, nobody thinks of them that way, except perhaps the first-time visitor. It is useful, when possible, to give information which complicates our image of such contrast sets, such as which stops form nodes and landmarks in the pattern of a city; which stops have connections to other transport lines; or, perhaps, at which stops it is possible to go shopping or to find something to eat late at night. Similarly, the linking of photographs or comment fields to a customer database adds liveliness and distinctiveness to a record that might otherwise indeed be "just a number."

### 3.6 Norms of attention to labels

In the American children's book *Alvin's secret code*, a grandfatherly neighbor shows Alvin how to read the manufacturing codes printed inside his shoe and to understand the call number system in the library. Alvin puts his skills to use when, after figuring out how the manufacturing date of a hi-fi stereo system is coded on the product tag, he exposes a case of false advertising at the local department store (forcing the embarrassed manager to offer Alvin's father a big discount). One of the goals of the book is to show how pervasive numbering systems and symbols are in everyday life, and to give children confidence in their ability to figure these systems out. The hero and his buddies learn that numbering systems and other codes are "much more widely used than you would imagine."<sup>70</sup>



Image 3.11 (059)

#### WHO CARES CLOCK

WHO CARES PRODUCTS  
99018  
\$39.95

#### What Time Is It? Who Cares!

The Who Cares!!! Wall clock has the right attitude. It's the perfect clock for your home, office, or wherever you need to leave your worries behind. If you're stressed, the Who Cares!!! Clock reminds you to relax and just enjoy the day. Made with a durable PVC face and sweep second hand. 10" diameter. Uses one AA battery (not included). Outer rim available in a White or Black face. Please specify.

Yet one is not supposed to be too interested in labels. Rather one is supposed to reserve one's attention for the nature of the thing itself. This is why trainspotters are considered

weird, as are idiot savants who have prodigious memories for labels.<sup>71</sup> This is also why the clock in Image 3.11, with its labeling system in ruins, is said to have "the right attitude." (The

<sup>70</sup> Clifford B. Hicks, *Alvin's secret code* (New York: Holt, Rinehart, and Winston, 1963).

<sup>71</sup> A literary reference that demonstrates this attitude is the description of a retarded boy in Carlo Levi, *Christ stopped at Eboli: the story of a year* (New York: Farrar, Straus, & Co., 1963), pp. 170-171. For an introduction to savantism with particular attention to calendrical knowledge, see Michael J. A. Howe, *Fragments of genius: the strange feats of idiots savants* (London: Routledge, 1989); see also Darold A. Treffert, *Extraordinary people: understanding "idiot savants"* (New York: Harper & Row, 1989).

message of its advertising copy is that categorization creates stress, which the clock helps release.) We use words like "nerd" for people who, by choice, pay more attention to contrast sets than to the "fuzzy" aspects of the rest of life. At least, there is a sense that one should be restrained in one's interest in sets. Normality is to focus on descriptive, not structural knowledge; one should capture the true identity and spirit of the moment, not focus on its place in a system of lifeless categories and tags.

There is a sense that labels are just discardable handles which help us find our way to the actual passion and pathos of the thing. Thus travel writer Paul Theroux titles his chapters with the names of trains, but tells us that "I sought trains; I found passengers."<sup>72</sup> The structural facts about a train (such as departure time, train number, and destination) may be all we know when we first step on board, but the passengers inside are one aspect of that train journey with much richer descriptive potential. In the same vein, knowing someone's birth and death dates and places of residence tells us quite little about the person themselves, the page numbers of a book are normally irrelevant to the message of the book itself, and the periodization of history into decades or centuries is something that is basically read into, not discerned within, the flow of historical events.<sup>73</sup> Thus it is considered not just a habit, but an eccentricity, of Iceland's second-most prominent twentieth-century writer, Þórbergur Þórðarson, that he regularly mentioned the precise date and time of events (and usually the weather conditions too) in his autobiographical essays.<sup>74</sup>

One author warns us of the "danger of taking numbers so seriously at the expense of what is non-measurable, non-calculable: intuition, creativity, imagination, happiness ..."<sup>75</sup> Some people feel that not only are labels irrelevant to the real nature of the things they tag,

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<sup>72</sup> Paul Theroux, *The great railway bazaar: by train through Asia* (Boston: Houghton Mifflin, 1975), p. 2. All the chapter titles follow the same form, e.g. "The 11:33 to Margate," in his book *The kingdom by the sea: a journey around Great Britain* (Boston: Houghton Mifflin, 1983). Venedikt Yerofeev uses a similar chapter titling motif in *Moscow stations* (London: Faber and Faber, 1997 [1976]).

<sup>73</sup> See Edwin Muir, *An autobiography* (London: Hogarth Press, 1954), p. 49; Garry Wills, "A guide to the century," *New York review of books*, 15 July 1999, p. 24; Eviatar Zerubavel, *Time maps: collective memory and the social shape of the past* (Chicago: University of Chicago Press, 2003), pp. 96, 139.

<sup>74</sup> For example, in one of his books, *Ofvitinn* (2d ed., Reykjavík: Mál og menning, 1964), the first sentence is "It was Sunday, 9 May 1909 in the early afternoon" and 17 of 43 chapters begin similarly.

<sup>75</sup> From the back cover blurb of David Boyle, *Why counting can't make us happy* (London: HarperCollins, 2002).

they even distract us from their true spirit. For example, it has been suggested that the introduction of postal codes in Sweden in 1968 made love letters less romantic.<sup>76</sup> Here the idea is perhaps not just that labels are unromantic, but also that categorical partitions and romance are antithetical.<sup>77</sup> However, even those who despise structural knowledge must admit that labels are often a good way of summoning forth descriptive images and memories of a person or a place or an experience.

If you still doubt that an interest in labels is considered deviant, consider the case of Michael W. Thyen. He has posted, on the Internet, a comprehensive list of fake phone numbers with the prefix 555 that have been used as stand-in numbers (see section 3.7) in American movies.<sup>78</sup> Connected to the list is a page where people can write in with comments.<sup>79</sup> Although the phone number site contains no other content, and absolutely no personal information about Mr. Thyen himself, the comments call him "strange," "obsessive," "too weird," "dull," "boring," "nutty," "like Rain Man," and "a loser" with "way too much time on his hands." Furthermore, his page was chosen for listing by another website, "The Useless Pages," which provides links to "useless" information on the Internet.<sup>80</sup>

I suggest that we disattend labels in the course of daily life because we consider them the *background* against which we do truly meaningful work that has value for other people — as opposed to preparatory work that consists just of debating what conventional symbols we should use during those real tasks. Labels are auxiliary tools for getting real things done. Reading an entire study devoted to labels has somewhat the same feeling to it as listening to an entire evening of opera preludes, or reading the prefaces to a series of books or the legends for a series of maps, without getting to experience the main body of the works involved.

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<sup>76</sup> "Men visst måste kärleksbrev ha varit mer romantiska förr, utan postnummer?" From Jacques Wallner, "Numren som retade svenskarna," *Dagens Nyheter* (Stockholm), 21 August 1998.

<sup>77</sup> On this theme see Zerubavel, *The fine line*, pp. 87-89.

<sup>78</sup> Michael Thyen, "555-LIST," <http://home.earthlink.net/~mthyen> (April 2004). As of my viewing, the site had not been updated since 2002.

<sup>79</sup> <http://home.earthlink.net/~mthyen/comments.html> (April 2004).

<sup>80</sup> "The Useless Pages," <http://www.go2net.com/useless/index.html> (April 2004).



Image 3.12 (034)



Image 3.13 (033)

At the same time, labels are frequent small-talk topics — perhaps not only because they are safe, impersonal, and external (like the weather), but also because people are truly curious about them, and even, *need* to be sure they know how they work. For example, the three-letter airport coding system was enough a part of everyday life to serve as the foundation for a humorous graphic motif in the 1992 Swedish advertising campaign illustrated in Image 3.12 and Image 3.13. (The booklet cover reads "Timetable for SAS and Linjeflyg"; the advertisement on the back of the airport bus seats reads "News from SAS and Lin.") Labels show up often in print journalism — never as breaking news, but rather as the focus of sometimes humorous, sometimes whimsical sidebars and features. Naturally, these articles do not go into great detail, they often apologize for foregrounding such a trivial subject, and they usually frustrate anyone who wants to find out the full details of a particular labeling system, but they do demonstrate peoples' half-suppressed curiosity about the central symbolic conventions that they use. It would be going too far to call labels "seen but unnoticed," but it is probably fair to say that they are rarely *fully* noticed, certainly taken for granted, and often tabooed in the foreground of daily life.

The truth is, though, that sets of things command a tremendous fascination that most of us know in our own personal way, whether it involves sorting through our baseball cards, learning about all the elements of the periodic table (or singing the Tom Lehrer song about them), knowing the capitals of all the countries in the world, or other such juvenile pursuits that many of us, sheepishly, never completely outgrow.<sup>81</sup> Even something so simple as the

<sup>81</sup> Those people who have developed special perceptual abilities in a particular domain can appreciate distinctions between contrast set members which others may not even be able to perceive. When I interviewed absolute pitch holders several years ago, one of them told me: "Once I was trying all the

contrast set of one's high-school teachers can provoke this sort of fascination. Elias Canetti practically falls into a reverie in his autobiography while recalling their paradigmatic procession through the same experiential slot: he describes "the alternation of their appearances, each one in turn appearing before you, in the same place, in the same role, with the same goal, thus eminently comparable ..." <sup>82</sup> Although Oliver Sacks exoticizes a set of mathematically gifted autistic twins he studied, who he observed visibly "savoring" the thought of particularly interesting prime numbers, this is an experience that most of us can find some sort of sympathy with in some labeling domain. Indeed, just a few pages later, Sacks confesses to having had his own fascination with numbers, and in another book he describes his even deeper childhood relationship with the periodic table of the elements. <sup>83</sup> Vladimir Nabokov, as well as his annotator and critics, saw commonality in Nabokov's passions for number theory, wordplay, chess, and lepidoptery, all fields which involve "patterning," or, in my terms, structural knowledge. <sup>84</sup>

The same tension between the usefulness and the eccentricity of structural preoccupation shows up in writing about the intense special interests of children with the increasingly commonly diagnosed Asperger's syndrome. <sup>85</sup> A recent guidebook to Asperger's syndrome mentions colors, letters, butterflies, beer-bottle labels, road signs, trains, timetables, lamp-post numbering in the United Kingdom, sports statistics, carrot varieties,

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notes on the piano, like, one by one, and really listening to them, and they're all different. It's really fun to experience that." I would like to be able to experience that difference as well, but I cannot and never will be able to because I do not have absolute pitch. See Ian Watson, "Pitch standardization and perfect pitch," unpublished term paper, Rutgers University, 2000.

<sup>82</sup> Elias Canetti, *The tongue set free: remembrance of a European childhood* (London: André Deutsch, 1979), p. 150.

<sup>83</sup> Oliver W. Sacks, *The man who mistook his wife for a hat and other clinical tales* (New York: Summit Books, 1985), chapter 23; Sacks, *Uncle Tungsten: memories of a chemical boyhood* (New York: Alfred A. Knopf, 2001). On the fascination of the periodic table, see further a fine web site, <http://theodoregray.com/PeriodicTable> (March 2004).

<sup>84</sup> Vladimir Nabokov, "Portrait of my mother." *The New Yorker*, 9 April 1949, pp. 33-37; Nabokov, *The annotated Lolita* (New York: McGraw-Hill, 1970), p. xxviii; D. Barton Johnson, *Worlds in regression: some novels of Vladimir Nabokov* (Ann Arbor: Ardis, 1985).

<sup>85</sup> On the increase in Asperger diagnoses see Erica Goode, "Autism cases up; cause is unclear," *New York Times*, 26 January 2004, p. A1; Amy Harmon, "Answer, but no cure, for a social disorder that isolates many," *New York Times*, 29 April 2004, p. A1.

and truck manufacturers as examples of the fixations of Asperger's children.<sup>86</sup> All of these fixations arguably involve richly structured fields of knowledge with many contrast sets and labels. To be fair, considering contrast sets and labels as typical of Asperger's syndrome is perhaps more of a stereotype than a regularity. The preoccupations of those children considered to be examples of the syndrome are actually much more diverse than the list above would suggest. The same book also cites fascinations with sliding doors, vacuum cleaners, yellow pencils, Vikings, toilet brushes, the Japanese tea ceremony, and a particular pop music star. One is tempted to hypothesize that the common thread here is exploring the diversity of a particular semantic domain or set of hyponyms, but the last two examples do not fit into even this weaker theory.

Even if one accepts the link between Asperger's syndrome and structural knowledge, the problem with medicalizing a fascination with structural knowledge is that an interest, sometimes intense, in contrast sets and labels is a common and very useful part of normal human development — both among children, adolescents, and adults. Just because it is correct to say that Asperger's syndrome often involves structural fascinations does not mean that it is right to suggest that structural fascinations are a sign of Asperger's syndrome.<sup>87</sup> The mastery of every facet of a particular semantic domain is essential to being able to do your job well, whether you are a doctor who knows lots of muscles or diseases, a carpenter who knows all about doors or types of wood, or a video shop attendant who knows exactly how your collection is organized. In primary as opposed to secondary socialization, we take it for granted that small children should become very interested in calendars, letters of the alphabet, and colors, and should also have a clear grasp of the difference between such things as the various grades in their school. In the working world, there are plenty of people who not only must master labeling systems in their work, but who must carefully and attentively create and manage such systems. There is, for example, a whole industry surrounding

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<sup>86</sup> Tony Attwood, *Asperger's syndrome: a guide for parents and professionals* (London: Jessica Kingsley, 1998), pp. 9, 89-102.

<sup>87</sup> On this issue see the response to Oliver Sacks regarding the relationship between absolute pitch ability and savantism by Gottfried Schlaug et al., *Science* 268 (5 May 1995): 621-622.

wildlife labeling<sup>88</sup> and an entire art and history to baseball scoring.<sup>89</sup> There are also people professionally charged with managing the labeling systems for library classification, telephone lines, and medical diagnoses.

Thus a recurrent difficulty in the Asperger literature is the conflict between the medicalization and exoticization of structural interests, and the undoubted essentialness of contrast set mastery in many highly paid and respected occupations. Is attention to labels and contrast sets deviant? Or simply a manifestation of talent? Or, perhaps, is talent deviant? If so, how do we cope with the fact that structural talents are simultaneously deviant and admirable?<sup>90</sup>

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<sup>88</sup> See, for example, [www.wildlifecomputers.com](http://www.wildlifecomputers.com) (March 2004).

<sup>89</sup> See Dickson, *The joy of keeping score*.

<sup>90</sup> I am reminded of a high school classmate who, I was told, kept the Metro map in his pocket on the French class trip to Paris, and took obvious pleasure in figuring out which routes the group should take. My other classmates ridiculed him as "Metro Man" (implicitly pressuring him to conform and not to excel), but made use of his skills nevertheless.

Another difficulty is the tension between "one-drop" and "whole-ocean" theories of deviant identity formation. In an environment where one-drop-based judgements of deviance flourish, "dressing in" to a cognitive style for ten minutes a day is enough to warrant a deviant label. But this reflects a lack of sensitivity to the temporal structuring of identity.<sup>91</sup> Surely the truly noteworthy deviance actually lies not in attention to labels, but rather in *not* being able to attend to the other aspects of social life such as making friends, falling in love, saying interesting and companionable things, earning a living, taking the car to be fixed and so forth. As long as attention to structural knowledge is temporally and situationally restricted — something you do not every waking moment of your life, but rather at work, or only as a hobby, or only on Tuesdays — an interest in labels or contrast sets is routine, indeed valuable. Still, it is unlikely to be considered the "coolest" part of one's identity, no matter how much some people claim that Bill Gates made it cool to be a nerd. And perhaps particularly in the United States, talent *is* often considered deviant; some say that in America a sense of shame is attached to intellectual interests even at the highest academic levels.<sup>92</sup> Indeed, I wonder if precisely this sense of shame is one contributing factor in the reification and backgrounding of contrast sets and label systems (see sections 1.2 and 6.2).

### 3.7 Meet John Doe: stand-ins

Here are several real-life examples of stand-ins:

**Anytown.** The 1999 edition of United States Internal Revenue Service Publication #334, *Tax Guide for Small Business*, includes two sample tax returns. The first is for Stanley Price, 99 Oak St., Anytown, TX 70000. His social security number is 000-00-0000, and he runs Stan's Barber Shop, 1001 Maple Ave., Anytown, TX 70000.

The other return is for Susan J. Brown, 1313 Empire Blvd., Franklin, NY 18725. Her social security number is 111-00-1111. She runs Family Fashions, 725 Big Sur Drive, Franklin, NY 18725. Family Fashions' employer ID number is 10-1234567.

**Roe vs. Wade.** In the early 1970s, a woman files suit to overturn the United States' legal prohibition of abortion. Because she does not want to reveal her real name, court records call her by the surname Roe — the full name of the case being, of course, *Roe v. Wade*.

**Buddy.** On February 26, 2000, the *Rochester (New York) Democrat and Chronicle* runs an article with advice for apartment hunters with pets. The article advises preparing a "pet

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<sup>91</sup> For a recent application of these concepts see Wayne H. Brekhus, *Peacocks, chameleons, centaurs: gay suburbia and the grammar of social identity* (Chicago: University of Chicago Press, 2003).

<sup>92</sup> See, for example, Leonid Fridman, "America needs its nerds," *New York Times*, 11 January 1990, p. A23.

resume" for your prospective landlord, listing information about your pet's age, health, and habits, and including the phone numbers of previous landlords. The fictional pet resume included with the article is for a mixed-breed dog named Buddy, who is 7 years old, neutered and flea-free, weighs 45 pounds, and is walked twice a day. Under "References," it says that Buddy's current landlord may be reached at 555-1212.

**Juanita.** A question on the math section of the SAT (a standardized test used to measure American high school students' abilities) reads, "It normally takes Juanita ten minutes to walk to school in the morning. If she walked twice as fast ..."

**Paolo and Monica.** My Italian textbook includes a made-up practice dialogue between two people named "Paolo" and "Monica."

**2,458.** A book I am reading, which is discussing theories of learning, says "Under this scenario — and it was a fashionable theory at one time — the brain would function like a giant switchboard, hooking up stimulus number 2,458 to response number 2,458."<sup>93</sup>

**Erika Mustermann.** In 1981, the West German State Printing Office introduces a new style of identity card. A widely circulated sample card (illustrated in Image 3.14) uses the following identity: name, Erika Mustermann (maiden name Gabler); birthdate, September 12, 1945; birthplace, Munich; eyes, blue; height, 176 cm; residence, Heidestr. 17, Munich. In 1997 and again in 2001, Germany redesigns its identity cards, continuing to use the name Erika Mustermann and birthplace Munich on samples (but with new photos and other details).<sup>94</sup> The name Erika Mustermann gains considerable currency in Germany as a stand-in of the "John Doe" variety, particularly in personal identification contexts.<sup>95</sup> The word "Muster" means "sample" or "specimen" in German.

Stand-ins exist all over the lexicon, and indeed for any cognitive entity that passes the "X and other Ys" test.<sup>96</sup> But they are more highly concentrated in the world of proper names, contrast sets, and labels. Common to all stand-ins is that an individual is selected to stand for an entire contrast set. (This is an example of what linguists call metonymy, and this particular type of metonymy has been called "role-for-individual" metonymy.)

Stand-ins are often, but not always, deliberately and consciously chosen (as in most of the examples above, including that of Erika Mustermann). In some cases, particular stand-

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<sup>93</sup>This example is from Roger Fouts, *Next of kin: what chimpanzees have taught me about who we are* (New York: Morrow, 1997), p. 166.

<sup>94</sup>See "The changing Ms Mustermann over the years," press release, Berlin, 12 November 2001, [http://www.bundesdruckerei.de/en/press/press\\_archive/e\\_2001/p12\\_11\\_2001\\_en.html](http://www.bundesdruckerei.de/en/press/press_archive/e_2001/p12_11_2001_en.html) (January 2005); "Photo archive — identification documents," [http://www.bundesdruckerei.de/en/press/photo\\_archive/4\\_4\\_03/index.html](http://www.bundesdruckerei.de/en/press/photo_archive/4_4_03/index.html) (January 2005), all on the website of the Bundesdruckerei (German State Printing Office).

<sup>95</sup>A web site about Erika Mustermann is Uwe Haupt, "Sonntag, 12. September 2004: Erika Mustermann ist 59," <http://134.102.55.200/haupt/erika> (January 2005).

<sup>96</sup>In the sentence "If Johnny told you to jump off the Empire State Building, would you listen to him?" — a commonly used admonishment to children not to be overly suggestible — the "Empire State Building" is a stand-in for "any tall building" whereas the verb phrase "to jump off the Empire State Building" is a stand-in for "to do anything dangerous or stupid." Similarly, linguists are familiar with the problem of how to select example sentences that illustrate particular syntactic phenomena. In American classrooms, conventionalized names such as "John" and "Mary" are frequently used to make sentences like "John gave Mary a kiss," but one professor I knew tried to make class a little more interesting by picking cartoon themes and using examples like "Calvin builds Hobbes a treehouse."



Security numbers. If pressed, and only if pressed, SSA staff could suggest the use of 000-00-0000 as a stand-in.<sup>99</sup>

Stand-ins can serve in two different roles, which I will distinguish with the terms *exemplifier* and *metasyntactic signifier*. All stand-ins are exemplifiers, but only some function as metasyntactic signifiers.

The best-known kind of stand-ins are those that also function as metasyntactic signifiers. Metasyntactic signifiers are always created within a contrast set that is being used for labeling. However, they lack specific reference themselves. But they do not refer to something unreal (like the phantom members discussed in section 2.8). Their purpose is to refer explicitly to the indefinite idea of "any member of the contrast set that is tagged by the label set that the stand-in belongs to." (Unlike superordinate signs, which also mark an entire contrast set, metasyntactic signifiers also "fit in" the slot that would normally be filled by the label for a contrast set member.) The best-known and most-documented example of this phenomenon is the stand-in proper name. Most commonly "John Doe" in English, there are equivalent versions in other languages, such as Otto Normalverbraucher (literally Otto Normalconsumer) in German, Zhāng Sān (literally Zhāng Three) in Chinese, or Matti and Maija Meikäläinen (literally Matti and Maija Yourstruly) in Finnish.<sup>100</sup> (Different stand-in names are more popular in different contexts; consider the different registers in which one might prefer "John Doe" or "Joe Sixpack.") In computer science, "foo" and "bar" are among the conventionalized stand-ins for "any algorithmic variable," and my use of the term "metasyntactic signifier" is based on computer scientists' use of the term "metasyntactic

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<sup>99</sup>"Nonprogram Use of the Social Security Number (SSN)," Social Security Administration Program Operations Manual System, RM 00201.010, version of 22 January 2001. <http://policy.ssa.gov/poms.nsf/0/9c606d03be36ec7785256e370011e5f2?OpenDocument> (January 2005).

<sup>100</sup>Xiaohui Xin and Aino-Maija Muuri supplied the Chinese and Finnish examples. On stand-in proper names, see Paul Dickson, *What's in a name? Reflections of an irrepressible name collector* (Merriam-Webster, 1999), pp. 131-134; Roger Clarke, "Famous Nyms," <http://www.anu.edu.au/people/Roger.Clarke/DV/FamousNyms.html> (April 2004); and "Anonymous Names," <http://www.funnynames.com/anonymous.html> (April 2004), which gives the most complete list of equivalents in other languages that I have seen. "Meet John Doe," by the way, is the title of a 1941 movie starring Gary Cooper and directed by Frank Capra; see <http://www.imdb.com/title/tt0033891> (April 2004).

variable" for these stand-ins.<sup>101</sup> In the list at the beginning of the section, the terms "Anytown," "10-1234567," "555-1212," and "Erika Mustermann" are classic, conventionalized metasyntactic signifiers; the name "Roe" is a conventionalized metasyntactic signifier which is being used as a pseudonym; and the number "2,458" is a metasyntactic signifier which is understandable but not conventionalized. Within the lexicon proper, "widget" may be the best known English metasyntactic signifier, familiar to anyone who has studied economics. Anyone using the word "widget" typically expects that their readers will understand it is a way of referring metasyntactically to the set of "all possible industrial products" or "all possible items for sale." Algebra rests on the use of metasyntactic signifiers, such as the signifier  $x$  in the statement "For any integer  $x$ , there is an integer  $y$  such that  $x+y=0$ ."<sup>102</sup>

The other stand-in role is to be a representative exemplifier of the contrast set that the stand-in belongs to, whether that contrast set has a labeling function or not. For example, in the list at the beginning of the section, the names "Paolo," "Monica," and "Juanita" exemplify the contrast set of Italian and American first names but do not refer metasyntactically to the class of all potential people that could fill the same slot (whereas the use of the number "2,458" does asks the reader to extend the truthfulness of the sentence to all the things with similar numbers). "Erika Mustermann" is a fictional name which metasyntactically represents the idea of "any German," but Erika's photograph, date of birth, and height are real instantiations which exemplify the set of photographs, dates of birth, and heights of Germans. If the designers of the specimen had wanted to use exemplifiers which were also metasyntactic signifiers, they could have listed her height as "xxx cm," her date of birth as "dd.mm.yy," and put a conventionalized silhouette in the photograph spot. Consider, as well, the choice of Lěi Fěng (雷锋) and Stakhanov to represent "everyman" in communist China and Russia respectively, or a school's choice of which student (or students) they should picture on the cover of their prospectus. Metasyntactic signifiers are exemplifiers too,

<sup>101</sup> "Metasyntactic variable," in *The jargon file*, version 4.4.7, edited by Eric S. Raymond, <http://catb.org/~esr/jargon/html/M/metasyntactic-variable.html> (January 2005).

<sup>102</sup> On this issue see George Lakoff and Rafael E. Núñez, *Where mathematics comes from: how the embodied mind brings mathematics into being* (New York: Basic Books, 2000), pp. 74-75.

but not of the contrast set that they label; rather of the label set that they belong to. "Erika Mustermann" is an exemplifier of the set of German names at the same time as it is a metasyntactic signifier of the set of all Germans. If "Lěi Fěng" appeared, as a name and not a personality, in the "name" field of the instructions for a form to be filled out, it would be a metasyntactic signifier too.

Those exemplifiers which are not metasyntactic signifiers are typically real members of the contrast set they belong to (such as "Juanita," "176 cm," "99 Oak Street," or "7 years old"). Those exemplifiers which *are* also metasyntactic signifiers are more often unreal (for example, "Joe Sixpack," "MM/DD/YY," and widgets). In everyday discourse, a common way of signaling that one is temporarily using a real-life exemplifier as a metasyntactic signifier is to prefix it with the word "say." (Imagine that the Slovene ice hockey team was playing, say, the Slovak team.) Many metasyntactic signifiers are, technically, well-formed members of their label set (such as 987-65-4321, John Doe, or XYZ Corp.), but most are oddly formed in some way, and few are fully typical and convincing.

Most of the metasyntactic signifiers discussed so far are *conventionalized*. The process of stand-in conventionalization is one that designers can potentially influence. Conventionalization means that when people see the stand-in, they know right away that it is a stand-in rather than a "real" member of the contrast set. Also, when people find themselves in need of a stand-in for a particular contrast set, they usually think of the conventionalized ones first. It is, of course, entirely possible to use nonconventionalized metasyntactic variables (such as Stanley Price or 2,458 instead of John Doe or  $x$ ), but when one does, users may interpret the stand-in as real, just as one easily falls for a non-obvious pseudonym.<sup>103</sup>

When a metasyntactic stand-in becomes conventionalized, its availability as a label is eliminated or limited. In the most extreme cases, it conventionally *cannot* be used as a label for a real member of that set, or at least cannot be used without special confirmation that it refers to something real. If your name really were John Doe or Erika Mustermann, you would

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<sup>103</sup> For an interesting account of falling for a non-obvious pseudonym see Thomas Satterlee, "A Case for Smilla," *Translation Review* 50 (1996): 13-17.

have to constantly emphasize to people that that really *is* your name and not a pseudonym. If your telephone number really were 123-4567, if you really had a dog named Fido, or if you really lived at 123 Any Street, you would constantly have to say things like "My phone number is, now get ready for this, 987-6543. No, I'm not kidding. Really." Thus the conventional use of "John Doe" or "Erika Mustermann" is predicated on the hope that everyone in society will understand not to name their daughter Erika Mustermann, and a common theme in popular writing about stand-in is to wonder whether (or fantasize that) they actually exist in real life.<sup>104</sup>

The establishment of a conventionalized stand-in thus marks off a particular member of the contrast set as unusual, unavailable, and special. Conventionalized metasyntactic signifiers are not "normal" members of a label set; they are outside the conventionally "used" and meaningful area of that set. In giving these parts of a contrast set a role which somehow calls attention to the nature of the contrast set itself, metasyntactic signifiers are somewhat similar to the idea of control sequences in computer science. These are specially marked members of a label set which are meant to prefix signification outside that normally permitted by the "regular" use of that label set. For example, the character "&" is used as a control sequence introducer in HTML to tell us that the characters which follow have something other than their usual meaning.<sup>105</sup>

Very often — and especially for metasyntactic signifiers — it matters much less (often not at all) *what* exact member of a contrast set is chosen as a stand-in and much more that *some* member is simply chosen. If "John Doe" and "widget" were not already conventionalized stand-ins, "Richard Roe" and "glork" might be just as good ones. "ABC" and "8,542" are no worse than "XYZ" and "2,458." In the terms that I use in section 6.4, quite often the act of solving the problem is more important than the identity of the solution chosen, and the process of deciding on a stand-in is more a process of picking than choosing.

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<sup>104</sup> See Dickson, *What's in a name?*, pp. 133-134, and the "search" for Erika Mustermann by Xaver Frühbeis, "12.09.1945: Erika Mustermann geboren," <http://www.br-online.de/wissen-bildung/kalenderblatt/2001/09/kb20010912.html> (April 2004).

<sup>105</sup> See, for example, Elizabeth Castro, *HTML for the world wide web* (Berkeley: Peachpit Press, 2003), p. 30.

But there are also very definite norms or typical strategies for stand-in design, and it is often (though not always) possible to argue that one contrast set member works better than another as a stand-in. This is particularly true for exemplifiers which are chosen to convey an impression of what a contrast set is or should be like, as well as those stand-ins which need to be obviously recognizable as such.

A very typical strategy for creating stand-ins that will be easy to conventionalize and easy for people to recognize as such is to use specially salient or marked areas of the contrast set involved (the same strategy is used in creating contrast set topologies; see section 4.5). Fame is a way in which certain members of a contrast set come to be specially marked, and in one example at the beginning of the section, the dog's name is Buddy — the name of the dog of the then American president Bill Clinton. One can also take advantage of other types of salience, focality, or centrality. Using Social Security number 000-00-0000 or the Empire State Building as a stand-in follows the strategy of focusing on superlatives (the first in numerical order, the tallest building).<sup>106</sup> Using round numbers or numbers whose digits form a sequence (in the first example, the employer ID number is 10-1234567 and the barber shop's zip code is 70000) is another strategy whose salience is inspired by the same principle responsible for the fact that one wins a game of gin rummy or poker by accumulating a sequence of cards.

An entirely different strategy for making a metasyntactic signifier obvious is to use a clearly unreal member of a contrast set. "So-and-so" is obviously not a name, and Otto Normalverbraucher is not only not a familiar German name, it even encodes its stand-in status in the transparent derivation of "Normalverbraucher." The obvious use of numbers

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<sup>106</sup>This strategy has some bearing on a well-known paradox in certain debates about the nature of linguistic categorization. Specifically, the problem is how to reconcile the fact that all odd numbers are (mathematically speaking) equally odd, with the existence of prototype effects for the class of odd numbers (namely, that subjects asked to state the best example of the class "odd number" tend to choose "3"; see John R. Taylor, *Linguistic categorization: prototypes in linguistic theory* (2nd ed., London: Clarendon Press, 1995), pp. 68-71). I would suggest that what these subjects were actually responding to was not so much the question as literally posed, but rather the somewhat different and more easily answerable issue of what a good exemplifier of the contrast set "odd number" would be. The choice of "3" as a stand-in is consistent with the typical norms of stand-in choice; the avoidance of "1" can be explained by the fact that its salience as the first number overwhelms its salience as the first odd number.

instead of names in the Chinese stand-in Zhāng Sān and its companion forms Lǐ Sì and Wáng Wǔ (Zhāng Three, Lǐ Four and Wáng Five) serves a similar function. The goal in these cases is to be deliberately non-valent, thus making it obvious that the name does not *really* exist.

There are other times when one wants the stand-in to blend in and to "appear" like a normal member of the contrast set (as pseudonyms do). This typically involves avoiding sequences, round numbers, and famous labels in favor of ordinary-looking labels such as "2,458" in the list above. This is why the common Social Security Number stand-in 078-05-1120 has been described as "convincing-looking."<sup>107</sup> Consider also the intent of Douglas Adams, author of the *Hitchhiker's Guide to the Galaxy*, in which the answer to the obviously very important question of the meaning of life is the very mundane number "42."<sup>108</sup> Or the case of the 1980s popular song "Jenny." This song would not have had the same effect if the lyrics had endlessly repeated an obvious stand-in phone number such as "123-4567" instead of the real-sounding "867-5309." Unfortunately, by choosing not to use an obvious stand-in, it made many people start to wonder whether 867-5309 was someone's actual number, and created considerable inconvenience for some people who did have that number.<sup>109</sup> (Israelis may recall the similar song "Dina Barzilai" from the late 1950s — Dina's phone number was 496351.<sup>110</sup>) Designers who create stand-ins and pseudonyms meant to be convincing can, if they wish, build a "self-destruct" feature into this convincingness, so that it becomes obvious after a little reflection that the stand-in does not actually exist. For example, any American road atlas will confirm that there is no interstate highway 13 in the United States (perhaps for the same reasons that many tall buildings in America have no 13th floor). An ethnographer who wanted to realistically convey the life of the municipal police department he was studying used Interstate 13 as a pseudonym for the city's actual expressway. This allowed him to simultaneously conceal the identity of his subjects, preserve the flow and

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<sup>107</sup> Clarke, "Famous Nyms."

<sup>108</sup> Douglas Adams, *The hitchhiker's guide to the galaxy* (New York: Harmony Books, 1980).

<sup>109</sup> See Barbara and David P. Mikkelson, "Jenny 867-5309," *Urban legend reference pages*, <http://www.snopes.com/music/songs/8675309.htm> (April 2004), citing Julie Brener, "New phone exchange leads to confusion, prank calls," *Brown Daily Herald*, 10 September 1999. The original song is by Tommy Tutone from *Tutone 2* (Columbia Records, 1981).

<sup>110</sup> "Dina Barzilai," by Haim Hefer and Sasha Argov, recorded by Lahakat Ha-Nachal, circa 1957-59.

literary effect of his writing, and communicate that he was using a pseudonym to any readers willing to linger long enough on the number 13.<sup>111</sup>

Exemplifiers often need to come across as even-handed and fair, especially when they are representing a collective domain with politically charged diversities. It is no coincidence that the Italian dialogue in the example at the beginning of the section is between one man and one woman, not between two men or two women. It has become almost a cliché for American university admissions prospectuses to depict students of several races on their cover photos. When the structure of the slot being filled makes it only possible to choose one exemplifier, several different strategies emerge. Sometimes, "legacy" inequalities and defaults persist (despite their injustices) in, for example, the tendency for their to be much more general agreement on the primacy of "John Doe" and "Otto Normalverbraucher" as stand-in personal names in English and German than on the primacy of any particular female equivalents, and in the tendency of the male names to be used for people of both sexes. Sometimes, we see an effort at rectifying injustice by deliberately choosing an exemplifier from an ostensibly disadvantaged group (the idea being that such usage will help create a sense of equality for members of that group). The "Juanita" example above shows a deliberate symbolic effort to convey a sense of equal opportunity to the Spanish-speaking community in America. As for the lexicon, some people use conditional sentences like "imagine that you step on someone's toe and *she* ..." Such efforts sometimes work, and sometimes come across as heavy-handed and forced.<sup>112</sup>

An entire book could be written about stand-ins. This section is just a very brief but hopefully helpful summary. In conclusion, let me say a word about the translation of stand-ins between one culture and another. It is a curious phenomenon because, instead of the

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<sup>111</sup> This example comes from John Van Maanen, *Tales of the field: on writing ethnography* (Chicago: University of Chicago Press, 1988), p. 110. A somewhat similar example was the cunning use of "Nacirema," a pseudonym derived from the actual name by a reversible process, in the classic article about American hygienic norms by Horace Miner, "Body ritual among the Nacirema," *American Anthropologist* 58 (1956): 503-507. For a description of the consequences of having no self-destruct feature built into a pseudonym, see Satterlee, "A Case for Smilla."

<sup>112</sup> The choice between being fair or heavy-handed can, in such cases where you are limited to a single exemplifier, make you feel damned if you do and damned if you don't. It is therefore perhaps not surprising that some choose a third way, a neither-nor strategy which avoids the horns of the dilemma. Witness the increasing popularity of "they" as a singular third person pronoun in English.

translator's usual task of determining which member of a specific contrast set in language Y to use to match a specific member of the corresponding contrast set in language X, the translator must figure out which part of the contrast set in Y has been marked out as non-referential. Such translation is not so difficult when a conventional stand-in exists (for example, "Karakószörsög" is the conventional Hungarian equivalent of the pejorative American English metasyntactic town name "Podunk," although I had to find this out by asking a Hungarian rather than looking in my English-Hungarian dictionary). However, when no conventional stand-in exists, such translations present a particularly interesting challenge. The translation of Lewis Carroll's semi-nonsense poem *Jabberwocky*, although it involves nonsense words instead of stand-ins, is a fine and well-known illustration of the problem.<sup>113</sup> The task is, instead of translating one word to another on the basis that they refer to the same thing in different languages, finding equivalents for words on the basis that both are within the domain of potential words but "outside" the set of words that has been conventionally created within that domain. In the specific case of *Jabberwocky*, the complicating and enriching factor is that since even nonsense words can convey meaning by virtue of sound-symbolism, phonesthemes or by analogy to other words, the translator needs to choose "meaningless" words in the target language that are "meaningless" in the same way (or an equally interesting if different way) as the words in the original.

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<sup>113</sup> On translations of *Jabberwocky* see Keith Lim, "Jabberwocky variations," <http://www76.pair.com/keithlim/jabberwocky/index.html> (April 2004); Jessica Augustsson, "Jabberwocky," <http://www.augustsson.net/jessica/Jabberwocky> (April 2004); David Shaw, "Glorious nonsense," <http://www.jabberwocky.com/carroll/jabber> (April 2004); Douglas Hofstadter, *Gödel, Escher, Bach: an eternal golden braid* (New York: Basic Books, 1979), pp. 366-368, 372-373.

## 4 Mapping

Consider the names of the ten provinces of Canada. There is nothing about the form of the name which tells you anything about those provinces themselves. It is possible to sort the provinces themselves by any number of criteria — west to east, east to west, date of accession to the union, population, whatever. It is possible to sort the names as well — by alphabetical order, or length, or quality of the first vowel. In the lists that result, there would be no correlation between the order of the provinces and the order of the names, except perhaps by chance.

Now think of the system used to label interstate highway numbers in the United States (or in the many other countries which use a similar principle). The major highways use numbers greater than zero and less than 100. In America, odd-numbered highways run north-south and even-numbered ones run east-west. The easternmost odd-numbered highways and southernmost even-numbered highways have the lowest numbers. There is thus a direct relationship — in fact, two direct relationships — between the number that labels the road, and other aspects of the road, namely its axis of travel and its latitude or longitude. This kind of labeling relationship is an example of what I call a mapping.

I use the word "mapping" to mean a type of labeling in which a principled or iconic relationship is created between a contrast set and a label set. A mapping is a labeling relationship which involves a regular, predictable correlation between certain attributes of the elements of the respective sets. One could, alternatively, call mapping simply "iconic labeling" or "principled labeling." I often use a bracket notation to express a particular mapping principle, so that the two mapping principles in American highway numbering can be expressed by the notation {east-to-west, north-to-south} = {even, odd} and {south or east : north or west} = {lower number : higher number}. In the bracket notation, the elements within a single set of brackets are the set of members or polarities within a contrast set (colons divide polarities, commas divide set members). Although I normally discuss

mapping as something that applies only between contrast sets and their label sets, one can also speak of mappings involving domains, and I will occasionally mention such examples.

**Clarification of signification terminology used in this book**

Unavoidably, for the purposes of this book I have had to conventionally settle on a particular terminology to discuss processes of signification. In the terminology I have adopted, mapping is a type of labeling and labeling is a type of signification.

- links between signifiers and signifieds: **signification**
- links between entire sets of signifiers and sets of signifieds: **labeling**
- signifier-signified links that are not parts of sets: **signification that is not labeling**
- links between contrast sets and labels based on a principle: **mapping**
- links between contrast sets and labels not based on a principle: **labeling that is not mapping**

It might have been less confusing to call mapping "principled labeling," since the term "mapping" has been used in a different way by authors such as Fauconnier. But it is a short and convenient word, and moreover, one appropriate to the meaning it is used for.

As with any labeling linkage, there is an inequality between the two contrast sets involved in a mapping. One of the sets labels the other. In this chapter, I will use the terms "source set" and "target set" to refer to these two paired roles (or, when appropriate, "source domain" and "target domain"). The target set labels the source set. Although the terminological pairs signified and signifier, thing and word, referent and symbol, and so forth often get used to label the two roles in mappings, these very singular words fail to convey the plural and collective flavor appropriate to thinking about *sets* of signifiers and signifieds instead of individual pairs. The terms *signantia*

and *signata*, which were used by Roman Jakobson and Linda Waugh,<sup>1</sup> do have a plural flavor, but are unfamiliar and difficult to tell apart.

The six drawings in Image 4.1 illustrate different types of mappings. The first drawing ("Signification") shows a single entity which is labeled by a single signifier. This is not a case of mapping or even of labeling (because it does not involve multiple members of sets) and it is included to highlight how mapping and labeling differ from simple signification. Any average word in the lexicon could serve as an example of this kind of signification, as could an example such as "Kraków is the Boston of Poland" which connects two points in the domains of "the United States" and "Poland."

<sup>1</sup> Roman Jakobson and Linda R. Waugh, *The sound shape of language* (Bloomington: Indiana University Press, 1979), p. 196. (Also published as Jakobson, *Selected writings*, volume 8. Berlin: Mouton de Gruyter, 1988.)

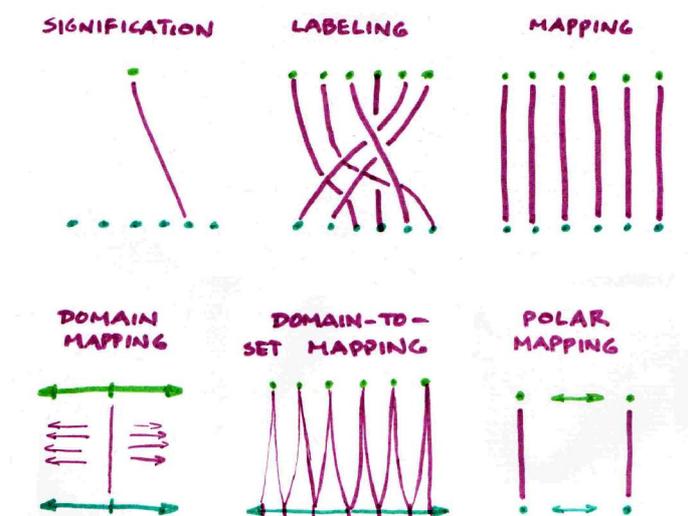


Image 4.1 (079)

The second drawing ("Labeling") shows a set of six labels which are attached to the six members of a contrast set. In this particular case, the linkage is exhaustive, in that all the points in both sets are linked. An example of this kind of labeling would be the way that American radio station call

letters label frequencies, or the relationship between the letters of the alphabet and the sounds they stand for, in which two contrast sets are linked but there is no principle to the linkage.

The third drawing ("Mapping") shows the same situation, with the added difference that it is mapping, not labeling: it proceeds by taking account of correspondences between some aspect of the source set and some aspect of the target set. In the diagram, "leftness" and "rightness" are the aspects of both sets that are used; the leftmost member of the source set is mapped to the leftmost member of the target set. In reality, any aspect of the source and target sets could be used. Simple examples of mapping are the way pages are numbered in a book (the "frontness" of the page corresponds to the "lowness" of the number), or the way that streetnames work in certain parts of Washington, D.C. (the number of syllables in the streetname corresponds to the street's distance from the center of the city).

The fourth drawing ("Domain Mapping") shows a somewhat similar mapping, but one in which the source and target are continuous domains instead of contrast sets. The characteristics of these domains vary smoothly instead of discretely. The mapping between the domains involves, metaphorically speaking, "contact" between the entire "surface" of both domains rather than links between specific points or entities. An example of this kind of mapping is the relationship between a physical quantity, such as weight or temperature, and an analog instrument dial which measures that quantity (such as the one on your bathroom

scale), abstracting away from any marks which impose a unit scale on the movement of that dial.

The fifth drawing ("Domain-to-set mapping") is similar to the third and fourth pictures, except that in this case the mapping is between a domain and a contrast set. An example of this kind of mapping is that between the domain of temperature and the units of the Celsius scale used on a digital thermometer which reads to the nearest single degree. However, I suggest that it is easier to consider this kind of mapping as a combination of two processes, the first being the creation of units within the domain, and the second being a mapping from the resulting contrast set to an appropriate label set (for example, the creation of divisions within the domain of temperature by means of the Celsius scale and then the mapping of the set of those divisions to a set of labels).

The sixth drawing ("Polar mapping") shows the case in which two binary polarities are mapped onto each other. A literal example of this kind of "mapping" is the cartographer's choice of how to map the polarity {north : south} onto {up : down}. There are only two ways to align a pair of polarities — in the map case, either {north : south} = {up : down} or {north : south} = {down : up}. Another example is the choice of whether to put the low notes on the left or the right of a keyboard, the source and target sets here being {left : right} and {low : high} respectively. This type of mapping is familiar to many people because it is very common in orientational metaphors such as "happy is up, sad is down."<sup>2</sup> In many polar mappings, the polarities are facts of nature but the choice of which way to map them is made by the workshop.

In cognitive science, the term "mapping" is often used in studies of analogy, a tradition in which Dedre Gentner's "Structure-mapping: a theoretical framework for analogy" (1983) is the seminal article.<sup>3</sup> My use of the terms "source" and "target" is taken directly from these authors' use of "source domain" and "target domain." But this tradition

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<sup>2</sup> See George Lakoff and Mark Johnson, *Metaphors we live by* (Chicago: University of Chicago Press, 1980), chapter 4.

<sup>3</sup> Dedre Gentner, "Structure-mapping: a theoretical framework for analogy," *Cognitive Science* 7 (1983): 155-170.

use the terms "domain," "mapping," and "cross-domain mapping" in a way distinctly different than mine. Essentially, these authors' domains are schemas and scenarios. My domains are sets of hyponyms. Their analogical mappings deliberately and purposefully carry over the *internal relations* between the elements of both domains. My contrast set mappings are first and foremost one-to-one mappings between the members of two sets of hyponyms. The two types of "mappings" connect different types of material.

However, contrast set mappings are, like analogical mappings, "relational." Indeed, in my terms, a relational element (an iconic principle or correlation) is what distinguishes mapping from mere labeling. I mean that, in mappings, the relation between the elements of a label set does indeed in some way correlate with the relation between the elements of a contrast set. But the second key difference between analogical mappings and contrast set mappings is this: the point of analogical mappings is to understand the target domain in terms of the source, while the point of contrast set mappings is primarily to label the source domain, but to do it in a slightly richer and more meaningful way. A further difference is that, at least in the examples I use, the relational structures of the source sets that are replicated in the target sets are generally relatively primitive and crude ones (of sequence or position in the set) — not the complex relations that hold between the different elements of image or verbal or action schemas.

One might try to sum up the difference between analogical and contrast set mappings by saying that the tradition stemming from Gentner studies analogues for the syntagmatic relationship between several elements of a set, where I am interested in how we create analogues for the paradigmatic relationship between several elements of a set. Concisely put, the Gentner tradition is more interested in the mapping from the concepts {two, four} to {three, six} or {five, ten}. I am more interested in describing the mapping from {two, four} to {2, 4} or {II, IV} or {二, 四}.

I have had difficulty finding a satisfactory discussion of these "paradigmatic" or "hyponymic" or "contrast set" mappings within the existing semiotic, lexical-semantic, and cognitive science literature. The most broad-minded source I have found so far, and one

which does explicitly recognize them, is Donald Norman's popular discussion of mappings. Norman defines "mapping" very generally as "a technical term meaning the relation between two things" and gives some examples comparable to those I discuss.<sup>4</sup> Umberto Eco comes close to a theory of such mappings when he discusses the establishment of correlations between the "expression plane" and "the content plane" (examples of which would be a contrast set and its labels), but he does not make the final step from talking about single links to principles that govern many links.<sup>5</sup> Paul Kay lays out a useful theory of labeling in taxonomies which explicitly uses the term "mapping," but he does not generalize the theory beyond strictly lexical taxonomies and he reviews only a minimum of concrete cases.<sup>6</sup> The title of one of Gilles Fauconnier's books (*Mappings in thought and language*) raised my hopes, but he mentions contrast set mappings only in passing, using the term "projection mappings"; for the most part the book is interested in other phenomena.<sup>7</sup> Mathematicians do discuss "many-to-many" and "one-to-one" mappings in the description of functions. And cryptographers use the term "mapping" in a way similar to my use of the term labeling (speaking, for example, of the mapping between plaintext and ciphertext).<sup>8</sup> Database designers have also come up with concepts analogous to those I use here. But not surprisingly, these technical fields' expositions of mapping do not generally make the link to the issue of designing conventional mappings for everyday use.

The rest of this section goes into more detail about how mapping works, includes many examples of mapping design, and draws design advice conclusions about how to map. The section's focus is on mapping *design*, and the major issue for mapping designers is the choice of the principles which relate attributes of the source set to attributes of the target set. I will also mention in passing certain mappings which (whether natural or emergent) are not

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<sup>4</sup> Donald A. Norman, *The design of everyday things* (New York: Doubleday, 1990), pp. 23-27.

<sup>5</sup> Umberto Eco, *A theory of semiotics* (Bloomington: Indiana University Press, 1976), p. 50. The contrast between "expression" and "content" planes traces to Louis Hjelmslev, *Prolegomena to a theory of language* (Madison: University of Wisconsin Press, 1961 [1943]), pp. 47-48, 59-60.

<sup>6</sup> Paul Kay, "Taxonomy and semantic contrast," *Language* 47 (1971): 866-887.

<sup>7</sup> Gilles Fauconnier, *Mappings in thought and language* (Cambridge: Cambridge University Press, 1997), pp. 1, 9.

<sup>8</sup> See Bruce Schneier, *Applied cryptography* (2nd ed., New York: John Wiley & Sons, 1996), pp. 2-3.

products of the workshop, such as "iconicity" in language and other systematic form-meaning relationships. I also discuss ordering standards for contrast sets (which are formally similar to mappings), and the issue of optimality in mapping and labeling (the communication of one set of distinctions by means of another in the most efficient, elegant, and easy-to-use possible way). I finish the chapter with a sections on private labels and mappings, and a discussion of "the case of the revolving restaurant," both topics that build on the cumulative understanding of contrast sets, labels, and mapping that this chapter and the previous two have built up.

## 4.1 The nature of mapping principles

There are several traditional ways of defining or describing mapping principles which come originally from the study of mapping in the lexicon (or iconicity, as lexical mapping is often called). One is to say that mappings are relationships between the signifier and the signified — to be more precise, *systematic* relationships between a *set* of signifiers and a set of signifieds. Another is to say that mappings are the quality which a set of signifiers possesses when those signifiers have been chosen according to a set of principles which derives each signifier from some attribute of the signified, or which at least constrain our choice of signifier for each signified. Social scientists might find it helpful to think of the (imperfect) analogy between mapping and correlation, in which a label set, a contrast set, and the relationship between them can be likened to a dependent variable, an independent variable, and a significant correlation between the two (if one is willing to muddle the distinction between causality and representation). The broadest definition of mapping is to say that given two sets or two domains (or a set and a domain), where one is the source and the other is the target, it is any kind of principled relationship between attributes of the elements of source and target set members.

In all such situations — going back to the original terms of Plato's *Cratylus*,<sup>9</sup> the earliest surviving treatment of the issue of mapping in the lexicon — to know the name *is* to

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<sup>9</sup>Quoted by, among others, Roger Brown, *Words and things* (Glencoe, Ill.: Free Press of Glencoe, 1958), p. 110.

know something about the thing, once you have figured out the system that relates the two. Another way of phrasing it is to say that in mapping, the form of a label gives clues to its meaning. In naive terms, people might describe mappings by saying that they have a structure, a system, a kind of architecture, or a consistency to them.

Not only does mapping allows people to predict relationships between labels and the things they label, it allows a labeling system to be expressed, at least in part, by stating its principle rather than by listing each individual link. This mapping principle can be applied to any given label or entity to generate at least some aspects of the corresponding entity or label. For example, it is simpler to store the naming convention for New York City street numbers as a principle (streets are labeled by consecutive numerals and the further north, the higher the numeral) than by remembering every individual link between street name and street.

This is generally seen as a positive thing, the idea being that the retrieval and manipulation of contrast sets is much easier when the are labeled by principle rather than without a principle.<sup>10</sup> The design advice given in this chapter proceeds from the assumption that, all other things equal, a mapped label set is usually more convenient for users than an unmapped one.

As an example of how not just the retrieval but also the use of a contrast set becomes easier when one maps instead of labels, consider that if you are on 79th Street in New York City and understand the street naming system, you have a good idea of where 81st Street might be, whereas knowing that you are on Lexington Avenue does not tell you where Park Avenue is unless you have memorized the individual links between avenue names and avenues. Similarly, if you are playing the piano (at least in the key of C) and know how to read music, you can be sure that a note a little higher on the staff will be a little further to the right on the piano. The key here is how mapping creates what I call *navigational ability* in a contrast set. If you know there is a principle to the linkages between contrast set members

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<sup>10</sup> See Thomas Crump, *The anthropology of numbers* (Cambridge: Cambridge University Press, 1990), pp. 29-30.

and their labels, and you know what that principle is, and you know that signifier  $X_1$  refers to referent  $Y_1$ , and you are given signifier  $X_2$ , you can predict, or at least guess, the nature of its referent  $Y_2$ . (You may also be able to guess  $X_2$  if given  $Y_2$ .) A mapping is, thus, like a linear equation (if it is determinative) or a regression line (if it is only suggestive) which allows one sometimes to determine and always at least to make an educated guess at the value of one quantity, if you know the value of the other quantity.

Mapping requires a certain amount of isomorphism between the topologies of the source and target sets, whereas plain labeling can take place between two contrast sets with different topologies. Thus the material used as a target set in mapping depends on the topology of the source set. If the source set is linear, the target set should be too. If the source of a mapping is a continuous domain, the target must naturally also be a continuous domain. For example, a thermometer maps the continuous variation in temperature onto the continuous variation in the level of the mercury in the tube.

The source set topology that really matters, however, is actually that of the particular attribute of the source set that is reflected by the target set. The relationship between target and source sets is never to *everything* about the source set members, but only to certain aspects of those members, which designers select and users are ideally aware of. Thus New York City street numbers relate to how far north or south the street is, not the average height of the buildings; American interstate highway numbers relate to the geographical position of the highway, not how much it cost to build; and airport codes relate to the name of the airport or city, not to the length of the longest airport runway or to the name of the architect of the most recent airport terminal.

For linear source sets, numeric labels are the most commonly used material used to make target sets. Numeric labels commonly reflect the temporal, spatial, or narrative order in which they were assigned: in New York City, the higher the street number, the further north the street. The first six digits of Icelandic identification numbers encode the holder's

date of birth.<sup>11</sup> Assigning even numbers to north- and east-bound flights, and odd numbers to south- and west-bound flights, is one of several iconic conventions used in airline flight numbering.<sup>12</sup> Although one might think that because of privacy concerns, American Social Security numbers would be non-iconic (so that nothing about an individual could be predicted from their ID number), in fact the first three numbers straightforwardly reflect the state of issue.<sup>13</sup> (The Social Security Administration maintains a page on their website specifically to debunk the myth that the fourth and fifth numbers code a person's racial identity.<sup>14</sup>)

Despite the fundamentalness of numbering as a mapping strategy, it is important to remember that it is a strategy that did have to be discovered and popularized. Bertrand Russell comments that "it must have required many ages to discover that a brace of pheasants and a couple of days were both instances of the number 2; the degree of abstraction is far from easy."<sup>15</sup> Using numbers as target sets is yet a further development from the idea of counting. There is, as well, other labeling material that serves easily as a target set for linear source sets, such as the letters of the alphabet.

In mapping, as opposed to labeling, not only must the topologies of the domains correspond, but also the relational structure within the domains must carry over.<sup>16</sup> For example, in the travel bookstore where I once worked, different regions of the world corresponded to different bookshelves in the store, but did not do so in a principled way; if you knew that books on region  $X_1$  were on shelf  $Y_1$ , you could not predict which shelf books

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<sup>11</sup> "Kennitala — reikningsaðferð," <http://www.hagstofa.is/template38.asp?PageID=808> (October 2003).

<sup>12</sup> Mary Breslin, "Flying by the numbers: destinations, whimsy help airlines pick flight symbols," *Chicago Tribune*, 6 April 1997, section 12, p. 1.

<sup>13</sup> "Quick intro — Social Security numbers," <http://www.ssa.gov/history/ssn/ssncards.html> (January 2005).

<sup>14</sup> "The SSN numbering scheme — Debunking a myth." <http://www.ssa.gov/history/ssnmyth.html> (January 2005).

<sup>15</sup> Quoted by Crump, *The anthropology of numbers*, p. 10. See also pp. 83-87.

<sup>16</sup> Douglas Hofstadter makes the same point, using the term "isomorphism" to describe a linkage between two "complex structures ... in such a way that to each part of one structure there is a corresponding part in the other structure, where 'corresponding' means that the two parts play similar roles in their respective structures." *Gödel, Escher, Bach: an eternal golden braid* (New York: Basic Books, 1979), p. 49.

on region  $X_2$  would be on. This was, then, labeling instead of mapping, because the relational structure of the shelves did not match anything about the relational structure of the regions.

A more complicated example of a topological isomorphism in which the relational principles between the members of each set do not fully hold (and which thus fails to qualify as a mapping) is Douglas Hofstadter's search for the "Bloomington of California."<sup>17</sup> Consider as well that I regularly do tell tour group participants that Kraków is the "Boston of Poland"; that a culinary memoirist calls pastry chefs the "neurologists of cooking";<sup>18</sup> that a Norwegian scholar of language standardization described Vuk Karadžić as the Ivar Aasen of Yugoslavia, and vice versa;<sup>19</sup> and that one might speak of the "Cadillac of beers" or the "Harvard of the West." What is amusing about these examples is that although the link between single instantiations in the source and target domains cannot be extended to a "full-body" mapping between all of the instantiations, they do invite us to imagine trying. Specifically, the *topologies* of Indiana and California, the United States and Poland, or the domain of doctor specializations and culinary specializations are sufficiently isomorphic to try mapping the instantiations of each domain onto one another. And the *single relations* between {Kraków : rest of Poland} and {Boston : rest of America} do map onto each other. But the relational correspondence does not necessarily go further; we cannot find links for all the other points in the domains, and thus the attempt fails not only as mapping but also as an exhaustive labeling of all set members. The breakdown of this correspondence provides many comic opportunities as we fruitlessly search for, say, the Edsel of beers or the sommelier of the medical world.

Returning to typical mappings such as the New York City street numbers, another important issue is whether mappings are *determinative* or *suggestive*. If a mapping is totally determinative, one can take the features of a source set member and work out from the

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<sup>17</sup> Douglas R. Hofstadter, *Fluid concepts & creative analogies: computer models of the fundamental mechanisms of thought* (New York: Basic Books, 1995), p. 331.

<sup>18</sup> Anthony Bourdain, *Kitchen confidential: adventures in the culinary underbelly* (New York: Ecco Press, 2000), p. 62.

<sup>19</sup> Einar Haugen, "Linguistics and language planning," in *The ecology of language: essays by Einar Haugen*, pp. 159-190 (Stanford: Stanford University Press, 1972 [1966]), p. 187.

mapping principle exactly what the corresponding member of the target set will look like. A determinative principle leaves no freedom to choose the label that will signify a particular member of the source set. (Certain signifiers — those called *indices or indicators* in classifications of signs derived from the theories of C.S. Peirce<sup>20</sup> or *symptomatic* signs by Keller<sup>21</sup> — are always determinative. Note that the other types of signifiers in these classifications — *iconic* and *symbolic* signs — are not necessarily *not* determinative.)

If an iconic principle is only partially determinative, it specifies *something* about the form of that label but not everything, and leaves the system's designer a certain amount of wiggle room to decide the actual form of the label. Within this wiggle room the labeling remains a conventional product of the workshop and its form may be the result of a somewhat arbitrary decision. For example, there is already a conventional iconic or at least motivated principle for airline flight numbers in which east-west flights are numbered with odd numbers and west-east flights with even numbers. *Within* those restrictions, however, there is a lot of wiggle room to number flights however the airlines want — a given east-west flight could be labeled with any odd number. Ultimately, we may number things randomly; we may choose a new mapping principle which applies at this sublevel within the constraints of the larger principle; or we may take advantage of our wiggle room to make whimsical, individual labeling choices which appeal to our sense of humor and play, such as the ones that have resulted, in the United States, in United Airlines flight 1776 to Boston (center of the American Revolution whose Declaration of Independence was signed in the year 1776) and flight 1492 to Columbus, Ohio.<sup>22</sup> Scholars of iconicity in language have often described partially determined target sets as *motivated*, a word that describes the middle ground in between complete specification and complete lack of specification.

A case which stretches the concept of mapping slightly is that of abbreviation, which operates on names. Abbreviations are distinguished by the fact that the source and target

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<sup>20</sup> Eviatar Zerubavel, *Social mindscapes: an invitation to cognitive sociology* (Cambridge: Harvard University Press, 1997), pp. 69-72, among others, gives an introduction to Peirce's distinction.

<sup>21</sup> Rudi Keller, *A theory of linguistic signs* (Oxford: Oxford University Press, 1998 [1995]), p. 100.

<sup>22</sup> Breslin, "Flying by the numbers."

domains are made of the same material.<sup>23</sup> Thus both an abbreviation and the thing it abbreviates are usually made of letters or the elements of a writing system. The relation between source and target is that the abbreviation usually selects certain elements of its source and is thus constrained in potential form by the makeup of the source. Consider that three-letter airport codes generally bear some relationship to some alphabetical attribute of the airport that they stand for, whether it is the name of the city it is in (e.g., BOS for Logan Airport in Boston) or the name of the airport itself (e.g., JFK for John F. Kennedy International Airport in Queens), which is why people sometimes have trouble remembering that the ISO 3166 code for "Switzerland" is CH (as in *Confederatio Helvetica*, its Latin name), not SW, SV, SU or SC (as in Switzerland, Svizzera, Suisse, or Schweiz). While the form of abbreviations is motivated, there is not necessarily a clear principle which determines their form, although the acrophonic principle (that the first letter of a word has special prominence) does exert a strong influence on the form of abbreviations.<sup>24</sup> The abbreviations for universities, in languages as diverse as English and Chinese, typically string together the initial written symbols in each word of the university's name (thus RU for Rutgers University, and 哈工大 *Hāgōngdà* for 哈尔滨工业大学 *Hārbīn Gōngyè Dàxué* or "Harbin Institute of Technology"). The postal code for Ontario is ON while Saskatchewan is SK. In the case of postal abbreviations for American states or Canadian provinces, the process of abbreviation operates on a bounded contrast set of names for a bounded contrast set of geographical entities, and the target set is a bounded set of 676 (26 x 26) two-letter sequences. In the wider world of general abbreviations for all sorts of things, although it is easy to think of abbreviations as both labels and mappings, what makes them different is that like the lexicon, they do not always operate on contrast sets. The set of things that gets abbreviated is unbounded and lacks a natural topology. The relationship between a name

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<sup>23</sup> This fact that the source and target sets involve the same material means that abbreviations are effectively exempt from the requirement that there be a correspondence between the topologies of the two sets; in many cases of abbreviation neither set can really be said to have a topology.

<sup>24</sup> For a discussion of the acrophonic principle in the history of writing systems, especially the process by which a sound came to be represented by a drawing of something whose name begins with that sound, see John DeFrancis, *Visible speech: the diverse oneness of writing systems* (Honolulu: University of Hawaii Press, 1989), p. 277.

and its abbreviation is often an individual case of signification which does not necessarily have a sense of paradigmatic "sisterhood" with other abbreviations.

If one wants to open up the scope of the concept of "mapping" as broadly as possible, one can actually apply it to any design task where two contrast sets are linked to each other. To ask whether two such contrast sets are "mapped" is to ask whether this linkage proceeds in a systematic way. Donald Norman, for example, emphasizes the art of matching the location and appearance of switches to something about the thing that they control (lights or oven burners, for example).<sup>25</sup> Since the switches are derivative of the thing they control, and some aspect of the switches might by design replicate some aspect of the things controlled, the mapping concept can be made to apply to such situations, but such "mapping" no longer really involves signification.

## 4.2 Mapping in the lexicon

Mapping has a long and controversial history as a topic in linguistics, in which it is often referred to as *iconicity* or *sound symbolism*.<sup>26</sup> The age-old question of whether the form of a word bears an arbitrary or motivated relationship to its meaning is usually resolved in introductory linguistics classes these days by treating form-meaning relationships that work according to a principle as somewhat cute exceptions to the general rule that the relationship between linguistic form and linguistic meaning is arbitrary. Thus a tremendously popular recent introductory text tells us that "Since a word is a pure symbol, the relation between its sound and meaning is utterly arbitrary" and then dismisses certain exceptions to this rule as a "quaint curiosity."<sup>27</sup>

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<sup>25</sup> Donald A. Norman, *The design of everyday things* (New York: Doubleday, 1990), pp. 94-97.

<sup>26</sup> On the terminology of lexical mappings see, among others, John Lyons, *Semantics* (Cambridge: Cambridge University Press, 1977), 1: 105.

<sup>27</sup> Steven Pinker, *The language instinct* (New York: Harper Collins, 1995), pp. 152, 166-167. Even Ferdinand de Saussure's famous textbook introduces the principle of arbitrariness quite strongly (*Course in general linguistics*, (London: Duckworth, 1983 [1916]), pp. [100]-[102]) and only then admits certain exceptions to it (pp. [102], [180]-[184]).

There is overwhelming scholarly recognition that mapping principles do affect the form of the lexicon.<sup>28</sup> There are emergent principles which operate conventionally within the limits of particular speech communities. There also seem to be certain natural principles which surface in many different languages. Yet some linguists can be so zealous in their desire to establish that linguistic form is arbitrary and abstract, that they make too much of the fact that when these principles exist, they do not usually *fully determine* the form of the words in the lexicon that they affect. This leads them to the point of implying that the form of words is never even *influenced* by mapping principles, and thus disregarding even the small degree of effect that those principles have. Thus the general linguistics text mentioned above tells us that "Onomatopoeia ... is almost as conventional as any other word sound."<sup>29</sup>

This bias against form-meaning relationships comes through even in the study of the obviously iconic domain of animal-sound words. A popular textbook in historical linguistics,<sup>30</sup> and the introductory matter of the "Sounds of the World's Animals" website maintained at the Georgetown University linguistics department,<sup>31</sup> both chose to focus on the minor differences between different languages' words for the same animal sound as evidence of arbitrariness, rather than on their overwhelming acoustic similarities as evidence of motivation by the actual sound of the animal's vocalism.<sup>32</sup>

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<sup>28</sup> See, for example, Leanne Hinton, Johanna Nichols, and John J. Ohala, *Sound symbolism* (Cambridge: Cambridge University Press, 1994); Brown, *Words and things*, chapter 4; Eco, *A theory of semiotics*, pp. 191-217; Lyons, *Semantics*, 1: 99-109; Alessandro Duranti, *Linguistic anthropology* (Cambridge: Cambridge University Press, 1997), pp. 205-207. See also Paul Friedrich, "The lexical symbol and its relative non-arbitrariness," in *Linguistics and anthropology in honor of C.F. Voegelin*, edited by M. Dale Kinkade, Kenneth L. Hale, and Oswald Werner, pp. 199-247 (Lisse: Peter de Ridder Press, 1975); Jakobson and Waugh, *The sound shape of language*, pp. 181-207; Benjamin Bergen, "The psychological reality of phonaesthemes," *Language* 80 (2004): 290-311, esp. section 5.2.

<sup>29</sup> Pinker, *The language instinct*, p. 152.

<sup>30</sup> The textbook tells us: "We need merely note that English speakers reproduce the barking of a dog as *bow-wow*, whereas Japanese hear a dog saying *won-won* and Turkish dogs bark by pronouncing the syllables *hav-hav*." — Anthony Arlotta, *Introduction to historical linguistics* (Boston: Houghton Mifflin, 1972), p. 34.

<sup>31</sup> The website tells us: "Animals make much the same sounds around the world, but each language expresses them differently. English and French cows sound the same, but not in English and French!" — Catherine Ball, "Sounds of the world's animals," <http://www.georgetown.edu/cball/animals/animals.html> (January 2005).

<sup>32</sup> In actual fact most words for canine vocalisms (which are just one of many examples) contain at least three of the following four items: a velar constriction, a labial constriction, a low back vowel, and an r. That there are similar cross-linguistic tendencies in other animal-call words can be seen by a quick look through a childrens' book like Hank De Zutter's *Who says a dog goes bow-wow?* (New York:

This is simply a matter of seeing the glass as half empty rather than half full, by focusing on the remaining wiggle room in the form of a motivated sign, rather than on the existence of motivation and constraint. That an element of conventionality exists even in motivated words demonstrates how one should not imagine that iconicity and mapping principles are necessarily determinative, but does not call into question the fact that non-arbitrary form-meaning relationships exist, and quite widely so.<sup>33</sup> This realization is often phrased by saying that iconic principles may *motivate* without *determining*.

To me, it seems that the tendency to belittle iconicity is greatest among those linguists who are committed to an autonomous or modular view of language (the idea that it forms a separate organ in the brain). Perhaps that is because iconicity threatens theories of linguistic autonomy and modularity by pointing out systematic links between the lexicon and aspects of cognition entirely outside language.

Against the background of this debate, it is of course fascinating to see that outside of the lexicon, in the world of consciously designed contrast set mappings, iconicity is not only common, but *valued*. It seems very useful for the members of a target set to bear some relationship to the source set. Indeed, in the deliberate *design* of labels for contrast sets, one can actually argue that the use of an obvious mapping principle increases the designer's chances of success.<sup>34</sup> At the very least, resolving the question of whether one should use one is one of the most important decisions of the workshop.

There is, however, a reason why mappings in the lexicon are relatively rare, and mappings in constructed label systems so much more common. It is a direct consequence of the fact that semantic domains in the lexicon rarely have a simple topology, whereas the

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Doubleday, 1993). Linguists who have been taught to see the disjunct contrast set of phonemes more readily than the acoustic similarities in the underlying domain of sound might understandably overlook these patterns.

<sup>33</sup>Rudi Keller, in *A theory of linguistic signs*, chapter 10 ("Arbitrariness versus motivatedness"), pp. 130-140, and Umberto Eco, in *A theory of semiotics*, pp. 191-217, do a particularly good job of making this point.

<sup>34</sup>This argument has two components: one is that any newly created sign must be motivated in some way, and the other is that a newly created sign is more likely to catch on and spread if that motivation is apparent to potential users. On the first point, see Edmond L. Wright, "Arbitrariness and motivation: a new theory," *Foundations of Language* 14 (1976): 505-523, pp. 515, 517. On the second point, see Keller, *A theory of linguistic signs*, p. 140.

domains that contrast sets are formed out of frequently do have a simple topology. Not surprisingly, the search for iconicity in the lexicon has borne the most fruit when it has been conducted on those sets of lexical terms which are closed (or at least well defined), and are similar enough to share distinct attributes or features — size, age, longitude, name, and so forth — that can be measured, compared, and checked for statistical correlations with some aspect of the word that signifies them. Thus, for example, using corpuses of Central American bird and fish names, Brent Berlin has demonstrated systematic correlations in certain Central American languages between the size of a bird or fish and the quality of the vowels in its name.<sup>35</sup> He was able to do this because one can measure and compare the length of different birds and different fish, and because there is a fairly clear natural boundary between birds and non-birds, and fish and non-fish. It might not be going too far to say that iconicity in the lexicon can *only* be evaluated for such sets of terms.

Such sets are, however, not particularly abundant in the lexicon. Mostly the lexicon does not consist of closed paradigmatic classes, and groups of lexical items rarely possess one obviously salient variable to which their labels can be mapped. The tomato in my refrigerator, the cutting board in my kitchen drawer, and the light fixture above the stove are not particularly equivalent nor is there any obvious need for a mapping system to label them.

But many contrast sets, especially those created in the workshop, routinely constitute well-defined sets whose members share measurable features. Contrast sets such as airports, telephone area codes, and New York City streets all have attributes (such as city name, population, and latitude) that can be systematically measured, and there is quite a clear boundary between items that belong to the set or do not. And when labels are also deliberately planned, not emergent, one can easily ensure that a mapping principle is carried out consistently through all links between a contrast set and label set. For example, in a mail order business, where it is extremely important to keep the hundreds or thousands of

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<sup>35</sup> Brent Berlin, *Ethnobiological classification* (Princeton: Princeton University Press, 1992), chapter 6. See also Berlin, "Evidence for pervasive synesthetic sound symbolism in ethnozoological nomenclature," in *Sound symbolism*, edited by Leanne Hinton, Johanna Nichols, and John J. Ohala (Cambridge: Cambridge University Press, 1994), pp. 76-93.

equivalent pending orders distinct and to have some easily sortable way of referring to each one, one can easily pick out an attribute to use as the input to a labeling principle, such as an order's position in a chronological sequence, and apply it dependably.

Overall, the ability to sustain a mapping instead of plain labeling requires that both the source set and the target set be able to support it. And while emergent, self-ordering mappings do occur, mapping comes about much more often through deliberate planning. While investigations of iconicity in language have been all about *looking for correlation* in the emergent label set of language, the rest of this chapter returns to the subject of *designing correlation* as opposed to trying to asking whether it exists in the world we inherit.

### 4.3 The design of target sets



Image 4.2 (035)

The designers of the floor labeling system in the Sydney Casino parking lot in Sydney, Australia seem to have been trying to use mapping principles to label the contrast set of floors — but their efforts fell short of the mark. The table lists the correspondences they set up, while Image 4.2 shows the elevator buttons.

<b>Floor</b>	<b>Color</b>	<b>Image</b>
1 (highest)	green	bird
2	yellow	moon and stars
3	purple	crocodile
4	pink	snail or shell
5 (lowest)	blue	whale or fish

Surely the colors and images make it easier to remember what floor you parked on than if all you had to go by was the floor number. However, they do so as a set of unprincipled labels rather than as a consistent mapping. The colors are not organized in any obvious order. While there seems to be a loose relationship between the altitude of the parking lot level and the altitude of the image, it does not hold fully (the moon is higher than any bird), and such a mapping is sufficiently unconventional that one doubts many users would notice it. The designers did build in a floor numbering system with a clear mapping principle: {lower number : higher number} = {physically up : physically down}. However,

although this mapping is not unusual in buildings which are largely underground, it would not be surprising if some users of the system naively expected the reverse polarity. The overall result is that if you are standing on floor 3, see a picture of a purple crocodile, and remember only that you parked by the green bird, you have no information which tells you which direction your car is in. You only know it is not on the floor where you currently are. Even if you are on floor 3 and know you parked on floor 4, and have correctly guessed that you are only one floor away from your car, you still might not know whether to go up one or down.

This example shows that the goal of mapping design is to help users navigate successfully among the members of a contrast set, reasoning in the same way described by the tour guide in the bus parking lot (see section 2.10). Mapping designers want users who parked by label  $X_1$  (say, the lion) to know that being near label  $X_2$  (say, the elephant) has a certain meaning for how they should look for their vehicle — and want users to be able to work out what that meaning is.

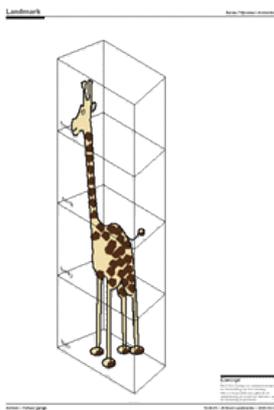


Image 4.3 (028)

Image 4.3, courtesy of Martijn Geerdes of the Bureau

Mijksenaar wayfinding signage consultancy in Amsterdam, shows a very clear example of a target set which has the proper topology for a multilevel parking lot. It was considered for (but not used on) a parking garage in Arnhem in the Netherlands. The four levels were to be labeled, from top to bottom, with the head, neck, body, and legs of a giraffe. The partitioning of the giraffe has the same topology as the partitioning of the parking lot. The reason that this

target set was not used probably has more to do with the unconventionality of the target set material rather than with anything about its topology.

The discipline that has thought the most about the labeling, visual communication, and graphic representation of linear contrast sets is cartography. Solving the familiar cartographic problem of partitioning continuous domains such as altitude (see section 2.7) brings cartographers to the next step of designing a set of labels which can graphically, on a

map, indicate membership in one of the resulting categories as an attribute of a particular point in space. In the case of altitude categories, color is a very appropriate labeling tool, and Eduard Imhof's book *Cartographic relief presentation* offers advice on the best sets of shades to choose.<sup>36</sup> Mark Monmonier suggests that such contrast sets are best mapped to value distinctions within a single hue (e.g. pale green to dark green; the hue may be gray) or to a part-spectrum scale (such as the green-to-brown scale commonly used on relief maps). The problem with the green-to-brown scale is that people understandably imagine that it must be representing a source set involving something about vegetation cover instead of altitude.<sup>37</sup>

An example of another common type of mapping problem in cartography (no pun intended) is as follows: there are a lot of towns on your map, each is located at a particular point, and you have already sorted the towns into different categories according to population — say, {0-2,000, 2,000-5,000, 5,000-20,000, 20,000 and up}. Now you want to mark each town's location with differently sized symbols so that there is a mapping between the size of the point and the size-category that the town is in. What do you do? The design of symbols to mark different types of roadways (which vary in width, freedom of access, and speed limit) is similar, and there are many analogous analogous symbol design challenges outside cartography too. This type of problem involves not the choice of colors, but the definition of a set of stand-alone graphic symbols, out of the infinitely large domain of possible graphic symbols, which has the same topology as the source set. Such sets of symbols have been called "graphical variables." The pioneering work on graphical variables was *Semiology of graphics* by Jacques Bertin, but there is now a large literature on them.<sup>38</sup>

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<sup>36</sup> Eduard Imhof, *Cartographic relief presentation* (Berlin: Walter de Gruyter, 1982 [1965]), chapter 13 (pp. 295-324). See also Edward Tufte, *Envisioning information* (Cheshire, Conn.: Graphics Press, 1990), pp. 91-94.

<sup>37</sup> Mark Monmonier, *How to lie with maps* (Chicago: University of Chicago Press, 1991), pp. 24, 151-154.

<sup>38</sup> Jacques Bertin, *Semiology of graphics* (Madison: University of Wisconsin Press, 1983 [1968]). See also the special issue on Bertin in volume 10, number 1 of *Information Design Journal* (2001); the table of graphical variables in Robert L. Harris, *Information graphics: a comprehensive illustrated reference* (New York: Oxford University Press, 1999), p. 231; and Paul Mijksenaar, *Visual function: an introduction to information design* (New York: Princeton Architectural Press, 1997), pp. 38-39. On graphical variables for corridor width, see Otl Aicher and Martin Krampen, *Zeichensysteme der visuellen Kommunikation: Handbuch für Designer, Architekten, Planer, Organisatoren* (Stuttgart:

An important issue in the choice of graphical variables as target sets is whether the user will focus on one contrast set member at a time or whether (as in the case of color-to-altitude mapping) they will process a large number of symbols simultaneously as part of a visual pattern. In the latter type of case, where the data needs to be quickly scannable, it is best to choose a target set which has an unmistakable sense of graphic progression and which can thus "give viewers a sense of natural visual sequence."<sup>39</sup>

The two tables that follow illustrate the difference that a good choice of target set can make.<sup>40</sup> The two tables display the same information — the same four ratings of the same eighteen imaginary products. The source set mapped by both tables is the same — a five-member contrast set with a linear topology: {bad, poor, average, good, excellent}. The difference is in the choice of target set. The first table is in the style currently used by the Icelandic consumer magazine *Neytendablaðið*, which labels this contrast set as {1, 2, 3, 4, 5}. The second table is in the style current used by the American consumer magazine *Consumer Reports*, which labels this contrast set as {●, ◐, ○, ◑, ●}.

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Alexander Koch, 1977), pp. 92-93.

<sup>39</sup>Tufte, *Envisioning information*, p. 92.

<sup>40</sup>Note that the example of consumer magazine rating labels is also used (to make a different point) by Edward Tufte, *The visual display of quantitative information* (Cheshire, Conn.: Graphics Press, 1983), p. 174.

	rating I	rating II	rating III	rating IV		rating I	rating II	rating III	rating IV
product a	2	4	5	2	product a				
product b	4	3	4	4	product b				
product c	2	5	5	3	product c				
product d	4	4	4	4	product d				
product e	4	5	5	4	product e				
product f	2	2	4	4	product f				
product g	4	4	4	3	product g				
product h	4	4	5	4	product h				
product i	4	4	5	3	product i				
product j	4	4	5	3	product j				
product k	2	5	5	2	product k				
product l	2	4	5	2	product l				
product m	2	4	5	2	product m				
product n	3	3	5	3	product n				
product o	3	4	5	2	product o				
product p	2	2	2	4	product p				
product q	1	2	4	1	product q				
product r	2	2	4	1	product r				

I do not think it is only because I am used to reading *Consumer Reports* and have committed their labeling system to mind that I feel much more quickly able from their table to pick out, for example, the superiority of product *e* and the inferiority of product *q*, or the generally poorer performance of all products on rating IV than on rating II. I think it has to do with the fact that nothing about the graphic form of the numerical labels replicates the linear relational structure of the source set, whereas the axis "black to red" not only replicates that structure but does so in a way that is very easy for human beings to process visually. The Arabic numerals certainly form an unambiguous and well-known sequence, but their linear topology is abstract, based on something they signify rather than something about their physical nature, so they do poorly as visual communicators of this sequence. *Consumer Reports'* visual system allows the user to quickly pick out the best and worst products by color patterns. Surely it would be possible to confirm the superiority of this style experimentally if it has not been done so already.

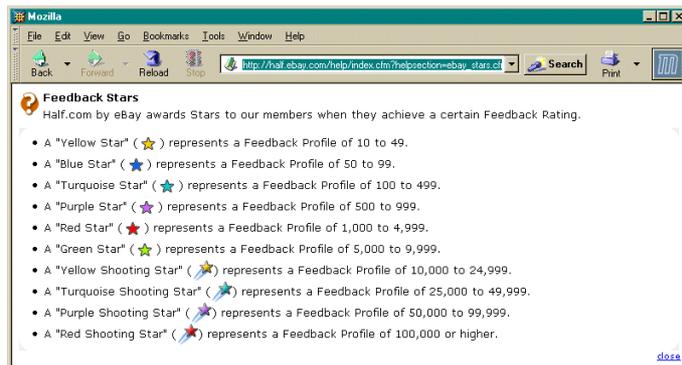


Image 4.4 (070)

In general, the topology of any target set mapped to a linear source set should have an "easily comprehended order"<sup>41</sup> which lends itself easily to the (usually visual) perception of difference. Thus, for example, one cannot recommend the system of "feedback stars" assigned to sellers at the online retailer "Half.com by eBay" in 2003 and illustrated in Image 4.4. The sequence starts with a yellow star and then increases in value through blue, turquoise, purple, red, and green; then it goes around again through the cycle, starting at yellow but going only to red (and skipping turquoise), with the addition of a shooting star motif, so that the top rating is red with a shooting star.<sup>42</sup> This contrast set does not have a natural sequence and is hard to learn to "read" without quite a bit of practice, as the very complexity of the description hints. Similarly, I did not predict a long life for the mapping {lava, fjord, glacier, ice, geyser, ocean, steam} = {most restrictive fare : least restrictive fare} which was introduced by the airline Icelandair as part of a promotion in the American market in spring 2004,<sup>43</sup> and indeed it was no longer being used in January 2005. Although color is a fine labeling tool, it is generally best to avoid the rainbow colors as a target set in mapping: although they have a clear order, it is not an easily perceptible one, as "the mind's eye does not readily give an order to ROYGBIV."<sup>44</sup>

Image 4.5  
(066)

The target set {bronze, silver, gold}, usually mapped to {less valuable : more valuable}, is considerably well conventionalized in the public mind (and rooted in the history of metal values). We see it used in the Olympics, in credit card and membership levels, and also in the Danish and British coinage systems (Image 4.5 shows the Danish system; the least valuable coins are at the

<sup>41</sup> Tufte, *The visual display of quantitative information*, p. 154.

<sup>42</sup> "Feedback stars," [http://half.ebay.com/help/index.cfm?helpsection=ebay\\_stars.cfm&popup=1](http://half.ebay.com/help/index.cfm?helpsection=ebay_stars.cfm&popup=1) (January 2005).

<sup>43</sup> <http://www.icelandair.com/index.jsp?branch=3050805> (May 2004).

<sup>44</sup> Tufte, *Envisioning information*, p. 92; see also Monmonier, *How to lie with maps*, pp. 21-22, 150.

top). It can be useful for small contrast sets, but it does not have enough visual salience to work well in charts nor enough members to be applicable to larger contrast sets.

When a mapping involves a continuous source domain rather than a source set, the target must also be a continuous domain. For example, a weather map may, instead of using a choropleth approach to divide the map into areas of 30s, 20s, 10s, 0s, and so on, map the exact temperature at each point (say, 28.44) to an exact color value scaled iconically to represent 28.44 by means of a mathematical function. (Of course, since no weather forecaster can possibly have data for every single point on their map, some smoothing and estimation would be required.) In such cases, instead of selecting a contrast set of points from the target domain to use as tags for choropleth categories in the source domain, the target domain is itself transformed into an actual measure of the source domain. This is the distinction made by Edward Tufte between "color as label" and "color as measure."<sup>45</sup> Polar mappings such as that between {north : south} and {up : down} on a map work according to similar principles.

Sometimes several mapping principles intersect in the design of a label set. The lettering system for the campus buses at Rutgers University offers a real-life example. As it existed in 1999, the system consisted of a set of unprincipled labels, not a mapping. There was very little relation between the bus letter and anything about the route it followed. Some people felt that the lettering system was confusing. As part of a project for a graduate course on tourism planning, I came up with a redesign of the system that built in a correspondence between each label and what it stands for, turning a set of labeling links into a multi-principle mapping:

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<sup>45</sup>Tufte, *Envisioning information*, p. 81.

Existing name	Route	Proposed name
A	College Ave.–Busch via stadium	B
H	College Ave.–Busch via Bevier Rd.	B2
L	College Ave.–Livingston	L
LX	College Ave.–Livingston (express)	L2
EE	College Ave.–Douglass/Cook	D
F	College Ave.–Douglass–Corwin	D2
B	Busch–Livingston	BL
G	Busch–Douglass/Cook	BD
GG	Livingston–Douglass/Cook	DL
C	College Ave.–Stadium	S

With the partial exception of the "S" bus, my redesign would allow people to internalize five reliable principles relating attributes of the set of buses to attributes of the set of letter labels:

All buses that go to Busch, Douglass, or Livingston	have B, D, or L respectively in their label
Buses that run on evenings, weekends, and during the summer	have a label consisting of one letter only
Buses that are "alternate routes" to a campus and do not run outside termtime weekdays	have "2" in the label
Buses that stop at College Avenue	have only one letter in their label
Buses that do not stop at College Avenue	have two letters in their label

If implemented, these formal correspondences would bring practical advantages for users. The status of College Avenue as both bus hub and "central" campus would be enshrined in the system. Bus labels would always include the first letter of the peripheral campus(es) to which they go, so that a person needing to go to Livingston could be told that getting on any bus with "L" in the label would eventually do the trick. My redesign would improve on the easily muddled distinction between the routes originally labeled "G" and "GG," which no one at Rutgers could ever keep straight. The bus originally called "C," which served the football stadium and had a completely different type of route from any other, would be given a letter which symbolized that separateness by not being easily groupable with the other route labels.

An interesting, and common enough problem for mapping designers occurs when several closely related contrast sets exist in very closely related domains, each contrast set with its own set of labels. Think of a hotel: the rooms in the hotel form one contrast set, and the telephone lines that run to those rooms form another. The question in such situations is whether there is a principled relationship between the labels for two different (but linked) contrast sets. Does the number of your hotel room predict anything about the number of the telephone line going to your room?

This question basically amounts to asking whether the label sets for two closely related contrast sets have been created in tandem and coordinated. If so, there may well be a correlation between the two label sets (even if neither of the label sets happens to map to any features of the contrast set it labels). This correlation does not quite constitute a "mapping" in my terms, especially if neither of the correlated label sets was the primary "source" of the relationship, but it does at the least manifest what we could call the phenomenon of "coordinated labels." And if one considers the number of the room it runs to as an attribute of a particular telephone line, one can in fact stretch the definition of "mapping" to cover such cases.

A fine example of coordinated labels comes from the Faroe Islands in the late 1980s. The numbering systems for telephone codes, ferry routes and bus routes were harmonized so that in any given part of the islands all these numbers began with the same digit: for example, the town of Klaksvík was served by ferry number 50, bus route number 500, and all its phone numbers began with 5.<sup>46</sup> (This harmony lasted until Faroese phone numbers were lengthened to six digits in 1998.) Image 4.6, from the 1986 Faroese transport map, shows part of this system of correlations. The three-digit numbers are bus route numbers, the two-digit red numbers are a destination code used in the bus fare table, and the one- and two-digit black numbers are ferry route numbers. (The letters D and E refer to helicopter routes, which were not part of the coordinative scheme.)

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<sup>46</sup> See the corresponding timetable, *Ferðatlan 30. mai 1988 - 27. mai 1989* (Tórshavn: Samferðsluskrifstofan, 1988).



Image 4.6 (062)

Contrast the United States, where highway numbers, telephone area codes, and postal codes bear no relationship to one another. Thus in Rochester, New York, there is no relation between the local telephone code (585), postal codes (which all begin with 146), and the number of the local interstate highway (90).

Coordinated labeling is usually a positive thing, as long as users know it exists. In most cases of labels for linked domains, one wants people to be able to have some basis for

guessing the relationship between an unfamiliar signifier-signified pair. For example, consider that in Germany (and some other European countries), the structure of the telephone numbering and switching system makes it easy to assign direct-dial telephone numbers to the rooms in a hotel. In these countries, the direct-dial room numbers are formed by adding a certain number of digits (usually one, two or three digits) onto the main number of the hotel. Having direct dial into the room means that calls need not go through the hotel desk, saving time for both staff and guests. Guests in German hotels often ask how to work out their direct dial number, and usually assume that it might bear some relationship to their room number. From the hotel staff's point of view, it is nice to be able to remember the answer to this question as a single statement that concisely expresses the principle relating any phone number to its room number or vice versa. This allows the staff to keep less knowledge in their heads, and also builds in a positive redundancy for guests, who potentially have two ways of remembering their phone number (both the principle and the actual number).

Two hotels I have worked with ran into problems with this relationship. At one hotel, room numbers and phone numbers were related by a fairly simple principle, but the

overworked staff had apparently grown tired of explaining it. They felt they needed to take action. Technical reasons made it difficult for them to change the (three-digit) telephone extensions to match the (two-digit) room numbers, so instead they changed the room numbers to match the telephone extensions. In the other hotel, the system for relating room number to extension number involved three different principles for rooms in different sections of the hotel. The staff members themselves had not committed the principles to memory, and found them quite difficult to explain to guests; although they could consult a list where all the correspondences were written out, more often they simply discouraged guests from using the direct dial system. Both cases show that there is often an incentive to design the simplest possible principle for relating two labeling systems used for closely related contrast sets — and by extension, the simplest possible mapping principles in general.

### Taxonomies create pseudo-mappings

Say that you know I live in Ireland, but not where, and I tell you my phone number is 021/2345678. This number is a label, and if you know something about the way Irish telephone numbers work, you can tell something about the phone line that it labels. It is in Cork. How do you know that? Because all Cork numbers begin with "021." The form of the number tells you something about what it labels. So this is a mapping.

Or is it? Maybe so, but if so, only in a special way. Telephone number labeling is taxonomic, involving a hierarchy of contrast sets. In Ireland, as in many countries, there are city codes, like 021, and local numbers, like 2345678. A label for a unit at the terminal level of a taxonomy, that is formed by compounding the labels for the units at each successive level of that taxonomy (such as 021/2345678), possesses a sort of "pseudo-iconicity" and the set of such labels exhibits what we could call a "pseudo-mapping." Such labels are formed compositionally. The iconicity of a "complete" label, specified from the unique beginner of the taxonomy all the way down to the bottom, exists only by virtue of the fact that although it refers to a unit at the terminal level of the taxonomy, it also specifies the upper level divisions to which that terminal unit belongs, and that this specification constitutes the aspect of that

unit which gives rise to the mapping principle. But if the labels for each level were considered in isolation there might be nothing iconic about them. The upper level labels, when used as part of the label for a terminal level unit, constitute a "superordinate sign" (see section 3.3).

Another fine example is that of the streetnames in Reykjavík, Iceland. All over the world, street names include what we might call a street type — which in English might be Avenue, Street, Court, Place, Road, and so on. Reykjavík and its suburbs use an unusually large number of street types. Much more systematically than in other cities, most of these street-types are associated with a particular section of town, in which all the streets bear that and only that street-type. The street-types thus effectively label city neighborhoods. If one remembers the individual links between the perhaps thirty or forty street-types and the area they cover, one can tell, from a fully specified streetname, which part of town the street can be found in. Thus all the streets ending in *-grandi*, *-skjól*, *-melur*, *-hagi*, *-hlíð*, *-tún*, *-teigur* and so forth are clumped together. At the level of the street-type, there is no mapping principle which relates the street-type to something about the neighborhood that it covers. One must memorize each of these links individually. But at the level of the full street-name, the street-type creates a pseudo-mapping principle that confers navigational ability. Practically speaking, if you are looking for an address on Faxaskjól and find yourself on Sörlaskjól, you can be sure you are pretty close by.<sup>47</sup>

Exactly the same principle applies in parking lots which post two-level alphanumeric labels like "G23" on lampposts (meaning lot or level G, section 23). If you are under a sign saying G5 (and able to read), you can guess that G23 is probably not far away, or at least, closer than B10. Guessing that G22 and G23 are next to each other constitutes navigational ability based on the mapping principles of the terminal-level labels, but guessing that G23 and G5 are closer together than B10 and G5 constitutes navigational ability based on the pseudo-mapping of taxonomic organization and compositional labeling.

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<sup>47</sup>This system is briefly described by Þorsteinn Vilhjálmsson, "Hverjir ákveða götunöfnin og eftir hverju fara þau?" *Morgunblaðið* (Reykjavík), 13 September 2003, Lesbók, p. 11.

The principle can be expressed another way: In taxonomies, a labeling system for superordinates becomes a mapping principle for their subordinates, if the superordinate labels are included in the subordinates' labels. For example, in the Korean writing system (hangul), vowels are visually distinct from consonants (vowels have a more linear appearance and consonants a squarer look). At the level of the distinction between vowels and consonants, this is simply a two-member label set applied to a two-member contrast set. But at the level of individual signs, it becomes possible to predict something about the sound that it stands for (namely, whether it is a vowel or consonant), from the form of its graphic sign. (Compare the Roman alphabet and numerous other writing systems where there is no analogous distinction — nothing about their graphic form separates the vowels *aeiou* from the consonants *mrstx*). To take another case, in a bookstore, the location of the cookbook section may tell you nothing about the location of, say, the music section, but encountering a book in the cookbook section tells you that it does probably have to do with cooking. (To put this example in abstract terms, the arrangement of each *category* of book may have been done without the use of a mapping principle, so that there is no other way to understand the relations between categories and locations other than to list them all; but the location of an *individual* book within the area devoted to a given category gives a clue to the nature of its contents.)

In the United States, where the first three digits of phone numbers are an "area code" which formerly told you something about the physical location of the telephone line, new developments in telephone technology mean that it is no longer possible to be sure that the person answering your call is actually located in the place that those three numbers label. This example illustrates the breakdown of a pseudo-mapping: the superordinate sign no longer has any superordinate meaning, and in a certain way, two levels of the telephone number taxonomy are effectively collapsing into one. (This particular change, taking place in a very widely used labeling system, has aroused strong and not necessarily rational feelings: one commentator claimed it was "a form of progress in the irreversible evolution of humanity," while another called it a "deeply confusing development" which would result in

"one less North Star and one less compass point that people have to help orient themselves in an increasingly complicated world."<sup>48</sup>)

One could turn the tables at this point and ask whether, in fact, all iconic labeling actually amounts to the creation of a taxonomy and the labeling of its levels and units.<sup>49</sup> The strongest version of this would suggest that all cases of "mapping" can be reduced to cases of compounding, and that the only reason a label ever correlates to something about its referent is because it is a compound. I suggest that this would be going too far and that mapping sometimes reduces to compounding, but not always. In the case of a hotel whose room numbers really are formed compositionally from the floor number and then the room number within the floor, the mapping and the taxonomy are one and the same. But it seems a little far-fetched to consider cases such as two-letter abbreviations for states, airlines, or countries, where the mapping principle is more suggestive than determinative, as taxonomies. There is, however, a certain gray area where mapping principles and the compounding of labels in a taxonomy overlap.

## 4.4 The drawbacks of mapping

The previous section might make it seem like there is never any reason *not* to build an iconic mapping principle into a set of labels. But in fact, mappings pose a series of maintenance problems which should make designers, before choosing, think twice about whether a mapping principle will wear well on the contrast set they are working with.

### Exhaustion

A mapping principle increases the speed with which the target set can become exhausted. Requiring that there must be a motivated relationship between each source and target set member reduces the number of potential labels in the target set that will be suitable for any member of the source set. If the size of the source set expands (with new

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<sup>48</sup> Ian Urbina, "Area codes, now divorced from their areas," *New York Times*, 1 October 2004, p. B1.

<sup>49</sup> The question is similar to the linguistic conundrum of whether a compound word that contains two morphemes or other distinguishable units counts as one signifier or two. The words *mailbox*, *raspberry*, and *sneeze* are progressively murkier cases which move from simple compounding through so-called cranberry morphemes to phonesthemes.

members needing to be labeled according to the same mapping principle as older ones), while at the same time the number of labels in the target set is limited, the system can break down.

Thus, for example, the American Social Security number system has a theoretical maximum capacity of one billion numbers, of which it has currently only used just over four hundred million; it would exhaust its capacity slightly more slowly if it did not use a mapping principle relating the number to the state of issue.<sup>50</sup> Because the Icelandic personal identification number system uses a mapping principle relating the number to the holder's date of birth, it will break down if it ever has to assign numbers to more than one hundred people born on the same calendar day. (As the number of babies born in Iceland has hovered around 4,000 per year for several decades, this is exceedingly improbable.<sup>51</sup>) In street-naming, many mapping principles have been exhausted as cities have grown and built more streets than the capacity of the target set.<sup>52</sup> And as the quantity of telephone numbers in America grew, three mapping principles in the telephone numbering system had to be progressively sacrificed in order to avoid increasing the standard length of the numbers beyond their current ten digits.<sup>53</sup> Similarly, although the development of platinum credit cards and membership levels responds to the desire in these contexts to create a status more valuable than gold (see further section 6.7), it is problematic because it disrupts the conventional familiarity of the trio of bronze, silver, and gold. In general, choosing an

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<sup>50</sup> "FAQs — Frequently Asked Questions," <http://www.ssa.gov/history/hfaq.html> (January 2005).

<sup>51</sup> *Landshagir 2002 / Statistical yearbook of Iceland 2002* (Reykjavík: Hagstofa Íslands, 2002), table 2.30 ("Fæðingar og fædd börn 1951–2001"). Also available at <http://www.hagstofa.is/template25.asp?pageid=299> (January 2005).

<sup>52</sup> See Fred Tarpley, "Street names as signposts of world cultures," in *Namenforschung: ein internationales Handbuch zur Onomastik*, edited by Ernst Eichler et al., pp. 1481-1499 (Berlin: Walter de Gruyter, 1995-1996), p. 1489.

<sup>53</sup> These three mapping principles were (1) the correspondence between the two letters which used to form the first two figures of the central office code, and something about the location of the central office; (2) the correspondence between the middle digit of the area code, and whether the state that area code was located in was divided into one or more than one area code; and (3) the correspondence between the middle digit of the area code or central office code, and whether that code referred to an area code or a central office. See Ian Watson, "Equilibrium and exhaustion: can America survive when we run out of area codes?" *Exposé: essays from the Expository Writing program*, 1988-89, pp. 4-9.

unprincipled labeling strategy allows one to be freer and less disciplined in linking labels and referents.<sup>54</sup>

## Principles that disappear

The navigational ability conferred by a mapping principle is fickle. The conditions that allow one to perceive a correlation between source and target set can vanish. If a mapping principle requires that a target set member reflect something about a source set member, an existing signifier-signified pairing can start to violate the mapping principle if something about the source set member changes. For example, in labeling systems which involve a geographical taxonomy or a geographically based mapping principle, one of the most common problems is that the things labeled may move from one geographical category to another. In Iceland, Reykjavík telephone numbers begin with 5 and Akureyri numbers with 4; if you allow people to keep their 5-number when they move from Reykjavík to Akureyri, you lose the benefit of being able to predict where the owner of a given number lives. But if you insist on preserving the principle, you force people to get a new number whenever they move, and to alert all their friends. The same tradeoff applies in the choice of whether to use a mapping principle in the assignment of car license plate numbers (which Germany does, and Iceland once did). There is thus a tradeoff between the benefits of iconicity and the benefits of portability. The more the referents of a label set are likely to change character, the less advisable it is to try to enforce continual compliance with a mapping principle.

This does not mean that one should not initially assign labels to a contrast set based on a mapping principle or other type of motivation, if one can reconcile oneself to the fact that the mapping principle may cease to confer navigational ability or that the motivation may become obscure. Some might put it this way: all labeling is somehow motivated (and there is a reason for every choice), and sometimes this motivation may even involve a

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<sup>54</sup>Linda R. Waugh has made the same observation and uses the terms "mediacy" and "immediacy" to describe non-iconic and iconic labeling methods respectively in "On the sound shape of language: mediacy and immediacy," in *Selected writings*, by Roman Jakobson, 8: 255-271 (Berlin: Mouton de Gruyter, 1988).

mapping principle; but this motivation becomes obscured as both source and target set members change over time. Those without historical knowledge of those developments lose the ability to trace that motivation. One can summarize this view by calling the process "the symbolification of icons"<sup>55</sup> or the "erosion of iconicity,"<sup>56</sup> or by saying that "many causal links are partially or entirely asymmetrical,"<sup>57</sup> meaning that when a source set member changes, the corresponding target set member will not necessarily change to match it. When iconic relationships erode in this way, a dictionary etymology, or a history of any other convention, effectively becomes an exercise in tracing the reason why we use a particular conventional form for a particular purpose back to a time when the motivation for it was more obvious than it is now. (In the terms used in section 6.3, erosion effectively amounts to the replacement of natural justifications by historical justifications.)

In the lexicon, *both* labels (through sound change) and their meanings (through semantic change) can mutate considerably over time, and perhaps part of the explanation for why there is relatively little iconicity in the lexicon is that regular change, both in source and target sets, ultimately tends to erode any motivated relationships that make it into the system.

One way that mapping principles can erode is if a label's association with the thing it labels starts to become stronger than its sense of simply having been assigned to that thing temporarily as a function of a mapping principle. This is why, in revising the manuscript of this book, I might continue to refer to "chapter 5" even when chapter 4 has been deleted so that chapter 5 now succeeds chapter 3. In effect, "5" is no longer the output of a mapping principle, but has become simply a label for a particular chapter. Consider as well the following three ways of labeling seats in single-aisle airplanes:

A B C D E F  
A B C D  
A C D F

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<sup>55</sup> Keller, *A theory of linguistic signs*, pp. 150-155.

<sup>56</sup> John Haiman, *Natural syntax: iconicity and erosion* (Cambridge: Cambridge University Press, 1985).

<sup>57</sup> Stanley Lieberman, *A matter of taste: how names, fashions, and culture change* (New Haven: Yale University Press, 2000), pp. 267-268.

The mapping principle  $\{A, B, C \dots\} = \{\text{leftmost seat} : \text{rightmost seat}\}$ , which is usually applied in six-across jets such as a Boeing 737, is not always applied in four-across aircraft, which often use the ACDF label set rather than the ABCD mapping. A good reason to use ACDF is that for the employees of a company which uses both six-across jets with ABCDEF labeling and four-across jets with ACDF labeling, A and F then reliably mean "window" while C and D reliably mean "aisle," window- and aisleness being important attributes of seats. In such cases, the seat numbers that were assigned according to a mapping principle in the six-across aircraft have become just labels in the four-across aircraft. The motivated origin of the ACDF label set can only be shown historically, by referring to its development from labeling in six-across aircraft. "D" has come to take on a meaning (right-hand aisle seat) which originated as an incidental and trivial consequence of a mapping principle used in another context. (The drawback to using ABCDEF together with ACDF is that one then knows whether two people sitting in A and C seats are seated next to each other only if one knows the type of aircraft.)

## The effort of taxonomy maintenance

In cases of pseudo-mapping in which terminal labels are composed out of the labels for successive levels of a taxonomy, the organization and labeling of the taxonomy can be quite time-consuming. For example, organizing your computer files into a sensibly labeled system of folders and subfolders, probably several levels deep, takes quite a bit of time and thought as well as continued maintenance when new categories and partitions emerge.

One can work around this problem by eliminating the intermediate levels of the taxonomy — for example, keeping all your computer files in one folder. This has drawbacks, of course: one must then name the files so they contrast with all other files in the system, not just all other files in the same immediate paradigm, and one loses the benefit of the fact that the taxonomy's categories serve as searching devices within a body of information. However, systems of information storage and retrieval which use extremely powerful search engines can tolerate less robust systems of classification and subclassification because of what we

could call the "Google effect," by which the search engine compensates for the lack of classifications and subclassifications as a lookup facilitator. Using this principle, the stepfather of a friend of mine designed a system for the storage boxes he uses in his home for old papers and other such things. He numbers all the boxes sequentially, so that the only source set that the numbers map to is the set of dates the boxes were first filled. The boxes are then placed all over the house — not only in designated storage areas but also the odd box or two in corners, or under chairs, wherever they just happen to fit. There is no mapping between the number of the box and the location or contents of the box, and it is also not necessary for the numbers to run in perfect sequence with no breaks. A master list of each box's number, contents, and location is on his computer. The lack of iconicity in the labeling system is compensated for by the power of the search function in the computer application. In order to find the box with the widgets, he needs only to plug in the word *widget* into the search window of the program. In exchange for complete reliance on a search engine, one avoids the need to build iconic principles into a labeling system.

### Iconicity as a scarce resource

A feature of mappings which is both a drawback and a curiosity of its own is that, in those mappings which are not fully determinative, and which leave some wiggle room in the ultimate assignment of a label, a clear sense of prestige may become associated with "owning" an iconic label, and the ability to have an iconic label may become a scarce resource.

For example, in the airline industry, where each airline company is represented by a two-character code, it is the old, established airlines which have a motivated, iconic code (like AA for American Airlines or LH for Lufthansa) and the recent startups which have non-iconic codes (like 7Y for Greendale Aviation). As the two-character codes have been progressively exhausted, it has been harder and harder for new airlines to find an iconic code.<sup>58</sup> Similarly, the concern in the late 1990s over "cybersquatting" (registering in-demand

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<sup>58</sup>On airline code assignment see International Air Transport Association, "IATA coding systems," <http://www.iata.org/whatwedo/coding> (January 2005) and the links therein.

Internet domain names and then reselling them at a high price) reflects the uncertainty over whether having an Internet domain name that directly relates to the name of your organization is a right, or a privilege you have to pay for — and whether the principle of first-come-first-serve is fair.<sup>59</sup>

The competition for iconic domain names is not only a problem because it can exhaust certain parts of the set of labels, but also because the competition for names creates bad feeling and bureaucratic confusion. Frustration, conflict, and formal dispute resolution procedures have arisen in the Internet domain name system because people and companies want to have a domain name that bears a relationship to their own.<sup>60</sup> Other number issuers, such as some telephone companies and personal identification number authorities, avoid this problem by refusing to give users any control over the form of their label at all. License plate issuers commonly charge car owners for the privilege of choosing their own "vanity" license plate number, which also certainly keeps demand for motivated numbers down.

The prestige of iconicity is a phenomenon distinct from the way that certain sections of a label set come to take on value (see sections 4.5 and 6.7). Here the prestige is not attached to a specific section of the label set (those labels that begin with A, for example) but rather to the ability to have a motivated relationship between label and referent. However, it *can* indirectly lead to prestige differences between certain areas of label sets. If certain parts of those label sets rarely happen to be the result of a motivated choice (for example "7Y" is rarely a motivated airline abbreviation because airline names rarely include numbers), those sections may acquire an air of unwantedness and unattractiveness. Conversely, although iconicity by itself does not explicitly confer prestige on any area of the label set, certain areas of the label set may turn out to be in higher demand than others.

In a few cases, it seems that particular authorities have voluntarily agreed to use relatively less prestigious areas of a target set. Whether this was deliberate or not, it does reduce the pressure of competition within the system as a whole. For example, at some point

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<sup>59</sup> See James Gleick, "Get out of my namespace," *New York Times Magazine*, 21 March 2004.

<sup>60</sup> See, again, Gleick, "Get out of my namespace."

it was decided to give almost all Canadian airports codes starting with "Y" so that, for example, YVR is in Vancouver, YWG in Winnipeg and YYZ in Toronto.<sup>61</sup> The attempt to map from the name of the city or airport to the code affects only the last two letters. The State University of New York adopted an identical strategy for the three-letter codes identifying libraries in the OCLC system. Thus while the *Rush Rhees Library* at the University of Rochester was very iconically coded RRR, all SUNY schools' codes began with Y (the *Milne Library* at SUNY Geneseo, for example, is coded YGM). Similarly, American radio stations which try to build iconicity into their call letters are constrained by the rule that station names east of the Mississippi must all start with W and those west of it with K.<sup>62</sup> In these cases, what seems at first as a drag on form-meaning correspondences turns out to create its own sense of signification, so that the "Y" becomes a sort of superordinate sign which marks out Canadian airports (admittedly, not reliably so). Once one learns the system, one can predict that an airport whose code begins with Y is in Canada, and that an American radio station whose call letters begin with K is in the West.

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<sup>61</sup>I have not been able to find an authoritative source for the history of this decision.

<sup>62</sup>See Thomas H. White, "K/W call letters in the United States," <http://earlyradiohistory.us/kwtrivia.htm> (March 2004).

## Restrictions on the topology of target sets

A minor drawback of mappings is that they discourage designers from using labeling "material" that is not easily sortable. Mappings sometimes favor numbers instead of names as target sets — and this leads to a system which may lack the "flavor" of a named or colored system (see section 3.5). There is something more human about "February" than "2" and indeed in labeling the months of the year we can choose between the principled strategy of numeric labels running from 1 to 12, and the non-iconic but more vivid set of labels which runs from January to December. Similarly, the American practice of numbering expressway exits either ordinally or by milepost allows for easy navigation, so that a pair of exit labels instantly tell us something about the exits' relative position; but the Israeli approach of naming each intersection, though it reduces novice users' navigational ability, has a certain aesthetic appeal.

## Mapping principles which disclose things that some would like to keep secret

A final drawback to mapping is that the clues a target set provides about the nature of the source set may not be desirable. For example, a member of parliament in Iceland recently proposed that the personal identification number system be changed so that birthdates would no longer form the first six digits of each identification number. According to the proposal, since people constantly find themselves required to give their ID number, they should at least have the right to choose whether to communicate their birthdate — an important and, to some, sensitive piece of personal information — or not.<sup>63</sup> The solution proposed is to remove the mapping principle from the numbering system. Similarly, we usually try to avoid marking keys in a way which would, if we lost them, allow an unknown person to figure out what they open. The general lesson is that any mapping principle allows

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<sup>63</sup>"Vill breyta kennitölukerfinu," *Fréttablaðið* (Reykjavík), 1 April 2004, p. 20; "Tillaga til þingsályktunar um breytingu á kennitölukerfi," Alþingi [Icelandic Parliament], 130. löggjafarþing 2003–2004, Þskj. 1248 - 820. mál, <http://www.althingi.is/dba-bin/ferill.pl?ltg=130&mnr=820> (April 2004).

those who understand the target set to "be in the know" about aspects of the source set that, some may feel, should only be disclosed if people really *need* to know (see section 7.3).

## 4.5 The design of contrast set topologies

Why is it that the numeric keypads on calculators have "1 2 3" as the bottom row, but those on telephones have "1 2 3" as the top row? Why is it that, in some lists of American racial classifications, "white" comes first and "Asian/Pacific Islander" comes last? Why is it that the letter Å precedes Ö in Swedish alphabetical order, but follows it in Danish? And why is it that king-ace-two is a permissible sequence in some card games but not in others?

All these questions revolve around the choice of a topology for a contrast set. Many contrast sets, such as the alphabet or the different American racial categories, lack a natural topology. Others, such as the numbers, have an obvious topology in one dimension, but not in two. Others, such as the set of countries in the world or students in a class, suggest several different linear topologies depending on what attributes one sorts them on. An important job for the design workshop is to create topologies for contrast sets which lack them. In doing so, the designer is getting a contrast set ready to serve as a source or target set in a mapping, since mapping requires that the sets involved have some kind of topology. The designer can choose to form these topologies in many different ways.

The most typical artificial topology is linear, and the arrangement of a contrast set into a linear topology is commonly called "ordering." Because it is common to map linear topologies to the set of numbers (so that the letter *a* or the racial classification "white" might be labeled 1), it is easy to get ordering confused with numbering. In fact, though the two processes are analytically separate. The act of arranging the letters of the alphabet in the order {A, B, C ... X, Y, Z} has to precede the act of numbering them one through twenty-six. The first involves ordering — creating a topology from scratch — and the second involves mapping — using that topology to make systematic links to a target set. (Of course, numbering a contrast set, or creating some other kind of mapping to it, is often the ultimate

goal when one creates a topology. Without putting racial categories in an order, for example, one would not be able to number them and store them in a computer database as easily.)

The word "ordering" does not easily fit those cases where we outfit contrast sets with two-dimensional or other more complex topologies. In these cases, an alternative to talking about "designing a topology" is to speak of designing the "layout" or "presentation" of a contrast set.

Contrast set topologies typically serve as *collation standards*. To collate a set of items is to sort them so that they can be found again. Arranging a card catalog in alphabetical order, putting books on the shelves by call number, or keeping a paper file of customer orders sorted by order number are typical cases of collation. Because people often need to find things that other people have collated, it is specifically the shared knowledge and the conventionalization of a contrast set topology that allows it to be used by many people as a collation standard. For example, it is only because many people agree on what alphabetical order is that we use it as a collation standard. Since "collation standard" is only a role that a contrast set topology may (or may not) take on, the design of a topology and a collation standard may take place separately. For example, the Unicode standard created a linear topology involving thousands of sequentially numbered characters, but allows the separate definition of collation standards which do not replicate that linear topology (although they do reference its numbering system).<sup>64</sup>

When a contrast set (say  $X$ ) is given a topology and then mapped to a label set (say  $Y$ ), and there is a mathematical relationship between the elements of  $Y$ , it is important to remember that that mathematical relationship does not automatically extend to the elements of  $X$ . For example, if the linear contrast set {white, black, Hispanic, Native American, Asian/Pacific Islander} is mapped to the contrast set {1, 2, 3, 4, 5}, that does not mean that anything about the original relationship between "Native American" and "black" is analogous to the mathematical relationship between 4 and 2. The only thing that "4" and "2" measure

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<sup>64</sup> See Mark Davis and Ken Whistler, "Unicode collation algorithm," Unicode Technical Standard #10, version 4.0, <http://www.unicode.org/reports/tr10/tr10-11.html> (January 2005).

or map to is the place of "Native American" and "black" in the artificial topology. They do not measure or map to any *inherent* attributes of "Native American" or "black." The numerals here are just tools which "provide for a convenient catalog of the objects."<sup>65</sup> Indeed, in such situations, if it could be made to be practical, it would be less misleading to label the racial categories with another set that also lacks a clear topology (five contrasting fruits or animals, for example). The use of numerals to label contrast sets whose linear topology is artificial was called a *nominal scale* in Stanley Smith Stevens' "N-O-I-R" classification of types of scales.<sup>66</sup> Otis Dudley Duncan argues that N "scales" should not even be called scales because their values do not measure anything about the things that they label.<sup>67</sup> Indeed, nominal scales commonly confuse beginning social science statistics students, who need to be cautioned specifically that while correlations involving ordinal, interval, and ratio scales can be measured by mathematical techniques, mathematical measures of correlation cannot apply to entire nominal scales at once but only to their individual elements (which one can treat as binary variables using logistic regression).

The process of specifically designing contrast set topologies has received little direct scholarly attention as an abstract social form. Two writers who have touched on the theoretical aspects of the subject have done so out of a desire to understand the contrast set of number, which has a linear topology that, though not entirely natural and inevitable, is at least very difficult in practice to escape.<sup>68</sup> Another close approach to the subject has been the study of degree words and polarities in language, which typically have a linear or polar topology.<sup>69</sup> A few scholars have found their way into a discussion of ordering through an interest in the development of lists and tables.<sup>70</sup> It is somewhat easier to find descriptive

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<sup>65</sup> Otis Dudley Duncan, *Notes on social measurement: historical and critical* (New York: Russell Sage Foundation, 1984), p. 128.

<sup>66</sup> Stanley Smith Stevens, "On the theory of scales of measurement," *Science* 103, 2684 (7 June 1946): 677-680.

<sup>67</sup> Duncan, *Notes on social measurement*, chapter 4 ("On scales of measurement," pp. 119-156).

<sup>68</sup> Bertrand Russell, *Introduction to mathematical philosophy*, chapter IV ("The definition of order," pp. 29-41); Crump, *The anthropology of numbers*, pp. 6-11, especially p. 10.

<sup>69</sup> See, for example, Lyons, *Semantics*, 1: 288-290.

<sup>70</sup> Jack Goody, *The domestication of the savage mind* (Cambridge: Cambridge University Press, 1977), chapter 5 ("What's in a list," pp. 74-111); Joshua R. Goldstein, "What's in an order? Reading statistical tables as cultural artifacts," paper presented at the Dialogues in Culture and Cognition conference,

studies and references on the individual histories of the artificial topologies created for particular sets, such as alphabetical order or the keyboard layout of pianos and typewriters, but much more could be written on these topics as well.

## Brief case studies: alphabets and keyboards



Image 4.7 (013)

The domain out of which our letterforms were chosen has no natural topology, and neither does the conventional set of focal points in that domain. The order we use for them seems to be purely a matter of convention. The Roman, Cyrillic, Greek, and Hebrew alphabets use variations of the same order. This "ABC" order is, along with the seven-day week, among the existing standards and conventions that has the longest record of continuous use.<sup>71</sup> We know that it goes back at least as far as its use in Ugaritic cuneiform in the 14th century B.C., since the alphabetical order we still use today appears (in cuneiform) on a tablet found in the excavation of the Royal Palace of Ugarit (currently in northern Syria) in 1948.<sup>72</sup> Image 4.7 shows a Syrian postage stamp celebrating the tablet's discovery.



Image 4.8 (012)

Image 4.8 shows the approximate phonetic values of each of the tablet's cuneiform

signs in the Ugaritic language. The signs marked in bold have definite relatives in the English

Princeton University, 17 April 1999.

<sup>71</sup> On the history of why alphabetical order follows the order that it does, three helpful, but unfortunately less than in-depth resources are David Diringer, *The alphabet: a key to the history of mankind* (3rd ed., London: Hutchinson, 1968), 1: 169-170; John Healey, *The early alphabet* (London: British Museum Publications, 1990), pp. 22-26; O'Connor, "The alphabet as a technology," pp. 788-790. The temptingly named *Contributions to a history of alphabetization in antiquity and the Middle Ages*, by Lloyd W. Daly (Brussels: Latomus, 1967) is unfortunately not the illuminating treatment of the history of alphabetical order that the title suggests it might be. On the use of alphabetical order as an information-retrieval technology, see Daniel R. Headrick, *When information came of age: technologies of knowledge in the age of reason and revolution, 1700-1850* (Oxford: Oxford University Press, 2000), pp. 160-167, which links the history of alphabetical order to the development of collation technologies, and Goody, *The domestication of the savage mind*, pp. 110-111.

<sup>72</sup> For the original report of the Ugaritic discovery see Charles Vroilleaud, *Le palais royal d'Ugarit, II: textes en cunéiformes alphabétiques des archives est, ouest, et centrales* (Mission de Ras Shamra, tome VII, Paris: Imprimerie Nationale, 1957), pp. 4-5, 199, planche 1.

alphabet (shown below). The Ugaritic alphabetical order is, of course, not identical to today's, but the essential continuity is obvious. The tablet's order must, of course, have had some motivation, but no material remains allow us to trace it further, so the original principle behind the order is not yet and may never be recoverable. That means that we do not and probably never will know why the conventional order for the script you are reading runs in the way that it does.

Other major scripts use different orders with different histories. To take a few examples, the modern Ethiopian alphabetical order has its roots in the order of the ancient South Arabian script, while the order used in modern Arabic is a (relatively) new creation which is based on the recoverable, traceable principle of grouping similarly shaped letters together.<sup>73</sup> Japanese kanji and Chinese character dictionaries are traditionally ordered by a natural, mostly recoverable principle — the number of strokes in the most fundamental radical of the character. (Unfortunately, it is not always obvious which part of the character is fundamental, and the system is cumbersome. Recently, romanized Chinese dictionaries have become more common, and in many circumstances they speed lookup.<sup>74</sup>) Meanwhile, the two parallel graphic variations of the 48-element Japanese syllabary (hiragana and katakana) can be organized into either of two topologies. The most common approach (called *a-i-u-e-o jyun*) arranges them by initial consonant, in the order *øksthmyrw* (*ø* represents "no initial consonant") and thereunder by vowel (in the order *aiueo*). This yields either a ten-by-five matrix or the linear sequence *a i u e o ka ki ku ke ko ...* An older principle (*iroha jyun*) arranges the syllable signs linearly, according to the text of a famous medieval poem which contains each syllable once.<sup>75</sup> The old Scandinavian runic alphabet had its own order, of so far irrecoverable derivation, the first six letters of which (*fupark*) have become

<sup>73</sup> Healey, *The early alphabet*, pp. 48, 56.

<sup>74</sup> On Chinese character dictionary lookup, stroke order, and the identification of radicals see William C. Hannas, *Asia's orthographic dilemma* (Honolulu: University of Hawaii Press, 1997), pp. 139-140, 281-284. An example of a romanized dictionary is John DeFrancis, *ABC Chinese-English comprehensive dictionary* (Honolulu: University of Hawaii Press, 2003).

<sup>75</sup> The original text of the poem, now archaic in modern Japanese, is いろはにほへと / ちりぬるを / わかよたれそ / つねならむ / うゑのおくやま / けふこえて / あさきゆめみし / ゑひもせす. It is similar to the English sentence "The quick brown fox jumps over the lazy dog," which uses all twenty-six letters of the alphabet.

the name for the alphabet itself on the same principle as the word "alphabet." Daniels and Bright's *The world's writing systems* gives basic information on alphabetical order for most of the scripts it lists.<sup>76</sup>

The problem of keyboard layout, like the problem of alphabetical order, involves coming up with a topology for the set of letterform. The differences are that keyboard layouts also include punctuation, numbers, and both capital and small letters, and that their topology is two-dimensional (or three-dimensional, if one thinks of the shift and control keys as creating extra planes which overlay the regular key identities).

Just as with alphabetical order, the real value of a keyboard layout is that it is standardized. People often switch from one computer to another. It helps to be able to depend on one's expectations of keyboard layout, so that one knows where to find each of the symbols even on a keyboard one has never seen before. Imagine having to switch between multiple computers each of whose keyboards had been customized in a completely idiosyncratic way. While (as I know from personal experience) it is not so difficult to learn two different keyboard layouts for the same writing system, having to switch between them is an unwelcome bother.

Virtually every country and every language has a different keyboard layout standard. The American Sholes or QWERTY layout is the basis for many layout standards used by cultures that write with the Roman script. But the basic Sholes form has been significantly altered from its original American form in many of these standards. In France, for example, five of the twenty-six keys have been rearranged so that the three main rows are AZERTYUIOP, QSDFGHJKLM, and WXCVCBN. The diversity becomes even greater if one includes punctuation marks and numbers. In Hungarian, the zero key is to the left of the "1" key, not to the right of the "9" key, while in Czech, what is the number row in other layouts is transformed into ĚŠČŘŽÝÁÍÉ (these keys still give the numbers too, but for this one has to press shift). Many non-Roman scripts have entirely unrelated layouts, and the function of the

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<sup>76</sup>Peter T. Daniels and William Bright, ed., *The world's writing systems* (New York: Oxford University Press, 1996).

shift key is totally different in layouts for languages like Thai, Korean, or Arabic which do not have capital letters.<sup>77</sup>

It has been widely reported that the layout of the Sholes keyboard originally reflected a desire to keep the most common letters of the English alphabet physically as far away as possible. However, one has to wonder whether this principle can explain all the letter placements. There must be more to the story. Indeed, it seems that we lack a fully reliable, precise, and detailed account of the QWERTY layout's creation (likely because, as with the genesis of many other conventions, the keyboard's designers did not think it was important enough to record in detail at the time).<sup>78</sup>

Notwithstanding the fact that we do not really seem to know why it has the layout it does, the story of the Sholes keyboard shot to prominence in American intellectual life as an example of standardization in 1985 when an economist, Paul David, wrote an article on the history of American keyboard layouts.<sup>79</sup> David stated the commonly held position that the Sholes layout is less efficient than certain other layouts which (though they have been used) have not become the standard. His theoretical hypothesis was that the best solution to a given standards problem does not always win out over other competing ones. Rather, the solution that wins is the one that has the most "early adopters." Thus "markets" for standards solutions are not fully "efficient" in terms of providing optimal value to society. David's article has reverberated widely and the keyboard story has been extensively quoted in both popular and academic literature.<sup>80</sup>

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<sup>77</sup> A handy source of information on dozens of different keyboard layouts is Datacal Enterprises, "Use international overlays to create a bilingual keyboard," <http://www.datacal.com/dce/international-overlays.htm> (January 2005).

<sup>78</sup> A good starting point on the history of the typewriter is Richard N. Current, *The typewriter and the men who made it* (Urbana: University of Illinois Press, 1954).

<sup>79</sup> Paul A. David, "Clio and the Economics of QWERTY," *American Economic Review Papers and Proceedings* 75 (1985): 332-337; see also Paul A. David, "Understanding the economics of QWERTY: the necessity of history," pp. 30-49 in William N. Parker, ed., *Economic history and the modern economist* (Oxford: Basil Blackwell, 1986).

<sup>80</sup> An example of popular treatment is Peter Passell, "Why the best doesn't always win," *New York Times Magazine*, 5 May 1996, pp. 60-61; of semi-popular, Donald A. Norman, *The design of everyday things* (New York: Doubleday, 1990), pp. 145-151; of academic, Douglass C. North, *Institutions, institutional change and economic performance* (Cambridge: Cambridge University Press, 1990), pp. 76, 93-95.

The article, however, was not a systematic investigation of the history of the keyboard but rather a rhetorical piece designed to orient economists' attention to the power of history as a determining factor in standards development. Capitalizing on this fact, two other economists, Stan Liebowitz and Stephen Margolis, criticized both David's assumption that the Sholes keyboard is inferior, and his hypothesis about the historical development of standards. But Liebowitz and Margolis's work is also open to severe criticism.<sup>81</sup> Since David's hypothesis, if true, is an argument for government involvement in the design of conventions, while Liebowitz and Margolis's perspective, if correct, is an argument in favor of a laissez-faire approach, the debate has a strongly political aspect (on which see section 6.3).<sup>82</sup> The actual history of keyboard layout has almost been forgotten in the battle, and the combatants do not mention that there are entirely different keyboard layouts in countries other than the United States which must be taken into account. My hope is that the next scholar to tackle the subject will do so with ideological balance, worldwide reach, and careful historical and factual detective work.

Several other layout conventions are similar to the typewriter keyboard case but much less politically controversial. The layout of numeric keypads also involves figuring out how to arrange a standard contrast set of symbols in two-dimensional space, with the same provision that they must be densely packed and organized into rows. As Image 4.9 shows, telephones tend to have 1 2 3 as the top row, computers and calculators 1 2 3 as the bottom row. Other similar examples include the piano keyboard, whose layout is quite well

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<sup>81</sup> See Stan J. Liebowitz and Stephen E. Margolis, "The fable of the keys," *Journal of Law and Economics* 33 (1990): 1-25; *The economics of QWERTY: history, theory and policy* (New York: New York University Press, 2002); *Winners, losers & Microsoft: competition and antitrust in high technology* (Oakland, Calif.: Independent Institute, 1999); and "Typing errors," *Reason*, June 1996, <http://reason.com/9606/Fe.QWERTY.shtml> (December 2004). To take a fairly mundane example of the kind of argumentation that leaves Liebowitz and Margolis open to criticism, consider a statement from "Typing errors," their popularized article: "the advent of computer keyboards, which can easily be reprogrammed to any configuration, lowers the cost of converting [from one keyboard layout to another] to essentially zero (not counting retraining)." This sentence uses verbal sleight of hand to exclude the cost of retraining from the cost of change, even though the cost of retraining might be the largest component of the cost of change. The result is that the article conveys an inaccurate conception of the process of standards change, specifically suggesting that physical commitments (e.g. keyboards) matter and cognitive commitments (e.g. familiarity with them) do not.

<sup>82</sup> A useful review of the debate, though biased in favor of Liebowitz and Margolis, is Peter Lewin, "The market process and the economics of QWERTY: two views," *Review of Austrian Economics* 14 (2001): 65-96.

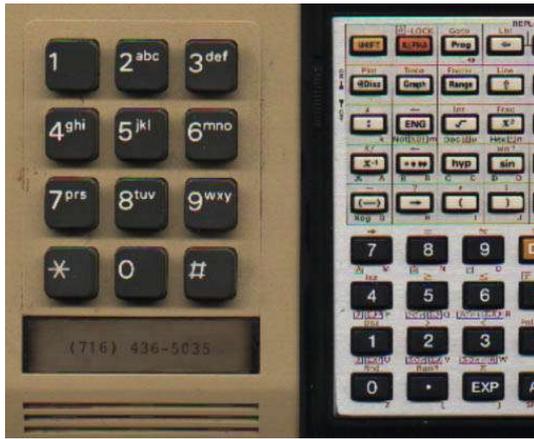


Image 4.9 (026)

standardized today but has been the subject of much experimentation in the past,<sup>83</sup> and the spatial placement of sets of buttons, switches, or switch positions (consider the layout of rangetop burner controls<sup>84</sup> and manual transmission gearshifts, or the standard positioning of clutch, brake, and accelerator).

## Creating starting points and directions

Sometimes necessary in the creation of a topology for a contrast set is the definition of starting points and directions of precedence within the set.<sup>85</sup> This is particularly important if the set is to be mapped to a target set which has clear starting points or precedence relations (such as the set of numbers).

The most memorable cases of starting-point choice involve contrast sets (and domains) with circular topologies. The definition of a prime meridian on the earth (or, for that matter, the moon or Mars) involves assigning artificial prominence to one single meridian for the purpose of making it easier to map a set of numbers to all the other meridians. The conventional choice of a first day of the year (such as January 1 or March 25) or the week (such as Sunday or Monday) is similar.

Certain unbounded or only partially bounded linear domains, such as time and temperature, also require the definition of a starting point. Most systems for counting years define a particular year as anchor point of the system, such as 1 A.D. or the year the Prophet Mohammed was born. The Celsius scale uses the freezing and boiling points of water as

<sup>83</sup> Edward Tenner, *Our own devices: the past and future of body technology* (New York: Alfred A. Knopf, 2003), pp. 161-186.

<sup>84</sup> See Norman, *The design of everyday things*, p. 75-78.

<sup>85</sup> Two previous (but brief) discussions of starting points are Eviatar Zerubavel, *Time maps: collective memory and the social shape of the past* (Chicago: University of Chicago Press, 2003), pp. 90-91, and Crump, *The anthropology of numbers*, pp. 82-83.

anchors for its mapping to the set of numbers (they are represented by 0 and 100 degrees respectively).

Even the simple act of listing the members of a contrast set which might otherwise not have any clear topology at all requires choosing one of them to list first. Listing the members of a contrast set thus "transforms" the set because "it establishes the necessity of a beginning and an end."<sup>86</sup>

Choosing directionality can be thought of as creating a polar mapping in which the members of the target set stand in some kind of sequence, so that the natural directionality of the target set is transferred over to the source set. This happens in a conventional way. The Celsius scale could just as well have used 0 to label the *boiling* point of water and 100 the freezing point, thus using the mapping {warmer : colder} = {lower number : higher number} rather than {warmer : colder} = {higher number : lower number}. (If you think this sounds absurd, you might be surprised to learn that this is the way Celsius originally conceived of it!<sup>87</sup>) The numbers on clock faces could just as well be laid out in the opposite direction (which would force the hands to run in the direction we now conventionally call counter- or anti-clockwise), and it would be perfectly possible to build pianos with the low notes on the right instead of the left.

In binary, polar topologies, as well as in bounded linear topologies, the process of defining a starting point and a direction of precedence are usually one and the same, because when there are only two terms the definition of a starting point implies the definition of a direction. In unbounded linear topologies and circular topologies the two decisions may be quite distinct.

Another type of directional convention involves whether to "zoom in" or "zoom out" in presenting the successive levels of a taxonomic hierarchy. In Europe, February 3, 2001 is sometimes abbreviated as 03.02.01 and sometimes as 01.02.03 — the former style zooms in, moving from the top to the bottom of the taxonomy, while the latter style zooms out, moving

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<sup>86</sup> Goody, *The domestication of the savage mind*, p. 105.

<sup>87</sup> W.E. Knowles Middleton, *A history of the thermometer and its use in meteorology* (Baltimore: Johns Hopkins Press, 1966).

from bottom to top.<sup>88</sup> (The American style — 2/3/01 — differs, I would argue, in a more complicated way: it creates an internal frame around the two lower levels of the taxonomy (day and month), and zooms in within the internal frame, but zooms out overall.) Another such "zooming convention" involves envelope addressing styles. The zooming-in approach, found classically in Russia or China, is to start with the country, then list the town, street, house number, and name. The zooming-out approach, found classically in Britain, is to start with the name of the person, then list the house number, street, town, province, and country. The information presented is the same, but the order is different.



Image 4.10  
(002)

Digressing away from contrast sets for a moment, consider how many fundamental directional conventions we use in daily life, some of them involving topologies assigned to contrast sets, others polar mappings between domains. Image 4.10 shows how the titles on book spines run top to bottom in Scandinavia and the United States, but bottom to top in Central Europe. Meanwhile, it causes no end of confusion for Western European and especially American travelers in Hungary that Hungarians always put the family name *before* the given name. (A number of Asian countries, including China, regularly use this same name ordering style.) In some cultures one writes from left to right, in others from right to left. Americans flip light switches up to turn them on, New Zealanders flip them down. The humor of a colleague who teases me in Hungarian contexts by calling me "Watson Ian," or the watch with a counterclockwise face that a friend of mine used to wear, all revolve around play with these binary directional standards, reversing conventional polar mappings just like the postcard on sale in New Zealand and Australia which shows a world map where south is up, proclaiming that "we're not down under any more."

<sup>88</sup> For more information, and references to the ISO 8601 date notation standard, see Markus Kuhn, "A summary of the international standard date and time notation," <http://www.cl.cam.ac.uk/~mgk25/iso-time.html> (April 2004).

## Value in order

In another nationalist gesture Pyongyang denounced the English spelling of Korea as a national humiliation imposed on it a century ago by the "Japanese imperialists." The official news agency has prominently reported a call by North Korean scholars to correct the spelling to Corea.

The Japanese colonial government is alleged to have changed the C to K so that the peninsula would not be listed alphabetically before Japan.<sup>89</sup>

Image 4.11 (071)

The development of a conventional topology for a contrast set often leads to the inadvertent conferral of value on some of the set members, where no value judgements may have existed before. Whichever entities within the contrast set have a privileged position in the newly created topology (which often but not always means being or being near an anchor or starting point) come to have intrinsic value.

Once a conventional topology confers value on certain members of a contrast set, people often start to catch on. They choose those members of a contrast set above others in situations where they can benefit from that value, even though those same members of the contrast set have no intrinsic value other than that derived from the conventional topology. Although Americans usually consider alphabetical ordering a relatively impartial organizing tool, consider the many companies named "AA" or "AAA" who know that their name and phone number will appear first in many lists. Or the person I know whose name is on a list of willing substitutes at work, who is happy to have a name beginning with A because it seems to result in getting more calls than others on the list. Or the relatively large number of used booksellers registered at Amazon.com whose names begin with A (the booksellers with a particular title in stock appear in alphabetical order by name). "A Aaaaaaaba Carl's Professional Sewer and Drain Cleaning" of Rochester, N.Y., whose phone book listing is illustrated in Image 4.11, shows the extreme lengths that people will go to to be first in a list

<sup>89</sup> John Gittings and Oliver Burkeman, "Bush plans sanctions in N. Korea stand-off," *The Guardian Weekly* (London), 2-8 January 2003, pp. 1-2.

(spaces actually come before *A* in many collation orders, but a name cannot begin with a space). But if everyone else is doing it — after all, a web site offering advice on how to make your web site more prominent recommends that, if practical, you "choose something as close to the beginning of the alphabet as possible"<sup>90</sup> — it is hard to avoid getting sucked into the game. It is not a very worthwhile game, though, since if everybody changes their name to begin with *A*, people will soon need to choose names beginning with *Aa* to get the same value that they once got from *A* (see section 6.7).

The construction of a topology can thus become a sort of expulsion from the Garden of Eden for a contrast set, because it can monetize previously unimportant differences between its members, changing innocent coexistence into inequality, jealousy, and competition for a "resource" that was never previous thought of as such. Even an order designed value-neutrally will likely come to take on a value gradient. It is easy to feel troubled by the unfairness of ordering, but it seems virtually impossible to create a linear order without conferring value: one cannot create such an order for a contrast set without singling out certain members, and as Nöth comments, "any selection is an implicit evaluation since it implies the rejection of all nonselected items."<sup>91</sup> We can, however, try to even things out by (for example) sometimes proceeding in reverse alphabetical order instead of regular alphabetical order.

The sense of value in certain label sets is so strong that we often assign labels to sets of things in different ways depending upon whether we want to associate a hierarchy of value with them or not. Thus at the school I attended, from seventh grade on students were placed in separate math classes according to ability. The most advanced class was labeled 7A while the less challenging ones were 7B and 7C respectively. However, in dividing the nursery class of 3-year olds there was no tracking or ranking involved, and thus a neutral label system was chosen which did not suggest any ordering (as well as being understandable without knowing the alphabet): the three groups were called Nursery Blue, Nursery Yellow, and Nursery Red.

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<sup>90</sup>Yelena Shapiro, "The importance of alphabetical priority," <http://www.searchengines.com/alphabet.html> (January 2005).

<sup>91</sup>Winfried Nöth, *Handbook of semiotics* (Bloomington: Indiana University Press, 1990), p. x.

In East Asia, one can use both the regular numerals and the sixty compound *gānzhī* (干支) symbols as tools for ordinal labeling. According to Thomas Crump, the *gānzhī* symbols are preferred in cases where value-neutrality is desired, since the ordinal numbers carry strong connotations of value and good or bad luck.<sup>92</sup>

Once a contrast set or domain starts to feel "spoiled" or "dirtied," with different values attached to different parts of it, it becomes very difficult to ever again consider the choice of a member of that contrast set (or instantiation of that domain) as unconscious, uncalculated, and innocent. One starts to wonder whether the choice was made deliberately, or not; with, or without consciousness of the position in the domain that it would confer; innocently, or strategically, with the intent to take advantage of the system. If a new country were founded next year and named "Abzania" (a name which would come first alphabetically in the list of countries of the world), we would naturally ask whether the people living there had called themselves Abzanians since time immemorial, or whether they made up the name so they could be first on lots of lists. Using Erving Goffman's distinction between signs "given" and "given off,"<sup>93</sup> if the Abzanians had been called that for millenia, we could say that this label functions as a sign which is innocently "given off"; if they chose the name deliberately for its value, it functions like a sign which is calculatedly "given" as part of a sort of impression-management or branding strategy.

Archeologist Frederick Wainwright's interesting discussion of placenames as clues given off rather than given,<sup>94</sup> Daniel Boorstin's criticism of "pseudo-events" which are held "primarily for the immediate purpose of being reported,"<sup>95</sup> and the investigative style of consumer magazines reveal that many people feel that only signs that are innocently "given off" can be taken seriously and scientifically — as indicative of some true quality of the things

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<sup>92</sup> Crump, *The anthropology of numbers*, pp. 39-40. On the *gānzhī* system see Colin A. Ronan and Joseph Needham, *The shorter science and civilization in China* (Cambridge: Cambridge University Press, 1978-1994), 2: 184-186.

<sup>93</sup> Erving Goffman, *The presentation of self in everyday life* (Garden City, N.Y.: Doubleday, 1959), p. 2.

<sup>94</sup> Frederick T. Wainwright, *Archaeology and place-names and history: an essay on problems of coordination* (London: Routledge and Kegan Paul, 1962), pp. 45-47.

<sup>95</sup> Daniel J. Boorstin, *The image: a guide to pseudo-events in America* (Revised edition, New York: Atheneum, 1987), pp. 9-12.

that they label — and that signs that are chosen deliberately for the purpose of spin, striking an image, or looking good are diversions and decoys which it is scientists' job to unmask. This helps us understand better why many people regret the conferral of value on a contrast set like the letters of the alphabet. It is a process which encourages people to manipulate appearances for their own benefit, and reduces the value-neutrality of an originally innocent contrast set.

In statistical tables, on signs, and on numbering plans, it would be nice if we could avoid any hurt feelings about listing-order, and bring about a state of affairs where no Koreans would even care whether they were listed before or after the Japanese. But the fact is that a list simply must have a beginning and an end, so that either Finnish or Swedish must be listed first on signs in the Helsinki public transport system, and the main standard language of Yugoslavia had to be called either Serbo-Croatian or Croatia-Serbian if it was to be based on the names of its two main components.

Unfortunately, there is also really no way around the fact that the choice of anchor points and start points in a set tends to privilege both the point of view and the position within the set of the people who are doing the choosing, at the time the choice is made. One cannot fully separate a solution from its solver.<sup>96</sup> Those who select often place some aspect of their personal environment in first place.<sup>97</sup> The makers of a list may put themselves first. People name companies after their spouses and dogs. It is not a coincidence that the United States has the telephone country code 1 whereas Italy has the telephone country code 39, and that the international country code system was designed in a century of American and not Roman dominance in international politics, or that the Internet domain names which express location by default assumption rather than explicit statement (especially .com and .edu) are in America, and that the early Internet was largely an American phenomenon. Nor is it coincidental that the Greenwich meridian was already in use by many countries when it

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<sup>96</sup>This is a paraphrase of a statement by Clark Blaise, *Time lord: Sir Sandford Fleming and the creation of standard time* (New York: Pantheon, 2000), p. 212.

<sup>97</sup>This point is also made by Goldstein, "What's in an order?"

was officially chosen as the prime meridian in the 1880s. Just as one of the norms of stand-in choice involves choosing something well-known to you, one of the norms of starting-point choice in the creation of topologies involves choosing yourself or what you already use.

## 4.6 Efficiency and economy in labeling

Implicit in much of my discussion of labeling so far has been the question "What is the best possible way to design labels for a given contrast set?" There are several ways of interpreting and restating this question. One way focuses on the display qualities of labels, asking whether a given label set (within a distinct display context) is aesthetically pleasing and makes it easy for users to perceive the underlying contrast set. This is the main approach that I have, so far, used in this book (for example, in section 4.3). Another approach is to ask whether a given label set is the most efficient way of encoding a contrast set. A third approach asks whether the labels in the set are easy to remember. These three approaches might be called the *ease of decoding*, the *efficiency of encoding*, and the *memorizability* approaches. This section briefly discusses the second and third approaches.

These sorts of questions are part of a long tradition of scholarship which evaluates the fitness of consciously designed sign systems — which one might call a kind of unapologetically prescriptive "cognitive ergonomics." Scholars of writing systems ask which ones work better, as do the people charged with the development of road signs. In the area of language planning, Einar Haugen cites the Swedish linguist Esaias Tegnér, writing in 1874, who said that the best language is "that which, most easily uttered, is most easily understood."<sup>98</sup> The introduction of postal codes in the 1960s led to a substantial body of research on memorizability (summarized below). The Internet poses new label design challenges and a 2001 article on e-mail address design issues includes a useful, if incomplete review of recent literature.<sup>99</sup>

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<sup>98</sup> Haugen, "Linguistics and language planning," p. 173.

<sup>99</sup> Pei-Luen P. Rau and G. Salvendy, "Ergonomics of electronic mail address systems: related literature review and survey of users," *Ergonomics* 44,4 (2001): 382-401. See also, by the same authors, "Ergonomics guidelines for designing electronic mail addresses," *Ergonomics* 44,4 (2001): 402-424.

The table below invites you to evaluate the encoding efficiency of schemes for labeling the days of the week. It shows the shortest commonly used, unambiguous abbreviations for the days of the week in a selection of European languages. Which language, would you say, is most efficient?

English	M	T	W	Th	F	Sa	Su
Dutch	Ma	Di	Wo	Do	Vr	Za	Zo
German	Mo	Di	Mi	Do	Fr	Sa	So
Swedish	Må	Ti	On	To	Fr	Lö	Sö
Icelandic	Má	Þ	Mi	Fi	Fö	L	S
French	L	Ma	Me	J	V	S	D
Italian	L	Ma	Me	G	V	S	D
Romanian	L	Ma	Mi	J	V	S	D
Czech	Po	Út	St	Čt	Pá	So	Ne
Polish	Po	Wt	Śr	Cz	Pi	So	Ni
Slovene	Po	To	Sr	Če	Pe	So	Ne
Russian	Пн	Вт	Ср	Чт	Пт	Сб	Вс
Lithuanian	Pr	An	Tr	Kt	Pn	Št	Sk
Greek	Δε	Τρ	Τε	Πε	Πα	Σα	Κυ
Hungarian	H	K	Sze	Cs	P	Szo	V
Estonian	E	T	K	N	R	L	P
Finnish	Ma	Ti	Ke	To	Pe	La	Su
Basque	Al	As	Az	Og	Or	Lr	Ig
Turkish	Pzt	Sal	Çar	Per	Cum	Cmt	Paz



Image 4.12 (072)

It is clear that Estonian has the most economical system of abbreviations. Indeed, if we had a chance to choose the names of the days of the week over again, we might try to use Estonian as a model. Certainly it takes the least amount of ink to print calendars in Estonian, the least amount of space to run listings of museum hours in Estonian, and the least amount of stick-on letters to post opening hours in the window of an Estonian shop (as Image 4.12 shows). And there is something attractive about the consistent single-letter length of the Estonian abbreviations. Of course it is just happenstance that in Estonian, and no other European language listed, all seven names for the days of the week begin with a different letter.<sup>100</sup>

<sup>100</sup> The names of the days of the week in Estonian starting with Monday are *esmaspäev*, *teisipäev*, *kolmapäev*, *neljapäev*, *reede*, *laupäev*, and *pühapäev*. The chances of all seven names for the days of the week starting with a different letter in an equally distributed alphabet of 26 letters would be

This example shows how, for any deliberately designed set of labels, one can ask whether the label set, and the mapping rules which encode contrast set members as labels, have been designed with the maximum possible efficiency. Efficiency is defined as the average amount of information necessary to communicate the identity of the contrast set members involved. This question, and the idea of signaling efficiency, rests ultimately on information theory, which provides a way of discussing the amount of energy it takes to communicate the message carried by the variation between any number of instantiations in a domain or members in a contrast set.<sup>101</sup> It bears saying that for information theorists, encoding is (though important) something of a side issue; most of information theory is concerned with how to deal with the problem of noise in the communication channel (for example, by the use of error-correction algorithms). With labels, the sender's and recipient's facility with the code is perhaps more of a reliability problem than the fidelity of the communication channel.

The issue of encoding and signaling efficiency is also part of a much broader tradition in linguistics and semiotics, which relates both to Grice's Maxim of Quantity (the axiom that we should not say that which is unnecessary, see section 2.10) and to Zipf's "principle of least effort." Eleanor Rosch discusses "the almost common-sense notion that, as an organism, what one wishes to gain from one's categories is a great deal of information about the environment while conserving finite resources as much as possible," and calls this the principle of "cognitive economy."<sup>102</sup> Einar Haugen calls it the "criterion of efficiency."<sup>103</sup>

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$\frac{26!}{(26-7)!}$  or 41%, but since the letters of the alphabet are not equally common, the actual chances are  $\frac{26!}{26^7}$  considerably less than that.

<sup>101</sup> For a concise introductory treatment of coding within information theory, see Gareth A. Jones and J. Mary Jones, *Information and coding theory* (London: Springer, 2000), chapter 2 ("Optimal codes," pp. 19-33). The seminal article on information theory was Claude Shannon, "A mathematical theory of communication," *Bell System Technical Journal* 27 (1948): 379-423, 623-656.

<sup>102</sup> Eleanor Rosch, "Principles of categorization," in *Concepts: core readings*, edited by Eric Margolis and Stephen Laurence, pp. 189-206 (Cambridge: MIT Press, 1999), p. 190.

<sup>103</sup> Haugen, "Linguistics and language planning," p. 173.

Harald Weinreich has written a useful survey article on the history of the idea of economy and efficiency in language.<sup>104</sup>

In practice, a maximally efficient label system would be one in which contrast between the different labels in a set is achieved with the minimum label length possible. Thus there would be no point in labeling things 11 and 12 when 1 and 2 would do. Information theorists have found that the most efficient way to encode a set of distinctions depends on the number of members in the source set; the relative frequency of each member (if there is great variation in frequency, one gains efficiency by using shorter labels for more frequently occurring members); the number of members in the label set; and the likelihood that the labels will be misperceived or misremembered, which depends greatly on the discourse context of the labels' use.<sup>105</sup>

There are obvious advantages to a maximally efficient label system. In a computer data structure it requires less space to store labels that are shorter. Designing things that are efficient and concise brings a kind of aesthetic satisfaction. Many people find efficiency a compelling challenge. Certainly any label designer should be aware that some labels are more efficient or less efficient. But it would be going too far to argue that labels should always be designed with the maximum efficiency.

It has partly to do with who is going to be using the labels. If we are designing a computer database which includes information on the day of the week, it would be very sensible and efficient to use the Estonian abbreviations. (It could also be very efficient to use the numbers 1-7 to correspond to the days of the week, as printed airline schedules do; this is particularly convenient for speakers of Chinese, Hebrew and Arabic, in which the name of each day of the week actually contains that day's "number" in the weekly cycle.<sup>106</sup>) But what is most efficient for a computer is not necessarily what is best suited for human beings. And for

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<sup>104</sup> Harald Weinreich, "Economy and ecology in language," in *The ecolinguistics reader: language, ecology, and environment*, edited by Alwin Fill and Peter Mühlhäusler, pp. 91-100 (London: Continuum, 2001).

<sup>105</sup> "Information theory," in *Encyclopædia Britannica*, 15th ed. (1975), Macropædia, 9: 576.

<sup>106</sup> The same is true of the names of some of the days of the week in some European languages. See Zerubavel, *The seven day circle*, p. 123.

general use in society by both people and computers it is not really possible to conclude that efficiency in the days of the week is of real positive value. There are two reasons why. We humans can attend to context and to multiple identity cues even if we lack explicit instructions to do so; thus we do not requiring complete unambiguity in labeling. And because we humans are fallible, we can benefit from redundancy and double marking (which are of no use in a computer database).

The human ability to take account of context explains why, a few years ago, I was able to use a Croatian calendar on which the days of the week were marked as "P U S Č P S N" even though this uses both the letters P and S twice, thus failing to distinguish Monday from Friday and Wednesday from Saturday. I knew that I was looking at a calendar, knew that the week has seven days which were likely to be represented on the calendar in order, knew what country I was in, and (although I do not speak Croatian) had some idea of what the names of the days of the week might be based on my familiarity with related languages. Thus I did not need to have the names unambiguously spelled out in order to interpret the calendar properly. Context resolved the ambiguity of the two "P" and "S" labels.

For human beings, there are in fact advantages to using a label set that conveys more than the minimum necessary distinction, by means of redundancy or double-marking. The advantage of double marking is that if one mark is missed the other can be picked up on. Thus livestock are often earmarked *and* branded to identify their owner, since long hair or dust can obscure a branding and real problems result if it is impossible to discriminate livestock marks.<sup>107</sup> Polish abbreviates the names for Tuesday, Saturday, and Sunday with two letters although only one would technically suffice.

When trying to match the labels they perceive in the environment to those they carry on a mental or physical map, it is easier and makes people feel more secure to have *more* than the minimum necessary number of points to match.<sup>108</sup> Consider for example the naming system for the New York City subway stops such as "34th Street — Penn Station," "59th

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<sup>107</sup> Per Mollerup, *Marks of excellence* (London: Phaidon, 1997), pp. 30-31.

<sup>108</sup> See Marvin Levine, "You-are-here maps: psychological considerations," *Environment and behavior* 14 (1982): 221-237, p. 230.

Street — Columbus Circle," and "65th Street — Lincoln Center." Simply for the purposes of achieving contrast it would be more efficient to use the street number alone. But adding in the name of a landmark makes the subway stop name more meaningful and practical to the system's users, just as the Sydney Casino parking lot designers (see section 4.3) had good intentions when they added color and shape to the purely numerical identity of each level.

Linguists too have long noticed the historical balance of redundancy in grammatical systems such as number, person, or singular/plural marking. There is a tradeoff between the benefits of a concise, efficient marking system and of a redundant marking system that makes it harder to miss the message being conveyed.<sup>109</sup> As Stanley Smith Stevens put it (speaking about acoustic phonetics):

The fact of redundancy increases the reliability of speech communication and makes it resistant to many types of distortion. By limiting the number of discriminations required of the listener [i.e., not making contrast sets too big] and by assisting his choice through the redundant coding of information [i.e., giving multiple clues to the identity of a member], we make talking to one another a reasonably satisfactory business.<sup>110</sup>

It is also good to make the members of a set of labels sufficiently distinct from one another that common errors in reproducing a label do not yield other valid labels in the set. Internet addresses, which do not have any such safeguards, are terribly prone to failure, because while computers have no problem perfectly copying them, humans have difficulty typing them correctly from scratch. And simply typing one letter wrong means that your e-mail might go to a completely different person than you intended with no failure message whatsoever, or that you may not only not reach the web page you are looking for, but be redirected to a completely different page without even realizing it at first. (Crafty folks like the owner of [www.yahoo.com](http://www.yahoo.com) have learned to exploit this for profit.) In working with multi-digit identification numbers, the idea of a "checksum" digit (derived by a formula from the

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<sup>109</sup> On redundancy and double-marking in language, see the discussion of Lüdtke by Rudi Keller, *On language change: the invisible hand in language* (London: Routledge, 1994 [1990]), pp. 108-110, and John Haiman, *Natural syntax: iconicity and erosion* (Cambridge: Cambridge University Press, 1985), pp. 180-195. Also see Wendell R. Garner, *Uncertainty and structure as psychological concepts* (New York: John Wiley & Sons, 1962), chapters 5, 7, and 8.

<sup>110</sup> Stanley Smith Stevens, "A definition of communication," *Journal of the Acoustical Society of America* 22 (1950): 689-690, p. 690.

other digits in the number) is a way of adding in extra security against such human mistakes by ensuring that an error in a single digit will result in an invalid label.<sup>111</sup>

The question of whether labels should be efficient codes also brings back the old design debate about how strictly form should follow function, and to what extent we should allow (technically purposeless) convention and stylization to affect our design choices whether those are in writing systems, graphic design, or architecture. Should we discourage label designers from creating mappings which reflect trivial or unimportant attributes of the members of a contrast set — and if so, how does one judge which attributes are unimportant?

In architecture, some of the most extreme moves in the direction of making form strictly follow function were taken in central Europe in the early twentieth century. Adolf Loos, in his 1908 essay "Ornament and crime," maintained that "The evolution of culture is synonymous with the removal of ornament from objects of daily use."<sup>112</sup> It was only a short while before these ideas filtered into the world of cognitive design. The German typographer Jan Tschichold put forth a set of ten principles including that "the purpose of all typography is communication," that "this communication must appear in the shortest, simplest, most forceful way," that typography should "serve social purposes," and that this "precludes the use of any ornament" which does not directly aid in communication.<sup>113</sup> The Bauhaus design school put these principles into practice:

"At the end of 1925 the Bauhaus decided to abolish capital letters and only to use printed materials satisfying existing DIN norms. The bottom of every piece of Bauhaus writing paper carried the line: 'we only use small characters because it saves time. moreover, why have 2 alphabets when one will do? why write capitals if we cannot speak capitals?'"<sup>114</sup>

<sup>111</sup> For example, see the explanation of the computation of the checksum digit in Icelandic personal identification numbers at "Kennitala — reikningsaðferð," <http://www.hagstofa.is/template38.asp?PageID=808> (October 2003).

<sup>112</sup> Quoted in Paul Greenhalgh, ed., *Art nouveau 1890-1914* (London: V&A, 2000), p. 433.

<sup>113</sup> Jan Tschichold, ed., "Elementare Typographie," *Typographische Mitteilungen, Zeitschrift des Bildungsverbandes der deutschen Buchdrucker*, October 1925 special issue. My translation. This was during Tschichold's most ardent internationalist phase, during which he also briefly changed his first name to Ivan. Later in life Tschichold criticized these ideas as juvenile. See Ruari McLean, *Jan Tschichold: typographer* (London: Lund Humphries, 1975), appendix 8 (pp. 155-158).

<sup>114</sup> Magdalena Droste, *Bauhaus 1919-1933* (Köln: Taschen, 1998), p. 139. On the same period see also Alan Bartram, *Bauhaus, modernism and the illustrated book* (New Haven: Yale University Press, 2004), pp. 48-82; Sebastian Carter, *Twentieth century type designers* (new ed., London: Lund Humphries, 1995), p. 123.

In German, all nouns (not just proper nouns) and the beginnings of sentences are traditionally capitalized, but these radical thinkers felt that the distinctions that capital letters mark are not important, or at least not worth the bother of supporting two separate versions of the same label set. The debate has a long history, which extends beyond Germany, and it is still alive today.<sup>115</sup> Although the capitalization of common nouns has been abolished in Scandinavia (which formerly used the German approach), the entire Roman-script world still continues to use the special capital form for the first letters of sentences and of proper nouns. Yet many of the world's alphabets get by fine without such a distinction — examples include Thai, Hindi, and Georgian. And in one Roman-script environment where the effort of retaining the capital/lower-case distinction rises dramatically — the sending of SMSs, short text messages, on GSM cellphones, which requires that extra buttons be pushed for upper-case — we see people abandoning the effort to use upper-case "properly." Nevertheless, numerous studies have shown that people read Roman-script signage with the customary mixture of upper- and lower-case letters better than signs in all-upper or all-lower case.<sup>116</sup> However, one must ask carefully whether any experimental study involving already socialized adults can tell whether using upper-case is a better strategy because it is naturally superior, or because they are already used to it.<sup>117</sup> (For more on this problem, see the discussion of the appeal to nature in section 6.3.)

Overall, encoding efficiency in the design of a label system is a valid issue and an interesting question to raise. In practical terms, though, efficiency is only sometimes the right goal to keep in mind. Inefficiency, redundancy, and double marking have plenty of value — up to a point. Less is not always more. People are able to cope with a certain amount of unnecessary complexity — such as capitalization or italics — and even, in some cases,

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<sup>115</sup> Several organizations in the German-speaking world agitate for the abolition of capitalization for common nouns in Germany; see, for example, [www.kleinschreiben.de](http://www.kleinschreiben.de) (February 2005).

<sup>116</sup> Mijksenaar, *Visual function*, pp. 20-22, 24.

<sup>117</sup> This point is also made by Johanna Drucker, *The alphabetic labyrinth* (London: Thames & Hudson, 1995), p. 301, and by Susanne Wehde, *Typographische Kultur: eine zeichentheoretische und kulturgeschichtliche Studie zur Typographie und ihrer Entwicklung* (Tübingen: Niemeyer, 2000), pp. 70-77. For further reading on capitalization debates, see also the references given by Herbert Spencer and Linda Reynolds, *Directional signing and labeling in libraries and museums: a review of current theory and practice* (London: Readability of Print Research Unit, Royal College of Art, 1977), p. 29.

enjoy or benefit from it (see further section 6.5). There is, though, surely a limit to the amount of unnecessary complexity and inefficiency that we ought to make ourselves endure. However, even in cases where this limit has been exceeded (as is probably the case with the Chinese and Japanese writing system), the difficulty of changing an entrenched labeling standard may be an almost insurmountable barrier to greater efficiency.

## Memorizability

Another efficiency consideration to consider in the process of designing label systems is whether they are easy to memorize (and reproduce accurately) or not. Experimental psychologists carried out a number of studies in this area in the 1950s and 1960s,<sup>118</sup> a particular spur to such research being the introduction of postal codes by many national postal systems.<sup>119</sup> As a result, much of this research focused on the development of alphanumeric codes of roughly five to ten characters (although the question of memorizability is perfectly appropriate to other types of labels). Six of the key results that designers should keep in mind are:

(1) People remember codes better when they are consistently subdivided into groups of about three or four characters each: 123-4567. Blank space, or a hyphen, or contrasting character type may be used to mark off the groups: A12 B345.<sup>120</sup> Canada's postal code system, which violates this principle by using alternating letters and numbers (such as L3Y 4W9) has been called "Exhibit No. 1 in how *not* to design a code intended for memorizing" and "reliably worse than even randomly assigning letters or numbers"; moreover, its designers should have known better, since it was "introduced well after psychologists had learned how difficult it is for humans to process strings of symbols from alternating categories."<sup>121</sup>

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<sup>118</sup> A useful review of some of this research is C. C. Gallagher, "The human use of numbering systems," *Applied Ergonomics* 5,4 (1974): 219-223.

<sup>119</sup> On the applications of this research for postal code design see R. Conrad, "Designing postal codes for public use," *Ergonomics* 10 (1967): 233-238.

<sup>120</sup> Gallagher, "The human use of numbering systems," pp. 220, 223.

<sup>121</sup> Richard Hébert, "Code overload: doing a number on memory," *American Psychological Society Observer* 14, 7 (September 2001). Available at <http://www.psychologicalscience.org/observer/0901/code.html> (February 2005). Hébert is quoting Alan D. Baddeley in the second instance and Saul Sternberg in the third.

(2) If a code contains mostly numbers and just one letter, such as A12345, people will remember the letter better than the numbers (and vice versa if a code contains mostly letters and just one number). This is called the Von Restorff effect. Designers can use such distinctive characters in particular sections of a code where they want to improve users' chances of accurate recall.<sup>122</sup>

(3) The initial characters in a code are remembered best and the characters towards (but not at) the end worst, so designers may want to put less critical characters just before the end.<sup>123</sup>

(4) Memory for a string of numbers improves when the memory can be based on a principle rather than simply on the brute recollection of all the digits. For example, the sequence 581215192226... is better recalled when thought of as 5+3+4+3+4 ... than as 5 8 1 2 1 5 1 ...<sup>124</sup> This is an effect quite similar to the helpfulness of remembering labels as a mapping principle rather than a set of individual links.

(5) Memory for sequences of letters improves when the labels are "meaningful" or at least can be pronounced, so that CAT is more easily remembered than XQR and QWERTY more easily remembered than RTYEQW.<sup>125</sup>

(6) The recall of strings of letters shows systematic errors whose principal cause is confusion between the conventional names of the letters (ay, bee, see, dee, etc.), not something about the letters themselves (such as their graphic form).<sup>126</sup> Just as one ought not to use a set of labels which are visually easy to confuse, one should also try to avoid labels for which it is easy to confuse the names we use to read them off.

The memorizability of codes has been a mostly dormant area of psychological research since the early 1970s. However, the issue has come back into public and scholarly

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<sup>122</sup> Gallagher, "The human use of numbering systems," p. 220.

<sup>123</sup> Gallagher, "The human use of numbering systems," pp. 220-221.

<sup>124</sup> Alan D. Baddeley, *The psychology of memory* (New York: Basic Books, 1976), pp. 270-274.

<sup>125</sup> Benton J. Underwood and Rudolph W. Schulz, *Meaningfulness and verbal learning* (Chicago: Lippincott, 1960).

<sup>126</sup> R. Conrad, "Acoustic confusions in immediate memory," *British Journal of Psychology* 55 (1964): 75-84; Gallagher, "The human use of numbering systems," p. 222.

consciousness with the recent proliferation of usernames, passwords, and PIN numbers — which users are often instructed to keep secret and unique, to change regularly, and not to write down — thus frustrating our hope that technology would lighten our cognitive loads and allow us, increasingly, to outsource our memory to external devices.<sup>127</sup>

## 4.7 Private labels and private mappings

Many of us, if not directly then through a second-hand report or an article in the media, have come into contact with a person who claims to "have" a color for every letter of the alphabet, every standard musical pitch, or every day of the week. The letter *A* or the pitch *E flat* might "be" red. Now, the common labels for letters, pitches, and days of the week (such as "ay," "E flat," and "Monday") are widely intersubjective, socially shared, and serve as a general means of communication. These colors, by contrast, are *subjective, private* labeling systems which are not shared with the outside world, yet are deeply fixed into peoples' memory and cognitive organization. These "private labels" have received wide attention since the late 1980s,<sup>128</sup> though more often from neurology and neuroscience than from lexical semantics, social science, or the historians of the contrast sets involved. This section briefly reviews the phenomenon, and shows its crucial dependence on contrast sets and its similarities and differences with labeling and mapping in general.

The most commonly reported private label systems tag the letters of the alphabet, the numerals, and the set of socially standardized pitches (or their corresponding key signatures).<sup>129</sup> One also finds private labels for temporal units, geographical categories, and

<sup>127</sup> See Hébert, "Code overload."

<sup>128</sup> This section draws on recent scholarly surveys including Lynn C. Robertson and Noam Sagiv, eds., *Synesthesia: perspectives from cognitive neuroscience* (Oxford: Oxford University Press, 2004); Richard E. Cytowic, *Synesthesia: a union of the senses* (2nd ed., Cambridge: MIT Press, 2002); John Harrison, *Synaesthesia: the strangest thing* (Oxford: Oxford University Press, 2001); John Harrison and Simon Baron-Cohen, eds., *Synaesthesia: classic and contemporary readings* (Oxford: Blackwell, 1996). Two recent popular treatments are Patricia Lynne Duffy, *Blue cats and chartreuse kittens: how synesthetes color their worlds* (New York: Times Books, 2001); Richard E. Cytowic, *The man who tasted shapes: a bizarre medical mystery offers revolutionary insights into emotions, reasoning, and consciousness* (New York: G.P. Putnam's Sons, 1993). There are many websites devoted to private labels, as well as an electronic mailing list, for which see <http://home.comcast.net/~sean.day/Synesthesia.htm> (March 2004).

<sup>129</sup> Sean Day, "Some demographic and socio-cultural aspects of synesthesia," in *Synesthesia: perspectives from cognitive neuroscience*, edited by Lynn C. Robertson and Noam Sagiv, pp. 11-31

units of measurement, but the labels for these entities are usually derived acrophonically from the the element's number or the first letter of its name (so that the label for "January" would be the same as the label for "J" or "1"). It is noteworthy (but often overlooked in the literature) that all these "things that get labeled" are socially conventional contrast sets with relatively few members (say, five to fifty).<sup>130</sup> A confusing factor in the analysis of private labels is the fact that some of these "things that get labeled" are contrast sets that very often take on a labeling role themselves — such as letters and numerals.

By far the most commonly reported type of private labeling for the alphabet and the numerals tags every letter or numeral with an instantiation in the domain of color. It is also not uncommon for people to think of each letter and numeral as either male or female. While color is also the most common tag for standardized pitches, another tool for private pitch labeling is to use the name of a tune which features that pitch prominently (most typically, a tune which starts with that pitch) — such as "that's the first note in the song 'Hotel California.'" <sup>131</sup> Similarly, key signatures may be internally labeled with the name of a piece written in that key.

People with private color labels report that, say, seeing the letter Q, or listening to a middle C (261.6 Hz) — or just thinking about doing so — will more or less automatically bring to mind the color that the letter Q or the note C is tagged with, in somewhat the same way that visualizing a lion or elephant might bring to mind the word "lion" or "elephant," or that those with a firmly planted image of the calendar year might automatically visualize something that happened in the month of March against that image. The color links are lifelong. Private color labels do not force their possessors to focus on the color sensations as

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(Oxford: Oxford University Press, 2004).

<sup>130</sup> This fact was, to my knowledge, first emphasized by Benny Shanon in "Colour associates to semantic linear orders," *Psychological research* 44 (1982): 75-83.

<sup>131</sup> See Daniel J. Levitin, "Absolute pitch: self-reference and human memory," *International journal of computing anticipatory systems*, 4 (1999): 255-266, section 1.2; Daniel J. Levitin, "Memory for musical attributes," in *Music, cognition and computerized sound: an introduction to psychoacoustics*, edited by P. R. Cook, pp. 209-227 (Cambridge: MIT Press, 1999), section 17.9; and Richard Parncutt and Daniel J. Levitin, "Absolute pitch," in *New Grove dictionary of music and musicians*, edited by Stanley Sadie, 1: 37-39 (2nd ed., London: Macmillan, 2001). See also Ian Watson, "Pitch standardization and perfect pitch," unpublished term paper, Department of Sociology, Rutgers University, 2000.

they read or listen to music, but the colors are, so to speak, automatically there if they want to pay attention to them. This automaticity helps distinguish private labels from other subjective types of labeling. For example, in revising this book I devised a subjective label — green pen — to mark material which I had already entered into the computer. I am the only one who understands the meaning of that label, just as I am the only person who knows which bin in my office holds the scrap paper, but "green" is a conscious semiotic construction which means "already entered," not my automatic lifelong response to thinking about the category of "already entered material."

This shows that, despite my use of the term "private labeling," what is going on is slightly different from signification in the Saussurean sense. Tagging letters with a gender is obviously not a way of uniquely identifying them, nor does even a color tag necessarily serve as a unique identifier for the thing that it tags (the same color may tag several different letters of the alphabet). Even when a color tag does uniquely identify the member of a contrast set, the tag does not tend to function like a label but rather as a concurrent sensation whose practical value is more confirmatory than indicative — for example, although seven might be the only number which is yellow for someone with private labels, it would still primarily be the shape of the numeral seven that tells them that they are seeing a seven, with its yellowness serving only as a confirmatory signal. Still, private labels are sufficiently label-like that I prefer the term "private label" to the term "synesthesia."<sup>132</sup> Though it has become the regular way of referring to private labels, the word "synesthesia" has misleading connotations of sensory crossover, and masks the close relation between private labels and contrast sets.

This connection to contrast sets is one of the most important features of private labels. Private labels always tag contrast sets that exist in a stable, recurring, durable, conventional form. They are applied to conventional contrast sets produced by the workshop, not to natural phenomena such as random shapes or features of the landscape.

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<sup>132</sup> Shanon, in "Colour associates to semantic linear orders," also avoids the use of the term "synesthesia."

Only people who have learned to tell the members of a contrast set apart seem to have private labels for them, so that only people with absolute pitch have color tags for pitches, just as color tags for letters apparently occur only among people who know how to read. Although this is, logically speaking, obvious and a tautology, those of us who take pitch or letterform for granted as sets of distinct categories often forget that the distinctions are conventional and it is in fact hard to learn to tell the members of both sets apart. It is thus only society's consistent use of the same focal points in the domain of letters, numbers, the days of the week, and the months of the year that makes these contrast sets stable enough for people to develop private labels for them. Similarly, absolute pitch possession — the ability to recognize, label, and sometimes reproduce the pitch of any given musical tone — depends crucially on the standardization of pitch categories. If one did not hear the same standardized pitch foci over and over, it would not be possible to think of them as a contrast set, much less to come up with a labeling system for them (whether private or shared).<sup>133</sup>

Private labeling systems coexist with socially shared label systems. "C sharp," "277 Hz," "mi," and standard musical notation are examples of socially shared pitch label systems which are widely understood by other people, just as "ay" and "bee," "alpha" and "bravo," ASCII 65 and 66, or Unicode U+0041 and U+0042 are common ways of referring to the graphical shapes that constitute the first two letters of the Roman alphabet. Private labeling systems tag these very same contrast sets, but in ways which no one else will ever share unless their "owner" tells people about them specifically. (Typically, those with private labeling systems reify their subjective experience, imagining that *everyone* uses such a system until they at some point find out that they are the exception rather than the rule.)

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<sup>133</sup> Absolute pitch decomposes into two abilities, which Daniel Levitin calls *pitch memory* and *pitch labeling*, and which could respectively be called "the ability to represent the contrast set of pitch" and "the ability to label its members." Someone with good pitch memory, the first ability, can recognize when two given instantiations in the domain of audible frequency belong to the same socially standardized pitch focus, and may be able to reproduce that pitch focus at will (saying, for example, "Those two songs begin on the same note, and here, I'll hum it for you ..."). Pitch labeling means being able to use some kind of identification strategy to refer to such pitch foci: ("... and it's an A flat.") See Daniel J. Levitin, "In search of the musical mind," *Cerebrum: the Dana forum on brain science* 2,4 (2000): 31-49 for a convenient introduction to absolute pitch; on pitch labeling and pitch memory see also Daniel J. Levitin, "Absolute memory for musical pitch: evidence from the production of learned melodies," *Perception & Psychophysics* 56 (1994): 414-423.

Certain phenomena closely related to private labels need to be analyzed with a slightly broader arsenal of semantic concepts than the strict idea of the contrast set provides — specifically, one that includes domains and polarities rather than just contrast sets, and mapping rather than labeling. In most (though not all) cases of color tags, the set of numbers or letters is labeled not by a restricted contrast set of color such as ROYGBIV, but rather by fairly specific and not necessarily focal instantiations within the continuous domain of color: "bluish-purple-black," for instance, not just "black" or "blue." In these cases, a contrast set is being tagged by instantiations of a domain, not members of a label set. Similarly, there are well-attested reports in the literature on private labels of people who say very convincingly and consistently that each letter of the alphabet has a different "personality" for them.<sup>134</sup> Here, a collection of entities is being labeled not with another contrast set, but rather by a set of points that are the instantiations of some other semantic domain and do not constitute a contrast set.

Another similar private labeling tool involves different positions along a polarity, which contrast only in degree. For example, a friend of mine, a musician, though he does not possess absolute pitch, consistently claims to feel that the flat end of the "circle" of fifths (an ordered array of key signatures) is more "salty" whereas the sharp end is more "sweet."<sup>135</sup> In another, much-publicized case which inspired a book on private labels, the subject had a private labeling system where increases and decreases along the polarity {pointiness : roundness} were used to tag some part of the semantic domain of taste. The investigator

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<sup>134</sup> For example, the following letter to the Synesthesia list from Damian Stewart, 30 October 2003: "I find letters have personalities. Rounded 'a' like an 'o' with a stick is naive, but 'a' with a third bar across the top is smug. 'u' has just made a statement it's particularly proud of (despite its obvious stupidity). 'f' is eager to go somewhere. 't' is cute and female, 'e' is happy ... they all have some personality or other." List archive access via <http://home.comcast.net/~sean.day/Synesthesia.htm> (November 2004).

<sup>135</sup> Queried further, he tells me (personal communication, 1 April 2004) that for him, this does not have to do with the sound of the key signature, but only with its position on his mental image of the contrast set of the circle of fifths (which form a line, not a circle, in this particular way of viewing it). Thus D flat and C sharp, though they are on equal-tempered instruments just different ways of representing the same key and encode exactly the same pitches, are for him at extreme poles of saltiness and sweetness.

came up with a scale of different degrees of pointiness and roundness to be able to chart the subject's private system.<sup>136</sup>

In these two cases, the source, the target, or both source and target are domains or polarities, not contrast sets, and they are more continuous than they are discrete. These private linkages involve labeling less than they do private polar mappings, such as {flat : sharp} = {salty : sweet}. These private mappings are similar to the apparently universal human sensory scale mappings such as {pointiness : roundness} = {high pitch : low pitch} that have been documented in psychophysical experiments.<sup>137</sup> Like any mapping, these private mappings link not only the points in two domains, but also the relational structure of the domains themselves. Such private mappings for continuous domains are less well documented or understood than are private labels for collective domains and contrast sets.

Though private labeling systems do seem to be less common than the private images of domains discussed in section 2.12, they are by no means extraordinarily rare. Some researchers, especially those who discuss private labels in a medically tinged discourse frame, have tended to romanticize, exoticize, and medicalize them, showing amazement that private labels exist,<sup>138</sup> overestimating their rarity,<sup>139</sup> and waxing ecstatic over the idea that they might give insights into the deepest and most spiritual workings of consciousness.<sup>140</sup> One researcher has proclaimed that those with private labels are "cognitive fossils" with overactive limbic systems<sup>141</sup> while others have theorized that the phenomenon is due to

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<sup>136</sup> This is the case that inspired Cytowic's title *The man who tasted shapes*; further details are given in Cytowic, *Synesthesia*.

<sup>137</sup> See Lawrence E. Marks, *The unity of the senses: interrelations among the modalities* (New York: Academic Press, 1978).

<sup>138</sup> On medical doctors' amazement that subjective labels are common among "normals," see the anecdote related by Gladys A. Reichard, Roman Jakobson, and Elizabeth Werth in "Language and synesthesia," *Word* 5 (1949): 224-233, p. 224.

<sup>139</sup> See, for example, how private labels are called a ten-in-a-million and one-in-25,000 phenomenon in Cytowic, *The man who tasted shapes*, p. 6, and Cytowic, "Synaesthesia: phenomenology and neuropsychology — a review of current knowledge," in *Synaesthesia: classic and contemporary readings*, edited by John Harrison and Simon Baron-Cohen, pp. 17-39 (Oxford: Blackwell, 1996), p. 17. Then compare the much higher prevalence figures, based on more objective research, cited by Shanon, "Colour associates to semantic linear orders," and now also suggested by more recent research.

<sup>140</sup> See, for example, Cytowic, *The man who tasted shapes*, p. 7; the subtitle of this same book speaks of "a bizarre medical mystery [which] offers revolutionary insights into emotions, reasoning, and consciousness."

<sup>141</sup> Cytowic, *Synesthesia*, and Cytowic, *The man who tasted shapes*.

insufficient neuronal pruning during brain development.<sup>142</sup> I am skeptical of such claims, and would point out that Kevin Dann demonstrates at length that, especially among investigators who do not have personal experience of private labels, there has long been a tendency to hijack the study of the phenomenon to advance other scientific, intellectual, or spiritual interests.<sup>143</sup> That said, many of those researching private labels in the last fifteen years have worked diligently to document the phenomenology of the topic in a systematic and objective way, and to confirm introspective reports by means of cerebral blood flow measurements.

Still, the medical discourse frame for private labels has made unnecessarily deep inroads into public consciousness through articles in the popular media. It is visible in many postings to the online synesthesia mailing list. Private labels are discussed as a "condition" and one often sees people asking whether it might be comorbid with other "conditions" such as depression or anxiety. This discourse frame reifies social conventions such as the alphabet and the musical scale, conveys the misleading sense that private labels are a consequence of fundamental, hard-wired, inborn, strictly nature-driven peculiarities of sensory perception, and hides private labels' dependence on the workshop's role in creating standardized contrast sets and socializing children to them. Even in scholarly discussions of private labels, few recent authors have paid attention to the actual nature of the contrast sets and domains involved in private labels, and few have any training in the linguistics, sociology, or history of these sets as conventions. My view is that private labels, and private images of domains, are quite an unsurprising consequence of the encounter between our everyday cognitive abilities (including the attaching of signifiers to signifieds, the construction of mental maps and images, and the mapping of contrast sets and domains onto one another) and the contrast sets that we are conventionally required to master. One can think of building a private label system as a very natural and even mundane step that, by amplifying the distinctiveness of contrast set members with a colorful tag or some other attribute, conceivably aids in learning

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<sup>142</sup> Simon Baron-Cohen, John Harrison, Laura H. Goldstein, and Maria Wyke, "Coloured speech perception: Is synaesthesia what happens when modularity breaks down?" *Perception* 22 (1993):419-426, p. 425.

<sup>143</sup> Kevin T. Dann, *Bright colors falsely seen: synaesthesia and the search for transcendental knowledge* (New Haven: Yale University Press, 1998).

and manipulating socially conventional contrast sets. Such a view can still coexist comfortably with the belief that the scholarly rediscovery of private labels opens up exciting new methods for neuroscientists to research the physiological basis of cognition and perception.

## 4.8 The case of the revolving restaurant



Image 4.13 (048)

This section concludes the chapter with a case study which brings together several of the themes of the last three chapters. The case involves a real-life physical environment with a particularly unusual topology for which a contrast set, a set of labels, an anchor point, and a directional mapping for the labels were created.

The case is the design of the seating area of the revolving restaurant in Sky Tower, Auckland, New Zealand, and my discussion is based on my own lunch in the restaurant in August 2001. Since I was never actually able to speak to the interior designer of the restaurant, my account of the design process is unfortunately hypothetical, and does not attempt to be an accurate record of the actual thought processes of the system's creators. But regardless of whether it is historically accurate in all its details, my account does illustrate the cognitive design challenges which the restaurant's designers must have faced.

The design goal for the restaurant was the definition of a spatial contrast set within the seating area, with the twofold aim of helping the staff productively refer to particular locations within the seating area ("here's the order for table X") and of helping customers to find their way back from the bathroom more easily. As in other revolving restaurants, the kitchen and prep areas, as well as the entrance bathrooms, are in the stationary inner "core" of the building, while the seating area is a ring-shaped platform which revolves around this core. The restaurant makes roughly one full turn every hour. Since it is not possible to take in the entire seating area at one glance (part of it is always obstructed by the building core), and bothersome to have to walk the entire circumference of the seating area in a trial-and-error

search for a particular table, some kind of contrast set and label system had the potential to make navigating within the restaurant much easier both for staff and for guests.

The first necessary choice was of a contrast set to partition the circular space of the restaurant seating area. This, in turn, required the creation or identification of a set of entities within the seating area. One could, of course, create sections within the seating area entirely artificially, by marking lines on the floor and considering the space between each line a section of the restaurant. It is, however, normal to want to seize on some natural feature of the seating area — something from outside the workshop — as an inspiration for one's choice of partition. A peculiarity of revolving restaurants is that since the seating area revolves with reference not only to the restaurant core but also to the outside world, it is very difficult to base a partition on absolute reference points. You can never say that you are in the north section of the seating area because fifteen minutes later it will be in the east. (You could only devise a reference method based on compass directions if you were able to count on all concerned being able to taking into account the time of the reference, the current time, and the speed of revolution — a difficult task in which everyone would have to spend all day keeping track of which part of the seating area was to the north at, say, 8:00 this morning.) For the same reason, plus the fact that circles do not have different "sides," it is also impossible to use relative direction partitioning strategies in a revolving restaurant; even if you could call part of the seating area the "starboard" side, it would be the port side a half-hour later.

Is there, then, no featuredness in the structure of a revolving restaurant seating area that suggests where the partitions within it could be laid down? Is the effect similar to that of trying to "decide" where is the "best" place to write the address on a totally blank mailing tube? In fact, no. There were two features in the Sky Tower seating area that suggested themselves as the basis for the creation of a contrast set and a labeling system: the set of tables, and the set of short stairways between the restaurant core and the seating area. Of course, neither the stairways nor the tables existed prior to the building of the tower; both features were designed by people. But the stairways and tables were not created as part of the

partitioning process, like section lines drawn on the floor of the seating area would have been.

The tables in the restaurant constitute a contrast set which, in some ways, makes a good candidate for a navigational labeling system. There are a finite number of them — say, fifty — and they clearly form a set of entities. So one solution to the problem would be to consider each table as a member of a contrast set, to label it somehow, and to encourage staff and customers to learn the table numbers. After all, restaurants typically do label tables, although usually only staff know each table's number. But since it is customers here who need the most help, this solution would saddle the designer with the extra problem of deciding how to display the numbers tastefully. And it would repeatedly force on staff, and even worse, on customers, the task of finding by number one of fifty different tables which are moving around all the time (imagine having to peer at the number of many occupied tables in the restaurant in order to find yours). This would be particularly difficult for customers, who are not used to knowing their table number at a restaurant, who probably do not like being made to feel like "just numbers" when they are paying for a nice restaurant meal, and for whom an actual table number is an unnecessarily precise label for the goal of finding their way back from the bathroom (a label designating an area of several tables would be enough).

Given these problems, it seemed that at least for customers, defining a somewhat smaller number of areas or sections within the seating area — consisting of eight or ten tables each — would set up a level of precision sufficiently fine to help with navigation back from the bathroom and sufficiently coarse not to seem pedantic. Such sections could be created artificially with partitions, but this turned out not to be necessary. A set of six stairways (physically part of the revolving section) leads down a few steps from the slightly higher restaurant core to the slightly lower revolving seating area. The stairways are evenly spaced around the 360 degree circumference of the seating area. The six focal points suggested by these six stairways were ultimately the seed of featuredness that inspired the partition of the seating area into six sections defined around those focal points.

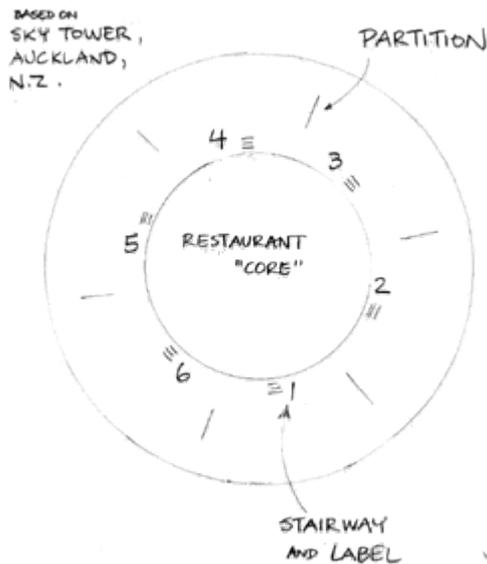


Image 4.14 (009)

After accepting the stairways as focal points, the next problem was to label them or otherwise confer identity on them. There are several ways of conferring identity. One could, for example, define a particular theme (tropical, desert, forest, etc.) or decorate in a particular color (red chairs and upholstery, blue chairs and upholstery, etc.) for all of the tables surrounding each of the six different stairways. The strategy chosen, however, was to label the actual stairways

themselves. This could have been done with colors (red, blue, etc.) or letters (A through F), or native birds (kiwi, kea, etc.), or the names of famous New Zealanders, but the solution actually chosen was to use the numbers 1 through 6. A large number (1 through 6) is posted up on the banister of each stairway, as illustrated in Image 4.13, which shows stairway 5. On your way to the bathroom, if you take note of the number of the stairway you walked up, it is possible to then find your table again using it, as long as you remember the (thankfully fixed) spatial relationship between your table and the stairway. The number signs are very large and prominent, so that customers can get a clear sense of the identity of where they are sitting by taking in the information passively and unconsciously, since they may not realize until the moment of disorientation when they come out of the bathroom that this is a piece of information they need to know.

The six stairways were for all practical purposes identical before they were labeled, so this is a case in which the labeling of a contrast set is what made the contrast set members truly different from one another — the labels made the contrast set not just a set but a contrasting set. The waitstaff, of course, if they need to refer to specific tables, may simultaneously use a table numbering system, which could well be coordinated with the stairway numbering system.

A final problem arises in the decision about how the labels 1 through 6 should be assigned to the six stairways. Surely they should be assigned in sequential order, so that stairway 1 is in between stairways 6 and 2, stairway 2 is in between stairways 1 and 3, and so on around. This strategy, using a mapping principle rather than random labeling, means that customers who know or guess the principle and who see that they are by stairway 2, can know that stairway 3 will be just next to it, and that stairway 4 will be further in the same direction. Customers and staff who happen to know that there are six stairways and who can grasp the way that linear and circular topologies map onto each other can also figure out that stairway 6 is next to stairway 1 (just like knowing that king-ace-2 is a valid straight under some gin rummy rules). Indeed, because the restaurant constantly moves relative to all its environmental reference points, the internal orientation provided by this mapping of relational structure between the set of stairways and the set stairway numbers is the *only* navigational aid available to customers looking for a specific table by its stairway number.

But in addition to settling on this topology, the designer had to solve the problem of where to begin, and which direction to proceed, in assigning labels to each stairway. There were six different possible solutions to the question of which stairway to make the anchor or starting point (the stairway that would be numbered 1), and then there were two possible solutions to the problem of how to assign the remaining numbers (one can proceed either in clockwise or counterclockwise fashion).

While going through all this detail may feel tedious, Sky Tower is a fine example of how the creation of contrast sets in a domain is a practical, everyday life task and also of how the abstract properties of domains and contrast sets are actually important and relevant to us. As we go about designing seating areas, sorting books or CDs, dividing the gym class students into two teams, separating East from West Germany or creating alphabets or pitch standards, we too rarely step back to consider our decisions as examples of a social form.

## 5 Standardization

I had a professor in college who had put a great deal of thought into his grading system. When he passed out an assignment, he also passed out a sheet showing how he would assign grades. He always used a numerical scale — 1 to 5, 1 to 10, 1 to 20. For each number he wrote a prose description of the corresponding level of quality. Eight out of ten might mean "a well argued paper showing a good command of the literature but with certain flaws and omissions." While I was not used to such careful measurement design, I sympathized with the problem he was trying to solve. After all, what kind of common understanding exists between the professor, the student, the university, and the outside world about the meaning of a grade? Very often, virtually none. My professor had tried to introduce a little more certainty into the process. He wanted to make it very clear that if you got an "8" it meant something fairly definite and precise about the quality of your work.

The preceding sections of this book showed how we create contrast sets, label them, and order them. To create a set is a fine thing. But to get lots of people to use it in their daily life is a harder problem. Contrast sets are not only semantic and onomastic, but also explicitly social. This section discusses contrast sets as *norms*, *conventions*, *standards*, and *coordinated procedures* which are shared throughout an entire community of people.

My professor's grading standard did not extend beyond the limited realm of the classes he taught. When he submitted his grades to the registrar at the end of the semester, they had to be in the standard American format of A, A-, B+, and so on down to F. Since these grading labels form an ordered series, within one teacher's gradebook we can be pretty sure that an A- represents better work than a B+. But it is not very clear exactly which part of the domain of student performance an A- or a B+ refers to. Americans have not generally coordinated and standardized the relationship between grade labels and performance.

There are many contrast sets in society where such coordination *needs* to be repeated, anticipated, and indeed institutionalized in peoples' minds and deeds and expectations, and

often we are able to (and need to) do a better job of it than in the world of American grading standards. It is inspiring to think that if you organize a list in alphabetical order, that really will make it easier for other people to find things on it, because they know the alphabetical order too; that musical manuscripts written by Mozart more than two hundred years ago can be understood today; that if you suggest to me on the telephone that we meet today at two-thirty, I will show up just about at the point when your watch does read half past two; that if a recipe tells me I should stop boiling the sugar at the soft-ball stage, I can follow these directions and make a successful batch of candy that replicates the recipe-writer's result; that the telephone book says the phone code for Latvia is 371, and if you dial 371, you really do get Latvia; and, last but not least, the fact that you are able to interpret the marks on paper that you see as indicative of something I am thinking and saying.

There are also plenty of things that have little or nothing to do with contrast sets that function in the same sort of coordinated way. It is also inspiring to consider that the music I can purchase at the store (whether vinyl records, tapes, or CDs) will play on my stereo back home; that the software that runs on my computer will also run on yours; that, at the store, I can buy an Allen wrench that will fit my bicycle handlebar screw perfectly; that if I speak French in France, it is likely that I will be understood;<sup>1</sup> and that if I live anywhere in Canada and turn out of my driveway onto the right side of the road, I can be fairly confident that no one will be approaching head-on in the same lane.

These are the standard operating procedures of society, which allow people to predict what others will do, and to act in a complementary way. One can use many terms to describe these procedures, including *standard*, *convention*, *norm*, *coordination*, and *equilibrium*. These terms are overlapping, and, often, substitutable. They refer to the same family of things, but with slightly different emphasis and connotations. *Convention* carries the sense

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<sup>1</sup> For the argument that speaking one language and not another is a convention comparable to the others mentioned here, see David Lewis, *Convention: a philosophical study* (Cambridge: Harvard University Press, 1969), pp. 49-51; Edna Ullmann-Margalit, *The emergence of norms* (Oxford: Clarendon Press, 1977), p. 75; Thomas Schelling, *Micromotives and macrobehavior* (New York: Norton, 1978), p. 39; Rudi Keller, *On language change: the invisible hand in language* (London: Routledge, 1994 [1990]), pp. 129-132.

that a standard could have been chosen differently; *norm* carries the sense that not following the convention is deviant; *coordination* carries the sense that a norm is tacitly, intersubjectively shared by many independently acting people in society; *equilibrium* is a game-theory term referring to a coordination strategy which nobody has any incentive to abandon; and *standard* carries the sense of an equilibrium which an entire society has agreed on and formally committed to. Jon Elster has put together a detailed taxonomy of social norms which is more carefully subcategorized.<sup>2</sup>

This chapter and the following two explore how contrast sets become norms and standards, social facts and social institutions. Anyone telling the social history of an individual contrast set can make their tale richer by showing how the story of its emergence as a norm is an instance of a widespread social pattern. In order to understand this larger pattern, these chapters lay out some of the theory of standardization as a general phenomenon, which involves much more than contrast sets. (In the same way, chapters 2-4 discussed contrast sets against the background of general theories of categorization and labeling.)

This chapter lays out the basic concepts of standardization with specific reference to contrast sets. Most of these concepts have appeared in previous literature, which I reference. In chapter 6 I discuss the types of beliefs that tend to arise around contrast sets, concerning their origin, justification, and changeability. In that chapter I have also tried to make more of an original analytical contribution, but also relate my discussion to existing literature. Chapter 7 is a brief overview of both childhood and adult socialization to contrast sets.

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<sup>2</sup> Jon Elster, *The cement of society: a study of social order* (Cambridge: Cambridge University Press, 1989), pp. 12-13. Elster uses the term "convention equilibrium" for a subcategory of norms that corresponds closely to that which I have under analysis here.

## 5.1 Basic concepts of contrast set standardization

### Task, problem, and solution

In the story of any standard one can usually find three elements. I call them the *task*, the *problem*, and the *solution*.<sup>3</sup> The *task* is usually a technology (in a broad sense of the term which includes writing systems, calendars, indexes and measurement), which we want to use. The *problem* is an issue that needs to be resolved in carrying out the task, and which everyone who participates needs to resolve in a coordinated way. A *solution* is a particular way of resolving the problem. For example, if the task is the production and use of the typewriter, one problem is the design of the keyboard, and the Dvorak and QWERTY layouts are two potential solutions to the problem. If the task is the design of a grading system, how fine-grained to make the divisions is one problem, and how to label them is another.

Making the distinction between task, problem and solution helps us discuss standardization more precisely and accurately. The word "standard" is often ambiguous between "problem" and "solution" readings, such as if we say that "the rule of the road is an example of a standard." We may mean the entire issue of which side of the road to drive on (the coordination problem): "I'm very interested in the worldwide history of the rule of the road." Or we may mean a *particular* rule of the road (one solution to the coordination problem): "The rule of the road in Ireland is keep-left."

To solve a coordination problem, you must *choose* a solution, even in those cases where none stands out as best. Then, in order for the solution to a problem to become accepted as a social norm, it must be not only chosen but popularized, so that it is re-chosen, or re-enacted, or at least accepted, by many people at different times and in different places. Plenty of standards ideas pass the first step but not the second, such as the dollar coin, the

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<sup>3</sup>The use of the terms "problem" and "solution" dates back at least as far as Thomas Schelling, *The strategy of conflict* (Cambridge: Harvard University Press, 1960), p. 57. They have also been used by Ullmann-Margalit in *The emergence of norms*, p. 76, and by Susanne Schmidt and Raymund Werle in *Coordinating technology* (Cambridge: MIT Press, 1998). David Lewis in *Convention* uses "coordination problem" but prefers "equilibrium" to "solution"; in game-theory language, a coordination solution is an equilibrium strategy.

metric system, and Benjamin Franklin's revised spelling system (to take three American examples). A parent measuring their child's height on the pantry door with a yardstick, a foundry creating rail-car bogies to the Russian track gauge, or a student using the Roman alphabet to write an English composition are all re-enacting and perpetuating a particular standards solution, even though other solutions are available to them. The person who puts the new dollar coin in a jar and not in their coin purse is deliberately refusing to re-enact.

This coordination and re-enactment is largely *tacit*, meaning that it is usually assumed and expected rather than discussed and planned, and it happens at a distance. We coordinate our decisions, at one time and place, with other peoples' decisions at what may be a totally different time and place. For example, to wire a house with American standard electrical plugs later constrains a house's owner to buy appliances which fit those plugs. To use alphabetical order or musical staff notation presumes the existence of as yet unspecified people who will know that order or understand such notation. The decision by a paper mill to cut paper to an A4 size, that by a copy machine maker to design the machine for A4 size paper, that by a consumer to buy an A4 size inbox tray, and that by a retailer to sell the A4 paper and the A4 copy machine are all dependent on each other in a ritual of social coordination across time and space. "Across time and space" is the key. Standards solutions are not negotiated during face-to-face interaction. That is why they must be more precise and specific than other conventions which can be renegotiated during the act of coordination itself, such as greeting customs like a handshake or a kiss.

## Conventionality and wiggle room

Standards solutions could always have been otherwise. We could have picked or chosen a different one. Standards solutions are *conventional*. That means that they are not entirely determined by nature. They may be partly constrained by nature (obviously, we choose standard paper sizes that are not too small for us to write on or too large to store comfortably), but nature often leaves society some wiggle room within which societies make a purely conventional choice: between Roman versus Cyrillic, or five-tone versus seven-tone

scales, or the A4 and 8½-by-11 paper-size foci. With the design of alphabets, certain primitives of form, such as lines, circles, crosses, and right angles, must obviously be taken into account in any explanation of why written languages have the forms that they do. But beyond that, the distinctions that we make between letterforms are only a subset of the vast number of potentially salient ones available to us. Which distinctions we consider important is a conventional matter which varies from culture to culture.

Just as nature only partially constrains social convention, convention only partially constrains individuals. Even a well-established norm or standards solution may leave individual re-enactors of the solution a certain degree of tolerance. Just as we may let our feet or elbows intrude just slightly into the space of the airline passenger next to us, people are granted a limited amount of leeway to sign their name just a little bit differently than on the bank's signature card, to be less than *exactly* on pitch, or to park a little bit towards the left edge of the parking space.

## Game theory notation

The terminology and notation of game theory sometimes helps clarify how standardization works.<sup>4</sup> Most standardized contrast sets are pure coordination norms where all the "players" in the "game" have an incentive to coordinate their behavior and no one has an incentive to "defect." The "payoff matrix" is a notation commonly used by game theorists which adopts the convention of numerically quantifying the benefit to each player of different combinations of behavior. The matrix shown below is an idealized one which shows a pure coordination problem in which the two players (X and Y) benefit equally regardless of which solution to the problem is chosen (a or b), as long as both agree on their choice.

		<b>Player Y</b>	
		a	b
<b>Player X</b>	a	10	0
	b	0	10

<sup>4</sup>The pioneer in applying game theory concepts to social coordination was Thomas Schelling in *The strategy of conflict*. See also Lewis, *Convention*, and Ullmann-Margalit, *The emergence of norms*.

There also exist contrast sets whose use is more similar to the so-called prisoner's dilemma, where players *do* have an incentive to defect from the norm. These include musical pitch, student grading, and clothing-size labeling (see further section 6.7).

## Corpus and status standardization

One can speak of "the standardization of a contrast set," but it is good to distinguish between what, exactly, about a contrast set gets standardized. On the one hand, we can speak of the standardization of the individual elements of a contrast set. This includes the choice to make a norm out of the way the set members partition a domain (i.e., the choice of boundaries or focal points); the set's level of taxonomic precision; the type of labels applied to it; the way those labels relate to the set members; and the ordering and layout of the set members or their labels. For example, it is a fact of the internal makeup of the Roman alphabet that one extra mark is enough to distinguish an *O* from a *Q*, whereas adding a cross on a lower-case *z* or forgetting the dot on an *i* does not catapult you into a new contrast set member (except in Polish and Turkish respectively).

On the other hand, we can speak of standardization as society's choice to make a norm out of the solution as a whole. The solution here may be an ensemble or package of many smaller choices. We choose one solution above other potential contenders. Thus Romanians today have chosen to use the Roman instead of the Cyrillic alphabet.

The difference is that between standardizing the design of the solution, and institutionalizing the solution as a response to the problem. To take another example, consider the difference between the internal *design choices* made in developing the Celsius or Fahrenheit scale (unit size, zero point, and positive-negative mapping), and the *institutional choice* of whether to settle on Celsius or Fahrenheit as a social norm. The latter choice confers normative status on all of the former choices that come "inside the package."

Looking at the same distinction from the point of view of the history of a single coordination solution, the set design process can focus either on the internal makeup of the

solution, or on its promotion and marketing.<sup>5</sup> Designers may need to pay as much attention to turning contrast sets into norms, as to making the contrast sets themselves. This means planning the social status of the set, not just its composition. Language planners know that they must figure out not only which words to use ("corpus planning"), but how to get people to use them ("status planning").<sup>6</sup> The best-designed alphabet, measuring scale, pitch standard, or national border is almost useless without general agreement on it. Success comes easier for the contrast set designer who grasps how cognitive conventions succeed (or not) at becoming institutionalized norms.

Designing a coordination solution or choosing one solution over another can be a relatively stylistic decision, a matter of taste and fashion, but if the solution is to be broadly adopted such choices acquire considerable gravity. For example, the people who decide what colors or numbers to use for public transport routes may feel they are primarily making a stylistic choice. But since such design choices in public transport affect the way people conceptualize a city, designers really have an awesome degree of power over the mundane mental life of thousands, perhaps millions of people. Once everybody starts thinking in the same way and expects everybody else to too, the trend has been set, the fashion dictated, and there may be no going back.

## Choice and coordination

A common thread in both the design and the successful coordination of a standards solution is the process of selection, choice, and decision making. In designing a solution, one chooses between different ways of creating and labeling a contrast set. In selecting a standards solution as a norm, one chooses between different solutions. Thus Celsius chose 1/100 (not, say, 1/180) of the difference between the freezing and boiling points of water as

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<sup>5</sup> On the parallel theme of "language planning as marketing," see Robert L. Cooper, *Language planning and social change* (Cambridge: Cambridge University Press, 1989), pp. 72-79.

<sup>6</sup> On the distinction between "corpus planning" and "status planning," originally introduced by Heinz Kloss, see Cooper, *Language planning and social change*, pp. 31-33, and chapters 5-6; Robert B. Kaplan and Richard B Baldauf, Jr., *Language planning from practice to theory* (Clevedon: Multilingual Matters, 1997), pp. 28-49.

the size of the unit of his temperature scale. Meanwhile, societies as a whole choose between Celsius, Fahrenheit, and other temperature scales as social institutions.

However, choice and selection are not uniquely associated with coordinative standardization. Societies, designers, and planners make many choices and selections between different possible courses of collective action which differ from my concept of "standards" in their lack of a coordinative requirement. For example, choosing where to locate a new train line or expressway, the form of a new building, what color shirt to wear today, which typeface or map projection to use,<sup>7</sup> or what to name your child are design choices and matters of taste,<sup>8</sup> not coordination problems. I admit that the distinction is a bit fuzzy. Thus clothing choices and fashion trends do involve the social coordination of behavior and aesthetic judgement, but the coordination is not essential to the task of clothing oneself. A construction project involves coordinated action, but it is not tacit. Once chosen, a child's name later does become the solution to a problem of coordinated reference; but before the choice is made, society is not relying on its expectations of whether parents choose to name a girl Ashley and not Brittany in the same way as they are relying on their expectations that the parents will drive home from the hospital on the right and not the wrong side of the road. Fashion and design choices lack the reciprocal interlock, the intolerance of deviance, and the sense that social harmony depends on many peoples' simultaneous, individual, and tacit decisions to do the same thing, that I am concerned with in this section. They are, of course, fascinating in their own right, and they do have many things in common with coordinative standards.

With some other choices and selections, coordination is central to accomplishing a shared task, but only momentarily so. Thus if you and I meet walking down a hall we may have trouble figuring out whether to pass each other on the left or the right. We both must

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<sup>7</sup> On map projections, see John P. Snyder, *Flattening the earth: two thousand years of map projections* (Chicago: University of Chicago Press, 1993).

<sup>8</sup> A good entry point to the study of taste and fashion is Stanley Lieberson, *A matter of taste: how names, fashions, and culture change* (New Haven: Yale University Press, 2000), especially chapters 1, 9, and the prologue. See also Pierre Bourdieu, *Distinction: a social critique of the judgement of taste* (London: Routledge, 1984 [1979]) and Jukka Gronow, *The sociology of taste* (London: Routledge, 1997).

agree on one way or another, but we are then free to forget what we chose. We set no norm. We might pass on the left today and the right tomorrow. Other choices involve long-term coordination but have nothing to do with contrast sets as I define them, such as the choice of which electrical plug shape to standardize, or the decisions made in the process of language planning.<sup>9</sup>

## Emergent and planned standards solutions

The power of the designer and the workshop over the social status of a contrast sets varies, just like the power of the designer over the partition of a domain. Sometimes we can plan coordination solutions and sometimes we cannot. Indeed there is a continuum of plannability between coordination problems whose resolution is the hands of the workshop and in the hands of forces beyond deliberate control.<sup>10</sup>

Solutions to problems which are less plannable tend to emerge out of the crowd-behavior of society, by means of an "invisible hand" composed of the sum total of many individual coordinative actions. They sometimes happen without anyone really noticing, and certainly without anyone sitting down and deciding on them. By imperceptible stages, an entire society might come to use the same type of computer operating system, proofreading marks, or vacuum cleaner bag even though twenty years before there were a dozen competing systems. There may be leaders, early adopters, or "influentials" in the spread of such standards, but most are actors acting in their own interests and influencing society unintentionally, rather than actors deliberately attempting to influence an entire society. The typewriter keyboard is alleged to have developed in this way. Most (though not all) ice cream stores sell much the same range of flavors. The lexicon works in this way more often than not: nobody decreed that Americans should ultimately prefer to say "dot" instead of "point" in reading off Internet addresses, nor did a committee sit down to oversee the process of tacit coordination between your expectations and the kitchen's that happens when you order

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<sup>9</sup>On language planning as choice and decision-making see Cooper, *Language planning and social change*, pp. 87-97; Haugen, "Linguistics and language planning," pp. 162-163.

<sup>10</sup>For another statement of this, see Young, *Individual strategy and social structure*, pp. 145-146.

"eggs over easy" at a restaurant.<sup>11</sup> Similarly, when Sweden became the last country in continental Europe to change from keep-left to keep-right driving in 1967, it was because the change was in Sweden's interest, not that of some supranational driving-customs planner.<sup>12</sup> While some might say that the term "invisible hand" is just a way to whitewash attempts by those with a financial interest in the institutionalization of one solution to influence individual choices, there are many cases where such interests simply do not and cannot wield much power. There was no "author" of the keep-right, eggs-over-easy, or dot (not point) standards. This does not mean that the solution is natural and that the problem could not have been solved any other way. The solution is still conventional, but was arrived at through an organic, emergent, self-selecting process.

But many coordination solutions are plannable — many contrast sets in particular. Some (like character set standards or the streetnames in a new development) *need* to be planned, in order to get synchronization and coordination to work. In other cases, we decide to take deliberate control of a contrast set that has so far developed more organically. We sit down and decide that now we are going to do things "this way": we assemble together all the vacuum cleaner manufacturers and agree on one system of bags, we decide how to rename street and place names after a revolution, we revise the writing system for a language, we devise a new measurement system, or, as in Soviet Russia, we try to change the number of days in the week from seven to five.

Along this continuum of plannability, contrast set and label set design is located more towards the plannable end, and language planning more towards the uncontrollable end (particularly when it tries to affect spoken norms). The workshop has little influence over the grammar and lexicon of spoken language, whose norms are an emergent product of group dynamics and crowd behavior, perpetuated and perturbed through constant reenactment by vast numbers of mostly anonymous users. Even in the realm of personal and geographic

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<sup>11</sup> For a detailed statement of this view see Rudi Keller, *On language change: the invisible hand in language* (London: Routledge, 1994), pp. 61-67.

<sup>12</sup> Of course, within the context of Swedish society, the change from keep-left to keep-right was planned and not emergent. But the generalization of the keep-right rule across Europe was emergent, not planned.

names it is difficult to steer new spoken usage or revise entrenched custom. It is possible to try to popularize a new word or two or to change a name, but one almost never has the opportunity to design or redesign whole chunks of the set of words or names at a time. It is somewhat easier, although still difficult, for a "language designer" to influence the norms and conventions of putting words onto paper, and hence the written form of words is more often a target of language planning than the spoken form.<sup>13</sup>

These challenges notwithstanding, throughout history people have dreamed of the ability to take control over the forms of spoken language, either through the process of remaking or sometimes "purifying" existing lexicons, or of constructing entirely new languages like Volapük or Esperanto.<sup>14</sup> Many people have committed years of their lives to both of these types of effort. Strictly limited, small-scale lexical planning within an existing language has often succeeded. But no artificial language has managed to win over the whole world. The fact is that planning language requires not only devising a new standard lexicon, but convincing thousands of people to willingly and repeatedly re-enact it — something that can take place only under very unusual circumstances.

Contrast sets and labels are more plannable than language. They do not usually evolve as spontaneously. Quite often they really are, or at least once were, under the direct control of particular people or institutions, and the design decisions that those people make really affect how other people think. (The fact that labels have a stronger existence as written than as spoken symbols is consistent with the fact that they are consciously planned.) The design of contrast sets and labels is a more realistic playing field for those attempting to affect the shared mental life of society. The design process is less frustrating because designers have a much greater chance of success. And in studying this type of design we get to see what kind of cognitive structures we humans create when we really do have the opportunity to consciously design and control them.

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<sup>13</sup> Einar Haugen, "Linguistics and language planning," in *The ecology of language*, pp. 159-190 (Stanford: Stanford University Press, 1972), pp. 163, 165-166.

<sup>14</sup> See Andrew Large, *The artificial language movement* (Oxford: Basil Blackwell, 1985).

## 5.2 Contrast sets as social facts

When you get up in the morning you could, if you wanted, go totally against all the conventions of the world. You could reject all the contrast sets and labels that we normally use and substitute others. You could use a different alphabetical order, even a different alphabet, tune your piano differently, act as if Spain and Portugal are no longer separate countries, drive on the wrong side of the road, redesign your typewriter keyboard, start observing a ten-day week, and refuse to speak English any more. Some of these choices might be a little difficult to carry out, but they are, at least, theoretically conceivable.

The point is that even in those cases where a contrast set has become an entrenched social norm, we have some choice about whether we are going to re-enact a it. *We do not absolutely have to. We could do something else.* So, then, if we are almost never in a position where we are entirely prevented from choosing an abnormal coordination solution, what is it that causes us to choose the prevailing norm over and over again? What makes us re-enact the solutions that we already have?

The sociological tradition answers these questions by saying that social norms are built into our environment, built into our buildings, built into our organizations, and built into our minds before we ever come to question them. People follow prevailing norms because they are born into a world in which other people follow them. Their general use acts as a coercive force upon us. It is almost impossible for any single person to change them or escape them without losing some of the ability to coordinate their behavior with the rest of society. Why write in a new alphabet if no one else will be able to read it? When Richard Feynman, as a schoolboy, invented his own symbols for sine, cosine, tangent, and their inverses, he justifiably felt that his symbols were better — after all, why use three letters when one will do? — but he quickly gave up when he saw that no one else could understand his homework papers.<sup>15</sup> Most people do not even think about the possibility of choosing an

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<sup>15</sup> Richard P. Feynman, *"Surely you're joking, Mr. Feynman!": adventures of a curious character* (New York: Bantam, 1986 [1985]), pp. 11-12.

alternative solution to a standards problem. It has never occurred to some people that clocks even *could* run counterclockwise.

The currency of a contrast set within a group is not fixed irrevocably by the laws of nature. It exists only insofar as the group perpetuates it. The group, along with the things it creates, carries the norm. If the group disappeared, so would the norm. A standards solution is not something like the earth, the moon, the sun, or the planets, which were created by vast, unimaginable natural forces. A standards solution is something that was created by human beings acting (more or less) together and collectively.

The name that is most commonly given to these sorts of entities or concepts is *social facts*, the idea being that the earth and the sun are "facts" too, but more natural ones. The term "social fact" traces to Emile Durkheim.<sup>16</sup> A large literature has grown up in the social sciences around the idea of such things which persists in society by virtue of being there already.<sup>17</sup> The word *institution* can be substituted for "social fact," and often connotes something larger than a single standards solution — typically an organization, tradition, or an entire social system which has a life of its own that transcends the individual people involved in it.

Any social fact might alternatively be thought of not as an monolithic abstraction, but rather as the innumerable actual diverse re-enactments of it. In saying this I am trying to pay respect to a huge body of recent social science writing which emphasizes the messy concrete realities of cultural practices and acts, over the sanitized abstraction of social facts and institutions.<sup>18</sup> But no matter how deep one's sympathy to this view, one must strike a balance.

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<sup>16</sup> Emile Durkheim, *The rules of sociological method* (Glencoe, Ill.: Free Press of Glencoe, 1938), chapter 1 ("What is a social fact?")

<sup>17</sup> In addition to the works I have already cited, a few other references in this tradition that I have reviewed are George Herbert Mead, *Mind, self, and society: from the standpoint of a social behaviorist* (Chicago: University of Chicago Press, 1934), especially his definition of "institution," p. 211; Lynne G. Zucker, "The role of institutionalization in cultural persistence," *American Sociological Review* 42 (1977): 726-743; John R. Searle, *The construction of social reality* (New York: Simon & Schuster, 1995); Eerik Lagerspetz, *The opposite mirrors: an essay on the conventionalist theory of institutions* (Dordrecht: Kluwer, 1995); Pitirim Sorokin, *Sociocultural causality, space, time: a study of referential principles of sociology and social science* (New York: Russell & Russell, 1964); Mary Douglas, *How institutions think* (Syracuse: Syracuse University Press, 1986).

<sup>18</sup> A convenient summary with references is Duranti, *Linguistic anthropology*, pp. 43-46.

Challenging the "monolithicness" of cognitive conventions is fine so long as one recognizes that one also gets somewhere by considering them as institutions with histories that can be told and continuities that can be analyzed. Postulating the existence of, say, the seven-day week as an "institution" or a "social fact" is a simplification, and it seems a worthwhile one.

How much deviance from a standardized contrast set do we, in fact, permit ourselves? The focal point of any contrast set member permits a certain degree of tolerance (see section 2.4) and slight deviations from standardized focal points and boundaries are sometimes actually encouraged. Thus it is OK if the orchestra is tuned a fraction flat as long as they stay together, and we actually like to have a characteristic, individual style of handwriting so long as it does not differ too much from the norm. But rejecting a standardized contrast set in favor of an entirely different solution, or mixing up the internal links between a set and its labels, isolates you from the mainstream and restricts your coordinative ability to the very small community of people who share your choice. You can design your own keyboard layout, tune your guitar differently, measure in rods and perches, think in terms of the pre-1974 British provincial system, wear a watch which goes counterclockwise, or call a pen a "frindle"<sup>19</sup> as long as you keep your coordinative activity to yourself or within a group of like-minded people. You can choose your own style, but you lose something by doing so. And in other cases, where coordination with people you do not know is the point of the whole contrast set, deviance is foolish: you cannot use your own system of telephone numbers, reverse the order of postal addresses, or pay people in half-crowns or shillings and expect to get by. Indeed, society sanctions those who refuse to respect prevailing coordination norms, so that the police or the army will likely stop you if you try to cross an international border without respecting the change of authority that such partitions institutionalize.<sup>20</sup>Durkheim tells us that

A social fact is to be recognized by the power of external coercion which it exercises or is capable of exercising over individuals, and the presence of this power may be recognized in its

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<sup>19</sup> See the children's novel *Frindle*, by Andrew Clements (New York: Simon and Schuster, 1996).

<sup>20</sup> See Elizabeth Bard, "How to cross borders: social or otherwise," *New York Times*, 27 October 2004; Heath Bunting, "BorderXing Guide," [www.irational.org/borderxing](http://www.irational.org/borderxing) (November 2004).

turn either by the existence of some specific sanction or by the resistance offered against every individual effort that tends to violate it.<sup>21</sup>



Image 5.1 (010)

The Microsoft advertisement shown in Image 5.1 illustrates the principle of Durkheim's statement. The advertisement leads us to believe that, one fine day, a Microsoft marketing executive in Seattle took out their calculator and divided the number of new users of Microsoft Office in, say, November 1996 by the number of seconds in November 1996, getting an answer of 20.008467—most calculators display eight digits at a time. We see the *external coercion* of standards of precision in the fact that the advertising executive followed a socially conventional standard of precision (the conventional division of the minute into 60

seconds, not more and not less) and rounded this number to 20. The charm of the advertisement is that it also tells us that one *sanctions* someone who disregards convention and uses unnecessary degrees of precision by calling them a geek!

## Who's in charge of a social fact? The control of contrast set design and institutionalization

Very often we can identify a few select people (who may be inventors, industry representatives, or government workers) who actually sat down to design a contrast set, or to

<sup>21</sup> Durkheim, *The rules of sociological method*, p. 10.

choose one of several competing sets to solve a certain problem.<sup>22</sup> Who are these people who have the power to choose what terms others will think in?

They are not normally "contrast set specialists." Even a contrast set that is part of the general knowledge of everyone in an entire society will only be used in a very definable subset of social situations. Most people pay attention to telephone numbers, house numbers, or library call numbers only when they are making a call, looking for an unfamiliar building, or going to the library. Contrast sets are tied to particular subcultures. Most are created, maintained by, and designed to benefit particular sectors of society such as the airline industry, the postal service, the music world, the faculty and staff and students of a university, or the employees of a company. Their creators do not usually think about contrast sets, or even about standardization, as a *general* phenomenon, and one cannot call in the consultants from the Contrast Set Division of a major business consulting firm to solve a contrast set design problem; there are no such consultants. Even when the maintenance of a contrast set has been centralized under a standards organization such as ISO (the International Organization for Standardization), the committee representation may still largely be from a particular industry or sector.

Thus it is no surprise that the development of contrast sets is something typically carried out not by hypothetical categorization and labeling experts, but by groups of experts in the sector which actually works with the contrast sets in question. The people involved might be telecom specialists, librarians, representatives from the airline industry, or the person who manages the university's course catalog numbers. Since this may be the only contrast set standardization project that they ever work on in their career, they may not be aware of formally similar problems in completely different sectors.

It is very often possible to identify the board or administrative body responsible for creating or maintaining a particular coordination solution. Contrast set standardization may

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<sup>22</sup> Paul Starr uses the term "official classification" to describe classificatory, naming, and ordering conventions authorized by a government body, and calls the question of which classification such a body should choose "the problem of legitimate classification." See "Social categories and claims in the liberal state," *Social research* 59 (1992): 263-295, pp. 264-265.

serve the interests of a government, a consumer advocacy group, an industry association, or of a particular dominant firm within an industry.<sup>23</sup> History is full of examples of industry gatherings where standards were hammered out, such as the standard time conferences of the 1880s,<sup>24</sup> the Unicode character set standardization discussions in the late 1980s and early 1990s,<sup>25</sup> or the many conferences that have been held to define international political boundaries. Today, for example, the non-profit agency responsible for managing the Internet domain name system is ICANN, the Internet Corporation for Assigned Names and Numbers ([www.icann.org](http://www.icann.org)). International character set standards are maintained by the Unicode Consortium ([www.unicode.org](http://www.unicode.org)) under the auspices of ISO. Both North American and European governments have contracted the administration of their telephone numbering plans to Neustar, Inc. of Sterling, Virginia ([www.neustar.biz](http://www.neustar.biz)). Product codes on consumer items (including ISBN numbers) are maintained by EAN International and the Uniform Code Council ([www.ean-int.org](http://www.ean-int.org) and [www.uc-council.org](http://www.uc-council.org)). The ISO ([www.iso.org](http://www.iso.org)), headquartered in Geneva, provides an umbrella under which technical committees from national standards organizations administer an extremely wide variety of coordinative, product, safety, and business process standards. This mundane but crucial organizational aspect of standardization has intrigued a number of scholars, who in writing about it have had to struggle to overcome the bureaucratic dryness of the topic, and to find common themes in vast diversity of standards activities.<sup>26</sup>

Once a contrast set has been designated as a norm, whether it catches on always ultimately depends on its users. But there is quite a bit of variation in the proportion of users

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<sup>23</sup> Charles P. Kindleberger, "Standards as public, collective, and private goods," *Kyklos* 36 (1983): 377-396, p. 385.

<sup>24</sup> See Eviatar Zerubavel, "The standardization of time: a sociohistorical perspective," *American Journal of Sociology* 88 (1982): 1-23.

<sup>25</sup> The full history of the development of Unicode has not been written but in the meantime one source is Tony Graham, *Unicode: a primer* (New York: John Wiley & Sons, 2000).

<sup>26</sup> See, for example, Nils Brunsson and Bengt Jacobsson, eds., *A world of standards* (Oxford: Oxford University Press, 2000); Henk J. DeVries, *Standardization: a business approach to the role of national standardization organizations* (Boston: Kluwer, 1999); Samuel Krislov, *How nations choose product standards and standards change nations* (Pittsburgh: University of Pittsburgh Press, 1997); Steven M. Spivak and F. Cecil Brenner, *Standardization essentials: principles and practice* (New York: Marcel Dekker, 2001); Lal C. Verman, *Standardization: a new discipline* (Hamden, Conn.: Archon, 1973).

who actually have a real, active "say" in whether a solution becomes institutionalized or not. One must distinguish between active users — players in the game, people who have a real choice of whether to accept or reject the solution — and passive consumers of a standard. Thus a library's decision to use the Dewey or Library of Congress classification system is a matter of active choice, but the library visitor's use of that system is a matter of passive consumption. My choice of "ianwatson.org" as my Internet domain name is a matter of active choice, but the fact that it ends in "org" and not "abc" is a matter of passive consumption.

At one end of the spectrum there are some contrast sets where active control is very democratic. The handwritten forms of the letters of the alphabet are recreated every day by everyone who knows how to write. Although peoples' handwriting styles come under many outside influences, it is difficult for anyone to control the form of a contrast set which has so many active re-enactors; a recent attempt to bring about mass change in Icelanders' handwriting styles did not succeed.<sup>27</sup> Similarly, we recreate the alphabetical order in our address books, Rolodexes and lists, even though there is not really anything to stop us from using a different approach. The American government can (as it often has!) mint a new coin and decree that it symbolizes a dollar of value, but it will never enter into Americans' mental register of legal-tender money unless millions of them choose to use it over and over again to pay for something. American thermometers and yardsticks are marked in both metric and standard units and Americans do make a choice of how to report those measures every time they do so.

Often, though, a restricted group of people determine the makeup of the set and have enough organizational or market power to promote its general acceptance. In some cases, such as political boundaries, a standardized set requires lockstep uniformity from all users, meaning both a common understanding of the form of the set and a common agreement to respect it. In the case of labeling standards, the only remaining wiggle room in which users can exercise some control is in the actual assignment of labels to entities. Here, power is typically shared with those who hold a stake in a particular entity. For example, when having

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<sup>27</sup> See Marion Muller, "Iceland goes italic," *U&LC* 15, 1 (February 1988): 12-15.

a new telephone installed, though one cannot choose one's country code, it is common to be able to decide between several potential candidates for the final digits of your number. Some people have compelling reasons for preferring one label to another. Consider the case of the University of San Francisco, a Jesuit-run school, which suffered for many years with phone numbers starting with "666" (a number traditionally associated with Satan) until it finally managed to have its prefix changed to "422".<sup>28</sup> It is easier to bear being "just a number" (see section 3.5) if you have some control over what number you will be. (With vanity license plates, it is even possible to charge people for the privilege.)

There is, then, a continuum of contrast set control. At one end we have contrast sets which are constantly re-enacted by every member of society. At the other are contrast sets that are reaffirmed by the members of a closed club or privileged subculture, invested in, and then more or less passively consumed by the "general public." In this book, I do not explore the consequences of this imbalance in detail, and I plead guilty to mostly having treated contrast sets "as an object of contemplation rather than as an instrument of action and power."<sup>29</sup> In taking this approach, I do not mean to say that the issue of power is uninteresting. Indeed it is fascinating, but it is material for a further study; this book's goal is to provide a clear understanding of how contrast sets work, which is a prerequisite for any investigation of the power relations surrounding them.

## 5.3 Contrast sets and thought communities

The collection of people who make use of a particular standardized contrast set (or, in fact, of any coordination solution) form a kind of community. It may be a very widely distributed community, which may be very different in many respects other than the fact that it shares a standard; it may, however, be a community of individuals who are defined in other ways which are exactly congruent with the distribution of the same standard. To the extent that a contrast set is something that affects and resides in the minds of its members, this

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<sup>28</sup> Don Lattin, "USF giving Satan's number the pitchfork," *San Francisco Chronicle*, 11 September 1996, section A, p. 13.

<sup>29</sup> Bourdieu, *Language and symbolic power*, p. 37.

community is a community of the mind, a community of shared thinking habits, a community of coordinated behavior, rather than a community in any of the standard senses of village, church, profession, and so forth. It is a community of people who think the same way. The two terms that have been most often used to describe this phenomenon are *thought community*<sup>30</sup> and *thought collective*.<sup>31</sup>

The existence of these thought communities is of tremendous importance to people. After all, we usually like to know whether someone shares our mental world before we start communicating with them. If you are a tour guide, a musician, an indexer, or an American census taker, it is quite important that your audience share the same fundamental ideas as you do about the layout of Venice, the well-formedness of a chord, the normal order of the alphabet, or the salience of certain "racial" features in ethnic classification. If you are trying to swindle somebody, it helps a lot to know whether they have a good sense of the value of the local currency or not. We would never buy a new computer without some basic level of assurance that we will be able to use familiar concepts, programs, and procedures on a new machine, thus not breaking completely with our previous thought community. Sliding into the seat of a car whose controls work differently — say, a differently laid out gearshift, or windshield wipers and headlights reversed — reminds us of the social gulf between, say, Toyota drivers and BMW drivers, or between the mental worlds of drivers who normally drive a right-hand drive car (as in Britain and Ireland) and those who drive a left-hand drive car (as in the rest of Europe).

If we take two individuals who belong to the same thought community in one sphere of social action, we will probably find that they belong to different thought communities in another sphere. Thus a teacher and a janitor may both be familiar with the room numbers in a classroom building, but one may speak Chinese at home and the other English. Each of us belongs to many different thought communities as readers, musicians, timekeepers,

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<sup>30</sup>Zerubavel, *Social Mindscapes*, pp. 9 and 116n16.

<sup>31</sup>Ludwik Fleck, *Genesis and development of a scientific fact* (Chicago: University of Chicago Press, 1979 [1935]), pp. 38-51 ("Introduction to thought collectives"). See also Bloomfield, *Language*, pp. 46-47, who describes in detail a rich network metaphor for the idea of "speech communities."

computer owners, measurers, and drivers. Part of what gives an individual identity and distinctiveness is the sum set of thought communities to which they belong, a set which is always a little different from person to person.<sup>32</sup>

Of course, thought communities distinguish themselves through a range of conventional thinking patterns much broader than the use of different contrast sets. But it is specifically the use of a common strategy for the partition and labeling of some kind of semantic domain which defines and unites the thought communities which share an understanding of metric measurement, the Japanese writing system, musical notation, baseball scoring, or the chapter divisions in this book. Of course, there are also similar communities of people who drive on the left, who use a particular type of electrical voltage or plug shape, watch TV encoded under the PAL standard, take trains running on five-foot rail gauge, and keep paper in three-ring (not two-ring) binders — all coordination solutions which do not involve contrast sets specifically.

The *distribution* of these communities — based on the fact that not every community chooses the same solution to a standards problem — may itself, ironically, give rise to an emergent partition of some sector of the domain of human beings. For example, the Dewey Decimal and Library of Congress book cataloguing systems are two competing solutions to the problem of partitioning and labeling the domain of books. But their *distribution* gives rise to a partition of the domain of libraries, into those using Dewey and those using LC. Similarly, the way different writing systems are distributed across the people and the countries of the world, with some using the Roman alphabet, some using Cyrillic, some using Arabic script, some using Korean hangul, and so forth, suggest a partition of the domains of people and cultures into Roman, Cyrillic, and Arabic, and other "zones."

In this way, thought communities are both consequences of conventional partitions, and a means by which partitions (of a different sort) emerge. To put it another way, the choice of the way to partition a particular domain (say, the domain of books or of letterform)

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<sup>32</sup> See Georg Simmel, *Conflict and the web of group-affiliations* (New York: Free Press, 1955), pp. 138-143.

can be a coordination problem, and then the contrasting solutions to that very same coordination problem can suggest a partition of the domain of users trying to accomplish the task involved. To explain this using yet another set of terms, imagine a large group of people who are faced with a task which requires the creation of a contrast set by means of conventional acts of partition of some semantic domain (the task might be the creation of a writing system and the problem might be the creation of a contrast set of letterform); there exists a thought community which agrees on a solution to that standards problem (say, the Roman alphabet); there are also thought communities which use different solutions to that same standards problem (say, the Korean alphabet); and the collective domain of the people who are all trying to carry out the task can then be partitioned on the basis of what solution they use. The two partitions involved are of completely different domains (letterform and people), but they are linked by being related to the execution of the same task (the design of a standard writing system). From the point of view of the standards problem involved, the one kind of partition takes place during the corpus planning of one particular solution, while the other partition is a product of the varying statuses of the different solutions to the problem. This double relationship is confusing, and somewhat paradoxical, but it is also important to be able to distinguish between the two types of partitions, and to understand how the theme of partition ties the two phenomena of standardization and classification particularly closely together.<sup>33</sup>

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<sup>33</sup> Geoffrey C. Bowker and Susan Leigh Star make a version of this same point in *Sorting things out: classification and its consequences* (Cambridge: MIT Press, 1999), pp. 13-16.

The thought community which shares a particular contrast set varies in its size and its permanence. Some contrast sets are designed for the general public, others for distinct subcultures within society. Some contrast sets are designed to last, while others are mentally disposable. A thought community can be very large, or can consist of a single person. Naturally, the contrast set designer should know the size of the intended user community as they consider how to construct and market a set. (Conventional wisdom would suggest that, for example, the members of a professional association probably have higher standards of precision than the general public.)

Any adult American is expected to understand how such contrast sets as the alphabet, zip codes, license plates, telephone numbers, Social Security numbers, and the fifty states function. They are expected to be able to sort things into alphabetical order and to identify each of the fifty states. Learning to understand these public labels is part of Americans' primary set socialization — by which I mean the acquisition of contrast set skills expected from every member of society. School, parents, friends, books, and games such as spot-a-license-plate-from-every-state ensure that we learn these things.



Image 5.2  
(078)

On the other hand, there are a lot of contrast sets which we only master in the course of the *secondary* cognitive socialization that introduces us to the sociomental customs of a particular *sector* of society. Thus, for example, it is only people in the book business, the supermarket produce industry, the university procurement field, or the interlibrary loan office who really understand the workings of the ISBN system, the four-digit codes for types of fruits and vegetables in Image 5.2, the university property identification sticker number on the computer I am using, or the three-letter codes used for libraries in the OCLC network. Only the people who work for the same travel company as I do know how we divide up and label the group tours we run. It is only people with an electronics education who know how to interpret the color codes printed on resistors, it is mostly just blind people who know Braille, and mostly just specialized stenographers who can read and write shorthand.

All of these examples are of durable contrast sets which, once mastered, stick in one's mind for many years. But other sets are designed to be used only for a single activity or project, and then forgotten. Consider, for example, labeling of the "Insert Tab A into Slot B" form, which we master just for a few minutes in the process of assembling something. Scholars number example sentences (in linguistics) or equations (in physics) so that they can then refer to them in the text, e.g. "(13a)", but these numbers matter only within the context of the article in which they appear.

The smallest possible thought community is a single person — over time. Think, for example, of the way you choose to divide up your music collection or filing system, or the scrawl that passes for my handwriting when I am the only intended audience. These conventions are still intended to be understandable by another mind at another time, even though that other mind is simply one's own, in the future.<sup>34</sup>

## 5.4 Contrast sets and the sense of identity

The so-called 'chancery double', a folded sheet of paper of prescribed dimensions and format, was perhaps the most indispensable requisite of the Austrian civil and military administration. Every request, every memorandum, every report, had to be sent in on this neatly trimmed form, which, owing to the uniqueness of its format, enabled official documents to be distinguished at a glance from private correspondence ... No communication is officially recognized unless it is made on this white rectangle of paper.<sup>35</sup>

Either an individual contrast set member, or an entire contrast set that has been chosen (over another set) as a standards solution, may come to serve as a symbol for an entire thought community.

Thus an individual can use a particular standards solution to demonstrate, reaffirm, or reject membership in a community. Meanwhile, other individuals place you on their mental maps of social groupings by attending to which solution you use. In this way contrast sets, like other conventions, customs, and norms, become symbols of nations and cultures, and badges of identity and locality in everyday social intercourse. They not only coincide with social and geographic taxonomies, but help to maintain them. When a number of standards

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<sup>34</sup> Douglas Hofstadter discusses the imperfect isomorphism between the same person at different times in *Gödel, Escher, Bach: an eternal golden braid* (New York: Basic Books, 1979), p. 369.

<sup>35</sup> Stefan Zweig, *Beware of pity* (New York: Harmony Books, 1982), p. 246.

boundaries coincide, the identity of the resulting "thought community" becomes even stronger.

Thus the contrast between simplified and traditional characters, as well as between the Pinyin and Wade-Giles transliteration systems, was for many years a symbol of the division between communist and capitalist China, just as metric and standard systems divide Canada and the United States, and the contrast between Fraktur (black-letter) and modern Roman typefaces signified both temporal and political differences within German culture. Meanwhile, Europeans in the United States often consider the constant attention to racial and ethnic categorization as "typically American."

Similarly, small differences in the execution of a commonly used contrast set also mark out subcommunities within, say, the wider world of people who use the Roman alphabet. Thus the presence of the letter Ð in the alphabet distinguishes the Faroese language from that of the Danes, their colonial masters, at the same time as it links the Faroese with the Icelanders (who also use Ð). This extra contrast-set member is so closely tied to the Faroese sense of national identity that a modern Faroese poet says "it is clear as day that without Ð, none [of us] could live."<sup>36</sup> Because we reify our own standards (see section 6.2), we often forget that such cognitive styles allow observers to "place" us even when we think we are anonymous. Thus C.S. Forester's fictional naval hero Captain Horatio Hornblower is able to recognize a French privateer otherwise well disguised as an English fishing trawler from an oar marked "27" with a Continental crossed seven instead of the uncrossed English version.<sup>37</sup> Here, the variation in the location of letterform prototypes marks different social groups. Indeed, though people often think of handwriting style as an individual matter, there are distinct national patterns within the Roman alphabet which allow one to guess (with less than complete certainty) whether the writer is, for example, British, Dutch, Polish, American, or Icelandic.

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<sup>36</sup> See the poem "alfabet" in Rói Pátursson, *Líkasum* (Tórshavn: Mentunargrunnur Studentafelagsins, 1985).

<sup>37</sup> C.S. Forester, *Hornblower and the Atropos* (Boston: Little, Brown & Co., 1953), p. 119.

Opposing identities may also be linked to the different members of a single contrast set, particularly when users have different "locations" within a contrast set — that is, a special relationship with one member of a contrast set and not another. For example, I might live in telephone area code 212 and you live in 718, or I might worship on Friday and you worship on Saturday; in these cases it is the contrast between {212, 718} and {Friday, Saturday} which defines one's identity. (The difference between identity that is linked to the respective elements of a single contrast set and identity that is linked to the competition among different contrast sets which all solve the same standards problem parallels to some extent the difference between corpus and status planning.)

The process of social integration and exclusion around symbolic boundaries actually involves a much wider range of semiotic raw material than contrast sets or standards solutions.<sup>38</sup> A sense of identity may form around oppositions such as classical music versus rock, or southern American English versus standard American English. These are not really contrast sets, or elements of sets, or standards solutions, and their contrast is more emergent than deliberately constructed.

When traveling to a foreign country, how do you tell that you have arrived? Of course, changes in the light, the temperature, the humidity, and the smell of the air may be enough to call to mind all the associations you have with a foreign place, especially on a return visit. But part of our sense of the identity of a new place is based on the structural oppositions we perceive in the use of contrast sets and in our location within a contrast set. For example, while Canada is outwardly very similar to the United States and even uses the same telephone code (1), one of the first real changes I notice on the drive between Rochester and Toronto is that signs express distance in kilometers. Travelers from North America to Britain can continue to speak English, but will notice that letterhead and business cards list the British telephone code (44). The image of a different writing system, coinage standard, rule

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<sup>38</sup> On the types of semiotic material that can be involved, see, among others, Pierre Bourdieu, *Distinction: a social critique of the judgement of taste* (London: Routledge, 1984 [1979]); Michèle Lamont and Marcel Fournier, ed., *Cultivating differences: symbolic boundaries and the making of inequality* (Chicago, University of Chicago Press, 1992). See also Eviatar Zerubavel, "The language of time: towards a semiotics of temporality," *Sociological Quarterly* 28 (1987): 343-356.

of the road, or typewriter keyboard layout is the kind of thing that can be used as shorthand in a movie or documentary to signify one's passage into another community. As the Stefan Zweig quote at the beginning of the section shows, the past is also like a foreign country, and an abandoned standards solution (the "chancery double" paper size in this case) can be a mark of a different *time* in the same geographic place.



Image 5.3 (074)

When two thought communities unify, the erasing of such boundaries becomes a way of symbolizing the union of the two units. Consider how Barry Levinson's 1982 movie *Diner* signals that the marriage between two characters is troubled — by showing the young husband's frustration over his new wife's inability to

understand the way he categorizes and alphabetizes his record collection. "Of the numerous disparities that set Southern apart from Northern society, one was entirely man-made: a difference of three inches between the predominant railroad gauge of the two sections," a famous American historian tells us. When the railroad gauge in the American South was finally changed to match the North's in 1886, it eliminated this symbolic distinction at the same time as other Northern norms were being forcibly imposed on the South.<sup>39</sup> The preservation of the East German *Ampelmann* (the walk light figure shown in Image 5.3) in unified Germany is an example where a similar regionalism was preserved, and standardization aborted, after a public outcry. This was possible not least of all because, unlike with track gauge, West and East German walk light figures can be considered allovariants of a single focal point. The debate was about whether the difference between them exceeded the permissible wiggle room of the normative specification.<sup>40</sup>

<sup>39</sup>C. Vann Woodward, *Origins of the new South 1877-1913* (Baton Rouge: Louisiana State University Press, 1951), pp. 123-124.

<sup>40</sup>On the history of the Ampelmann see Corinna Weber, "Ampelmann Geschichte," <http://www.ampelmann.de/html/geschichte.html> (February 2005).

For some people, familiarity (or even better, nonchalance) with other countries' standards solutions may become a way of demonstrating sophistication and cosmopolitanness. People often adopt standards solutions from other countries or groups (consider how some Americans cross their sevens in the European way or spell "color" as "colour") when those styles have more perceived prestige, or when they want to identify with the groups that use them routinely. The choice of contrast sets and mundane coordination solutions (such as bibliographic style, sort order, or the rule of the road) can also become a proxy issue in a power struggle between two thought communities vying to extend their influence. Because of the way mundane coordination is reified and backgrounded, such strategic efforts to manage identity and affiliations are easy to notice but conveniently too trivial to make into a focus of discussion.

## 5.5 Miscoordination

One of the best ways to understand social institutions is to study their breakdown, and nothing shows the importance of coordinating contrast sets so well as those cases when it fails. Looking at miscoordination to understand contrast sets is like studying suicide to understand the nature of social bonds and community solidarity, or the breaching of social norms to understand how those norms function in the first place.<sup>41</sup> Mathematicians use a somewhat similar strategy when they prove a theorem by showing that its negative could not be true.

To understand how important the standardization of contrast sets is to social life, imagine waking up to a world without the norms you are familiar with. You open the newspaper weather report and find that it uses a new temperature scale; driving to work, traffic flows sometimes on the right and sometimes on the left side; you open the index of a book to find things in an unfamiliar alphabetical order, or maybe no particular order at all; the clock above your desk uses a ten-hour metric face and your calculator works in base eight; and you have to hunt for each letter on your computer keyboard since it uses a totally

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<sup>41</sup> Emile Durkheim, *Suicide: a study in sociology* (Glencoe, Ill.: Free Press of Glencoe, 1951); Harold Garfinkel, *Studies in ethnomethodology* (Englewood Cliffs, N.J.: Prentice-Hall, 1967).

new kind of layout. In each case, our image of a particular domain no longer corresponds to the reality we see out in the world. This correspondence makes social life possible and helps us get through every single day. Every coordination norm makes possible something that we are hard pressed to live without. The alphabet itself is a standardized contrast set, so it is not just metaphoric to say that mastery of basic contrast sets is essential to anyone's cultural "literacy."

"Nightmares of miscoordination" are a common theme in dreams, folktales, and modern urban legends. Probably everyone has had a dream where they arrived naked (or in their pyjamas) to work or to school. The sense of shame we feel comes from the terror of losing our sense of socialization, so that we no longer fit in with the way everyone else behaves. When it is our expectations of a contrast set that the external world does not fulfill, the sense of terror may also come from a loss of synchronization between reality and our mental map of a contrast set or its underlying domain, as well as from the feeling that all our commitments to that contrast set were for naught. The following anecdote about not fitting into the pattern, most likely apocryphal, appeared recently on an Internet mailing list:

I heard of one person who had perfect pitch. The trouble was, the family piano was tuned a half a step low, so he learned them all wrong! And he couldn't "unlearn" them. He eventually gave up music out of sheer frustration.<sup>42</sup>

Miscoordination happens not just in nightmares, but all the time, in real life. Even small differences in contrast set norms lead to problems, such as mixing up the floor numbers in cases where one is not sure whether the ground floor is numbered or not, or getting confused about whether the calendar rows start with Sunday or Monday. Skilled typists and pianists find it frustrating to use computer keyboards with a foreign layout or pianos that are out of tune. Genealogists struggle to learn the handwriting norms of other times and cultures. When we see that a movie got three stars from a reviewer, we do not always know whether that means three out of four, or three out of five. The American participants on the European group tours I lead often get the day and the month confused

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<sup>42</sup>Nancy Edelmann, letter to the Synesthesia List, 28 Jan. 2002. Archive access via <http://home.comcast.net/~sean.day/Synesthesia.htm> (November 2004).

when buying tickets, thus mistakenly spending money on a concert that will (say) take place on September 8th but which they thought would be on August 9th. Although some of these problems are minor, others are not: during the American invasion of Grenada in 1983, the miscorrespondence between the map coordinates used by those ordering and carrying out an air strike led to eighteen needless casualties.<sup>43</sup>

Problems of miscoordination extend, of course, far beyond the world of contrast sets. Differing coordination norms most often cause problems of cross-cultural adaptation for visitors to a foreign country. This can mean anything from travelers not being able to use the electrical appliances they have brought from home, to looking the wrong way while crossing the street in a country which has an unfamiliar rule of the road, to the German army having to adapt their trains to the wider Russian track gauge on the eastern front in World Wars I and II.<sup>44</sup> Life often puts us in situations where we share no common spoken language or communication style with the people we meet. Despite using gestures, symbols, and other means of getting the message across, we often interpret signs meant to convey a certain message as meaning something entirely different. Thus early European explorers in the Pacific repeatedly had trouble communicating with the local islanders, and in New Zealand Captain James Cook first interpreted the Maori *haka* greeting as a "war dance."<sup>45</sup> Other problems have to do not with semantics or product standardization but simply with not knowing the rules of the game. For example, visitors to Amsterdam frequently have difficulty knowing which door one is supposed to enter or exit a public transportation conveyance through, and are rarely able to read the Dutch-only signs that sometimes try to help.

We often use the term "Kafkaesque" to describe situations of cognitive miscoordination because Franz Kafka was something of a specialist in writing fictional accounts of such situations. In his *Metamorphosis*, when Gregor Samsa wakes up as a bug, his parents not only can no longer understand what he says, but they do not know that he can

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<sup>43</sup> Monmonier, *How to lie with maps*, p. 45.

<sup>44</sup> On Germans and the Russian track gauge see Kindleberger, "Standards as public, collective, and private goods," p. 385.

<sup>45</sup> J.C. Beaglehole, ed., *The voyage of the Endeavour 1768-1771* (Cambridge: Hakluyt Society, 1955), p. 169.

still hear and understand them. A typical situation in Kafka's stories and novels involves a character whose expectations of others' behavior are confounded, or whose own view of a situation is not taken into account by those the character comes into contact with. This also shows that miscoordination plagues not necessarily just visitors to a foreign country, but anyone dropped into an unfamiliar thought community of any size. Also, although we usually think of miscoordination as a problem to be avoided, it can sometimes be a deliberate strategy meant to exclude people from a particular thought community (see section 7.3).

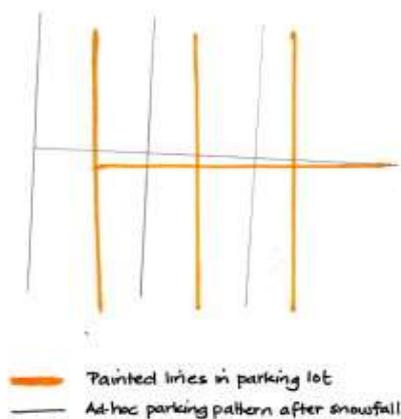


Image 5.4 (037)

In cases where a group of people know that a norm exists, but for some reason the actual norm is obscured, the entire thought community may lose coordination with the norm but keep coordination with each other. In these cases, miscoordination becomes a social fact within the bounds of the thought community. An everyday example is a choir which goes out of tune with standard pitch, but stays in tune with each other. This phenomenon also occurs in empty snow-covered parking lots, when people attempt to replicate a parking pattern without the actual painted lines being visible to guide them. Image 5.4 shows an example of the discrepancy that emerges when the snow melts and the lines are visible again. The power of social facticity manifests itself on the afternoon when the snow has melted: even though the guidelines may be visible again, parkers are still forced into the discrepant pattern by the power of the rest of the group's misreenactment. This type of collective miscoordination is most common in domains where people lack either internal or external knowledge of the normative solution to a problem, but do know that a norm exists. They attempt to coordinate their behavior, but cannot properly calibrate it to the standard. Thus collective miscoordination would be less likely to happen in the domain of letterform, where it is quite easy for a literate person to see that their lower-case handwritten *e* is veering dangerously close to looking like a *c*, because they have access to internal and external images of the normal shape of both letters. The H.G. Wells story "The Country of the

Blind," in which the one person with normal sight feels deviant, lets us imagine the feeling of someone in a situation of collective miscoordination who is familiar with the broader norm but has no power to impose it.<sup>46</sup>

Although we try to avoid creating confusion in "real life," in the worlds of play and recreation people are attracted to, seek out, and create framed-off experiences of disorientation and miscoordination, and participate in thought communities which use nonstandard contrast sets. Thus Douglas Hofstadter's drawings of ambiguous letterforms amuse us because they draw our attention to the conventionality of our writing system and lead us into an imaginary world where its rules do not apply.<sup>47</sup> The game of hopscotch partitions and labels territory and then "forces" us to respect its boundaries in a way that we may forget after the game is over, while board games and card games create imaginary mappings involving contrast sets such as color, shape, and number, or the four suits of spades, clubs, diamonds, and hearts.<sup>48</sup> Organized sports creates sets and labels such as teams, leagues, divisions, periods, innings, end zones, and jersey numbers, which are not "real" outside the frame of the game, although they certainly are real in their consequences for the livelihood of the players and the emotions of their fans. (Scholars and enquiring minds enjoy intellectual challenges to standardized contrast sets, so that a book like Fernand Braudel's *The Mediterranean* appeals by making us see how the countries that we might think of as belonging to Europe, Africa, and the Middle East also form a region of their own.)

Of course, the deliberate disruption of our contrast sets is just one example of the way that we create framed-off experiences in which knowledge becomes worthless, social norms do not apply, or expectations about the external world are confounded. Thus hedge mazes and labyrinths remove our sense of orientation in a playful way,<sup>49</sup> just as roller coasters

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<sup>46</sup> H.G. Wells, "The country of the blind," in *The country of the blind and other stories*, pp. 534-568 (London: T. Nelson & Sons, n.d.)

<sup>47</sup> Douglas R. Hofstadter, "Meta-Font, metamathematics, and metaphysics: comments on Donald Knuth's "The concept of a Meta-Font,"" *Visible Language* 16 (1982): 309-338, esp. p. 331; *Metamagical themas: questing for the essence of mind and pattern* (New York: Basic Books, 1985), pp. 243-244.

<sup>48</sup> On the relationship between games and number see Thomas Crump, *The anthropology of numbers* (Cambridge: Cambridge University Press, 1990), pp. 115-127.

<sup>49</sup> See Passini, *Wayfinding in architecture*, pp. 13-14.

remove the sense of control we have over speed and direction, and movies and literature take us to places that do not really exist, like Oz or 221B Baker Street.

## 5.6 Commitment

Imagine that you have the plans for your new house all set, but have received conflicting opinions about where to pour the concrete foundation. One person said, pour it here; another said, maybe just a few feet further this way. It does not matter so much where you choose to pour, but the pouring is an act of commitment, and once the concrete is set, you will be stuck with that location. We can measure your commitment by the cost of what you have already put into the project, and the cost of undoing it should you decide to choose to commit to something different.

Commitment takes place when a concrete action institutionalizes an abstract choice.<sup>50</sup> In the world of contrast sets, the abstract, sometimes arbitrary choice may be between different designs for the same set, or between different sets which solve the same coordination problem. Both individuals and entire societies can commit to a contrast set. If an individual expects to use the same contrast set over and over, they may choose to invest their time and energy in the choice of a single solution (by, for example, buying a metric ruler, or learning the alphabet and the numerals). Whole societies, or people acting in their name, make public commitments to particular contrast sets by, for example, posting metric signs which use the Roman alphabet and the Arabic numerals. These commitments make a culture's standard operating procedures into social facts, inscribe them into our external worlds, and thus give them the means of perpetuating themselves.

Speaking very generally, we can say that some of these commitments are more physical and practical, while others are more mental and cognitive. While they are generally reversible, this is possible only at a cost which is a little like that of moving the foundation of an already-occupied house. If the airport terminals are labeled by the letters A to F, they are

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<sup>50</sup> An alternative term for commitment is "entrenchment." See Paul Starr, "Social categories and claims in the liberal state," *Social research* 59 (1992): 263-295, p. 264, where Starr credits the term to Nelson Goodman.

likely to stay that way. There is a mental cost to individuals of changing their thinking, and a physical cost to both society and individuals of replacing every object that depends on a particular standards solution with a new one.

We commit physically to standards solutions when we modify the world outside ourselves in a way which is dependent on one solution. For example, the production of typewriters, calculators, keyboards, and computer fonts shows our commitment to the letters and numerals which we use to represent sounds and numbers. The location of courthouses, the painting of police cars, and the placement of border control stations shows our commitment to geographical boundaries. We become physically committed to the current system of measuring longitude and latitude when globe manufacturers label the meridians on a globe — a process which also, incidentally, shows our commitment to our alphanumeric standards. The production of tuning forks which vibrate at 440 hertz shows a commitment to the international pitch standard, while the production of pianos shows a commitment to the 7- and 12-tone musical scales and to our keyboard design conventions. Outside the world of contrast sets, we become physically committed to driving on the right side of the road when we make road signs and set them up on the right shoulder. Installing an electrical outlet or buying an appliance is part of the way that we physically commit to our electrical plug shape and electrical current standards, just as buying a three-ring binder commits you to the American hole-punching standard for 8½-by-11 paper.

Our cognitive commitment to a standard is, in contrast, intangible and interior. Of course, cognitive commitment partly means just the time it takes to learn one contrast set and not another. But we also allow contrast sets to form our patterns of thinking. Our mental systems are malleable by nature. After enough experience with any conventional way of partitioning a domain, we fundamentally conceptualize the world *using* its arbitrary units and labels.<sup>51</sup> We invest in a mental image of the domain. If, for example, we were raised in a country that uses the Fahrenheit temperature scale, eighty-five degrees *means something* to

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<sup>51</sup> For a similar statement, see Wendy Nelson Espeland and Mitchell L. Stevens, "Commensuration as a social process," *Annual Review of Sociology* 24 (1998): 313-343, pp. 329-330.

us — a particular way we should dress, memories of New York City in the summer, an interest in going to the beach. Similarly, it is my intuitive understanding of how much a pound is that allows me to decide between a two- and a five-pound sack of potatoes even before I see them in the supermarket produce section. People trained in the Roman alphabet develop a sense of difference between (for example) the letters *O* and *Q* which is not transferable to (say) the Arabic writing system. And not only do they invest vast amounts of time in learning letters and numerals in order to read and count, they also use them as tools in filing and ordering, grading, mathematical notation, and music. The facility with which we navigate through indexes, type, tell time, and buy T-shirts shows how we automatically and unthinkingly expect alphabetical order, the QWERTY keyboard, clockwise clockworks, small, medium, large, and extra large. In Edward Tenner's terms, contrast sets are technologies which shape the techniques of everyday living,<sup>52</sup> by making us organize our behavior in the terms they suggest.

Commitments of this type are deep and pervasive. Those people who build a conventional contrast set into their minds by creating a lasting private image (such as a number form, see section 2.12) or a private label system (such as a set of color labels for pitches, see section 4.7), are allowing social conventions to influence some of their most fundamental thinking processes. Similarly, those who grew up with a left-to-right writing system tend to build into their minds a mapping between lower numbers and "leftness," and higher numbers and "rightness," which influences their conceptual metaphors for arithmetic and other linear topologies (those raised with a right-to-left system reverse the mapping).<sup>53</sup> In anthropological linguistics, the longstanding debate over the Sapir-Whorf hypothesis is a

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<sup>52</sup> Edward Tenner, *Our own devices: the past and future of body technology* (New York: Alfred A. Knopf, 2003), esp. ch. 1.

<sup>53</sup> See Stanislas Dehaene, Serge Bossini, and Pascal Giraux, "The mental representation of parity and number magnitude," *Journal of Experimental Psychology: General* 122 (1993): 371-396, especially experiment 7, which demonstrates the dependence of this mental representation on the culturally conventional direction of writing that the subject was raised with. These findings are also summarized briefly in Stanislas Dehaene, *The number sense: how the mind creates mathematics* (New York: Oxford University Press, 1997), pp. 80-83. Also see Wim Gevers, Bert Reynvoet and Wim Fias, "The mental representation of ordinal sequences is spatially organized," *Cognition* 87 (2003): B87-B95; Ting Ting Chan and Benjamin Bergen, "Writing direction influences spatial cognition," unpublished manuscript, University of Hawai'i.

lexical analogue of these questions about the existence and permanence of our cognitive commitment to social convention, and about whether there are "convention[s] that our brains have come to expect."<sup>54</sup>

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<sup>54</sup>Dehaene, *The number sense*, p. 83.

# 6 Justification and Change

This chapter discusses the beliefs which people come to hold about the contrast sets that they use. It first lays out the difference between objective, subjective, and intersubjective reality, then shows the systematic confusions that arise about which of these three categories a particular contrast set belongs to. It then discusses the ways in which people justify and legitimate the design of a contrast set, or the fact that it has been chosen as a coordination solution. It describes the process of changing institutionalized contrast sets, and the people who agitate for change. Finally it mentions how in certain contrast sets with a value gradient, change takes place in an unplanned, emergent fashion which I call "creep" or "drift."

## 6.1 Objective, subjective, and intersubjective

For any contrast set, it is a typical and worthwhile scientific question to ask to what extent it is constructed and to what extent it is discerned; to what extent it is under the control of the human workshop and to what extent it is not. The week has seven days — is this a fact of nature or a product of the workshop?

Many debates about the nature of reality boil down to battles about placing them towards one side or another of the spectrum between constructedness and discernedness (see section 2.5). Nature-nurture debates, for example, are basically about whether things should be considered as stemming from universal, objective aspects of human nature, or from an individual's or group's subjective experience of their own time, place, and circumstances. I have already mentioned how there is no single universal answer to this question — the answer varies from contrast set to contrast set. I also discussed how we sometimes lose sight, in the bipolarity of these debates, of the fact that there are gradations and blends of universal and individual phenomena. Moreover, many of the "truths" of the external world are, in whole or in part, intersubjective and sustained by social convention.

There are, then, three different types of explanation that can be used: objective, intersubjective, and subjective.<sup>1</sup>

There is another related question that is also worth asking. Rather than trying to determine the true origin of a given contrast set in the world, one can ask what people generally *believe* about its origin — people who have not scientifically investigated its history. This means investigating not just the truth, but also peoples' folk beliefs about the truth. The answers can be sorted into the same three general types: one can believe that a contrast set is of subjective, intersubjective, or objective origin.

It is extremely common for the true story of the history of a contrast set to lie mostly on one of these three levels, while peoples' naive belief about the history of that same set lies mostly on another level.

The difference between the intersubjective and objective levels of explanation parallels the distinction between contrast sets that are constructed and discerned. When one imagines that U and V, F and F sharp, Monday and Tuesday, and Iran and Iraq are different things because these differences are given to us by the natural world, this is an objective explanation. We use the word "objective" to describe a reality that is difficult or impossible to challenge, ignore, or reshape. In contrast, an intersubjective explanation would say that that the boundaries between U and V, F and F sharp, Monday and Tuesday, and Iran and Iraq may be influenced by natural considerations, but their final determination is a matter of social convention and social fact.

The difference between the subjective and intersubjective levels of explanation is that between the purely individual world and the shared social world. The contrast set that you use to sort the books on your shelf, or the image of the calendar that you use to think about time, are known only to you (even if their creation was influenced by society). In contrast, the library call number or ISBN number of each book, or the fact that today is Monday and the first day in November, are facts shared by and indeed agreed upon by all participating

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<sup>1</sup> For more detailed expositions of this division see Eviatar Zerubavel, *Social mindscapes: an invitation to cognitive sociology* (Cambridge: Harvard University Press, 1997), pp. 1-10; Peter L. Berger and Thomas Luckmann, *The social construction of reality* (Garden City, N.Y.: Doubleday, 1966).

members of society. Both subjective and intersubjective phenomena share in common that their existence could someday be effaced because it is carried primarily in human minds. If civilization were wiped out tomorrow, the system of ISBN numbers would go with it. (While we do objectify intersubjective phenomena by making physical commitments to them, this objectification is, relatively speaking, quite fragile.) But what makes intersubjective facts different from subjective facts is that, while both are in our heads, intersubjective knowledge is in *all* of our heads — or at least the heads of everyone within the thought community in question.

The word "intersubjective," which was coined by Alfred Schutz, nicely captures how a collective phenomenon — the combination and coordination of many, many peoples' subjective beliefs — together comes to constitute something larger than each individual self. It emphasizes the fact that the perpetuation of these phenomena depends on the tacit coordination of many peoples' subjective reality. Contrast sets and coordination solutions become standards, institutions, and social facts by acquiring an unstoppable momentum that makes us forget that there was ever any other possible choice. They could have been otherwise, but they are not — so we accept them the way they are. This acceptance is predicated on the fact that lots of other people also accept the very same social fact. It is a fragile acceptance, because if everyone else dropped the fact, we would probably have to, too. As Schutz explains,

... the world of my daily life is by no means my private world but is from the outset an intersubjective one, shared with my fellow-men ... in brief, it is a world common to all of us. The unique biographical situation in which I find myself within the world at any moment of my existence is only to a very small extent of my own making. I find myself always within an historically given world which, as a world of nature as well as a sociocultural world, had existed before my birth and which will continue to exist after my death. This means that this world is not only mine but also my fellow-men's environment; moreover, these fellow-men are elements of my own situation, as I am of theirs.<sup>2</sup>

## 6.2 Reification

The most common confusion between the subjective, intersubjective, and objective levels of explanation is to imagine that an intersubjective phenomenon (for example, the

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<sup>2</sup> Alfred Schutz, *Collected Papers* (The Hague: Martinus Nijhoff, 1973), 1: 312.

letters of the alphabet) is actually of objective and natural origin. This is an understandable and predictable confusion, since our commitment to some standard solutions is so deep that it makes us forget they were ever designed and chosen by people. Sociologists call this process of forgetting "reification."<sup>3</sup> To reify a standardized contrast set is to imagine that it is an irreversible fact of nature; to forget our own power, and responsibility, to create the facts of the world around us; and to overlook how we perpetuate them only through a tacit, collective, intersubjective agreement to build them into our minds and our man-made landscapes.

It is terribly easy, for example, to imagine that our standards of length, temperature, pitch, or even writing systems or electrical plugs are objective facts of the natural world. From the child's point of view, a yard or a meter is as real as a mountain or a lake.<sup>4</sup> Many people simply carry this way of thinking into adulthood. (After all, when I revisit the school I attended as a child, it is hard for me to get used to the renovations which have knocked down walls and reshaped rooms which I once considered permanent.) By thinking this way, we forget the human authorship of the world.<sup>5</sup> We forget that our creations are "the product of human ingenuity, human passion, and the choices of particular people in particular times and places,"<sup>6</sup> and that their perpetuation is not inevitable but involves an *ongoing* element of choice, as well.

Reification also means that people forget how the status of a particular coordination solution can vary from group to group, with some societies choosing one solution and others another. Consider, for example, the old joke about the woman who encounters an immigrant family at the beach — say, from Korea — and hears their four-year-old child speaking a

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<sup>3</sup> A good overview of reification, applied to the case of temporal contrast sets, is Eviatar Zerubavel, *The seven day circle: the history and meaning of the week* (New York: Free Press, 1985), pp. 138-141. For a classic treatment of the concept see Berger and Luckmann, *The social construction of reality*, pp. 82-85.

<sup>4</sup> "Thought rests on the proposition that the objects confronting the child in the external world are permanent, so that they can be perceived of in terms that are constant ... Life is a process of learning that things are not what they seem to be." — Thomas Crump, *The anthropology of numbers* (Cambridge: Cambridge University Press, 1990), p. 16.

<sup>5</sup> See Berger and Luckmann, *The social construction of reality*, p. 82.

<sup>6</sup> Ken Alder, *The measure of all things* (New York: Free Press, 2002), p. 350.

foreign language fluently. "What a genius!" she says. "Four years old and he already speaks Korean." This joke shows how common it is for people to subscribe to a folk theory of the world that says "Everyone else is just like me except where I've been told otherwise." In this case, the mistaken belief that results is that Korean, for everyone, is a foreign language, which it takes great effort and skill to learn.

I propose that the phenomenon of reification is one of the reasons why we often background the fundamental coordination solutions that we live by. Reification can account for the fact that contrast sets are often ignored in studies of the phenomena that surround them, so that Max Weber's book on the sociology of western music says nothing about pitch standardization,<sup>7</sup> and the huge exhibit on the history of the telephone that I recently walked through in the Deutsches Museum in Munich says nothing about phone numbers. It can also account for the way in which we forget to mention other basic coordinative standards in writing about a particular society at a particular time: thus, although we have many records of the ancient world, none of the surviving authors thought fit to mention whether traffic in ancient Rome (or any other classical city) conventionally kept to the left or the right,<sup>8</sup> and I read weeks' worth of newspaper coverage of the Iraq war in 2003 without once getting to hear about what kind of language American troops used to communicate with Iraqi civilians. In particular, Max Weber and the Roman historians may not have even considered that there might be a worthwhile story to tell about pitch standardization or the rule of the road, because they may have thought little or not at all about the fact that anyone could have ever chosen a different solution to these mundane problems of everyday coordination.

If one analyzes the reasoning used in the world of scholarship, educated discourse, and political debate, it is surprisingly common to see authors reify contrast sets that are distinctly man-made, thus forgetting (or even refusing) to admit the human authorship of these sets into the discussion at hand. I do not think it would be going too far to say that this

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<sup>7</sup>See Otis Dudley Duncan, *Notes on social measurement: historical and critical* (New York: Russell Sage Foundation, 1984), p. 13.

<sup>8</sup>See Peter Kincaid, *The rule of the road: an international guide to history and practice* (New York: Greenwood Press, 1986), pp. 12-14.

reification sometimes leads people to overlook valid hypotheses or potentially reasonable courses of action. For example, both the huge literature on learning to read, and the huge experimental psychological literature which makes use of word recognition tasks, usually make no reference to the conventionality of the alphabet. Indeed, it is only recently that reading specialists have finally come to consider the quality of a writing system's correspondence to spoken language as a factor in the prevalence of dyslexia. (Dyslexia appears to be less common in cultures where that correspondence is close.<sup>9</sup>) To take another example, the fact that countries already exist adds an extra hurdle to those who wish to seriously question whether their existence as a single entity makes sense. Thus in the Iraq of 2003 and 2004 it is possible to discern three distinct cultural subgroupings; but when a respected newspaper columnist recently brought up the question of whether Iraq made sense as a single entity, the negative letters to the editor that resulted generally tabooed the idea of change, rather than rationally rejecting the cost or consequences of change.<sup>10</sup> Indeed, much policy towards Yugoslavia in the early 1990s was devoted simply to trying to keep the country from breaking up.<sup>11</sup> The Final Act of the Conference on Security and Cooperation in Europe in Helsinki in 1975 declared that "the participating States regard as inviolable all one another's frontiers," thus raising the human partitioning of a domain to the level of objective and unchallengeable reality.<sup>12</sup> Similarly, "powerful taboos have long prevented any serious discussion of alternatives to the post-colonial state in Africa"; any consideration of boundary changes, even if they would bring ethnic and political frontiers into closer correspondence,

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<sup>9</sup> Philip H. K. Seymour, Mikko Aro, and Jane M. Erskine, "Foundation literacy acquisition in European orthographies," *British Journal of Psychology* 94,2 (2003): 143-174; Charles A. Perfetti, "The psycholinguistics of spelling and reading," in *Learning to spell: research, theory and practice across languages*, edited by Charles A. Perfetti, Laurence Rider, and Michel Fayol, pp. 21-38 (Mahwah, N.J.: Lawrence Erlbaum, 1997). See also Wai Ting Siok, Charles A. Perfetti, Zhen Jin, and Li Hai Tan, "Biological abnormality of impaired reading is constrained by culture," *Nature* 431 (2004): 71-76.

<sup>10</sup> Leslie Gelb, "The three-state solution," *New York Times*, 25 November 2003, p. A27, and the responses under "Must Iraq be whole to be free?," *New York Times*, 30 November 2003, *Week In Review*, p. 8.

<sup>11</sup> See Warren Zimmermann's *Yugoslavia and its destroyers* (New York: Times Books, 1996) for an example of a diplomat deeply committed to the preservation of an existing contrast set. See also Benjamin Schwarz, "The diversity myth: America's leading export," *Atlantic Monthly*, May 1995, p. 57.

<sup>12</sup> Conference on Security and Cooperation in Europe, "Final Act," Helsinki, 1 August 1975 <http://www.osce.org/docs/english/1990-1999/summits/helfa75e.htm> (November 2004).

amounts to "thinking the unthinkable."<sup>13</sup> And the authors of a recent book on the optimal size of countries felt a need to persuade readers that it makes sense to "consider a country's borders subject to the same analysis as any other man-made institution."<sup>14</sup>

In describing his thoughts after his elementary-school mathematics students asked him where numbers come from, Georges Ifrah reveals the typical mindset of someone who has reified a fundamental contrast set:

Well, where do numbers come from, in fact? These familiar symbols seem so utterly obvious to us that we have the quite mistaken impression that they sprang forth fully formed, as gods or heroes are supposed to. The question was disconcerting. I confess I had never previously wondered what the answer might be.

"They come ... er ... they come from the remotest past," I fumbled, barely masking my ignorance.

[...] The arithmetic books and the school manuals which were my working tools did not even allude to the history of numbers ... It was almost as if a conspiracy of obviousness aimed to make a secret, or even worse, just to make us ignorant of one of the most fantastic and fertile of human discoveries.<sup>15</sup>

"A conspiracy of obviousness" is a fine way to describe the way we reify and background contrast sets. They are all around us, yet we rarely discuss them and even more rarely acknowledge our authorship, responsibility, and power over them.

The term reification refers to the act of mistaking the *social* as *natural*, or in other terms, mistaking the intersubjective world as objective. Note that it is, however, possible to mistake the *subjective world* as either intersubjective or objective — in other words, to mistake the *individual* as either social or natural. This happens on an everyday basis when we overestimate other peoples' ability to read our handwriting, or when we get used to a piano being out of tune. It also happens quite commonly with people who have unusual mental images of a particular semantic domain. Thus both people with variant color vision, and people with absolute pitch, initially tend to be surprised that the "normal" majority of people do not partition and label the domains of color or pitch in the same way as they do.<sup>16</sup>

<sup>13</sup> Christopher Clapham, "Rethinking African states," *African Security Review* 10, 3 (2001).

<sup>14</sup> Alberto Alesina and Enrico Spolaore, *The size of nations* (Cambridge: MIT Press, 2003), p. 2. The quote is actually from the book jacket.

<sup>15</sup> Georges Ifrah, *The universal history of numbers: from prehistory to the invention of the computer* (New York: John Wiley & Sons, 2000), pp. xvii-xviii.

<sup>16</sup> Peter K. Kaiser and Robert M. Boynton, *Human color vision* (2nd ed. Washington: Optical Society of America, 1996), p. 423; Ian Watson, "Pitch standardization and perfect pitch," unpublished term paper, Department of Sociology, Rutgers University, 2000.

## 6.3 Justifications

In any literate community with some tradition behind it there is a whole set of convictions and rationalizations concerning speech and writing, against which the planner may turn out to be powerless, unless he can turn them to account for his own purposes. However irrational they may be, they generally turn out to bolster the status and convenience of those who have invested effort in learning the social traditions.<sup>17</sup>

Contrast sets beget a whole range of explanations, justifications, and myths designed to shore up and legitimate their role in society. In this respect, they are no different from other norms, social facts, or choices between competing design options. Since, of all social institutions, it is hardest to imagine changing those which are objectively grounded, these justifications and legitimations generally aim at convincing people to see society's standard operating procedures as natural and inevitable, or, at least, as objectively the best choice among several competing solutions to a problem of choice or coordination. Note that while I use the term "justification" here, the classic description of justifications in Berger and Luckmann's *The Social Construction of Reality* uses the term "legitimation."<sup>18</sup>

The simple fact that a contrast set (or any other standards solution) was chosen to solve a coordination problem tells us that it had at that moment some salience within the domain of possible solutions.<sup>19</sup> Justifications may (or may not) point to this salience to explain the fitness of a particular standards solution. What is important and interesting about standards justifications is actually not the question of whether or not they are true and right, but simply the fact that they get used. Many justifications are irrational, misleading, or tell less than the full truth. (Consider how Latin instructors might argue for continued instruction in the language by emphasizing its intrinsic value, while never mentioning their own interest in the existence of a market for their own services.<sup>20</sup>) Like myths, the efficacy of a standards justification may lie more in its superficial plausibility than in its accurate

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<sup>17</sup> Einar Haugen, "Linguistics and language planning," In *The ecology of language: essays by Einar Haugen*, pp. 159-190 (Stanford: Stanford University Press, 1972 [1966]), p. 172.

<sup>18</sup> Berger and Luckmann, *The social construction of reality*, pp. 85-118.

<sup>19</sup> On salience, see Thomas Schelling, *The strategy of conflict* (Cambridge: Harvard University Press, 1960), pp. 54-58, 92-94; Edna Ullmann-Margalit, *The emergence of norms* (Oxford: Clarendon Press, 1977), pp. 83-84.

<sup>20</sup> This example is based on a comment by Pierre Bourdieu, *Language and symbolic power* (Cambridge: Harvard University Press, 1991), p. 57.

reflection of the truth.<sup>21</sup> And a deceptively marshalled justification is just as interesting as a rock-solid one, since what interests us primarily here is the process of legitimating norms, not which norm is truly the best.

During my own research on standardization, I have sorted standards justifications into five rough categories of my own devising. Each of these categories of justification appeals to something different as the determiner of what stands out as superior within the domain of possible solutions. This "something" may be *nature, the supernatural, history, conformity, or distinctiveness*. I go into more detail below, and give examples of each type of justification, focusing on contrast sets but also mentioning examples which involve standards solutions that are not contrast sets.

One may invoke these appeals to justify the *existence* of a contrast set, the *choice* of a contrast set, *or* a *change* in an existing contrast set. We justify an existing contrast set by telling a narrative, a sort of origin myth, which explains how it came to become a social norm. We justify the choice of a new standards solution by invoking one of the appeals to show that it would be the best response to an as yet unresolved coordination problem. And anyone who advocates changing an existing contrast set must also justify why their proposed standards solution is better than the current one.

To those studying the individual history of any contrast set or coordination solution, its justifications will seem intimately bound up with the unique history and circumstances of the problem in question. But after reading many, many accounts of specific coordination solutions, the justifications they present start to sound very familiar. The same patterns repeat over and over so frequently that even their language becomes predictable. Those deeply involved in the history of a single standards problem sometimes do not see the form behind the instance. (The effect is similar to how every medical patient sees their own symptoms as special and important, but doctors see a patient as just one more case of a particular disease pattern.) That does not mean that justifications are hollow or false or that

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<sup>21</sup>On plausibility versus truth in the explanation of changing tastes, see Stanley Lieberman, *A matter of taste: how names, fashions, and culture change* (New Haven: Yale University Press, 2000), pp. xiv-xv.

one should use my typology to dissolve their meaning and force. It means only that they recur. Knowing the five types listed in this section helps to place them in context.

## The appeal to nature

To justify a standard through an appeal to nature means looking outside the social world to some fact of nature which, at the least, narrows the field of possible solutions to a standards problem, and, in some cases, actually suggests which exact solution we should choose. Consider, for example, the use of the melting point of ice and boiling point of water as anchor points for the calibration of the Réaumur and Celsius temperature scales,<sup>22</sup> the probably apocryphal tradition that the standard railway gauge of 4 feet 8½ inches "originally represented the width of the hind end of a Norfolk mule used to pull coal wagons on wooden rails,"<sup>23</sup> and the historians of the alphabet who have tried to explain our choice of graphic elements by saying that the stars in the night sky spell out the letters of the Hebrew alphabet, or by invoking the fact that nature presents us with certain basic shapes (lines, crosses, circles, and so on) which constrain our choice of meaningful designs.<sup>24</sup> The grounding of the length of the meter in a natural fact (the dimensions of the earth itself) is probably the best known example of the appeal to nature. It is also a cautionary tale of how difficult it is to entirely eliminate wiggle room and thus arbitrary choice from a naturally grounded standard.<sup>25</sup>

Appeals to nature are particularly powerful and attractive justifications. They ground our choice of a seemingly conventional, social fact in something that is external and thus potentially impartial and nonpartisan. Natural solutions lack the sense of arbitrariness which makes entirely conventional and random choices uncomfortable. Natural solutions are often based on unchanging facts of nature (such as the boiling point of water at sea level), which

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<sup>22</sup> W.E. Knowles Middleton, *A history of the thermometer and its use in meteorology* (Baltimore: Johns Hopkins Press, 1966).

<sup>23</sup> Charles P. Kindleberger, "Standards as public, collective, and private goods," *Kyklos* 36 (1983): 377-396, p. 384.

<sup>24</sup> Johanna Drucker, *The alphabetic labyrinth* (London: Thames & Hudson, 1995), p. 192, 300; see also pp. 208-213 on efforts to relate the alphabet to the human body.

<sup>25</sup> See Alder, *The measure of all things* for a book-length treatment of this issue.

are scientifically reproducible and thus easy to calibrate, and do not require the circulation of physical standards like tuning forks or yardsticks. Other natural solutions are inspired by the inescapable and everpresent facts of human biology, an example being the entire class of "anthropometric measures," such as the cubit, which derive from the sizes of the parts of the human body.<sup>26</sup> Sometimes, an appeal to nature carries the message that a particular coordination solution is in some way naturally, inescapably better than others. In many of these cases the appeal to nature derives from (and encourages the further pursuit of) scientific comparison of the merits of the different solutions to a problem. (In other cases, such as the derivation of standard rail gauge from the hindquarters of a horse, the appeal to nature simply brings in a fact from the outside world that makes it easier to choose a solution.)

Indeed, many objective research-based comparisons of coordination solutions presuppose that we value natural grounds for choosing the solution to a coordination problem. Consider the effort to compare traffic accident statistics from different countries in an effort to decide whether driving on the left or the right side of the road is safer,<sup>27</sup> or to study typists' speed or finger movements in order to determine whether it is easier to use a Dvorak or a QWERTY keyboard. However, designing an experiment that distinguishes natural superiority (pre-commitment superiority) from superiority based on habituation (post-commitment superiority) can be very difficult. For example, how can we compare the effectiveness of a familiar and an unfamiliar road sign, given that we are already used to one of them, in a way which "does not simply describe the historical development of conventions"?<sup>28</sup> Is Venice really difficult to navigate around, or is it that German and American visitors are just not used to such street plans? Is roman type really easier to read

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<sup>26</sup> Witold Kula, *Measures and men* (Princeton: Princeton University Press, 1986 [1970]), pp. 24-28.

<sup>27</sup> See the review of J. J. Leeming's research by Kincaid, *The rule of the road*, pp. 25-27.

<sup>28</sup> Johanna Drucker, *The alphabetic labyrinth* (London: Thames & Hudson, 1995), p. 301. For an attempt to design exactly such a study see Robert W. Brainard, Richard J. Campbell, and Edwin H. Elkin, "Design and interpretability of road signs," *Journal of Applied Psychology* 45 (1961): 130-136. For a brief comment on the general problem of trying to distinguish between natural conditions and norms, see Edwin Battistella, *The logic of markedness* (New York: Oxford University Press, 1996), p. 11.

than sans-serif, or are we just more used to it? Do capital letters really make reading easier, or are we just unfamiliar with reading all lower-case (see further section 4.6)? Are initial and final letters in Arabic and Hebrew worth the bother? And what sort of test could we use to compare the Clutsam and Jankó piano keyboards with the traditional layout?<sup>29</sup>

Despite these difficulties, it is quite often possible to come up with convincing arguments for the natural superiority of one solution or another to a problem. The appeal to nature is regularly cited in debates about standards change, such as in the claim that current standard electrical plugs are better than the old light bulb sockets because they are safer,<sup>30</sup> that the Pinyin writing system for Chinese is better than characters because it is easier to learn, that 440 Hz is a better pitch standard than 439 Hz because 440 is not an unfactorable prime number,<sup>31</sup> or the idea that the current international paper size system is better than the standard used in America because its 1:2 and 1:√2 size ratios are convenient and mathematically elegant.<sup>32</sup>

## The appeal to the supernatural

The appeal to the supernatural also finds justification for a standards solution outside the social world, but assigns to God or a supernatural force the responsibility for having chosen that solution over others. If we use Durkheim's equation of God and society, we can read the appeal to the supernatural as an alternative way of expressing that standards are social facts, and that social facts have (or should have) the power to determine individual actions. The appeal to the supernatural has in common with the appeal to nature that it justifies social choices by reference to external forces, tends to downplay the human

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<sup>29</sup> On piano keyboards see Edward Tenner, *Our own devices: the past and future of body technology* (New York: Alfred A. Knopf, 2003), pp. 173-178.

<sup>30</sup> Fred E. H. Schroeder, "More 'small things forgotten': domestic electrical plugs and receptacles, 1881-1931," in *Technology and choice: readings from Technology and Culture*, edited by Marcel C. LaFollette and Jeffrey K. Stine, pp. 117-135 (Chicago: University of Chicago Press, 1991).

<sup>31</sup> Llewellyn Southworth Lloyd, "Standard pitch," *Grove's dictionary of music and musicians*, 5th ed. (1954), 6: 788-803, p. 789.

<sup>32</sup> Markus Kuhn, "International standard paper sizes," <http://www.cl.cam.ac.uk/~mgk25/iso-paper.html> (November 2003).

authorship of coordination solutions, and provides a way of ignoring, and thus coping with, the arbitrariness of social norms.

The supernatural is often invoked to justify standards whose origin is lost in time. For example, the Book of Genesis defends the origin of the 7-day week as part of God's original plan for creating the world.<sup>33</sup> Many societies with less highly developed historical and archeological techniques than we have today have had mythological explanations of the creations of their writing system by a supernatural force.<sup>34</sup> Even in Western Europe as late as the seventeenth and eighteenth centuries, Daniel Defoe and John Wilkins credited God and Adam, respectively, with the origin of writing.<sup>35</sup> But the case of an Internet home page offering a supernatural explanation of the international standard paper size system shows that people are also capable of invoking supernatural explanations for standards solutions with historically recoverable origins.<sup>36</sup> One must also mention the case of the Burmese dictator Ne Win, whose decisions to issue banknotes of 45 and 90 kyats (instead of, say, 50 and 100) and to change the rule of the road from keep-left to keep-right were apparently motivated by a belief in the significance of the number 9 and the advice of a fortune-teller respectively.<sup>37</sup>

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<sup>33</sup>Zerubavel, *The seven day circle*, pp. 6-7.

<sup>34</sup>For an overview, see Florian Coulmas, *The Blackwell encyclopedia of writing systems* (Oxford: Blackwell, 1996), pp. 119-124. For individual cases, see William A. Smalley, *Mother of writing: the origin and development of a Hmong messianic script* (Chicago: University of Chicago Press, 1990); David Dalby, "The indigenous scripts of West Africa and Surinam: their inspiration and design," *African Language Studies* 9 (1968): 156-197; Keith A. Basso and Ned Anderson, "A Western Apache writing system: the symbols of Silas John," in *Advances in the creation and revision of writing systems*, edited by Joshua Fishman, pp. 77-104 (The Hague: Mouton, 1977); Charles A. Ferguson, "St. Stefan of Perm and applied linguistics," in *Language problems of developing nations*, edited by Joshua A. Fishman, Charles A. Ferguson, and Jyotirindra Das Gupta, pp. 253-265 (New York: John Wiley & Sons, 1968), p. 260.

<sup>35</sup>Denise Schmandt-Besserat, *How writing came about* (Austin: University of Texas Press, 1996), pp. 3-4; Drucker, *The alphabetic labyrinth*, p. 217. For twentieth-century examples, see Drucker, pp. 293-294, 302-306.

<sup>36</sup>Vernon Jenkins, "The postscript," <http://homepage.virgin.net/vernon.jenkins/PS.htm> (November 2003).

<sup>37</sup>These justifications have been widely reported in the popular media, travel guidebooks, and on the Internet (e.g., <http://www.diacritica.com/degenerate/1/burma4.html>; <http://www.geocities.com/glossograph/burma9407funnymoney.html>; <http://de.wikipedia.org/wiki/Kyat>; all November 2004), but I have not found a source for either reform which I consider authoritative.

## The appeal to history

The appeal to history justifies continuing use of a standards solution on the grounds that it is already in use. This appeal is a recognition of cultural inertia, the social facticity of standards, and the power of our existing commitment to a standards solution: how society is set up today influences how it will be set up tomorrow.

For example, though it made sense as part of an overall program of decimalization, the introduction of the Celsius temperature scale in France after the Revolution was resisted by many people who were simply used to using the old Réaumur scale and did not want to disrupt their mental sense of what, say, thirty degrees meant.<sup>38</sup> Similarly, one of the reasons for the failure of Chinese script reform in the twentieth century, despite support from Mao and other Communist leaders and the obvious practical advantages of an alphabetic writing system, was simply the huge commitment of Chinese culture to its long-entrenched, if inefficient, character system.<sup>39</sup> Consider as well that my instructor encouraged me to send a copy of my proposal for the relabeling of the Rutgers campus bus routes (see section 4.3) to the campus bus management. I did so, and they sent me a nice thank-you note, but changed nothing. Maybe they disliked my design, but maybe it also had to do with the cost of making new signs, reprogramming display boards, and reprinting maps. After all, nobody likes to have to undo their cognitive or physical commitment to a standards solution or to have to consider the time spent creating knowledge of that solution wasted.

The appeal to history also furthers the interests of those who profit from the continued use of those solutions. It is no surprise to see the American Zinc Association weighing in against the idea of retiring the American penny (one-cent coin), which is 98

<sup>38</sup> Middleton, *A history of the thermometer and its use in meteorology*, p. 121.

<sup>39</sup> John DeFrancis, *The Chinese language: fact and fantasy* (Honolulu: University of Hawaii Press, 1984), pp. 247-259.

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percent zinc.<sup>40</sup> The appeal to history is often invoked to argue against changing coordination solutions. The message is: Don't change a thing.

While the appeal to nature interests scholars who want to make systematic comparisons of the fitness of different solutions, the appeal to history interests scholars who are interested in understanding the persistence of coordination solutions as institutional facts. For example, according to classical economic theory, the invisible hand of competition and free markets should steer societies in the direction of the most efficient possible solution to a coordination problem. The "institutional economics" school, on the other hand, would suggest that physical and cognitive commitments to conventional coordination solutions slow societies' ability to change over to solutions which are naturally more efficient. While the appeal to nature means judging the fitness of competing coordination solution on first principles, as if one were choosing for the first time, the appeal to history recognizes that the decision whether to continue a coordination solution may depend on the current level of commitment to it. This type of development, in which the probability of an event (such as the adoption of a solution) is dependent on the outcome of the preceding event in a series, is known as a Markov chain in mathematics. Combining this line of reasoning with a spatial metaphor for the different solutions to a particular coordination problem, institutional economists have proposed that the development of certain coordination problems is "path-dependent," meaning that if the choice of a coordination solution arbitrarily "starts out" in a particular "direction," it may have a very hard time "finding its way" to the solution which is ultimately best on natural grounds.<sup>41</sup>

This is, essentially, a rediscovery of the idea of social facticity as well as a challenge to the idea that markets are naturally efficient. These economists propose that the power of

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<sup>40</sup> "You can still do some good with a penny," letter to the editor from George Vary, Executive Director, American Zinc Association, *New York Times*, 21 November 1995, p. A20. It is no surprise that "Americans for Common Cents" ([www.pennies.org](http://www.pennies.org)), a pro-penny non-profit organization, is funded by "mining and coin-manufacturing interests." See Larry Copeland, "Bill would make pennies obsolete," *USA Today*, 18 July 2001.

<sup>41</sup> For this perspective put forth by an economist, see Brian Arthur, *Increasing returns and path dependence in the economy* (Ann Arbor: University of Michigan Press, 1994); by a scholar of standardization, see Samuel Krislov, *How nations choose product standards and standards change nations* (Pittsburgh: University of Pittsburgh Press, 1997), pp. 213-214.

continuity and inertia is so strong that we perpetuate coordination solutions that are not actually not in everyone's interest. What gets chosen depends not on what is best but on what has come before. Working from these arguments, many scholars would argue that the invisible hand has no certain power to bring about good in the solution of a particular coordination, and that injustice and inefficiency are the inevitable result of letting norms develop without some kind of government intervention. They would treat this as a call for collective action and planning.

Other economists, however, hold to a libertarian view and reject the idea that governments should assume the cost of change to a solution that appears superior. Even the most virulent libertarian critics of path-dependency theories do seem willing to admit that a coordination solution can persist despite the availability of a superior solution.<sup>42</sup> The difference seems to be that these critics believe that it is not the role of governments to reduce the individual costs of changing coordination solutions by creating incentives for individuals to change from one coordination solution to another: in other words, if incentives for change that operate at the individual level do not exist, governments should not create them artificially. (Pushed to its extreme, this line of argument might even say that not only should governments not do this, no person or group of persons who acts on behalf of an entire social group or thought community should ever take on such a role.) Institutional economists, on the other hand, seem to have more confidence in governments' abilities to judge whether the costs of trying to spur change in a community might be balanced by social benefit over the long term, and are thus more willing to disregard the appeal to history and to risk common resources to try to bring about common good.

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<sup>42</sup> Stan J. Liebowitz and Stephen E. Margolis, *Winners, losers & Microsoft: competition and antitrust in high technology* (Oakland, Calif.: Independent Institute, 1999), pp. 51-56.

## The appeal to conformity

Where the appeal to history reminds us that a coordination solution was in use in the same place<sup>43</sup> at a previous time, the appeal to conformity points out that the solution is in use at the same time in another place.

The appeal to conformity is often invoked in cases of standards change. Cultures and nations often have a strong incentive to harmonize their standards solutions with the people who live around them. For example, decimalization of the British monetary system in the early 1970s made it more similar to the monetary systems of other industrialized countries. In the 1990s, European countries tried to coordinate their telephone dialing systems, working towards a universal dialing lexicon in which (for example) "00" signals that a country code will follow. The primary motivation behind Sweden's changing its rule of the road from keep-left to keep-right in 1967 was to bring it in line with its neighbors Norway, Finland, and Denmark, as well as the rest of mainland Europe.<sup>44</sup> The appeal to conformity shows up often in the history of writing systems — among many examples, Atatürk's conversion of Turkish to the Roman script was closely connected to the desire to make Turkey like the West.

The appeal to conformity is a way of encouraging entire societies to join up with even larger groups. The promotion of international standardization by organizations such as ISO relies on the idea that the widest possible standards coordination will lower barriers to trade, reduce the cognitive dissonance of travel, eliminate pointless design inconsistencies, generate economies of scale, and thereby advance the public interest. Conformity brings many benefits. There is naturally a strong incentive to use the same numerals, musical tuning, alphabetical order, typewriter keyboard layout, library call number system, or clock

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<sup>43</sup>I say "the same place" to keep my language simple, but it would be more accurate to say "by the same thought community or social group." The same applies to the section on distinctiveness.

<sup>44</sup>Arne Dufwa, *Stockholms tekniska historia: Trafik, broar, tunnelbanor, gator* (Stockholm: Kommittén för Stockholmsforskning, 1985), pp. 144-154; Peter Kincaid, *The rule of the road: an international guide to history and practice* (New York: Greenwood Press, 1986), pp. 159-162.

face as everybody else does. We know this at the individual level and the appeal to conformity tries to justify this at the level of an entire group or society.

## The appeal to distinctiveness

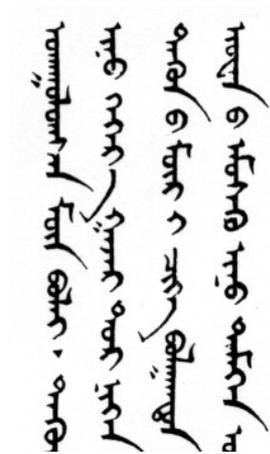


Image 6.1 (039)

Lest we think that there is any natural tendency to harmonize standards solutions temporally or spatially, the appeal to distinctiveness justifies a deliberate choice of standards solutions that are *different* from the ones that other people use. This difference may be across time, in which case it is the reverse of the appeal to history, or across space, in which case it is the reverse of the appeal to conformity. Thinking spatially, consider that since coordination solutions can be a badge of identity for a country and since changing solutions as you cross into a new country reinforces the experience of the border, having an unusual and distinctive norm can be a way for some countries to maintain their separateness and emphasize their distinctiveness to visitors and to their own citizens. This is one of the reasons why France developed its own color TV standard,<sup>45</sup> why Judaism, Christianity, and Islam rest on different days of the week<sup>46</sup> and number years differently, why the rules for when to celebrate Easter avoid any coincidence with Passover,<sup>47</sup> and why the closely related Havasupai and Hualapai languages in Arizona use unnecessarily different orthographies.<sup>48</sup> Consider also the American ice cream manufacturer that deliberately produces not "vanilla," "strawberry," and "chocolate" but flavors like "Phish Food," "Karamel Sutra," and "Cherry Garcia."<sup>49</sup> On an individual level, we are all familiar with teenage stylistic rebellion and

<sup>45</sup> Rhonda J. Crane, *The politics of international standards: France and the color TV war* (Norwood, N.J.: Ablex, 1979).

<sup>46</sup> Zerubavel, *The seven day circle*, pp. 20-26.

<sup>47</sup> Eviatar Zerubavel, "Easter and Passover: on calendars and group identity," *American Sociological Review* 47 (1982): 284-289.

<sup>48</sup> Rena Crook, Leanne Hinton, and Nancy Stenson, "Literacy and linguistics: the Havasupai writing system," *University Museum Studies* 11 (1977): 1-16. For more similar examples, see Joshua Fishman, "Introduction," in *Advances in the creation and revision of writing systems*, edited by Joshua Fishman, pp. xi-xxviii (The Hague: Mouton, 1977), p. xiii.

<sup>49</sup> See [www.benjerry.com](http://www.benjerry.com) (November 2003).

"antifashion."<sup>50</sup> As Kai Erikson expresses it, "There are people in any society who appear to 'choose' a deviant style exactly *because* it offends an important value of the group."<sup>51</sup>

Appeals to temporal distinctiveness are very common at points when entire cultures want to leave the past behind. For example, when Mongolia tried to reinstitute its native script (see Image 6.1) in 1992 — despite the fact that its top-to-bottom directionality and poor fit with modern Mongolian phonology made this very impractical — an overwhelming motivation was to symbolically reassert Mongolia's cultural independence, and to step out of the shadow cast by the Soviet Union and the Cyrillic script.<sup>52</sup> Similarly, the French Revolutionary calendar symbolized not just a spatial break with the rest of Europe, but a temporal break with the hated feudal past.<sup>53</sup>

## 6.4 The dilemma of arbitrariness

The final step in the choice of any coordination solution is often arbitrary, meaning that it is not possible to find a justification for why to select one solution over another. Even a coordination norm which is to a large extent naturally determined or inspired will usually leave some wiggle room within which an arbitrary choice must be made. Arbitrary choices cause many problems in the development of norms. Arbitrariness is attractive when we see it as fair and impartial, but it is unattractive when it leaves us with too much choice and no way of justifying what we eventually settle on.

We can say that when one selects with justification, one *chooses*, whereas when one selects arbitrarily, one *picks*. (This terminological difference was introduced by Edna Ullmann-Margalit.<sup>54</sup>) The difference between picking and choosing standards solutions is akin to the problem presented by a box of chocolates from which you are invited to select. If

<sup>50</sup> Lieberman, *A matter of taste*, p. 7, citing Fred Davis, *Fashion, culture, and identity* (Chicago: University of Chicago Press, 1992).

<sup>51</sup> Kai Erikson, *Wayward Puritans: a study in the sociology of deviance* (New York: John Wiley, 1966), p. 20.

<sup>52</sup> Stephane Grivelet, "Reintroducing the Uighur-Mongolian script," *Mongolian Studies* 18 (1995): 50.

<sup>53</sup> Eviatar Zerubavel, "The French republican calendar: a case study in the sociology of time," *American Sociological Review* 42 (1977): 868-877.

<sup>54</sup> Ullmann-Margalit, *The emergence of norms*, p. 115; she credits the idea to Sidney Morgenbesser.

the chocolates are all different, the issue is to *choose* the one you like the best; your preference justifies your choice. If the chocolates are all the same, you have to *pick* one of them (it doesn't matter which one). When one picks a solution, the act of solving the problem is more important than the identity of the solution chosen.

For the designer of a contrast set or any other coordination norm, the hardest thing is sometimes not to justify *what* you select, but to justify *not* selecting everything else.<sup>55</sup>

Arbitrariness is welcome when its message is that nothing you can do will be unfair or biased. The problem comes when one gets to the actual process of picking a solution. With so many attractive options, it is genuinely painful to have to pick just one.<sup>56</sup> One wants to do so randomly, but this turns out to be harder than it looks.

Regardless whether the issue is the selection of an order, a stand-in, an iconic principle, a contrast set, or any other of several competing solutions to the same problem, one can approach but never reach a fully random method. The philosophy of randomness confirms this at length.<sup>57</sup> To say that it is impossible to make a random selection means that it is never possible to make a selection in a way that has no origin story to it. What varies is to what extent the origin story is recoverable, and connected to the interests of those making the choice. The weaker the connection, the more we consider the choice "random." We think of rolling dice as a way of divorcing the process of selection from the interests of the person doing it. The physical reasons why a pair of dice fall the way they do can be recounted and can form an origin story for the actions which result, but the story will be irrelevant to the hopes and fears the players in the game had about the way the dice might land. Maximizing this kind of irrelevance is what gives arbitrary choice its sense of fairness, even though true "fairness" is as unreachable as true "randomness."

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<sup>55</sup> Recall again Winfried Nöth's comment from *Handbook of semiotics* (Bloomington: Indiana University Press, 1990), p. x: "any selection ... implies the rejection of all nonselected items."

<sup>56</sup> For a semi-popular treatment of this theme at the individual level, see Barry Schwartz, *The paradox of choice: why more is less* (New York: Ecco, 2004).

<sup>57</sup> See Bruce Schneier, *Applied cryptography* (2nd ed., New York: John Wiley & Sons, 1996), pp. 44-46, 421-428.

One common way of maximizing this irrelevance is to pick, or to claim that a solution was picked, through means which did not involve human intentionality. Think again of how students are assigned to houses in the first Harry Potter book with the conveniently magical assistance of the "Sorting Hat." Gym teachers resort to selection principles outside themselves when they divide a class into teams by counting off by ones and twos, or select a team captain by saying eenie-meenie-minie-moe (and *not* cheating by knowing how many syllables they say and the number of people they are choosing between), thus losing track of their own intentionality in the choice of how to execute a task.

The problem with such strategies is that outside the make-believe world of games, people are usually not proud of choosing a coordination solution for no particular reason. A journalist reporting recently from Armenia heard a joke that "when the Georgians needed an alphabet, they asked Mashtots [inventor of the Armenian alphabet], who took the macaroni he was eating and threw it against the wall. The patterns it made became the Georgian alphabet."<sup>58</sup> Contrast sets serve as badges of identity in this joke, with Georgians ritually denigrated as non-group members who use a norm whose origin story is no more noble than the way the macaroni stuck in place. The implication is that Mashtots designed the Armenian alphabet much more deliberately and carefully. This joke illustrates the value attached to coming up with non-arbitrary origin stories which make a solution seem inevitable. The use of supernatural justifications for the choice of a coordination solution has the same effect of transferring intentionality away from human beings in cases where a rationale for choice is not obviously apparent, but doing so in a way that masks the irrelevance and vulgarity of arbitrary choice. Outside the world of coordination, a typical strategy for reducing the arbitrariness of everyday design choices is the use of birthdays (a natural fact outside the control of the person born) as the basis for assigning personal identification numbers in Scandinavia, for choosing computer passwords and identification numbers, for deciding which composer's music to play on classical radio stations on a particular day, or simply for deciding when to hold a party or send someone greetings. Similarly, the conventionalization

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<sup>58</sup> Robert D. Kaplan, *Eastward to Tartary* (New York: Vintage, 2001), p. 312.

of a stand-in mercifully removes the sense of responsibility from one's choice of an exemplifier, by designating a particular hyponym which one may safely and reliably use, and thus saving one from being left adrift with the burden of making an arbitrary choice.<sup>59</sup>

The problem of arbitrary selection becomes particularly poignant when we have an opportunity to consciously choose a solution before we start to use it and physically commit to it.<sup>60</sup> Designing the new symbol for the euro, settling on 440 Hz as the anchor point for standard pitch, or defining a new international border after a war are examples of reflection and deliberate planning in the creation of contrast sets. Similarly, when cars came to Pitcairn Island in 1965, the island government had to choose a rule of the road for the first time.<sup>61</sup> In such situations, designers are the authors of social facts. They change the external reality of the world in a way they will probably will not be able to reverse, as it is easier to create physical commitments in the environment than to remove them from it. While it would be going too far to say that we only have one shot at each of these choices, it is true that they are very difficult to reconsider, that they affect the daily life of many people, and that those people will reify them and see them as unchangeable elements in their environment. One can easily develop a sort of nostalgia for all of the "norms not selected." After all, a coordination norm that has taken off and has a momentum of its own was once just a twinkle in the eye of its designers.

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<sup>59</sup>This explains why a professor of phonetics with whom I studied, whenever he asked a native speaker of language *x* to say a sentence or two in the language just to give us an idea of how it sounded, would ask the speaker to describe the process of cooking rice in their native language. "How to cook rice" is a relatively neutral discourse topic, and the choice of any such topic is a way of avoiding the tongue-tiedness that often results from the dilemma of arbitrary choice when people are asked to "say something in their native language." Consider, as well, comedian John Cleese's ability to speak in nonsense syllables that sound like English, but aren't. Has Cleese learned to make arbitrary choices on the fly? Actually not. Asked how he learned to talk nonsense, Cleese confesses that although it may appear spontaneous, one actually has to prepare and memorize the string of supposed nonsense sounds. "Believe it or not," he says, "I simply wrote it ... I can't make it up. It [only] sounds as if I'm making it up." (John Cleese, interview with Terry Gross on National Public Radio, 1990, <http://www.npr.org/rundowns/rundown.php?prgId=13&prgDate=29-Jun-2001>, October 2004.)

<sup>60</sup>On continuing versus inventing coordination solutions see Ullmann-Margalit, *The emergence of norms*, pp. 89-92.

<sup>61</sup>Kincaid, *The rule of the road*, pp. 150-51.

## 6.5 Change

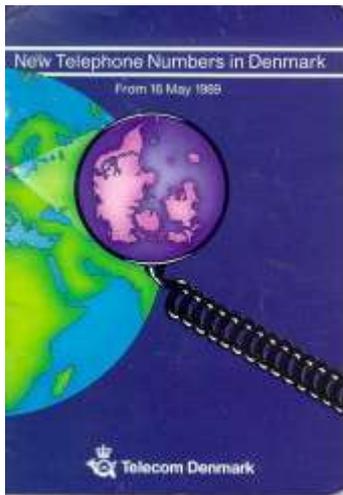


Image 6.2 (080)

Most adults, I think, have at some time had to cope with a change in an everyday contrast set or labeling system. Not long ago, for example, my home town's telephone area code was changed. It takes a while to get used to: I still sometimes have to remind myself to dial the new three-number sequence when calling my parents, and I still have the old code written down in a few places in my address book. Consider, as well, the other contrast sets in which you may have experienced changes: political boundaries, airport terminal numbers, computer character sets, postal codes, coins and banknotes, street names, bus or tram numbers, student grading systems, the categories in a bookstore or a music store, the ordering system of your own bookshelf at home, library call number systems, writing systems, spelling rules, the calendar, keyboard layouts, and measurement scales for wind, length, mass, and time. Many cases of contrast set change are "big ticket" items which affect all of society, such as the introduction of metric measurement. But other changes affect a contrast set used only by a small group within society, such as a company which reorganizes its order numbering system or renumbers its offices. Contrast sets are, of course, only one of many types of norms that can change. Changing other coordinative standards such as electrical plug shape, railroad gauge, or the rule of the road is quite similar.

The big puzzle of standards change is often why it fails to happen sooner. Some norms truly do appear to be better solutions to a particular coordination problem than others. Sometimes, one of these norms looks much better than the one we have in place right now. Why, then, don't these better solutions take over smoothly and automatically from the ones we have? If metric liters and degrees Celsius are so much better than gallons and Fahrenheit, why is the U.S. still using its old system? If it would really be much more efficient to replace the American dollar bill with a coin, why has every such effort failed? If the

difficulty of Chinese characters really wastes years of schoolchildren's time and renders much of China semiliterate, and if the Pinyin system would really be better,<sup>62</sup> why has writing reform failed there at the same time as it has succeeded in Vietnam?

And why is it that the entire world cannot agree on a single format for the size of paper or the citation of dates? It probably does not matter whether we settle on citing September 1, 2003 as 01-09-03, 09-01-03, or 03-09-01. But it is hard to argue that there is *any* value whatsoever to our constantly having to guess what format someone is using in a multicultural context. After all, we would think it absurd if half the world cited times with minutes before hours, and the other half with hours before minutes. So why not change?

One of the best ways to answer this question of why change is so hard is to recall the power of coordination solutions as social facts. Changing a coordination solution requires all the people who re-enact it to revise their daily habits. It means changing, sooner or later, all physical and cognitive commitments to the solution. It also means finding new justifications and new methods of socialization for the new solution. The identification of solutions with groups means that, for the group as a whole and for the individuals in it, to give up a standards solution is like giving up your identity. And the phenomenon of reification means that we often barely believe it is possible to change a solution because we forget that we have the power to.

The result is that the standards solution that we have is that which we find easiest to perpetuate. Any change must, for one reason or another, overcome this natural inertia — or at least perturb it. Otherwise we will continue to use the solution which we have already been using, even if better ones are available.

A scholarly history of the artificial language movement includes two quotations which illustrate the point:

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<sup>62</sup>This argument is given in detail by John DeFrancis, *The Chinese language: fact and fantasy* (Honolulu: University of Hawaii Press, 1984) and William C. Hannas, *Asia's orthographic dilemma* (Honolulu: University of Hawai'i Press, 1997).

"The root criticism of any revived or artificial language, however well designed, is that the immediate incentive which would make enough people learn and use one is lacking ... We may all wish that everyone would learn such a language. But these wishes, however strong they might be, will never be strong enough to make enough people put enough time into learning an artificial language as a speculative investment ... It is sad, but it is so."<sup>63</sup>

As a leading Esperantist conceded, "Every Esperanto propagandist knows by experience that outsiders hardly ever reject Esperanto for its linguistic defects, but mostly because it is of little use due to small numbers of users."<sup>64</sup>

Similarly, a psychologist who recommended reversing the order of the components of American phone numbers was told to go back to his ivory tower, not because he was wrong but since "the system ... was too big to make such a change, especially one that would in any way affect subscribers."<sup>65</sup> As Isaac Asimov said of English spelling reform, "I believe it is absolutely sensible and is the way to go — except that no one ever will."<sup>66</sup>

It does not always happen this way. Sometimes people do have a direct individual incentive to change standards. But usually they have an incentive to change only if they know everyone else will change too. Nobody wants to be the first. The collective, social benefit to changing standards is, in practice, blocked by the costs to individuals. To actually overcome this natural resistance to change, there have to be factors which transform the situation of social benefit and individual cost into one of both social and individual benefit.

One more strike against the idea that the best solutions should rise to the top is the possibility that societies engage in a kind of conspicuous consumption of contrast sets. I have not documented this (nor even looked for it), but it surely exists in the related areas of fashion and taste.<sup>67</sup> Human beings are not always efficiency maximizers (see section 4.6). Paradoxically, the maintenance of a naturally somewhat inferior coordination solution might actually be a positive for thought communities, because it shows that they are affluent

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<sup>63</sup>Large, *The artificial language movement*, p. 200, quoting I. A. Richards.

<sup>64</sup>Large, p. 201.

<sup>65</sup>Roger N. Shepard, "A funny thing happened on the way to the formulation: how I came to frame mental laws in abstract spaces," in *Psychologists defying the crowd: stories of those who battled the establishment and won*, edited by Robert J. Sternberg, pp. 215-237 (Washington: American Psychological Association, 2003), p. 226.

<sup>66</sup>This quote is from Isaac Asimov's introductory note to Dolton Edwards' "Meihem in ce Klasrum" in *Isaac Asimov presents the golden years of science fiction: fourth series*, edited by Isaac Asimov and Martin H. Greenberg, pp. 544-545 (New York: Bonanza Books, 1984).

<sup>67</sup>See Lieberman, *A matter of taste*, pp. 21-22; the idea of conspicuous consumption originated with Thorstein Veblen, *The theory of the leisure class* (New York: Macmillan, 1899).

enough to be able to afford inefficiency and luxury. The prestige of Chinese character usage in written language in Japan and South Korea, where transparent alternatives are readily available but might be thought to take too little effort, may be a good example.<sup>68</sup>

Given how high the deck is stacked against contrast set change, what can be done to make change easier to bring about? There is no simple recipe for making standards change succeed, but it is possible to pick out several factors that have, or seem to have, some effect. These factors have to do with the timing of the change, the nature of the thought community, the way the change is marketed, and the nature of the coordination problem.

### The timing of the change

Many changes in public contrast sets have been pushed through during or after revolutions, when many other changes are taking place in society at the same time and a new government may have the support or the vision to remake the rules of society. For example, many, though by no means all, adoptions of the metric system have been associated with revolutions.<sup>69</sup> Argentina, after invading the Falkland Islands in 1982, changed the Falklands' official language, currency, and the rule of the road.<sup>70</sup> But many standards changes have occurred at decidedly unrevolutionary times as well, and it would be wrong to think that revolution is by any means a prerequisite for standards change. Even in the case of writing systems, where there are ample examples of revolutionary change, Joshua Fishman is of the opinion that overall there is "no justification" for considering "'revolutionary success and non-revolutionary failure' as the proper summation of experience with orthographic reform," citing among others Chinese and Romanian Latinization, Irish spelling reform, and the phonetization of Hebrew words in Yiddish as reforms which have either succeeded peacefully, or failed *despite* the support of revolutionary authorities.<sup>71</sup> In some cases, such as

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<sup>68</sup> William C. Hannas implies the existence of such an effect in *Asia's orthographic dilemma* (Honolulu: University of Hawai'i Press, 1997), p. 74.

<sup>69</sup> Alder, *The measure of all things*, pp. 325-341.

<sup>70</sup> An eyewitness account is Rudolf Krautschneider, *Around the world for the feather of a penguin* (Usti nad Orlicí: Magalhães-Cano, 1999), p. 40.

<sup>71</sup> Fishman, "Introduction," pp. xvii-xix.

Sweden's change in the rule of the road in 1967, or the pitch standardization convention of 1939 which settled on 440 Hz as an international norm, peace seems to have been more of a prerequisite for change than upheaval.

Another timing factor is whether change in a coordination solution is "carried" or "piggybacked" on the back of another technological change. In such cases the solution's fortunes may rise and fall less on its own merits than on those of the new technology it is built into. Coordination solutions such as the QWERTY keyboard, VHS video cassette format, and Microsoft operating system may have "won" not because they were the best, but because they were packaged with good products — that is, with better typewriters, VCRs, or computers — whose advantages were so great that they made the question of what coordination solutions they used irrelevant. In the same way, an interior redesign in a building may provide a chance to change the labeling style for, say, floors, rooms, doors, terminals, or check-in desks in a way that seems trivial, or an afterthought, compared to the investment in the larger changes they are part of.

Similarly, some products have natural life cycles. When they wear out and need replacement, it gives us a fine excuse to re-choose the coordination solutions that they use. A bookstore that needs to buy new bookshelves might choose to rethink their shelving categories at the same time. For many people in the 1980s and 1990s, needing to buy a new telephone was a fine excuse to upgrade to a touch-tone keypad, allowing easier communication with automated answering systems. Such change spreads incrementally through society, and in such cases (since not everyone's phone wears out at the same time) there may be a transition period where one solution is thought of as the "old" solution and another as the "new." As well, those whose pulse-dial phones still worked could keep both the old and new machines around, preserving compatibility with both dialing standards for a time.

## The nature of the thought community

The incentive structure and the degree of central power in a thought community also seems to be a factor in the success or failure of change. The hypothesis here is that normally, no one in a community wants to change solutions unless they think everyone else will too. (Game theorists would model this hypothesis by considering the *observance* of norms as a coordination problem, but *changing* norms as a prisoner's dilemma type problem.) So, in those cases where individual users of a solution do not each have an immediate individual incentive to change, standards change usually requires collective action by a centralized body that represents the entire group and has some practical or moral leverage over them. For standards linked to a subculture, this often means an industry or professional association. In the case of standards that affect many people, this usually means the government of a region or country. For smaller groups, this means the leader of the group.

In these cases the transformation from social incentive to individual incentive is accomplished by force. It is common (as in the case of the Swedish change in the rule of the road<sup>72</sup>) for public opinion polls to actually show majority opposition to the change at the same time as the government is carrying it out. These changes work because, as Edna Ullmann-Margalit observes, fear may be a bigger motivator than projected gain. Government-led change can make you think that everyone else is going to move to the new system, and that you will suffer unless you switch too.<sup>73</sup> Thus the major reason for the failure of the U.S. Mint's introduction of a new one-dollar coin in 2000 (despite a marketing campaign with projected costs of \$40,000,000 involving Wal-Mart, Sam's Club, and Cheerios cereal) was the fact that the U.S. Congress expressly forbid the Mint to withdraw the one-dollar banknote at the same time, thus permitting the public an incentive to maintain current habits — despite surveys that demonstrated the public's willingness to give

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<sup>72</sup> Kincaid, *The rule of the road*, pp. 159-160.

<sup>73</sup> Ullmann-Margalit, *The emergence of norms*, p. 113.

up their instinctive opposition to abandoning the banknote in return for the cost savings it would bring.<sup>74</sup>

One can understand why democratic governments are often reluctant to legislate changes in the daily lives of their citizens. Change is difficult and expensive and no politician wants to be blamed for it. Changing standards brings short-term costs and long-term benefits, for which decision makers' time horizons may be too near. Change is even more difficult in a country (or organization) with weak central power and a strong libertarian tradition, like the United States (which marches out of step with the rest of the world on a number of standards problems and has spectacularly failed at metrological and coinage reforms). However, it is surely worth at least considering John F. Kennedy's statement that "those who make peaceful revolution impossible will make violent revolution inevitable."<sup>75</sup> Meanwhile, societies with stronger central control, or whose leaders have created a personality cult, sometimes seem to have an easier time changing coordination solutions. For example, Turkmenbashi, the president-for-life of Turkmenistan, faced little resistance when he appeared on television in 2002 to announce sweeping changes in the names of the months and the days of the week,<sup>76</sup> although I do not know if these have since succeeded in coming into common use.

In smaller environments — those that involve subcultures and subgroups rather than entire societies — change may be no less controversial, but perhaps easier to carry out. The smaller the community, the more likely that the short-term costs and long-term benefits of change will be realized by the same people, who can thus evaluate the worthwhileness of change more easily.

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<sup>74</sup> "Public views on changing coin design," Report to Congressional Committees GAO-03-206 (Washington: United States General Accounting Office, 2002), pp. 18-22; Corinna Wu, "The buck starts here," *Science News*, 1 April 2000; United States Public Law 105-124 (December 1, 1997), section 5; "U.S. Mint begins shipping new golden dollar coin to Federal Reserve banks," U.S. Mint press release, 18 January 2000, <http://www.usmint.gov/pressroom/index.cfm> (February 2005); John Yang, "Sacagawea's sad state," article posted at ABCNEWS.com, 4 April 2002, [http://abcnews.go.com/sections/wnt/DailyNews/dollar\\_coino20404.html](http://abcnews.go.com/sections/wnt/DailyNews/dollar_coino20404.html) (February 2004).

<sup>75</sup> *The Columbia World of Quotations* (New York: Columbia University Press, 1996), #32398, attributed to John F. Kennedy, 13 March 1962 (available at <http://www.bartleby.com>, February 2005).

<sup>76</sup> BBC Monitoring International Reports, Turkmen TV first channel, Ashgabat, Turkmenistan, 8 August 2002, 1600 GMT.

In those cases where a few select people are in charge of actually re-enacting a particular coordination solution, and the rest of the community simply passively consumes it, the task of bringing about change is much simpler. Unless a change is so explosively controversial as to incite a popular revolt, one need only convince those sectors of the user community who actively make the decision of whether to use a particular contrast set or not. Take, for example, the case of wind measurement in Iceland. Wind direction and speed is the first thing mentioned in Icelandic weather reports, since the air temperature tends to vary relatively little in Iceland, while the wind conditions are a very accurate predictor of one's personal comfort out of doors. On June 1, 1999, the Icelandic weather service changed from the Beaufort wind speed scale (a set of twelve sequentially numbered and quaintly named speed categories) to the convention of measuring wind speed in meters per second.<sup>77</sup> While everyone who reads or watches a weather report needs to understand the terms in which wind speed is stated, in actual fact, only the people who actually create the weather reports actually control which terms will be used. The general public are only passive consumers of this particular contrast set. Change, once accepted by the community of actual decision-makers, can be extended to the public more or less by fiat. Public statements of resistance to the change had little force.

Finally, marketing contrast set change to the appropriate sector of the thought community involved is crucial. It is very important to have a strategy to get knowledge of a proposed new coordination solution into the heads of the people who will actively re-enact it. During the Danish currency reform of the late 1980s, for example, the government printed free booklets explaining the change, including the details of a new standard of precision whereby all amounts would be rounded off to the nearest quarter of a crown (see Image 6.3). However, public relations are not enough to save an otherwise flawed plan (as the example of the American dollar coin shows).

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<sup>77</sup> See Magnús Jónsson, "Vindstyrkur — vindhraði," *Morgunblaðið* (Reykjavík), 1 June 1999, and "Vindstigin kvödd," <http://www.vedur.is/annad/vedurhorn/beaufort.html> (November 2003). For an example of resistance to the change, see for example Pál Bergþórsson, "Sunnan sex," *Morgunblaðið* (Reykjavík), 26 June 1999, Lesbók.



Image 6.3 (065)

## Nature of the coordination problem

The resolution of some coordination problems requires more commitment to the solution than the resolution of others. The difficulty of changing a solution depends, in turn, on the degree to which we are cognitively and physically committed to it. For example, teachers and students may be used to a particular grading system, but grading systems generally involve fairly weak physical and

cognitive commitments. Changing a highway numbering system (as Poland did recently) or an expressway exit numbering system (as Los Angeles did in the 1960s) is a bigger job, which requires governments and mapmakers to undo physical commitments, and drivers to "learn a new spatial language and reference system."<sup>78</sup> And changing telephone numbers is harder still: it requires undoing physical, software, and cognitive commitments made by all of society (not just certain subcultures) in a way that also disturbs peoples' sense of identity and threatens valuable mappings in the telephone number system. Not surprisingly, telephone number changes in America over the past ten years have generated considerable public controversy.<sup>79</sup>

The degree of plannability of the standards problem also affects the ease of change. The more a coordination solution is under somebody's clear control, the more easily it can be deliberately changed. Tram route numbers, coins and banknotes, the division of a book into chapters, or a system of postal codes can fairly easily be changed by a tram company, official mint, author, or post office. The coordination problems whose solutions seem to be most resistant to change are those like timekeeping, spelling systems, metrology, and the lexicon,

<sup>78</sup> Roger M. Downs and David Stea, *Maps in minds: reflections on cognitive mapping* (New York: Harper & Row, 1977), pp. 254-255.

<sup>79</sup> See, for example, Abby Goodnough, "Manhattan awash in area code angst," *New York Times*, 2 March 1997, p. 31; Sam Howe Verhovek, "Raised hackles over a phone plan," *New York Times*, 3 February 1996, p. 7; Roy Bahat, "Your call cannot be completed as dialed: big cities, small changes, and the unexpected politics of area code reform," A.B. thesis, Harvard University, 1998.

where there is rarely any administrative body with the legal authority and responsibility to administer them.

The degree of deviance and tolerance permitted in the solution of a coordination problem also has an effect on the way change can take place. Coordination problems like writing systems and standards of measurement do not require an absolutely uniform solution from all members of society. Individual and idiosyncratic measurement or writing styles can be tolerated as long as the people for whom they are intended understand their meaning. (This contrasts with problems like the rule of the road, which require complete and total uniformity.) Thus Halldór Laxness, Iceland's most famous twentieth-century author, used his own idiosyncratic Icelandic spelling system. He got away with it because it more accurately reflected spoken Icelandic, because his fame gave him a kind of market power, and above all, because his orthography was not dramatically different from the standard and thus did not hinder comprehension and the accomplishment of the coordination task.<sup>80</sup>

For coordination problems that tolerate imprecise or less than universal coordination, change can establish a beachhead within a subculture, and spread slowly throughout society rather than having to be decreed by fiat. American metrology is a good example of beachhead-style change. A top-down, legislated approach to metricization in the United States has repeatedly failed.<sup>81</sup> But metric use in the scientific and military communities has familiarized millions of Americans with metric measurements nevertheless (not to mention soft-drink bottling and marijuana packaging; P. J. O'Rourke has said that "drugs have taught an entire generation of American kids the metric system"<sup>82</sup>). One could also imagine Laxness's spelling system spreading slowly throughout Icelandic society (it did not). Beachhead-style change fits well with the process of technological obsolescence: we can ease the process of change by buying the DVD player only when we see our once-brand-new

<sup>80</sup> See Halldór Laxness, "Um stafsetningu," in *Vettvangur dagsins: ritgerðir* (2d ed., Reykjavík: Helgafell, 1962), pp. 225-229.

<sup>81</sup> See Charles F. Treat, *A history of the metric system controversy in the United States* (U.S. National Bureau of Standards Special Publication 345-10, 1971).

<sup>82</sup> The reputed source for this quote is the *Vancouver Sun*, 20 December 1991. I have not been able to verify this, but according to Mr. O'Rourke (personal communication, 12 March 2004) the quote is authentic.

VCR starting to wear out, and by having our children program the DVD while we program that "old-fashioned" VCR that they don't understand.

## 6.6 The standards evangelists

There exists a necessary sort  
of madness: to believe that precisely you  
can change the world.  
Madness that borders  
on genius  
and that is also the simplest  
everyday wisdom ...<sup>83</sup>

Recently I spent several hours browsing the web sites of organizations who want to change our contrast sets. In Britain, for example, there is the Simplified Spelling Society ([www.spellingsociety.org](http://www.spellingsociety.org)), which advocates "planned change in English spelling for the benefit of learners and users everywhere." The U.S. Metric Association ([lamar.colostate.edu/~hillger](http://lamar.colostate.edu/~hillger)) wants the U.S. to convert to the international SI system of measurement units. Supporters of metric time ([zapatopi.net/metrictime.html](http://zapatopi.net/metrictime.html)) want to use decimal units such as a ten-hour day, a hundred-minute hour, and a hundred-second minute. Calendar reformers ([personal.ecu.edu/mccartyr/calendar-reform.html](http://personal.ecu.edu/mccartyr/calendar-reform.html)) are searching for another system of dividing the year into months and inserting intercalary days, preferably one that might make the number of days in a month and the assignment of days of the week more regular. Fans of the Dvorak keyboard layout ([www.cse.ogi.edu/~dylan/dvorak/DvorakIntl.html](http://www.cse.ogi.edu/~dylan/dvorak/DvorakIntl.html)) offer instructions on how to convert your computer from QWERTY. If you want to learn Esperanto, you might start at the website of the Universala Esperanto-Asocio ([www.uea.org](http://www.uea.org)).

I call the people who advocate changes like these *standards evangelists*. The religious analogy is not facetious. Standards solutions are very much like religious rules about what to eat or when to celebrate. They are conventional restrictions on the way we act, which are shared by everyone in a group, and whose observance partly defines our membership within that group. Standards evangelists want you to join with them in a new and unfamiliar set of

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<sup>83</sup>This poem is by Bernt Rosengren, quoted and translated from the Swedish by Sissela Bok in *Alva Myrdal: a daughter's memoir* (Reading, Mass.: Addison-Wesley, 1991), p. 303.

rituals. They need you to help construct a community of believers. They want to change the fundamental regularities of your life, just like the brochure-bearing missionaries who knock on your door.

The Internet is the standards evangelist's modern soapbox. It makes it easy to get the message out, over and over and over, and it links kindred spirits across otherwise unbridgeable distances. The same is true for religious denominations with far-flung proselytizing efforts, such as the Jehovah's Witnesses ([www.watchtower.org](http://www.watchtower.org)), the Mormons ([www.lds.org](http://www.lds.org)), and the Seventh-Day Adventists ([www.adventist.org](http://www.adventist.org)). Before the Internet, standards evangelists were much more scattered and had much less visible press.

It is common to hear the view that standards evangelists are "crack-pots, visionaries, and fanatics"<sup>84</sup> concerned with "trivia of interest only to cranks."<sup>85</sup> As an informed and skeptical observer who (with the exception of the Rutgers University campus bus labels) has never been involved in any kind of standards evangelism, I will venture what I believe to be a balanced opinion. The proposals of standards evangelists are certainly impractical. Some standards evangelists are doubtless eccentrics. But most are not. (Andrew Large goes into this issue in depth in his history of artificial languages.<sup>86</sup>) The majority of standards solutions proposed on the web are well and sanely thought out, and present reasonable arguments against existing solutions. And if standards change is just a matter for cranks, how is that some standards change proposals become mainstreamed, so that governments and associations support them, not just groups of hobbyists? (Indeed, this process of mainstreaming is a fascinating topic on its own. Why, for example, did metricization fail to win official support in America, while the peculiar campaign to eliminate apostrophes from American placenames succeeded?<sup>87</sup>)

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<sup>84</sup> Quoted in J. Marshall Unger, *Literacy and script reform in occupation Japan: reading between the lines* (New York: Oxford University Press, 1996), p. 61.

<sup>85</sup> See DeFrancis, *The Chinese language*, p. 240.

<sup>86</sup> Large, *The artificial language movement*, pp. 109-112.

<sup>87</sup> See Thomas J. Gasque, "The apostrophe in U. S. placenames," in *You name it: perspectives on onomastic research*, edited by Ritva Liisa Pitkänen and Kaija Mallat, pp. 195-205 (Helsinki: Finnish Literature Society, 1997).

My design advice to the most fervent standards evangelists is to pay just as much attention to the process of implementing change as to the process of creating optimal solutions. Much of the cranky perception of standards evangelism has to do with the fact that, as the Esperanto case shows, the real problem is not to design a good system, but to get everybody to use it. The best proposal for calendar reform is hopeless without a plan for its acceptance. An impractical standards proposal seems pointless and its promoters' motives doubtful.

I would also draw standards evangelists' attention to the way that their activities are (consciously or unconsciously) perceived by the public. Standards evangelists have rejected society's intersubjective compact, and want us to do so too. They want to abandon the standard operating procedures and contrast sets that we organize life with. They want to divert our attention from the business of everyday life, to the rules by which we go about that business (an awfully annoying demand to those who are trying to get work done). They are, exasperatingly, not just protesters, but seers and visionaries. They have been riding the same train as the rest of us, and while they might be content to jump off it or derail it, what they really want is to redesign the cars and couplings in mid-journey. We call people who opt out of the intersubjective world "eccentric" at best and "insane" at worst.

Many coordination problems admit of an infinite number of possible solutions. The arbitrary choice of a solution is philosophically unsettling, and becomes more comfortable only by invoking some outside force as the deciding factor. Our commitment to a particular solution creates a veil which, so to speak, protects us from the incomprehensible flux of other conceivable standards. Standards evangelists are "silence breakers" who want to lift this veil and "try to make us see things we deliberately ignore";<sup>88</sup> they want to remove the social "lens"<sup>89</sup> through which we filter the world, and to openly discuss matters that are usually backgrounded. No wonder they are often perceived as a threat.

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<sup>88</sup> From the chapter "Breaking the silence" in Eviatar Zerubavel, *The elephant in the room: the social anatomy of silence and denial* (Oxford University Press, forthcoming).

<sup>89</sup> Eviatar Zerubavel, *The fine line: making distinctions in everyday life* (New York: Free Press, 1991), ch. 4.

Another reason why standards evangelists have difficulty getting their proposals taken seriously is that very often, people of special salience are the only ones who are ceremonially "allowed" to choose a course of action on behalf of the entire society they symbolically represent.<sup>90</sup> Thus we speak of Elizabethan theater in England, the Josephine reforms in eighteenth-century Austria, Hitler's Final Solution, and Stalinist architecture even though these people may or may not actually have been the ones who decided to institutionalize these particular norms. What is important is that they were in a ritually prominent position in society at the time. A standards proposal made by Joe down the street who works in his garage, or even by the learned Dr. Zamenhof of Warsaw (the inventor of Esperanto), does not have the ring of having been "chosen" by the "right" kind of person. Standards evangelists sometimes seem to forget that they do not possess the status — the cultural or political "capital"<sup>91</sup> — to be able to bear the torch for all society.

At the same time, we owe a debt to the standards evangelists. They are, first of all, the people who are truly willing to tackle the task of finding the best possible solution to a coordination problem. They ask questions such as whether we really do want to use capital letters to specially mark the first letter of a noun or a sentence. When a community does agree to change a solution, it can be a very positive thing. The Unicode character set standard, progressively adopted by the computer industry since the early 1990s, is surely one of the great advances in the history of literacy since the invention of movable type. And furthermore, to dereify our standards, to see the conventionality of things that we always thought natural, is an edifying process. It builds wisdom and perspective to see that it is possible for things to be "other than they are," even if we ultimately live with the world as it is. After all, the inability to imagine is just as handicapping as the refusal to accept reality. Benjamin Franklin's proposals for English spelling reform clearly did not affect his ability to communicate in standard orthography as a statesman and ambassador. Richard Feynman had the good sense to give up on his alternative notation for trigonometric functions, but he

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<sup>90</sup> For a concise statement of this view see John B. Thompson, "Editor's introduction," in *Language and symbolic power*, by Pierre Bourdieu, pp. 1-34 (Cambridge: Harvard University Press, 1991), p. 8.

<sup>91</sup> Bourdieu, *Language and symbolic power*, pp. 194-196.

did later invent a diagrammatic notation that became very widely accepted in quantum physics.

Ultimately, those who laugh at standards evangelism reveal how much societies are committed to their standard operating procedures. By re-opening the question of *how* society should work, standards evangelists force us to confront the frequent arbitrariness of our current solutions. The recognition that our standards could be changed and even perhaps improved, and that we ourselves have the power to set new ones, is disturbing and unsettling because it undermines both social harmony and our personal commitment to the setup of the world. Knowledge of the possibility of change is shielded and protected in society, first of all by the reification of standards solutions, secondly through their trivialization and backgrounding as a field of study, and lastly by calling many of the people who want to change them crazy. It is almost (but not quite) as if standards are inaccessible mysteries guarded by a social priesthood.<sup>92</sup> To someone deeply committed to standards change, this shielding might seem sinister, intentional, and even conspiratorial. But in another light it seems completely sensible that groups of people should guard so tightly the rules of life that glue them together as a society.

## 6.7 Creep and drift

Creep or drift is a type of unplanned change which tends to happen when the members of a target set have a value gradient, in terms of ease or prestige. Student grading is an example of a standardized mapping which, once in place, tends to shift. The original mapping between the labels and the part of the domain that they refer to starts to slide, so that the same label by imperceptible steps comes to refer to a slightly different section of the domain. Thus when grades "inflate," what once earned a C may now earn a B+.

Pitch standardization is an excellent example of drift. There is constant upward pressure on pitch standards, primarily because music tuned higher than the prevailing average tends to sound a little bit better to listeners. Orchestras and choirs have an incentive

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<sup>92</sup> Witold Kula comments on the sacral character of standards in *Measures and men* (Princeton: Princeton University Press, 1986 [1970]), pp. 18, 79-81.

to tune just slightly sharp. This, in turn, raises the prevailing pitch average and means that ever higher tuning is required to get the same effect. Instead of A above middle C referring to 440 Hz, it may come to refer to 441, 442, or 443 Hz or even higher points in the domain. Eventually, this starts to make impossible demands on singers' and instruments' upper ranges, at which point pitch has to be collectively pulled back down again.<sup>93</sup>

Another example, one which shows a very clear prestige gradient, is in womens' clothing sizes.<sup>94</sup> It is in the public interest to have a maximally standardized system of clothing sizes, particularly for mail order sellers and buyers. But at the moment, at least, many societies attach value to being thin. Clothing manufacturers thus have an incentive to undercut the standard. They can sell more clothes by offering women the reward of being able to fit into clothing one size smaller than their previous "location" on the scale. If you have usually worn a size 6, it makes you feel good to see that you fit in a size 4. Although the feeling of prestige should be associated with a location within the domain of body size (being thin), it has been effectively transferred to the target set that labels it, so that prestige is now associated with being towards the small end of the linear topology of labels used to refer to the domain of body size (the ability to say "I wear a size x"). The label becomes a proxy indicator for the domain, and suffers from an inflationary effect which erodes its "value" over time. (In the clothing industry, this type of standards drift is called "vanity sizing." As with vanity license plates, vanity sizing allows people in situations where they must be just a number at least the pleasure of having an attractive number.)

Put into game-theory terms, certain solutions tend to drift because the addition of a value gradient converts a pure coordination norm into a prisoner's dilemma. There is an incentive to conform to a contrast set that is a pure coordination norm. There is an incentive to defect — just a little — from the conventional solution when one adds in the sense of value.

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<sup>93</sup>Mark Lindley, Klaus Wachsmann, J. J. K. Rhodes, and W. R. Thomas, "Pitch," in *New Grove Dictionary of Music and Musicians*, 20: 779-786 (London: Macmillan, 1980), p. 785; Lloyd, "Standard pitch," p. 802.

<sup>94</sup>For a popular treatment of this particular type of drift see Alex Kuczynski, "One riddle fits all," *New York Times*, 30 August 1998, section 9, pp. 1, 5. For a comprehensive and sociologically informed reference on clothing size standardization see Susan Ashdown and Laura Cowie, "Sizing systems in the apparel industry," <http://www.human.cornell.edu/txa/faculty/SizingSystems> (November 2003).

Often one wants to defect just enough to gain an advantage, but not so much that it is obviously noticeable. But, of course, if you see everyone else defecting, you will probably want to too.<sup>95</sup> If we imagine two orchestras as players in the game of pitch standardization, and say that one orchestra is willing to defect and the other is honest but willing to follow defections, we can model standards drift with the following payoff matrix in which the choice is of what point in the domain of frequency the label "A above middle C" should refer to:

		<i>Defector</i>		
		440 Hz	441 Hz	442 Hz
<i>Follower</i>	440 Hz	10	11	
	441 Hz		9	10
	442 Hz			8

It is always in the defecting orchestra's interest to raise pitch by 1 Hz, and then it is always in the honest orchestra's interest to match the raise. In this case, as they move from 440 to 441 to 442 Hz, the utility of the solution becomes progressively less. Eventually the players may run into trouble and decide to agree on a solution. This entire bother could be avoided if the defecting orchestra had simply followed the norm from the beginning.

Defecting from any contrast set labeling or mapping standard confounds our sense of what a label can be expected to mean, and undermines hard-won coordinative compacts about the relationship between labels and contrast set members. The people who deliberately make labels drift thus take advantage of a social compact for their own profit, robbing value from a social institution as they do so. Of course, such behavior is all too human, since labels with a prestige gradient are a typical problem of the commons, in which the players in the game have an individual incentive to defect from the socially ideal equilibrium and be a "free rider" just so long as not everybody else is defecting as well. And in some cases, the damage is less because the utility of each successive solution is the same; as the value of a label deflates or its meaning dilutes, another label usually begins to take on the meaning that it once had.

<sup>95</sup>Thomas Schelling calls these situations "self-displacing prophecies" in *Micromotives and macrobehavior*, p. 118.

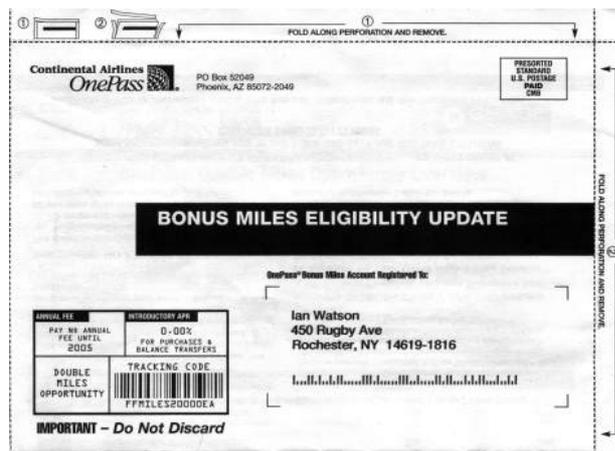


Image 6.4 (036)

Corresponding phenomena in the lexicon have been known for a long time, although linguists have not generally made the link between linguistic and non-linguistic coordination drift. The development of euphemisms often involves a process of standards drift, as does semantic change along vectors such as reek-

stink-smell-odor-fragrance. Recently the term "euphemism treadmill" has been suggested for this type of change.<sup>96</sup> One can also see a similar process at work in the way we label the urgency of discourse, as the picture shows. This piece of junk mail, received in August 2003, offered me a credit card with a frequent flyer mile benefit. The credit card offer is disguised as something more important, presumably in order to raise the chances that the recipient will open it.<sup>97</sup> The domain, then, is the importance or urgency of the message. The appearance and packaging of a message is in part a sort of label or indicator of that degree of urgency. Here the packaging of the message suggests more urgency than the message actually possesses, and it raises the bar for other messages which are truly urgent.

In an imaginary world where pure and perfect coordination was valued above all else, an omniscient and omnipotent contrast set designer would stamp out any cases of creep and drift before they had any effect. In the world as it is, although deceptive credit card offers are annoying, we seem to have no trouble managing a certain amount of drift, and euphemisms can be a source of pleasure. However, designers should know that when things go too far, as in the case of grading or pitch standards, someone may need to take deliberate action to reestablish general agreement on the relationship between a contrast set and its labels.

<sup>96</sup> Judith Neaman and Carole Silver, *In other words: a thesaurus of euphemisms* (London: Angus & Robertson, 1991), pp. 9-13; Steven Pinker, "The game of the name," *New York Times*, 5 April 1994, p. A21.

<sup>97</sup> The envelope says on it "Important — Do Not Discard," includes a fake "Tracking Code," has a pattern similar to a bank-check watermark on the back (not visible in this image), purports to be about "Bonus Miles," and the design of the envelope (especially opening by means of "fold along perforation and remove") is similar to official government communications.

## 7 Socialization

On the New York City subway one April day I overheard the following conversation between a mother and her daughter, about seven years old:

Daughter: "It's really hot out today. I think it must be like 70!"

Mother: "I think it's probably in the fifties."

Daughter: "I remember when it was really *really* hot last summer."

Mother: "Yes, it was probably in the eighties or nineties then."

This conversation is a reminder that the Fahrenheit scale is not just a scientific tool for recording temperature, but also a way of communicating our own experiences and memories to other people. Put more abstractly, any conventional set of labels is an intersubjective shorthand for sharing our thoughts with others. The little girl who I overheard knew that she can use the Fahrenheit scale to label the weather, and she knew that other people understand those labels too. However, she had not yet tuned her sense of correspondence between the scale and reality as finely as adult Americans have. In the conversation, her mother helped her to calibrate her sense of the meaning of the Fahrenheit scale so that she could use this cognitive standard to join in a "thought community" to which the rest of society already belongs.

Because looking right, telling time, alphabetical order, music notation, clothes sizing, and the use of rulers are norms of cognition and behavior that children do not always pick up automatically, society has many ways of teaching kids to observe them. Singing the alphabet song is not just a way to learn the twenty-six letters of the English language but an excellent way to figure out that H comes before T in the encyclopedia. Lessons on weights and measures in elementary school, and on the metric system in science class, are part of every American child's schooling. So are exercises in using our coinage standard by finding as many ways as possible to make, say, sixty-five cents by combining nickels, dimes, and quarters.

When socializing children to contrast sets it is very important to use nametags (see section 3.4) to help learners learn to tell where they are "located" within a contrast set at a

given moment. Just as it is important to know on a warm day that it is probably 70 or 80 degrees Fahrenheit and not 20 or 30, it is important to know that a slow-moving car is probably not going 75 miles an hour, that you are a Canadian and not an American or a Greenlander, that this room is your room and not your brother's or your sister's, that this coin is worth 5 cents and that one is worth 10, that this is an A and that is a B, and that you are in aisle 2 which is the produce section of the supermarket and the candy section is over there in aisle 10.



Image 7.1 (016)

In all of these cases the goal is for the child to learn to see the different "views" associated with the different positions in a domain as belonging to one member of a particular contrast set created within that domain, and to learn the label for that contrast set member as well. In other words, children may, at any given time, have a relationship with a particular instantiation of a domain — because they are looking at it, thinking about it, located in it, and so forth.

We must teach them to know that that instantiation belongs with a particular member of a contrast set that partitions that domain. Thus the teaching tool in Image 7.2 is designed to help children recognize, for example, the varying shapes that can count as (for example) the letter *e* or *w*.

Just as the environment we create for babies is full of things which develop basic motor and perceptual skills and the ability to recognize the parts of living creatures, the environment we create for somewhat older children (say three to eight) is full of things which help children see things as examples of particular contrast set members. In an elementary school classroom, you will usually find numerals, the alphabet (in order and in both lower case, upper case, and eventually cursive forms), clocks, calendars, and maps (sometimes in puzzle form), all of which are devices that allow children to locate themselves, or what they are doing at the moment, within one of the divisions of some domain. Many of these displays (such as clocks, calendars, alphabets, and lists) also suggest an image of a contrast set which

a child can use to help remember it. Thus the chart of all my classmates' birthdays that hung on the wall in my kindergarten classroom helped me understand what it meant that mine was in January, not December or February, just as the clock on the wall helped me understand when to expect recess (at 10:30) and nap time (at 1:00). By being told "you are here" within a given domain or contrast set, the child learns to be able to connect the experience of being "here" with the image of a particular point within the contrast set. Think, for comparison, of labels in zoos or botanical gardens, which tell us that this is an aardvark and that was an elephant, just as a calendar on the wall tells us that this is January and it is something else that was June. Most amazingly, because these images and contrast sets are social facts shared by an entire thought community, our socialization allows us to read other peoples' handwriting, look at other peoples' watches, interpret other peoples' thermometers, type on library computer keyboards which we have never seen before, and use indexes and alphabetized lists which we did not create.

## 7.1 Contrast sets and external cognition

One might imagine (as a sort of null hypothesis) that contrast sets, once learned, are simply carried whole in the minds of their users, who can re-enact them and recreate them in other minds without any help. It is, after all, true that literate people know the alphabet and usually the alphabetical order by heart, and if they were stranded on a desert island with a three-year-old, would probably be able to pass on the skill of writing without any outside assistance. We are, however, rarely so self-sufficient. Knowledge of a contrast set resides in many other places than in people's minds. Although we may carry the alphabet in our head, when we need to know what date tomorrow is, when the fourth Thursday in November will be this year, which note is a fifth up from A flat, or what the country code for Mexico is, we rely on knowledge that resides in our pocket, on our wrist, on our bookshelves, in a computer program, or at our side (in the head of a companion).

Donald Norman describes this phenomenon by speaking of the difference between "knowledge in the head" and "knowledge in the world."<sup>1</sup> The terms "external cognition" and "distributed cognition" have also been used to describe the way the knowledge put to use in a particular context is spread over a memory larger than that of a single human being.<sup>2</sup> Karl Mannheim put forth a version of the idea of external cognition when he said: "Strictly speaking it is incorrect to say that the single individual thinks. Rather it is more correct to insist that he participates in thinking further what other men have thought before him."<sup>3</sup>

The designer of contrast sets — or of anything that depends on people's knowledge of them — needs to have a realistic view of how much knowledge about them people will be able to keep in their heads. If the amount of knowledge about a contrast set that people can be expected to keep in their heads is less than the amount that they need to know in order to make proper use of that contrast set, the designer should try to make up for the gap by providing that knowledge at just the moment when people will need it. This is why there are system maps on subway station walls, calendars on bank writing tables, keys and legends in the front pages of an atlas, clocks in school hallways, latitude and longitude markings on maps, time zone charts and area code listings in the back of the phone book, size labels on clothing, and note names on the keys of pianos and xylophones meant for beginners. It is also why keyboards are marked with the graphic symbol that each key produces (even though skilled users know most of them by heart). Though we probably know our own house number and the postman probably knows it too, we post it on the door so that the postman can be double sure (and so that the package delivery service can find our house at all). Americans receive not only a Social Security number, but a card with the number printed on it, and most of use now have so many other identification numbers to remember that we

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<sup>1</sup> Donald A. Norman, *The design of everyday things* (New York: Doubleday, 1990), chapter 3 ("Knowledge in the head and in the world," pp. 54-80).

<sup>2</sup> Donald A. Norman, *Things that make us smart* (Reading, Mass.: Addison-Wesley, 1993), chapter 6 ("Distributed cognition," pp. 139-153); Edwin Hutchins, *Cognition in the wild* (Cambridge: MIT Press, 1995), chapter 9 ("Cultural cognition," pp. 353-374); Mike Scaife and Yvonne Rogers, "External cognition: how do graphical representations work?" *International Journal of Human-Computer Studies* 45 (1996): 185-213.

<sup>3</sup> Karl Mannheim, *Ideology and utopia: an introduction to the sociology of knowledge* (London: Kegan Paul, 1936), p. 3.

have to keep track of them on a sheet of paper. Russian envelopes have preprinted boxes which ensure that the postal code is the top, not the bottom line of the recipient's address. Vending machines usually tell us how much money we have put in even though we may be keeping track at the same time.

In other cases, knowledge is not provided at the point of need, but people are taught to know that there is a place that they can go to find it. This is the function of reference material, whose deliberate aim is to preserve the knowledge of a standard. The calendar in a farmer's almanac and the periodic table of the elements in an encyclopedia are all examples of printed material whose deliberate purpose is to pass on a particular contrast set. If we do not know somebody's postal code, we can look it up on a chart or directory at the post office, or now, on the Internet. Tuning forks and pitch pipes allow you to carry pitch standards in your pocket, but you might not need them in Budapest where you can (or at least once could) pick up the phone and listen to a standardized 440-Hz A above middle C by calling 117-1822.<sup>4</sup>

In other cases, knowledge of a contrast set resides incidentally in the world, and the reality of the set is reinforced by our casual contact with these representations of it. Thus we see alphabetical order in text and indexes and schoolroom alphabet charts. We see musical contrast sets reproduced in sheet music and in the layout of the keys on musical instruments, we see racial contrast sets perpetuated in tables and charts, and the calendar racks in stores in December remind us that January 1 is the beginning of a new year. We see our postal code listed on the mail we receive and others' codes on their return addresses. The elements of a contrast set may also be reflected in the structure of organizations, so that the makeup of the United States Senate ceremonially reflects the fact that the union consists of fifty states.

Because the standardization of a contrast set makes that set intersubjectively real, we can borrow the term "reality maintenance" from Berger and Luckmann to describe the process by which such external devices reaffirm and perpetuate conventionalized contrast sets and norms.<sup>5</sup> Individuals simply cannot keep all this knowledge in their heads all of the

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<sup>4</sup>See András Török, *Budapest: a critical guide* (Boston: Zephyr Press, 1992), p. 14.

<sup>5</sup>Berger and Luckmann, *The social construction of reality*, pp. 135-140.

time, and designers cannot rely on their ability to apply it unaided. Some of it needs to reside in the world.

For the designer who has managed to figure out how much information users can keep in their heads and how much they will need to source from the external world, the key design advice on the subject of external cognition is to make it as easy as possible for people to get the knowledge that they need.

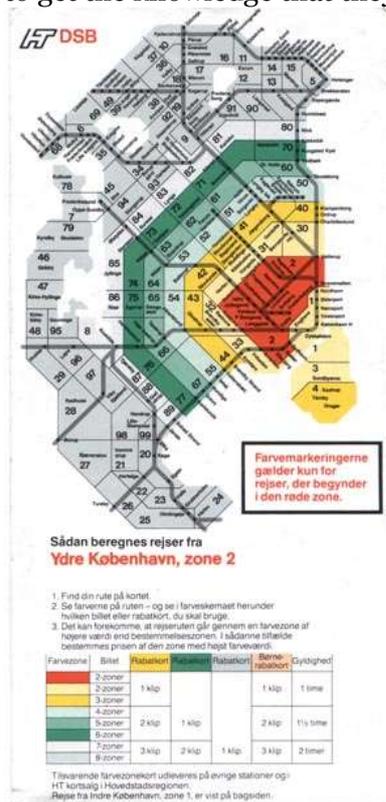


Image 7.2 (068)

names, route numbers, timetables, and system maps); and knowledge on or in the bus itself (route numbers, destination names, route maps and schedules). This knowledge that is out in the world is pulled into the mind of the person actually taking the bus at the time when they need to make their decisions. Of course, a good printed timetable can hold more information than an outdoor sign — but only if riders have taken the trouble to get copies.

The designer's role is, then, to use the limited financial resources at their disposal to do the best possible job of making this information available to the user at the time that they need it. While it is difficult to provide general advice applicable to all situations, we can pretty safely say that the New Jersey Transit bus sign illustrated in Image 7.3 is not a successful external cognitive aid for bus riders looking for the knowledge of the system that

A well-known arena for such "knowledge planning" is public transport, where there are many examples of successes and blunders to report. Successfully taking a public bus or tram involves using several contrast sets (bus numbers, routes, stops, fare levels) that people are rarely fully familiar with. Users' level of knowledge in the head may range from virtually zero to a relatively detailed mental map of the way the system works. The external knowledge that people can resort to includes knowledge in other people's heads (passers-by, bus drivers, acquaintances, fellow passengers); knowledge in one's pocket (a printed schedule or map or a guidebook); knowledge posted at each stop (stop

they need. It does not tell us which buses stop there and where they are going, there is no name to the stop, and since the sign has not been well maintained it is difficult to be sure that it really is a bus stop and that the bus stop is still in use. There are some confusing numbers on the sign, and no clue how to interpret them, which makes one wonder whether the sign is even intended for the public.



Image 7.3 (038)



Image 7.4 (020)

In contrast, the Helsinki bus stop sign in Image 7.4 is a better collection of external knowledge. The stop is named, route numbers are listed, and destination names are given in both Finnish and Swedish. Although providing bus travelers with such extra

knowledge is surely expensive, it does seem to increase ridership.<sup>6</sup> Public transport designers should surely make an effort to provide such information up to the point where the return on their investment starts to diminish. One of the reasons that visitors to an unfamiliar city tend to prefer traveling by subway or tram over bus is that fixed-stop transport systems like subways give the rider a sense of cognitive tranquility about whether they are waiting in the right place; whether they are going in the right direction; where the next stop will be; and how to backtrack if one overshoots. And subway travel is generally preferable to tram, because as long as one is "within" the subway system one has the sense that orientation information will always be accessible on maps and signposts, and if all else fails, by asking other passengers or at the ticket window. In the subway system, more knowledge resides in the world. Bus systems provide the least external knowledge and create

<sup>6</sup> Lyndsey Layton, "Turning back to the humble bus," *Washington Post*, 25 November 2003, p. B1.

the greatest fear of being stranded, in hostile weather, with no knowledge of how the system works, and no ability to backtrack along the route.

Another example of how *not* to provide information about a contrast set involves the purchasing procedure for international standards. To take one example, the need for standardized abbreviations for country names has grown over the past few years. There is an existing and regularly updated standard (called ISO 3166) which specifies two-letter, three-letter, and numerical labels for each country in the world. The two-letter abbreviations have become particularly well-known since they came into general use as the last element in Internet domain names. It quite commonly happens that people know the name of a country but do not know the two-letter abbreviation.

If you go to the ISO web site ([www.iso.org](http://www.iso.org)) to try to find an official copy of the list of two-letter abbreviations, you may be in for a bit of a shock. Getting a copy costs — and costs a lot. (The price in November 2003 was 148 Swiss francs.) Although the ISO secretariat naturally needs to cover its costs, if the goal is to bring a standardized label set into general use, it is unfortunate to have to impose high costs on those who are trying to learn the links between contrast set and labels. For many years, casual users of the ISO 3166 standard had to rely on various homespun or bootleg copies available on other organizations' web sites. Recently, in what seems to be a compromise approach, ISO has posted an informal (but also incomplete) version of the standard on its web site.

Both of these examples show that successful contrast set design involves much more than just matching entities to labels. Just as important as the creation of a contrast set and its institutionalization as a norm is the process of letting it reach the consciousness of its users at just the time when they need to know about it.

## 7.2 Cultural differences in contrast sets

This section has to do with what happens to us when we venture beyond the safety and familiarity of our own sociomental neighborhoods — for example, into a country with a different writing system, telephone numbering plan, or system of shoe sizes. Within the

thought communities that we are used to, we know how all the important contrast sets are set up, and we know how to find more information about the things that we are a little foggy on. When, however, we travel to an unfamiliar thought community — whether that be a new country, city, school, company, bookstore, or church — we must cope with new and confusing contrast sets. In a new cognitive neighborhood, we lose the sense of *cognitive tranquility* that we have back home. We become strangers. We no longer carry in our heads all the information we need to be a full-fledged "user" of the contrast sets we encounter. We have to pull that information in from the outside world all over again.

This section follows in the long sociological tradition of studying the role and position of the "stranger"<sup>7</sup> to a thought community. (Scholars in the growing field of tourism studies have also written about the cognitive repercussions of the tourist's strangerhood, although not in as much depth as one might expect.<sup>8</sup>) The stranger differs from the child in already having undergone primary socialization, and in being competent in their own social neighborhood. But like the child, the stranger is just beginning to learn the standard operating procedures of the new community in which they now find themselves.



Image 7.5 (023)

In fact, because of the phenomenon of reification, many strangers have never thought of a coordination problem as a "problem" before their arrival in a community where it is resolved in a different way. An American on their first overseas trip in, say, Russia, may never have even imagined that the long-distance dialing prefix could be anything other than "1", that people really do write with the Cyrillic alphabet, measure everything in meters and degrees Celsius, and use a different set of

<sup>7</sup>Sociological works on the theme of the stranger include Alfred Schutz, "The stranger: an essay in social psychology," in his *Collected papers*, 2: 91-108 (The Hague: Martinus Nijhoff, 1964); Pitirim A. Sorokin, *Social and cultural mobility* (Glencoe, Ill.: Free Press of Glencoe, 1959), pp. 508-521; Georg Simmel, "The stranger," in his *The sociology of Georg Simmel*, pp. 402-408 (Glencoe, Ill.: Free Press of Glencoe, 1950); Mary Margaret Wood, *The stranger: a study in social relationships* (New York: Columbia University Press, 1934).

<sup>8</sup>For a brief review, see John Urry, *The tourist gaze: leisure and travel in contemporary societies* (London: Sage Publications, 1990), pp. 1-15.

standard paper sizes. The foreignness of a different culture's standards solutions often comes as just as much of a shock as the fact that everyone around you really is speaking a different language. Another surprising aspect of foreign travel is the realization that your own country is seen by the locals as just another in the contrast set of "foreign" countries. Thus a Japanese on their first trip out of the country might never have dialed the country code for Japan before; it might never have occurred to them that telephone numbers are taxonomically organized and that there is such a thing as an international dialing prefix which signals a certain level within that taxonomy. The guidebook illustration in Image 7.5 tries to make that clear.

But one does not have to be a traveler in a foreign country to experience the kaleidoscopic variety of contrast sets and labels in the world. Almost any unfamiliar environment, whether an entire culture or simply a new city or a new building, presents visitors with a multitude of alphanumeric labeling systems: pier numbers in Seattle, house numbers in Venice, Roman-numeral district numbers in Budapest, seat numbers in stadiums or theaters, gate numbers at an airport, and store numbers on a shopping mall map.

Quite often the stranger is already familiar with the way a contrast set is partitioned and with the tools used to label it, but just needs to learn new values or labels for its members. Thus most cultures use a seven-day week, but generally have different labels for the days. One finds multi-floor buildings in many countries, but in some, the floor labeled "1" is at ground level, while in others, it is one level above. Europeans name streets just like Americans do, but the large-scale use of mapping in streetnaming (where the number or alphabetical position of the street correspond to something about its geographical position) is as unknown in Europe as it is common in the United States.

In the case of scale units, the basic idea of measurement is the same, but the stranger needs to learn the size of the basic unit. There are many countries which use money with a major and minor division in a 100:1 ratio, but the exchange value of the major division varies. The level of precision in a label set can vary, so that it might not occur to Europeans in Britain or America to think that there might be a difference between shoe sizes 10 and 10½,

as the same distinctions are expressed with whole integers in the continental shoe size system. In some cases it is possible to tell from the form of a label that you are using a particular system (41 is a quite ordinary shoe size in the European system but impossible in the British system) but in others it is not (it is equally possible for the outside temperature to be 25 degrees in either the Fahrenheit or Celsius scales, or for a price of \$5.00 to be in American or Australian dollars). Given enough time, the stranger will be able to build an new image or internal understanding of, say, "what 25 degrees means" in the new system, but they need not learn entirely new principles of partitioning in order to do so.

In other cases, the stranger does need to perform what Einar Haugen called a semantic *Umbau*<sup>9</sup> (remodeling) by figuring out completely new principles for partitioning a domain. While the distinctions that any society makes may appear natural to them, these conventional boundaries are often far from obvious to outsiders. Thus a label system that has been carefully constructed and explained to foreigners will still be useless if it is based on distinctions which visitors have never learned to make. Icelanders, Turks, and Poles are respectively trained to consider the differences between *p* and *þ*, *i* and *ı*, and *z* with and without a cross through it as significant, but few others share this sensitivity. A set of recycling bins labeled for different types of reusable material (for example, the beautifully designed ones on newer German railroad cars) will confuse strangers who are not used to distinguishing between "trash" and "recyclables" to begin with when they put out the garbage. An American making their first encounter with the Arabic script is unlikely to be able to tell where one letter starts and another stops, and will initially find strange the Japanese or Ethiopian scripts' focus on the syllable as a unit of analysis, not on single phonemes. Japanese might find the Western focus on streets as an intermediate taxonomic level for house numbering unfamiliar. The Dewey Decimal and Library of Congress systems use entirely different labeling and partitioning styles to catalog books. Meanwhile, visitors to

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<sup>9</sup> Einar Haugen, "Linguistics and dialinguistics," in *The ecology of language: essays by Einar Haugen*, pp. 299-306 (Stanford: Stanford University Press, 1972 [1970]), p. 304.

Beijing do well to act as if there is only one China, whereas in Taipei it might be better to consider that there are two.

There are, as well, a tremendous number of different ways to divide up the directional circle around us.<sup>10</sup> Many ship captains may think in terms of a 360-degree circle on the job.<sup>11</sup> For Icelanders, the four compass directions are terms of everyday folk reference and lack any technical flavor (Icelanders will routinely tell you that the potatoes are on the north side of the table).<sup>12</sup> Similarly, some Pacific islanders prefer to think in terms of seawards and mountainwards ("there is a spot of mud on your seaward cheek").<sup>13</sup> Americans, however, seem to prefer relative direction references ("the potatoes are on the left as you come in") and to consider absolute directional reference pedantic.

Many tourists do not realize that Florence has two separate house numbering systems, one for residences, and the other for businesses. The residence numbers are listed in red and the business numbers in black, but most tourists are not used to thinking about the color of a house number as one of its salient signifying features nor do they automatically think to categorize buildings as residential or commercial.

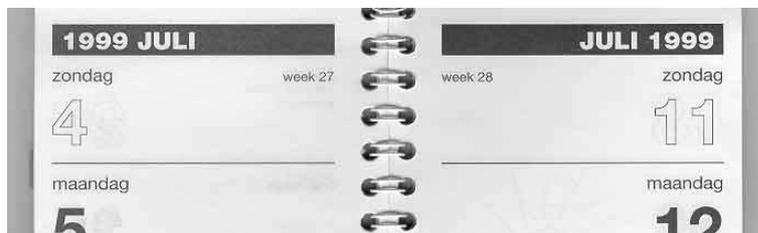


Image 7.6 (041)

Nor does it normally occur to Americans to divide the year into numbered weeks, as Northern Europeans do on their calendars and work schedules

(as Image 7.6 shows). I remember my confusion at a Swedish ferry schedule which listed two sets of timings for "even" and "odd" weeks as if there was no question that the reader would

<sup>10</sup> For a review of reference systems see Stephen C. Levinson, "Language and space," *Annual Review of Anthropology* 25 (1996): 353-382.

<sup>11</sup> See Edwin Hutchins, *Cognition in the wild* (Cambridge: MIT Press, 1995).

<sup>12</sup> See further Einar Haugen, "The semantics of Icelandic orientation," in *Cognitive anthropology*, edited by Stephen A. Tyler, pp. 330-342 (New York: Holt, Rinehart, and Winston, 1969); Jonathan Wylie and David Margolin, *The ring of dancers: images of Faroese culture* (Philadelphia: University of Pennsylvania Press, 1981), chapter 2 ("A sense of place," pp. 13-45).

<sup>13</sup> Kevin Lynch, *The image of the city* (Cambridge: Technology Press and Harvard University Press, 1960), p. 129. Also see, for example, Lesley Reader and Lucy Ridout, *The rough guide to Bali and Lombok* (4th ed., London: Rough Guides, 2002), pp. 542-543.

understand this distinction, and I still find it slightly exotic to see a Copenhagen department store announce their extended Christmas hours as "extra opening hours in week 51."<sup>14</sup>

These examples points up how the conventional partition of a domain depends on *rules of focusing and attending*, which tell us which significant differences between instantiations we should pay attention to.<sup>15</sup> Rules of attending suggest which boundaries might be a focus of partitioning, which attributes of contrast set members might be reflected iconically in their labels, and, conversely, which differences between instantiations are insignificant matters of allovariation.

Sociomental variation from country to country and culture to culture is not only inevitable but also exciting. Nevertheless, there are cases in which designers can and should work against it. A fine example involves the international standardization of telephone numbering. In European countries, you can always tell from the telephone number whether it is a land line or a mobile phone. This is quite important, since calls to mobile numbers in Europe cost considerably more.<sup>16</sup> Unfortunately, there is, as of 2005, no consistency to these labeling regularities. In Italy cellphones begin with 3, and landlines with 0; in France, cellphones begin with 06, and landlines with 01 through 05. In Iceland, numbers which start with 4 and 5 are land lines (which cost 1-2 crowns per minute to call from another land line) while numbers that start with 6 and 8 are cell phone numbers (10-20 crowns per minute), except for numbers that start with 800, which are free. (Then of course there are numbers that start with 900, which are very expensive.) To make matters worse, inter-network access charges are also becoming more common in European telephony, and unfortunately, there are no certain rules for figuring out which network a given number belongs to, because people are allowed to keep their old number when they change companies.

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<sup>14</sup> "Ekstra åbningstider i uge 51." Sign observed on the door of Magasin du Nord, Copenhagen, December 2004.

<sup>15</sup> On rules of focusing and attending see Zerubavel, *Social mindscapes*, chapter 3 (pp. 35-52).

<sup>16</sup> To make phone calls in Europe in an informed way, Americans first have to familiarize themselves with the idea that the phone numbering system *can* encode whether the telephone is a fixed or mobile phone. The American numbering system does not make this distinction. In America (with the exception of certain special numbers beginning for example with 800 or 900) the type of phone being called has no effect on the per minute cost to the caller, and the extra cost of calls to mobile numbers is borne by the called party.

The result is a breakdown of the coordinative compact which used to exist between telephone companies and users, allowing users to rely on their expectations of the relationship between the form of the numbers they dial and the cost of the resulting phone call. After all, in the old days of monopoly telephone service in America, a complete rate table was printed in the back of the phone book. Recently, this increasingly opaque linkage has captured the attention of European regulators and consumer groups; some have called for stricter requirements that users be informed of the per-minute cost of each call.<sup>17</sup> From a historical and sociological point of view, it would be interesting to know how such a situation developed. Why was this cognitive and semiotic impact of the changes in the telephone industry initially overlooked? Did those responsible for numbering management have any incentive to design meaningful and transparent labeling systems which newcomers to a culture could learn to understand?

In focusing on the role of contrast sets in a stranger's encounter with a new culture, I do not want to give the impression that they are the most important aspect of cross-cultural adaptation. Learning how a new environment works is not just a semiotic task.<sup>18</sup> It involves much more than the learning of new ways to partition and label a domain. Looked at in the broadest way, the stranger can lack an understanding of almost *any* social fact, including almost anything about the way a new environment works that is not universally and naturally determined, almost anything that requires being party to the type of coordinative understandings discussed in chapter 5, and almost anything that requires sharing the sociomental, intersubjective world of the locals. For example, they may not understand local rules for tipping, greeting customs, politeness, edibility, or attention; they may not be familiar with words, gestures, rites of passage, scripts, images, discourses, and frames of reference; and they may not be able to distinguish between the sacred and the profane, the

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<sup>17</sup> International Telecommunications Users Group, "Beyond national numbering: an issues paper" (2002), [http://www.intug.net/views/beyond\\_national\\_numbering.html](http://www.intug.net/views/beyond_national_numbering.html) (March 2005).

<sup>18</sup> See Jorge Frascara, *User-centred graphic design: mass communications and social change* (London: Taylor and Francis, 1997), p. 37, on "the insufficiency of semiotics."

clean and the unclean, the forbidden and the prohibited, the marked and the unmarked, the default and the exceptional, or the private and the public.

Contrast sets do, however, occupy a prominent place in this larger landscape of cross-cultural adaptation. For example, take the case of a passenger at a train station, which Paul Arthur and Romedi Passini considered in detail in their book on wayfinding.<sup>19</sup> The passenger's goal is to get on the right train and arrive at their destination. This might include such crucial steps as learning that the train leaves from platform 4a; figuring out which of several series of numbered signs labels the platforms; and understanding the taxonomic structure of the platform numbering system (4a and 4b are separate platforms in some stations, but different ends of the same platform in others). Of course, other problems have nothing to do with contrast sets, such as finding the elevator, knowing whether you need a platform ticket, knowing how far in advance you need to be at the station, or trying to understand the announcements on the public address system.

### 7.3 Resocialization, or not

"You know," I offered helpfully, "it would be really nice if there were some signs in English pointing out some of the more interesting places. That way people could find them and make their visit more interesting. Or maybe just some highway markers?"

"Signs?" said one of the optimistic pessimists. "We already have tourism signs, don't we?"

"Well, some," I conceded, "but they're in Estonian and Russian."

"But if we have signs," my dissenter continued, "that means tourists will find their own way around the island."

Leave it to an Estonian to take all the practicality out of logic. "Well, yeah, that's the idea."

"But what about us guides?" said another woman. "We need work or we'll all starve!"

"We can't just let people go around and look at things!" said a horrified older man.

"Ah, signs are expensive and no one will look at them anyway," grumbled a true pessimist.<sup>20</sup>

Sometimes, a cognitive designer has the ability to help — or hinder — a stranger from learning to master the contrast sets that are in use in a new thought community.

Consider the travel guidebook: it is a small, relatively inexpensive, portable information tool which is accessible almost at will and can contain a lot of information. An important part of any guidebook is usually a practical-information section which explains the

<sup>19</sup> Paul Arthur and Romedi Passini, *Wayfinding: people, signs, and architecture* (New York: McGraw-Hill, 1992), pp. 3-4.

<sup>20</sup> Douglas Wells, *In search of the elusive Peace Corps moment: destination Estonia* (Xlibris, 2001), pp. 141-142.

cognitive world of the country it covers. This section is usually distinct from the sections of a guidebook which describe particular places (towns, cities, national parks, etc.) and review restaurants, hotels, and sightseeing in each place.

Among the contrast sets that the introductory section of a guidebook usually explains are the telephone numbering system, time reckoning and temporal rhythms, the writing system and other conventional symbols, standard measures for length, volume, weight, temperature, and money, and naming, numbering, and addressing systems. For example, one major series of guidebooks to Europe for Americans includes examples of how European handwritten 1s, 4s, and 7s differ from American styles, and explains that Europeans refer to Christmas 2003 as 25/12/03 and use "first floor" to refer to what Americans think of as the second floor.<sup>21</sup> Naturally, these sections also discuss many other coordinative norms, such as what type of electrical plug one will need, what side of the road traffic drives on, and other general aspects of cross-cultural adaptation.



Image 7.7 (015)

Buying a guidebook is one of the many ways in which strangers are willing to pay money to various "cognitive intermediaries" for help in learning the contrast sets of an unfamiliar culture.<sup>22</sup> They thereby contract out to the world for the competence they do not possess in their heads. They willingly pay for language classes, tour guides, maps, guidebooks, brochures, or taxis from the airport into town, just as a ship arriving in an unfamiliar harbor may pay (and even be required) to take a local pilot on board. In my job as a tour guide, I give language lessons, pass out coin strips (illustrated in Image 7.7), and explain metric measurements and the 24-hour clock in order to introduce my American customers to the everyday European cognitive world. There is also a class of specialized guidebooks (one series is called *Culture Shock*) which do not cover restaurants and hotels, and focus on explaining the cultural peculiarities

<sup>21</sup> See, for example, Rick Steves, *Rick Steves' Italy 2003* (Emeryville, Ca.: Avalon Travel, 2002), p. 458.

<sup>22</sup> Urry touches on this theme briefly in *The tourist gaze*, pp. 7-8.

of a place, its contrast sets among them.<sup>23</sup> There is also an entire business in converters — tools which encapsulate within themselves the knowledge that takes us from one contrast set to another. Examples of converters are dictionaries, phrasebooks, translators/interpreters, the Windows Alt-Shift keyboard-map toggle button, currency conversion calculators, file format converters, thermometers or yardsticks in both metric and standard, dual video format recorders and playback devices, and reducing and enlarging functions on photocopiers (or anything else designed to cope with multiple standard paper sizes).

These services can also sometimes be available for free. Signs, notices, information boards, building directories, seating plans, and telephone books are all cases in which someone else has gone to the trouble of anticipating strangers' need to know about a partitioning or labeling system. One can usually ask friends, relatives, passersby, local proprietors, the tourist information office, ushers (who have a good command of the way seats in a theater are labeled), or salespeople (who are supposed to know the layout of a store and the way, for example, clothing sizes work) for help.

Despite all of this knowledge in the world, many people do not bother to resocialize themselves to a new community, but rather proceed with the faulty understanding of it that they already have, thus "satisficing" rather than striving for the best possible sense of their environment. This might mean not looking in the guidebook, not asking the tour guide or the usher for extra help, not looking up that funny word in the dictionary, or not converting the foreign currency to one that you know. These are all examples of "ignoring perfect knowledge in the world for imperfect knowledge in the head."<sup>24</sup> The reason is that very often we do not

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<sup>23</sup> A noteworthy example of this genre, and one especially attentive to contrast sets, is *The Russian's World*, by Genevra Gerhart, first published in 1974. This book explains the most mundane features of everyday Soviet life in uncommonly rich detail. Among the contrast sets and labels described and illustrated in the 1974 edition are Russian street addresses, school class levels, school grading, transliteration systems, road signs, chess notation, the Cyrillic alphabet, numeral orthography, standards of measure, standards of time, and coinage. The book also discusses Russian naming, body parts, tooth names, holidays, kinship terms, number names, and the use of the abacus. Genevra Gerhart, *The Russian's world: life and language* (New York: Harcourt Brace Jovanovich, 1974; 3rd ed., Bloomington, Indiana: Slavica, 2001).

<sup>24</sup> This phrase comes from the title of Wayne D. Gray and W.-t. Fu, "Ignoring perfect knowledge in-the-world for imperfect knowledge in-the-head: Implications of rational analysis for interface design," *CHI Letters* 3 (2001): 112-119.

find it worth the investment and bother to gain a comprehensive or even partially comprehensive knowledge of a new contrast set, and we just take the risk that we will be able to muddle through with what we know already. This is why the resocializer of last resort is learning the hard way, from our mistakes.

For many travelers, part of the fun is actually learning to accommodate to new coordinative norms, but other strangers prefer to pay extra for a protected experience (such as a guided tour or an international chain hotel) in which they are shielded from having to learn how the telephone numbering or the local currency works. In the most extreme cases tourists visit another country without ever leaving their own sociomental "neighborhood." Conrad Hilton, founder of the hotel chain that bears his name, boasted that "each of our hotels is a little America,"<sup>25</sup> and at the Istanbul Hilton, Daniel Boorstin explains how guests could effectively commute between their home country and the "real Turkey" by walking out the front door.<sup>26</sup> European tour guides working with American groups feel that they are giving good service when they go to the trouble of translating heights, weights, and distances into American terms, and not long ago I saw an advertisement in the *New York Times* by Perillo Tours, an American tour operator, trumpeting that they were now including bacon and eggs at all hotel breakfasts in Italy (a country where the natives are known for not making much of their morning meal).

There is, in fact, an entire class of people whose interest it is in that strangers *not* be able to adapt to the cognitive coordination norms of an unfamiliar community. In the quote at the beginning of the section, a local tour guide resists the provision of better tourist information because it would reduce the need for her services. Not only tour guides but touts, merchants in the marketplace, and even disreputable guidebooks all take advantage of the stranger's lack of local knowledge to make money. For example, it is quite easy simply not to correct an American at the Prague airport who misreads the price of a 190-crown telephone card as 790 crowns; the American is liable to read European handwritten 1s as 7s,

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<sup>25</sup> Quoted in Daniel J. Boorstin, *The image: a guide to pseudo-events in America* (Revised edition, New York: Atheneum, 1987), p. 98.

<sup>26</sup> Boorstin, *The image*, pp. 97-99.

and does not have their sense of value in Czech crowns calibrated sufficiently well to see that 790 crowns is a fairly high price for a telephone card. Tour guides, by misinforming their clients about local price levels, can increase the likelihood of those clients making a purchase from which the guide receives a commission. Touts can steer visitors to accommodations that they might not have chosen given more complete knowledge of local geography or prevailing costs. Typically, those practicing such deceptions are all smiles and make the stranger feel as if they have succeeded in bridging the communication gap with the "locals," when in fact the tout knows more about the stranger's perspective than the stranger knows about the tout's, and uses that difference to advantage. In a somewhat similar fashion, one can contend that the major telephone companies in Europe (despite their feel-good advertising campaigns) actually have a somewhat sinister interest in *not* harmonizing the numbering for different types of phone services, because they profit if it is next to impossible for users to minimize their expenditures.

My position is that those who have any design influence over such exploitative knowledge differentials should try to eliminate them, even at the risk of having their tires slashed by those whose financial interests this threatens. Over time, and over an entire community, are the social and economic benefits of transparency and honesty, and of giving strangers the opportunity to learn local norms, not far greater than the short-term spoils from keeping them in the dark? The general acceptance of norms of behavior for stranger-local interactions increases visitors' sense of cognitive tranquility and thus the likelihood that they will repeat, or recommend, a given interaction. For example, the public provision of resocialization information in tourist destinations, by means of signposting, informational leaflets, and tourist offices, aims at helping strangers bridge the knowledge gap that touts rely on. Although more often directed towards preventing physical rather than cognitive assaults, certain communities maintain a special enforcement service, often referred to as the tourist police, to make sure that strangers are not taken advantage of. Jamaica and Egypt are

two countries which have such brigades.<sup>27</sup> Similarly, most countries have some means of ensuring that measuring devices used in the retail trade are properly calibrated. The difficulty with these approaches is, of course, that the enforcers are not always around when there is something to enforce.

However, in some cases, entire communities — not just individual touts — deliberately try to preserve the distinction between the thought community of the stranger and the thought community of a local, making it hard for visitors to penetrate through the tourist "front" to the reality backstage.<sup>28</sup> The Intourist guide in pre-1991 Russia who energetically supervised the focus of her charges' attention, the red-striped Freedom Trail in Boston or the signposted tourist "magistral" in downtown Ljubljana that visitors are encouraged to follow, the tourist map which shows only selected parts of a town,<sup>29</sup> or the interior wayfinding signage that hides staff areas or other "backstage" elements of an building are all examples of efforts to control the amount of knowledge and command over an environment that visitors will acquire. Similarly, where dual-pricing standards exist (for example, at museums in China and national parks in Costa Rica, which cost more for foreigners than for locals), often only the higher price is posted; the lower price is available only to those who are "in the know."

When such barrier-building involves contrast sets, the goal is to deliberately make their standardized aspects *difficult* to learn. For those trying to bring this about, all the advice I give on the design of contrast sets may simply be turned inside out. Thus, when designing a code or cipher, one wants to *obscure* the relationship between label and referent so that only those with specific training can reconstruct it. Deliberately avoiding any

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<sup>27</sup> On Jamaica see "Jamaica takes steps to protect tourists," *New York Times*, 21 March 1999, travel section, p. 3; on Egypt, see for example Harvard Student Agencies, Inc., *Let's Go: Europe 1987* (New York: St. Martin's Press, 1986), p. 155.

<sup>28</sup> On the general phenomenon of designing impenetrability see Norman, *The design of everyday things*, pp. 203-206 ("Deliberately making things difficult"). On backstage and frontstage in tourism see Dean MacCannell, *The tourist: a new theory of the leisure class* (New edition, Berkeley: University of California Press, 1999 [1979]), chapter 5 ("Staged authenticity").

<sup>29</sup> Rob Shields, "Political tourism: mapping memory and the future at Québec City," in *Mapping tourism*, edited by Stephen P. Hanna and Vincent J. Del Casino Jr., pp. 1-27 (Minneapolis: University of Minnesota Press, 2003), p. 8.

predictable mapping between source and target sets makes it more difficult to guess the meaning of a set of labels by removing a user's "navigational ability" (see section 4.1) within the set. One may also try to obscure category boundaries in a message — for example, by running all the words of a sentence together without spaces. In certain steganographic messages, such as the cipher in the Sherlock Holmes story "The Adventure of the Dancing Men," the message creator hopes that no one but the intended recipient of the message will know that its elements form a consciously designed contrast set, and thus that they will never even get to the point of trying to decipher the way the the set labels its referents.

The designer can increase the likelihood that visitors will be able to understand messages that involve contrast sets, and thus to participate in the locals' cognitive world, by means of several different techniques. The most obvious strategy is simply to translate messages which use a purely "local" contrast set into ones that use contrast sets that will be understood by the stranger. Consider, for example, multilingual tourist brochures and wayfinding signposts, cookbooks which give measurements in both metric and standard, and French Internet cafes which set aside a section for users who prefer the QWERTY keyboard layout. The drawback of this strategy is that works only if the designer understands the cognitive world of the stranger.



Image 7.8 (042)

Other strategies try to use relatively more universal understandings which require very little resocialization on the part of the stranger. Often this means the effective creation of a simplified "lingua franca" which is more likely to be understood than purely local idioms. For example, linguistic strangers can often understand an image even if they do not understand the text, and in the twentieth century there has been a conscious effort to define worldwide, iconic, pictorial standards for commonly encountered messages. Although users must learn the conventional meaning of the pictures just as they must learn to read text, in the case of images the relationship between form and meaning is more motivated and easier to guess, as Image 7.8 shows. Conveying the message

"WALK" or "DON'T WALK" to a multicultural audience in pictures is also likely to be more effective than doing so in text. Similarly, a common strategy in Japanese guidebooks is to show *pictures* of destinations, not just text descriptions and labels like the street address. This relieves Japanese travelers of the necessity of matching their location to their goal by means of names and labels that use unfamiliar foreign writing systems, using instead a cognitively more fundamental strategy where the actual "view" at one's location can be matched to the view shown in the guidebook.

Labeling a set with contrasting colors (see further section 3.2) is another strategy which works well for a stranger who does not command local alphanumeric symbols. As long as they have normal color vision, someone who cannot read can still perceive and remember the distinction between one public transport line and another if color is the bearer of the semantic contrast. Indeed, this is one of the most common labeling devices for subways and suburban trains (in, for example, New York, Moscow, London, Paris, Boston, Rome, and Copenhagen). It is of course common (and desirable) to supplement color tagging with letter tags (Rome, Copenhagen, New York), numbers (Paris, New York), or different names to each line (Moscow, London), which allows users a choice of whichever labeling method is most convenient. But the salience of color as a tagging system is perhaps evident in the way many outsiders tend to refer to the New York subway lines by color, inviting correction from New Yorkers who know that the system's letter and number tags actually reflect the crucial distinctions between train destinations that a user needs to know.

Reducing the level of precision used in the formation of a contrast set can increase a stranger's sense of cognitive tranquility by not forcing them to take account of distinctions that they are not used to. Thus Icelandair's in-flight magazine simplifies the Icelandic writing system by transcribing the letters *þ* and *ð* as *th* and *d* respectively, making the text less jarring and more accessible for readers not familiar with Icelandic culture's standard focal points of graphic form. Many guidebooks also choose not to bother including diacritical marks in their rendering of foreign placenames and other proper nouns. In the Roman-script world, the basic set of twenty-six letters running from A through Z constitutes a sort of lingua

franca, whereas letters like Æ, Ð, Ĥ, Ł, Ñ, and Ū reside in a second tier of specialized focal points. Attempts to avoid misunderstanding by resorting to such a least common denominator have the unfortunate side effect of reducing national pride. The very same things that form your national identity may be hard to maintain in an international forum.

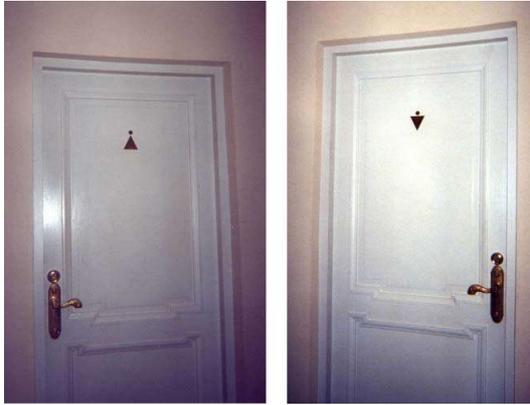


Image 7.9 (044)

Sometimes strangers cannot grasp the meaning of a set of strange symbols, but can perceive the contrast between them. In such cases designers can content themselves with having made the contrast between members of a label set clear, even if their referents remain obscure to those who do not know the meaning of the labels.

Thus, when foreigners who go to the back of a restaurant in Estonia looking for the restroom find two doors labeled with triangles, one pointing upward and the other downward (as in Image 7.9), they may not be able to figure out which triangle means "men" and which means "women." But, because it is not their first time in a restaurant, they can be pretty sure that the binary topology of the distinction between the triangles corresponds to the binary topology of the distinction between the sexes. If a person of the opposite sex comes out of one door, the stranger can be fairly sure that they should go in the other. Although triangles are the traditional labels for bathroom doors in Estonia, any other pair of definitely contrasting symbols would work as well. (Note that the symbols in Image 7.9 are exceptional in including a circle above the triangle; most Estonian bathroom doors are marked with triangles only.) Similarly, many traffic lights now come with standardized "chirping" signals to tell blind people when they can use the crosswalk. I have never paid enough attention to them to learn which signal goes with which message, but I do notice the contrast when they change.

# 8 Conclusion

## 8.1 Form, not content

Those who chronicle individual contrast sets rarely see their stories as instances of a widespread social form. Not long ago, for example, I read an article in the newspaper called "Hispanics Resist Racial Grouping by Census." It related the difficulties faced by many United States residents of Latin American descent in fitting themselves into typical racial categories, and the debates within the United States Census Bureau about whether to eliminate the "some other race" category from their forms. The article never mentioned any of the theoretical concepts developed by scholars of categorization — nor did it even suggest that the question of where Hispanics fit in American racial categorizations might be something that could be evaluated on anything other than its own particular terms!<sup>1</sup> Although problems of contrast set creation surround us, it is commonplace to treat each one as a separate issue. But we might gain something by encouraging people to see such individual issues in the context of a larger social form.

The same problem occurs when the story involved is that of the status of contrast sets rather than their internal makeup. Those who chronicle the standardization of a single contrast set often miss interesting analogies and generalizations that they could make if they saw their own case as just one instance of a social form or pattern. Those who chronicle the history of a single standards problem may see the formal links between different solutions, but miss the formal links between "their" standards problem and others.

For example, many scholars of writing systems have been able to see the common thread in the variety of different human solutions to the problem of how to transmit verbal messages. But they have not related the problem of the coordination of writing systems to, for example, the problem of the coordination of temperature measurement. Specifically,

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<sup>1</sup> Rachel L. Swarns, "Hispanics resist racial grouping by census," *New York Times*, 24 October 2004.

several respected scholars have proposed explicit theories of why it is difficult to change writing systems without connecting these theories to the issue of why it is difficult to change other coordinative norms. John DeFrancis came up with his "Law of the First Script," which predicts that no one who is not passionately committed to writing system reform will be interested in changing a script which is even minimally adequate, because the costs of change are so high for something so cognitively fundamental.<sup>2</sup> Denise Schmandt-Besserat, observing that the form of our numerals has changed little since 700 B.C., says that: "Signs and symbols have a pervasive endurance which makes them withstand time in a unique fashion ... After all, symbols are instituted for the purpose of communication, and any deviation in their use would create miscommunication and confusion."<sup>3</sup> Florian Coulmas, in discussing the arguments used by opponents of spelling reform, cites "the historical depth of the literary traditions which may be jeopardized ... the value of the written form of the language as a symbol of national identity; and ... the cost of implementation."<sup>4</sup>

None of these scholars brought in the general history of convention and standardization to support these points. None of them used broader concepts such as "social fact," "appeal to history," or "cognitive commitment." To be fair, it was not part of their purpose to demonstrate that their conclusions might be generalizable to other standards problems. But in fact they are. To recognize that is to see commonality in a huge range of social phenomena which "behave" similarly, and which can be compared to each other in an interesting and instructive way.

Even those scholars who are shooting for a high degree of abstraction and generalization have often failed to see that the social form they have isolated has already been described (often under another name) by another scholar who they simply have never happened to come into contact with. Thus, for example, linguist J. R. Hurford proposes an account of the standardization of numerical base, and works through a detailed simulation,

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<sup>2</sup> John DeFrancis, *Nationalism and language reform in China* (Princeton: Princeton University Press, 1950), pp. 199-200.

<sup>3</sup> Denise Schmandt-Besserat, *How writing came about* (Austin: University of Texas Press, 1996), p. 82.

<sup>4</sup> Florian Coulmas, *The Blackwell encyclopedia of writing systems* (Oxford: Blackwell, 1996), p. 480.

without any reference to broader theories of institutionalization or the emergence of norms.<sup>5</sup> Economist Joshua Epstein developed a computational model of reification in an article which never mentions the term "reification" or the sociological literature on it.<sup>6</sup> Johanna Drucker has given us an extremely detailed account of the justifications and legitimations that people have used for their alphabets and writing systems without ever citing Peter Berger and Thomas Luckmann's writing on the legitimizing of institutions.<sup>7</sup> For my part, in my first year of graduate school I wrote an entire term paper on standards of precision without citing Grice,<sup>8</sup> and I have surely committed similar sins of omission in this book too. My intent is not to condemn or shame these scholars, but simply to point out how much work we still have to do to link analytic literature on the same social forms in sociology, anthropology, psychology, philosophy, linguistics, economics, and geography.

An attention-worthy linguist whose work does make these links is Rudi Keller, who has related semiotics and language change to theories of convention and institutionalization.<sup>9</sup> Indeed, it is very gratifying to see that a change has come over linguistics in the past few years. Orthodox, formalist, generative linguists were so concerned with defining the extent of the innate human linguistic endowment that, when they saw evidence of social facts or social conventionality in linguistics, they dismissed it as uninteresting. But newer schools of linguistics find the conventional aspects of communication worth studying — those that take advantage of the wiggle room within the constraints of human nature.<sup>10</sup> These new traditions, such as cognitive linguistics, have

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<sup>5</sup> James R. Hurford, *Language and number: the emergence of a cognitive system* (Oxford: Basil Blackwell, 1987), pp. 274-301.

<sup>6</sup> Joshua Epstein, "Learning to be thoughtless: social norms and individual computation," *Computational Economics* 18 (2001): 9-24.

<sup>7</sup> Johanna Drucker, *The alphabetic labyrinth* (London: Thames & Hudson, 1995).

<sup>8</sup> I had even heard of Grice, but the formal similarity between classificatory precision and conversational quality had not yet occurred to me. Very often, the difficulty is not that one has not come into contact with another example of the form, but that it is hard to focus one's mind to perceive formal similarities between disparate examples.

<sup>9</sup> See Rudi Keller, *On language change: the invisible hand in language* (London: Routledge, 1994).

<sup>10</sup> See for example Michael Tomasello, "Cognitive linguistics," in *A companion to cognitive science*, edited by William Bechtel and George Graham, pp. 477-487 (Malden, Mass.: Blackwell, 1998), pp. 478, 480.

allowed the study of language to broaden its scope and to reapproach the other social sciences, finding common ground that many linguists abandoned during the 1960s, 1970s, and 1980s. (Scholars of convention such as David Lewis and Edna Ullmann-Margalit had, of course, never stopped finding the conventional aspect of language interesting.)

In order to see each individual story of contrast set design and standardization as an instance of a social form, one needs to have read a plain-language summary of the elements of that social form. When I began to research the history of various individual standards and conventions — both those that are contrast sets and those that are not — I found it very frustrating that there was no concise summary of the theory of the topic. This book has been my effort to lay out that theory in a way which can quickly give perspective and context to the history of any contrast set, and, to some degree, to the history of any kind of cognitive standard or convention.

Of course, a focus on social forms without reference to their contents can go too far. Economist Peyton Young's deep concentration on theories of standards change and institutionalization (rather than the historical facts of the particular cases he cited) perhaps drew his critical eye away from a thorough historical review of a crucial piece of evidence for his theory: the "fact" that Napoleon changed the rule of the road in Europe from keep-left to keep-right, which appears to be a myth.<sup>11</sup> When building a theory that covers many examples, one must try as hard as possible not to lose sight of the many concrete instances that are supposed to fit into the theory. Regrettably, the existing theoretical literature on both categorization and standardization does not always do a good job of this; it is sometimes incomplete, overly abstract, or hard to connect with the actual historical and practical facts of each case. This is why I have done my best to stud my exposition with examples which easily allow the reader to make the link between form and content, and pattern and instance.

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<sup>11</sup> H. Peyton Young, "The economics of convention," *Journal of Economic Perspectives* 10,2 (1996): 105-122; *Individual strategy and social structure: an evolutionary theory of institutions* (Princeton: Princeton University Press, 1998), pp. 16-17, 98. For more details on the Napoleon story, see Ian Watson, "The rule of the road, 1919-1986: a case study in standards change," unpublished M.A. qualifying paper, Department of Sociology, Rutgers University, 1999.

## 8.2 Cognitive design

The title of this book is misleading: the book is about contrast set design, not cognitive design. As someone who has always disapproved of titles which overreach (like, say, Foucault's *The order of things*) I have to confess to a great deal of guilt at having titled this book *Cognitive design*, and must plead that it was not originally my idea. (I wanted to call it *Set design*.) I also plead that, at least, contrast set design is a *type* of cognitive design. In the next few paragraphs I want to explain briefly what this wider field of cognitive design really is.

Some people surely think of "cognition" as something that humans do which is completely determined by our biological inheritance. In fact, our cognitive life, though sometimes dictated by natural factors, is sometimes conventional, shared, and social. So cognition is designable (sometimes, at least). Social groups share mental structures. Groups of people think in the same way. Sometimes these sociomental patterns are emergent and unplannable, with little or no traceable origin. But sometimes our patterns of thought were deliberately designed, and we can often point to specific people who shaped or created those shared mental structures. We can call these people cognitive designers, and the work that they do, cognitive design.

For some people, the word "design" calls up visual and tactile images such as chairs, drinking glasses, doorknobs, homes and buildings, and landscaping. In fact, though, many design choices, to a greater or a lesser extent, ask the designer to take into account the way that users *think*, not just their physical needs. So design is cognitive (sometimes, at least). Designers need to have realistic expectations of other peoples' mindsets.

Some designers have to consider how users think. Others have to create the terms in which users will think. One can, in other words, "design with cognition in mind," and one can also "design how cognition should work." Consider the difference between putting a list in alphabetical order (because you expect other people to know it) and creating alphabetical order to begin with. Consider also the difference between knowing that in a properly

designed font, the point of a capital A should extend a little bit higher than the curve of a capital O (which has to do with the way that humans perceive shape), and the task of creating the basic shapes of the alphabet in the first place. Or, the difference between communicating a single message to someone else, and communicating the terms in which such messages can be phrased.

Forget, for a moment, the entire idea of contrast sets, labels, mappings, topologies, and coordinative standardization, and consider *all* the phenomena and activities in which cognition and design intersect. It is a very broad topic, probably unmanageably so. Any communication across time and space can be called a kind of "cognitive design." Whenever we create information for use at another time, in another place, or by another person, we structure the ways in which another mind will think. Any time we design a situation which involves human interaction, and build into that situation a requirement that someone else must know something (how to read, or what day it is, for example) in order to participate in the interaction, we are building expectations about other peoples' cognitive world into our decisions. By deciding which things "one needs to know in order to behave as a functioning member of one's society,"<sup>12</sup> we shape the set of knowledge that people will have an incentive to acquire.

Many of these design tasks do *not* involve contrast sets. For example, the interior design and organization of homes involves both planning and shared understandings (within a family or between a family and visitors). Why is it, after all, that I know that the cupboard under the sink is a likely place to find the trash bin in many European and American homes?<sup>13</sup> The user interfaces of computer applications and the Internet have been a tremendous focus of cognitive design recently, but we must not forget that decades ago, the production of clock radios, ovens, thermostats, and even such relatively noninteractive household technologies as garlic presses, deadbolt locks, and shoelaces already depended on

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<sup>12</sup> Ward Goodenough, quoted in Dorothy Holland and Naomi Quinn, ed., *Cultural models in language and thought* (Cambridge: Cambridge University Press, 1987), p. 14.

<sup>13</sup> There is a humorous description of the process of trying to understand the organization of somebody else's kitchen in Tony Hawks, *Round Ireland with a fridge* (London: Ebury Press, 1998), p. 134.

the ability to create a shared understanding between designer and user of how the thing works.<sup>14</sup> When you press the "close door" button in an elevator, a conventional agreement on the meaning of your action between you and the designer of the machine is built into the elevator's circuits. The way a book or document designer chooses to use layout, artwork, and type styles sends a semiotic message which does not involve a consciously designed contrast set. An important aspect of our shared mental life is the culturally conventional use of shared schemas and models, which enumerate the related elements of a typical everyday life situation — elements whose relation to each other is much more complicated than the simple *X and other Ys* model that defines a contrast set.<sup>15</sup>

Contrast sets are "things," static phenomena, knowledge of which must be tacitly shared by many people in order for them to have any benefit. But one could also use the term "cognitive design" to describe dynamic, sequenced understandings whose purpose is to be communicated from one mind to another, rather than tacitly coordinated between two minds acting in concert. Thus organizing your record collection in an order that you, your spouse, or your customers can figure out later on means designing a static system which many people can share and use together. But movie makers, writers of detective novels, and designers of airport signage all must anticipate the passage of another mind through an unfamiliar environment, and to try to guess what they will be thinking at every turn in the path. These people, as well as rhetoricians and advertising designers, know how to strategically harness the power of the series of understandings that their audience will pass through.<sup>16</sup> Perhaps one call this kind of work "cognitive design" too — or would that stretch the term too far?

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<sup>14</sup> See Donald A. Norman, *The design of everyday things* (New York: Doubleday, 1990); Willett Kempton, "Two theories of home heat control," in *Cultural models in language and thought*, edited by Dorothy Holland and Naomi Quinn, pp. 222-242 (Cambridge: Cambridge University Press, 1987). On shoelaces, see Edward Tenner, *Our own devices: the past and future of body technology* (New York: Alfred A. Knopf, 2003), pp. xi-xii.

<sup>15</sup> A good introduction to these phenomena is Roy D'Andrade, *The development of cognitive anthropology* (Cambridge: Cambridge University Press, 1995); see also Holland and Quinn, *Cultural models in language and thought*.

<sup>16</sup> For a brief discussion of the issue of designing sequences see Paul Mijksenaar, *Visual function: an introduction to information design* (New York: Princeton Architectural Press, 1997), pp. 41-42.

Clearly, there is much more to cognitive design than the creation of contrast sets, but how broadly to define the term while still making it analytically useful is hard to say. Those looking for a good starting point for reading and thinking about cognitive design beyond the contrast set may want to look at a fine recent textbook called *Interaction design*.<sup>17</sup> Meanwhile, I hope that my limited study of contrast set design has at least awakened your awareness of our power as designers to shape the conventions that we carry in common in our minds.

### 8.3 The importance of contrast set design

Contrast sets *are* important and everpresent. They affect each and every day of our lives, even if we rarely think of them as a thing in themselves. And it is collaboration together, conscious or not, on contrast sets and other coordinative standards that makes us a community and not just a collection of individuals. Standardized contrast sets are, indeed, metaphors of civilization itself. Think of why Jack Goody titles a book about literacy *The domestication of the savage mind*,<sup>18</sup> or of how pianos and piano tuning have been used as a literary metaphor for the extension of European culture to the furthest reaches of the British Empire,<sup>19</sup> or of Robinson Crusoe on his lonely island, notching a stick to keep track of the days of the week.<sup>20</sup>

I have tried, for once, to bring contrast sets out from the shadows behind the curtain and to let them take a bow in the spotlight. Much of what I have written here only skims the surface of what could be said about these specific social patterns and specific coordination problems. Precision, stand-ins, private labels and images, justifications, standards change, and evangelism are all phenomena about which much more could be written. Most of the concrete coordination problems referenced in the text and the examples table lack adequate

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<sup>17</sup> Jennifer Preece, Yvonne Rogers, and Helen Sharp, *Interaction design: beyond human-computer interaction* (New York: John Wiley & Sons, 2002).

<sup>18</sup> Jack Goody, *The domestication of the savage mind* (Cambridge: Cambridge University Press, 1977).

<sup>19</sup> Daniel Mason, *The piano tuner* (New York: Alfred A. Knopf, 2002). Consider also the 1993 movie *The Piano*.

<sup>20</sup> Eviatar Zerubavel, *The seven day circle: the history and meaning of the week* (New York: Free Press, 1985), pp. 3, 132.

histories; a few which are in particular need are alphabetical order, paper sizes, Unicode and computer character sets, bar coding, student grading, and the belief systems surrounding political borders. Several scholarly lifetimes could be spent amplifying these topics into articles or books.

As a reader, I hope you have come away from reading this study with the sense that many contrast sets are under "our" control. We can design them. And we can understand how they are designed. Of course, "good designers can produce successful artifacts without explicit knowledge of the psychological theory that would justify why the design succeeds," as one commentator puts it (noting that there were bridge builders long before there were civil engineering curricula).<sup>21</sup> But we can help educate more good designers by taking the time to do a good job of explaining the principles of contrast set design, and relating them to more general insights about social life and cognition, and we can improve peoples' quality of life by spending time and money on consciously finding the best design solutions for particular design problems.<sup>22</sup>

Good contrast set design will not save the world. But it can help people work together better. We often trivialize contrast sets. But they deserve our attention and careful design. As Willett Kempton observed, Americans' cognitive models of their home thermostats may seem insignificant, until one considers the tens of *billions* of dollars that Americans spend on home heating every year.<sup>23</sup> The measurement of distance, the numbering of years, the labeling of clothing sizes, the identification of musical pitches, and the representation of number and sound with numerals and the letters of the alphabet are no less important. Thinking about how we design the mundane details of everyday life can be far more valuable than we imagine.

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<sup>21</sup>Alex Kirlik, "Everyday life environments," in *A companion to cognitive science*, edited by William Bechtel and George Graham, pp. 702-712 (Malden, Mass.: Blackwell, 1998), pp. 705-706.

<sup>22</sup>For a list of some of the arguments for spending money on good design, see Herbert Spencer and Linda Reynolds, *Directional signing and labeling in libraries and museums: a review of current theory and practice* (London: Readability of Print Research Unit, Royal College of Art, 1977.), pp. 8-9.

<sup>23</sup>Kempton, "Two theories of home heat control," pp. 238-239.

# List of Examples

This list tries to enumerate all of the different concrete standards problems that are used as examples in the text of the book, as well as a few that are not. Its ideal goal, although this has not always been achievable, is also to direct the reader to at least one good source of information on the history of each standards problem. The standards problems listed may involve partitioning (of several kinds), labeling (both with and without mapping principles), the definition of a standard of precision, the creation of a topology for a contrast set, or the definition of a starting point, anchor point, or direction. In some cases, a standards problem involves several of these types of conventional choice together (such as partitioning and labeling), and in some cases, several standards problems bundle together as consequences of the same larger task.

Unfortunately, I have not been able to track down a worthwhile reference on the history of each of the standards problems listed, and in many cases time constraints mean that I have not fully tried to do so. Indeed, the task of finding one or two ideal, reliable, and sophisticated reference works on a standards problem is particularly challenging and makes for time-consuming research work. (Just imagine where you would start if you were looking for a definitive history of star ratings for movies.) The search can be exciting, but it is simply not always possible to find scholarly works on standards problem with enough sociological sophistication to make them truly worth recommending. In some cases, I have listed a less satisfying reference simply in order to try to give the reader some direction to pursue instead of giving the impression that no one at all has thought about a particular standards problem.

Not included in this list are those standards problems which are not themselves solved by the creation of a contrast set, but whose solutions are distributed in the world in a way which gives rise to a contrast set (out of the collective domain of people or countries who have each chosen a different solution; see section 5.3). These standards problems include the rule of the road, television broadcasting encodings, electrical plug shapes and voltage

standards, computer operating systems, ring-binder hole-punching standards, and railroad gauge.

## BASIC MEASUREMENT STANDARDS PROBLEMS

### Unit of length

Type of problem: partitioning (single, repeatable unit span within a linear continuum)

Sample solutions: yard, verst, meter, furlong

Further reading: Alder, Ken. *The measure of all things: the seven-year odyssey and hidden error that transformed the world*. New York: Free Press, 2002.

Strasser, Georg. "The toise, the yard and the metre — the struggle for a universal unit of length." *Surveying and mapping* 35 (1975): 25-46.

### Unit of mass

Type of problem: partitioning (single, repeatable unit span within a linear continuum)

Sample solutions: pound, gram, *jin*

Further reading:

### Unit of temperature

Type of problem: partitioning (single, repeatable unit span within a linear continuum)

Sample solutions: 1 degree Fahrenheit, 1 degree Celsius

Further reading: Middleton, W.E. Knowles. *A history of the thermometer and its use in meteorology*. Baltimore: Johns Hopkins Press, 1966.

### Zero point for temperature scales

Type of problem: anchor point

Sample solutions: absolute zero, freezing point of water

Further reading: Middleton, W.E. Knowles. *A history of the thermometer and its use in meteorology*. Baltimore: Johns Hopkins Press, 1966.

### Direction for temperature scale

Type of problem: polar mapping

Sample solutions: {higher number : lower number} = {hotter : colder} or vice versa

Further reading: Middleton, W.E. Knowles. *A history of the thermometer and its use in meteorology*. Baltimore: Johns Hopkins Press, 1966.

### Size of unit for standard divisions of a circle

Type of problem: partition (single, repeatable unit span defined relative to (i.e., as a fraction of) the circle, and/or a set of focal points within the circle)

Sample solutions: 360 degrees, four compass directions

Further reading: Hutchins, Edwin. *Cognition in the wild*. Cambridge: MIT Press, 1995.

### Labeling system for the scale units or focal points formed out of the circle

Type of problem: labeling

Sample solutions: {1 ... 360}, {N, S, E, W}, {12:00 ... 6:00}, {forward, aft, port, starboard}

Further reading: Hutchins, Edwin. *Cognition in the wild*. Cambridge: MIT Press, 1995.

## TEMPORAL STANDARDS PROBLEMS

### Creation of temporal units smaller than the day

Type of problem: partition (set of unit spans within a linear continuum which are organized taxonomically so that smaller units partition larger units integrally)

Sample solutions: 1 hour = 1/24 of a day, 1 minute = 1/60 of an hour, 1 second = 1/60 of a minute

Further reading:

### Length of a standard cycle of days

Type of problem: partition (by lumping, that is, by choosing how many smaller units will combine to make up a larger unit)

Sample solutions: seven, five, ten, etc.

Further reading: Zerubavel, Eviatar. *The seven day circle: the history and meaning of the week*. New York: Free Press, 1985.

### **Labels for each member of the standard cycle of days**

Type of problem: creation of labeling set

Sample solutions: {Monday ... Sunday}, {1...7}, etc.

Further reading: Zerubavel, Eviatar. *The seven day circle: the history and meaning of the week*. New York: Free Press, 1985.

### **Linear topology for the cycle of days**

Type of problem: topological (starting point)

Sample solutions: Sunday, Monday

Further reading: Zerubavel, Eviatar. *The seven day circle: the history and meaning of the week*. New York: Free Press, 1985.

### **Deciding which day it is today**

Type of problem: labeling (linkage between linear source set and repeating circular target set)

Note: this problem only needs to be solved once, as the linkage is predictable according to a principle once the linear topology of days and the circular topology of the week are anchored at a single point.

Sample solutions: any of the seven possible ways of linking the two sets; if the length of the week is  $x$  days, there are  $x$  possible solutions

Further reading: Zerubavel, Eviatar. *The seven day circle: the history and meaning of the week*. New York: Free Press, 1985. Pp. 130-138.

### **Dividing the year into months and labeling the months**

Type of problem: partition and labeling (multiple units, which may be of different sizes, which jointly partition the year)

Sample solutions: current or Napoleonic system

Further reading:

### **Numbering the sequence of years**

Type of problem: labeling, anchor point

Note: the specific issues are which labeling tool to use, how many series to have, and which year should be the anchor point or year "1"

Sample solutions: systems using the birth of Jesus or Mohammed or the French revolution as a starting point, or of numbering years in multiple series corresponding to the reign of a king or other ruler

Further reading:

### **Choosing a day as the first day of the year**

Type of problem: topological (choice of a single anchor point in a circular topology)

Sample solutions: January 1, March 25

Further reading:

### **Location of prime meridian, scale unit for longitude measurement, and labeling system for other meridians**

Type of problem: partitioning, labeling, anchor point

Sample solutions: Greenwich meridian as prime meridian, 360 degrees of longitude, sexagesimal degrees-minutes-seconds system of referring to longitude

Further reading: Zerubavel, Eviatar. "The standardization of time: a sociohistorical perspective." *American Journal of Sociology* 88 (1982): 1-23.

### **Fixing of time zone boundaries**

Type of problem: partition

Note: solving this problem also requires defining the identity of each time zone, i.e. the amount of difference between the time in this zone and the time in other zones.

Sample solutions: the system we have, or any other reasonable division of the earth's surface into longitudinal zones

Further reading: Zerubavel, Eviatar. "The standardization of time: a sociohistorical perspective." *American Journal of Sociology* 88 (1982): 1-23.

### **Standard way of referring to a particular day, month, and year**

Type of problem: polar mapping for taxonomic levels

Note: successfully coordinating a solution to this problem means that sequences like 01-02-10 are unambiguous

Sample solutions: 98-12-25, 12-25-98, 25-12-98

Further reading: Kuhn, Markus. "A summary of the international standard date and time notation." <http://www.cl.cam.ac.uk/~mgk25/iso-time.html> (February 2005).

## MUSICAL STANDARDS PROBLEMS

### **Standard musical scale**

Type of problem: partition (multiple focal points within a single octave)

Sample solutions: five-tone, seven-tone, and twelve-tone scales

Further reading:

### **Tuning or pitch standard for any given musical temperament**

Type of problem: this aspect of pitch standardization does not actually involve contrast set creation although it is used as the input to the creation of a set of standard pitches by means of a standard scale and temperament. However, the problem is formally similar to the choice of anchor points in a domain, such as the prime meridian.

Sample solutions: 440 Hz, 439 Hz, 435 Hz, 415 Hz, etc.

Further reading: Lloyd, Llewellyn Southworth. "Standard pitch." In *Grove's dictionary of music and musicians*, 6: 788-803. 5th ed, 1954.

Lindley, Mark, Klaus Wachsmann, J. J. K. Rhodes, and W. R. Thomas. "Pitch." In *New Grove Dictionary of Music and Musicians*, 20: 779-786. London: Macmillan, 1980.

Haynes, Bruce, and Peter R. Cooke. "Pitch." In *New Grove Dictionary of Music and Musicians*, edited by Stanley Sadie, 19: 793-804. 2nd ed. London: Macmillan, 2001.

### **Labels for each standardized pitch**

Type of problem: labeling

Sample solutions: {A, B flat, B, C ...}, musical staff notation, {I, II, III ...}, {do, re, mi ...}

Further reading: Lloyd, Llewellyn Southworth, and Richard Rastall. "Pitch nomenclature." In *New Grove Dictionary of Music and Musicians*, edited by Stanley Sadie, 19: 804-807. 2nd ed. London: Macmillan, 2001.

### **Musical notation (other aspects)**

Type of problem: labeling

Note: there are more standardized contrast sets involved in musical notation than simply labels for standardized pitches. There are also graphical variables for different lengths of time that either a pitch or silence is held, as well as symbols (the F-clef or G-clef symbols, for example) which designate the precise pitches which the lines and intervals of a given musical staff are meant to represent.

Further reading: Rastall, Richard, et al. "Notation." In *New Grove Dictionary of Music and Musicians*, edited by Stanley Sadie, 18: 73-189. 2nd ed. London: Macmillan, 2001.

Gimm, Martin, et al. "Notation." In *Die Musik in Geschichte und Gegenwart*, Sachteil, 7: 275-431. 2d ed. Kassel: Bärenreiter, 1994-2003.

Rastall, Richard. *The notation of western music: an introduction*. London: J. M. Dent & Sons, 1983.

### **Layout of piano keyboards and other instrument controls**

Type of problem: topology for the set of standardized pitches. For pianos, this requires a polar mapping between {high : low} and {left : right}.

Note: The advantage of layout standardization is to allow those who have learned on one piano to also play on another.

Sample solutions: For pianos, the currently standard layout, or the Clutsam or Jankó layouts.

Further reading: Tenner, Edward. *Our own devices: the past and future of body technology*. New York: Alfred A. Knopf, 2003. Pp. 161-186.

## PROBLEMS INVOLVING WRITING SYSTEMS

### **Creation of a set of labels for recording language**

Type of problem: partition (creation of multiple focal points)

Note: These focal points will be used as labels and must be easy to perceive visually

Sample solutions: Roman or Cyrillic alphabet, Korean hangul, Chinese characters, shorthand, Braille, Morse code

Further reading: Daniels, Peter T., and William Bright, ed. *The world's writing systems*. New York: Oxford University Press, 1996.

### **Creation of an orthography, a system for relating symbols to sound**

Type of problem: labeling (linkage between symbols (or combinations thereof) and a set of existing phonetic or phonological entities in a language)

Sample solutions: The different values for the letters of the Roman alphabet in, for example, English, Italian, and Mandarin pinyin are products of different orthography designs

Further reading: Daniels, Peter T., and William Bright, ed. *The world's writing systems*. New York: Oxford University Press, 1996.

### **Creation of a standard system of distinguishing and identifying spoken sounds independent of any particular language and its orthography**

Type of problem: partitioning and labeling

Note: the partitioning takes place in multiple different dimensions and any notation aims at representing a given sound's position in several different dimensions simultaneously

Sample solutions: the International Phonetic Alphabet

Further reading: MacMahon, Michael K. C. "Phonetic notation." In *The world's writing systems*, edited by Peter T. Daniels and William Bright, pp. 821-846. New York: Oxford University Press, 1996.

### **Sort order for graphic symbols used in a particular language**

Type of problem: topological (creation of a linear topology)

Sample solutions: ABCDEFGHIJKLMNOPQRSTUVWXYZÆØÅ (Danish alphabetical order)

Further reading: David Diringer, *The alphabet: a key to the history of mankind* (3rd ed., London: Hutchinson, 1968), 1: 169-170.

Davis, Mark, and Ken Whistler. "Unicode collation algorithm." Unicode Technical Standard #10, version 4.0. <http://www.unicode.org/reports/tr10/tr10-11.html> (January 2005).

### **System of transliteration so that the product of one orthography can be represented by an entirely different set of symbols**

Type of problem: labeling

Sample solutions: the various standardized systems for representing Russian or other Cyrillic text in the Roman alphabet

Further reading: Wellisch, Hans H. *The conversion of scripts, its nature, history, and utilization*. New York: Wiley, 1978.

### **Development of a "base" to use in numerical notation**

Type of problem: partition by lumping a certain number of fundamental units

Sample solutions: 2, 10, 12, 16, 20, etc.

Further reading: Ifrah, Georges. *The universal history of numbers: from prehistory to the invention of the computer*. New York: John Wiley & Sons, 2000.

Chrisomalis, Stephen. "The comparative history of numerical notation." Ph.D. dissertation, McGill University, 2003.

### **Creation of a set of symbols for representing number**

Type of problem: partition by creating multiple focal points in the domain of potential symbols

Sample solutions: Roman, "Arabic," modern Arabic, Hebrew, Mayan, Chinese, hexadecimal number signs

Further reading: Ifrah, Georges. *The universal history of numbers: from prehistory to the invention of the computer*. New York: John Wiley & Sons, 2000.

Chrisomalis, Stephen. "The comparative history of numerical notation." Ph.D. dissertation, McGill University, 2003.

### **Assignment of number symbols to number concepts**

Type of problem: labeling

Sample solutions: {zero through nine} = {0, 1, 2, 3, 4, 5, 6, 7, 8, 9}

Further reading: Ifrah, Georges. *The universal history of numbers: from prehistory to the invention of the computer*. New York: John Wiley & Sons, 2000.

Chrisomalis, Stephen. "The comparative history of numerical notation." Ph.D. dissertation, McGill University, 2003.

### **Labeling position in a sequence**

Type of problem: labeling

Sample solutions: numerals, letters, *gānzhī* symbols

Further reading: Crump, Thomas. *The anthropology of numbers*. Cambridge: Cambridge University Press, 1990. Pp. 83-87.

### **Layout of typewriter keyboards**

Type of problem: topological (two-dimensional topology for a contrast set of letters, numbers, and other symbols)

Sample solutions: Sholes and Dvorak layouts as well as standard layouts in many other countries

Further reading: Richard N. Current, *The typewriter and the men who made it*. Urbana: University of Illinois Press, 1954, pp. 55-58.

Datacal Enterprises, "Use international overlays to create a bilingual keyboard," <http://www.datacal.com/dce/international-overlays.htm> (January 2005).

## **MORE COMPLEX STANDARDS PROBLEMS WITH BOTH A PARTITIONING AND LABELING ASPECT**

### **Partition of a geographical space into sovereign states**

Type of problem: partitioning (by boundary in a two-dimensional domain)

Further reading: Alesina, Alberto, and Enrico Spolaore. *The size of nations*. Cambridge: MIT Press, 2003.

### **Creation of standardized labels for geographical areas (e.g. sovereign states)**

Type of problem: labeling

Sample solutions: ISO 3166, American state abbreviations, Italian province abbreviations

Further reading:

### **Creation of a set of racial or ethnic categories for classifying people, and labeling those categories**

Type of problem: Partitioning (in a very large collective domain) and labeling

Sample solutions: Racial and ethnic classification systems used in the United States, the Soviet Union, South Africa, and other societies which place a high premium on such categorization

Further reading:

### **Promotion of standard written or spoken languages**

Note: this is a marginal case, as the contrast set of standard languages cannot be designed in its entirety and it is emergent

Type of problem: Partitioning (mostly by focal point in a multidimensional domain although one often thought of in two dimensions)

Sample solutions: one written standard for Scandinavia or three

Further reading:

### **Partition of a geographical space into voting districts**

Type of problem: partitioning (by boundary in a two-dimensional domain, but may also be thought of as grouping entities in a collective domain)

Further reading: Monmonier, Mark. *Bushmanders & bullwinkles: how politicians manipulate electronic maps and census data to win elections*. Chicago: University of Chicago Press, 2001.

### **Creation of telephone code areas**

Type of problem: partitioning (by boundary in a two-dimensional domain, but may also be thought of as grouping entities in a collective domain)

Further reading: Bahat, Roy. "Your call cannot be completed as dialed: big cities, small changes, and the unexpected politics of area code reform." A.B. thesis, Harvard University, 1998.

### **Labeling of telephone code areas**

Type of problem: labeling

Sample solutions: 1=USA, 7=Russia, 86=China (country codes); 212=New York, 312=Chicago (city or area codes)

Further reading: Bahat, Roy. "Your call cannot be completed as dialed: big cities, small changes, and the unexpected politics of area code reform." A.B. thesis, Harvard University, 1998.

### **Creation of postal zones and a labeling system for them**

Type of problem: partitioning and labeling

Sample solutions: American "zip code" system, Canadian or British postal codes

Further reading: Conrad, R. "Designing postal codes for public use." *Ergonomics* 10 (1967): 233-238.

### **Choice of a set of entities with which to refer to the different parts of a city**

Type of problem: partitioning

Sample solutions: streets (European style), blocks (Japanese style), wards (Venetian style)

Further reading:

### **Identifying streets**

Type of problem: labeling

Further reading: Tarpley, Fred. "Street names as signposts of world cultures." In *Namenforschung: ein internationales Handbuch zur Onomastik*, edited by Ernst Eichler et al., pp. 1481-1499. Berlin: Walter de Gruyter, 1995-1996.

### **Dividing a parking lot into sections and labeling the sections and the spaces within them**

Type of problem: partitioning and labeling

Further reading:

### **Identifying and classifying books**

Type of problem: partitioning and labeling

Sample solutions: Dewey, Library of Congress, and idiosyncratic classification systems, along with devices such as Cutter numbers to give each book a unique label; the ISBN system of labeling published books

Further reading:

### **Creation of a set of symbols to serve as proofreading marks, and assignment of those symbols to particular proofreading messages**

Type of problem: partitioning (creation of multiple focal points in the domain of graphic symbols); labeling and assigning those to proofreading concepts

Sample solutions: various systems in current use

Further reading: Aicher, Otl, and Martin Krampen. *Zeichensysteme der visuellen Kommunikation: Handbuch für Designer, Architekten, Planer, Organisatoren*. Stuttgart: Alexander Koch, 1977. P. 21.

### **Creation of contrast sets used in games**

Type of problem: partitioning, labeling

Sample solutions: Contrast sets used in Monopoly, hopscotch, card games, checkers, spectator sports like baseball and soccer; various labeling methods for them including color, size, and shape contrasts

Further reading:

### **A set of standard clothing sizes**

Type of problem: partitioning, labeling (creation and labeling of optimally precise multiple focal points within each apparel domain (shoes, shirts, etc.) and a way of labeling them)

Sample solutions: the British, American, and European shoe sizing systems

Further reading: Ashdown, Susan, and Laura Cowie. "Sizing systems in the apparel industry."

<http://www.human.cornell.edu/txa/faculty/SizingSystems> (November 2003).

### **A set of standard paper sizes**

Type of problem: partitioning, labeling (creation and labeling of multiple focal points)

Note: fixed sizes are essential so that xerox copies, folders, mail slots, notebooks, and paper all fit with one another, and the different sizes also can take on a symbolic identity (e.g. "legal size")

Sample solutions: ISO 216 metric system (A4, etc.); U.S. system (8½ by 11, etc.)

Further reading: Kuhn, Markus. "International standard paper sizes."

<http://www.cl.cam.ac.uk/~mgk25/iso-paper.html> (November 2003).

### **A set of monetary units and a set of standard denominations for coins and bills**

Type of problem: partition

Note: this problem involves the creation of a basic unit; the creation of multiple focal points within a linear domain based on it; and a lower limit of monetary precision is also part of the solution to the problem, so that users of the currency can avoid arguments about whether small amounts matter.

Sample solutions: basic units such as one euro or one cent; standard multiples of 1, 2, 5, 10, 20, and 50 cents and 1, 2, 5, 10, 20, 50, 100, 200, and 500 euros, or 45 and 90 Burmese kyats under Ne Win, or pre-decimal British system; convention of rounding to the nearest 5 euro cents in Finland

Further reading:

### **Measuring student performance**

Type of problem: partitioning, labeling

Sample solutions: A-F, 1-10, 0-100, 1-5, etc.

Further reading: Durm, Mark W. "An A is not an A is not an A: A history of grading." *Educational*

*Forum* 57 (1993): 294-297.

### **Measuring wind strength**

Type of problem: partitioning, labeling

Sample solutions: Beaufort scale, meters per second, knots

Further reading: Huler, Scott. *Defining the wind: the Beaufort scales, and how a nineteenth-century admiral turned science into poetry*. New York: Crown, 2004.

### **Creation of altitude categories for relief maps, class breaks for choropleth maps, or any other series of discrete steps within a continuum of measurement which aids in the display of information**

Type of problem: partitioning (usually by boundary) and labeling

Sample solutions: Varying precision and number of breaks and the varying labels that can be assigned to each resulting category

Further reading: Imhof, Eduard. *Cartographic relief presentation*. Berlin: Walter de Gruyter, 1982 [1965]. Pp. 113-126 (partitioning), 295-324 (labeling).

Monmonier, Mark. *How to lie with maps*. Chicago: University of Chicago Press, 1991.

Monmonier, Mark. *Maps, distortion, and meaning*. (Resource Paper 75-4.) Washington: Association of American Geographers, 1977.

### **Creation of Likert scales**

Type of problem: partitioning (by creating a limited number of focal points in a linear domain) and labeling

Sample solutions: {1, 2, 3, 4, 5} = {strongly agree, agree, neutral, disagree, strongly disagree}

Further reading:

### **Measuring and identifying the quality of movies, hotels, restaurants, or other consumer products**

Type of problem: partitioning (by creating a scale) and labeling

Sample solutions: star systems with various degrees of precision, *Consumer Reports* product labeling system

Further reading:

### **Deciding which points in the radio spectrum will be set aside for broadcasting and labeling those points**

Type of problem: Partitioning (by focal point) and labeling

Further reading:

## **SIMPLE LABELING PROBLEMS**

### **Creation of standardized labels for stations, airports, or other points within a transport system**

Type of problem: labeling

Sample solutions: IATA airport coding system

Further reading: International Air Transport Association. "IATA coding systems."

<http://www.iata.org/whatwedo/coding> (January 2005).

English, Dave. "Airport ABCs: an explanation of airport identifier codes." *Air Line Pilot*, December 1994. Available at <http://www.skygod.com/asstd/abc.html> (January 2005).

For a free-access database of the codes, see "Mapping.com's List Of Worldwide Airport Codes," <http://www.mapping.com/airportcodes.html> (January 2005).

### **Identifying houses**

Type of problem: labeling

Further reading: Pronteau, Jeanne. *Les numérotages des maisons de Paris du XV<sup>e</sup> siècle à nos jours*.

Paris: Ville de Paris, Commission des Travaux Historiques, 1966.

Tantner, Anton. "Galerie der Hausnummern."

<http://homepage.univie.ac.at/anton.tantner/hausnummern/index.html> (January 2005).

### **Identifying transport routes**

Type of problem: labeling

Sample solutions: colors, numerals, letters, names

Further reading:

### **Identifying people**

Type of problem: labeling

Sample solutions: American Social Security numbers; numbers for specific groups such as students, sports players, participants in a foot race

Further reading: Clarke, Roger. "Human identification in information systems: management challenges and public policy issues." *Information Technology & People* 7,4 (December 1994): 6-37.

Available at <http://www.anu.edu.au/people/Roger.Clarke/DV/HumanID.html> (March 2004).

### **Identifying retail products**

Type of problem: labeling

Sample solutions: UCC/EAN numbers and bar codes

Further reading:

### **Identifying carbon copies of a form**

Type of problem: labeling

Sample solutions: white is merchant's copy, yellow is customer's copy

Further reading:

### **Notation for the events in games such as chess or baseball**

Type of problem: labeling

Sample solutions: Any of the various chess notations or baseball scoring systems in use

Further reading: Dickson, Paul. *The joy of keeping score: how scoring the game has influenced and enhanced the history of baseball*. New York: Walker, 1996.

### **Nametags for electrical wiring**

Type of problem: labeling

Sample solutions: {red, black} in America, {blue, brown, yellow-green} in Europe

Further reading:

### **Identifying the floors of buildings**

Type of problem: labeling (by principle) and topological (choice of direction)

Sample solutions: letters, numbers, {lower number : higher number} = {down : up}

Further reading: Arthur, Paul, and Romedi Passini. *Wayfinding: people, signs, and architecture*. New York: McGraw-Hill, 1992. Pp. 193-195.

Spencer, Herbert, and Linda Reynolds. *Directional signing and labeling in libraries and museums: a review of current theory and practice*. London: Readability of Print Research Unit, Royal College of Art, 1977. Pp. 22-23.

### **Identifying rooms in buildings**

Type of problem: labeling

Sample solutions: The solution may use different labeling tools and may or may not involve mapping and a taxonomic hierarchy

Further reading: Arthur, Paul, and Romedi Passini. *Wayfinding: people, signs, and architecture*. New York: McGraw-Hill, 1992. Pp. 195-197.

### **Graphical variables in general**

Type of problem: labeling

Sample solutions: labels for categories of town size, quality labels for consumer products

Further reading: Bertin, Jacques. *Semiology of graphics*. Madison: University of Wisconsin Press, 1983 [1968].

### **Identifying the parts of books and documents, such as pages, chapters, and sections**

Type of problem: labeling

Sample solutions: Arabic numerals, Roman numerals, taxonomically organized (e.g. 1.1) or not

Further reading: Nash, Walter. *Designs in prose: a study of compositional problems and methods*. London: Longman, 1980.

Waller, Robert. "Numbering systems in text." In *The psychology of written communication: selected readings*, edited by James Hartley, pp. 145-153. London: Kogan Page, 1980.

### **Identifying footnotes or endnotes in a book**

Type of problem: labeling

Note: in the case of endnotes, the communication of the note's context or place in a taxonomic hierarchy (i.e., the chapter or page number of the referring sentence) is also important.

Sample solutions: {1, 2, 3 ...}, {\*, †, ‡, §}, etc.

Further reading:

## **PURELY TOPOLOGICAL PROBLEMS**

### **Arrangement of a stick shift**

Type of problem: topological (creation of a two-dimensional topology for a contrast set with a basically linear topology)

Sample solutions: the solutions chosen by different car manufacturers

Further reading:

### **Addressing of envelopes**

Type of problem: topological (polar mapping between taxonomy levels and the set {first : last})

Sample solutions: zoom-in (name last) or zoom-out (name first)

Further reading:

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- 4.5 066 "Møntreformen og hvordan den udmønter sig." Leaflet issued by Danmarks Nationalbank, circa 1989. (\*)
- 4.6 062 Ingi Joensen, *Ferðakort*. Tórshavn: Samferðsluskivstovan, April 1986. (\*)
- 4.7 013 Charles Virolleaud, *Le palais royal d'Ugarit, II: textes en cunéiformes alphabétiques des archives est, ouest, et centrales* (Mission de Ras Shamra, tome VII, Paris: Imprimerie Nationale, 1957), planche 1. (\*)
- 4.8 012 Author's drawing from data in Charles Virolleaud, *Le palais royal d'Ugarit, II: textes en cunéiformes alphabétiques des archives est, ouest, et centrales* (Mission de Ras Shamra, tome VII, Paris: Imprimerie Nationale, 1957), pp. 199, and M. O'Connor, "The alphabet as a technology," in *The world's writing systems*, edited by Peter T. Daniels and William Bright, pp. 787-794 (New York: Oxford University Press, 1996), p. 789.
- 4.9 026 Author's photograph, January 2004.
- 4.10 002 Author's photograph of the book spines of Lore Marr-Bieger, *Nordkroatien* (1. Auflage, Erlangen: Michael Müller Verlag, 2001) and Jonathan Bousfield, *The rough guide to Croatia* (London: Rough Guides, 2000).
- 4.11 071 First page of the 2004 Rochester, N.Y., telephone book. (\*)
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- 6.1 039 Eugene A. Nida, ed., *The Book of a Thousand Tongues* (London: United Bible Societies, 1972), p. 302. (\*)
- 6.2 080 Telecom Denmark, "New telephone numbers in Denmark from 16 May 1989." (\*)
- 6.3 065 "Møntreformen og hvordan den udmønter sig." Leaflet issued by Danmarks Nationalbank, circa 1989. (\*)
- 6.4 036 Solicitation received in the mail in August 2003.
- 7.1 016 Marianne Frostig, "Visual perception, integrative functions and academic learning," *Journal of Learning Disabilities* 5 (1972): 1-15. (\*)
- 7.2 068 Free map distributed by HT and DSB, Copenhagen, 1987. Designer cited as "DSB Reklamekontor 87.06-105/Roussell." (\*)
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## Curriculum Vita

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#### Education

2005            Ph. D. in Sociology, Rutgers University  
1999            M.A. in Sociology, Rutgers University  
1993            A.B. in Linguistics with Scandinavian and German, Harvard University

#### Principal occupations and positions held between the conferral of the baccalaureate and the doctorate

1997-2005      Tour Guide, Rick Steves' Europe Through the Back Door, Edmonds, Washington  
1997            Teaching Assistant, Department of Sociology, Rutgers University

#### Scholarly publications

"The challenge of maintaining parity for offshore islands." *Middle States Geographer* 31 (1998): 132-137.  
Review of *How nations choose product standards and standards change nations* by Samuel Krislov. *Contemporary Sociology* 27 (1998): 169-170.