2 LEXICALIZATION PATTERNS AND THE WORLD-TO-WORDS MAPPING

Barbara C. Malt, Silvia Gennari, & Mutsumi Imai

Knowledge of words and knowledge of the world must somehow be linked. Words evoke knowledge about the world, and thoughts about the world are conveyed through words. The precise nature of this linkage is far from known, however. Our goal in this chapter is to shed light on the connection. In the first part of the chapter, we consider arguments for a tight mapping between words and conceptual representations and discuss reasons why these arguments are not entirely convincing. We also briefly consider and dismiss the extreme alternative that there is only the loosest relation between words and conceptual representations of the world. In the second part of the chapter, we turn our attention to a third alternative that we call a "constrained but flexible" mapping. In this section we review data indicating that in at least some domains, the mapping between words and conceptual representations is not tight. We consider the ways in which the mappings may nevertheless be constrained, and we discuss where flexibility is possible despite the constraints. We present data from two studies on the naming of human locomotion that test the ideas about both where the mapping is constrained and where flexibility may enter the picture. In a final section, we discuss implications of the "constrained but flexible" idea for several associated issues.

THE TIGHT AND LOOSE MAPPING POSSIBILITIES

Tight Mapping

A widely accepted view of the language-thought linkage is that words map closely onto coherent packets of nonlinguistic knowledge constituting concepts. Under such a view, word meanings consist of concepts (e.g., Bloom, 2000; Markman, 1989; Murphy, 2002), and prelinguistic concepts may provide the basis for word learning (e.g., Carey, 2001; Clark, 1983, 2004; Landau & Jackendoff, 1993; Nelson, 1974). There are several different scenarios under which such a tight mapping could come about.

Universal Concepts Lead to Universal Word Meanings One simple scenario by which words and conceptual knowledge could be tightly linked is if human thought is grounded in a large stock of universal concepts. Such universal concepts might come about via any of several mechanisms (or a combination of them): Humans might all be driven by a set of shared needs, goals, feelings, etc., across cultures. Their presumably pan-human basic cognitive and perceptual capacities might segment the world for them in comparable ways by creating special sensitivities to some distinctions. And the world might present itself to the human observed packaged in chunks so

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salient that given shared perceptual and cognitive capacities, all humans recognize these chunks. These sources of uniformity of thought across cultures could even lead, over the course of evolutionary history, to the large stock of shared concepts being innate (Fodor, 1975). Regardless of origin, if humans across all cultures have largely the same concepts, then their languages may all develop words with parallel meanings to express these notions. This possibility is consistent with (although not required by) the idea that prelinguistic concepts provide the basis for early word learning. If infants universally share certain prelinguistic notions about the world, the word-learning process might help shape meanings that are shared across languages. It is also consistent with evidence in some domains for shared tendencies in patterns of naming across languages. Shared elements of naming patterns have been found in domains including color (Kay, Berlin, Maffi, & Merrifield, 1997), body parts (Majid, Enfield, & van Staden, 2006), cutting and breaking actions (Majid, Bowerman, van Staden, & Boster, 2007), and mental states (Goddard, this volume) and these commonalities occur to a greater extent than would be expected by chance (Kay & Regier, 2003).

But it is by now evident that cross-culturally shared concepts leading to shared meanings can account for only a limited portion of world-to-word mappings at best. A striking finding of recent cross-linguistic research has been pervasive differences in how speakers of different languages talk about the world. Languages show many differences as well as commonalities in how they divide up domain by name including color (see Roberson & Hanley, this volume), space (e.g., Bowerman, 1996; Levinson, 1997), motion (Talmy, 1985; Slobin, 1996a,b), emotion, kin relations, and mental states (Goddard, this volume; Wierzbicka, 1992), causality (Wolff, Jeon, & Klettke, 2009), and even ordinary household containers (e.g., Malt, Sloman, Gennari, Shi, & Wang, 1999). Detailed illustrations of this sort of diversity are provided in many of the chapters of this book. This well-documented and widespread cross-linguistic diversity indicates that the situation must be more complex than implied by strong universals of human thought coupled with a direct causal link from thought to word meanings.

Culturally Variable Concepts Lead to Culturally Variable Word Meanings An alternative scenario yielding to a tight mapping between words and conceptual representations, yet taking into account the widespread cross-linguistic diversity, would be to posit that members of different cultures form at least partially different concepts, leading them to develop differences in the meanings attached to words. Thus, concepts are the causal agent driving the associated languages to adopt different patterns of naming.

Under this solution, we need to ask what would have led to the different concepts that drive the linguistic differences. An obvious answer is different cultural needs, interests, ecologies, and experiences. Although the classic example of Eskimos having a highly developed set of lexical distinctions for types of snow may be apocryphal (Pullum, 1991), other examples along such lines are more grounded in reality. For instance, members of nonindustrialized cultures may experience and need to discriminate among relatively few color variations. And, in fact, members of nonindustrialized cultures do tend to have fewer color terms than members of industrialized cultures (Kay et al., 1997). Similarly, wine experts have elaborate vocabularies for wine (Lehrer, 1983). Thus it is not implausible to assume that the importance of a domain to members of a culture will tend to influence their lexicalized distinctions.

However, this answer fails to provide an explanation for many observed cross-linguistic lexical differences. Many differences that have been the focus of recent interest are not readily related to specific cultural needs, interests, ecologies, or experiences. What common aspects of culture would lead English, Russian, and Chinese speakers all to tend to encode manner of motion in their verbs, and what different but shared ones would lead Spanish, Greek, and Japanese speakers all to tend to encode path (or path and ground) of motion instead (e.g., Talmy, 1983, 1985; Slobin, 1996a)? What

differing cultural needs, interests, ecologies, or experiences would lead English speakers to make a lexical distinction between spatial relations called *in* and those called *on*, Dutch speakers to further split the relations encoded in English *on* into *op* and *aan*, and Spanish speakers to label all of those by a single word, *en* (Bowerman, 1996)? Furthermore, native speakers of the same language in diverse parts of the world—such as English speakers in the United States, Australia, and India, and Spanish speakers in Mexico, Spain, New York City, and Argentina—all follow these conventions of their shared language despite substantially differing cultures and daily experiences. What underlying cultural commonality would cause them to do so while others having no less cultural similarity diverge (e.g., Dutch citizens vs. Anglo Americans or English-speaking vs. Spanish-speaking Americans)? It is proposed that these linguistic features may have been shaped by shared cultural conditions among early speakers of each language. The current distribution of shared patterns may be the result of diffusion of a language to other parts of the world: Emigrants maintain language patterns but their culture changes, and the language may be adopted by other cultures in the new location. Under this solution, we move away from the core idea of a tight connection between words and concepts by suggesting that the tight connection may at best exist only historically and not synchronically.

Cross-Linguistically Variable Word Meanings Lead to Culturally Variable Concepts Another possible scenario for a tight connection between words and concepts makes language the causal agent. Under this scenario, by acquiring and using the naming patterns of their native language, speakers of different languages come to have concepts shaped by those patterns. If different languages have different meanings associated with words, then speakers of those languages will have correspondingly different concepts, producing the tight linkage. This possibility constitutes one version of the Whorfian hypothesis (Whorf, 1956) that language shapes thought (see, e.g., Gumperz & Levinson, 1996), and it is consistent with the developmental perspective on word learning that the learning process guides concept formation (e.g., Choi & Bowerman, 1991; Imai, Gentner, & Uchida, 1994; Imai & Mazuka, 2003; Waxman & Gelman, 1986). Even if prelinguistic infants appreciate global distinctions such as that between objects and substances, provided they do not have more fine-grained concepts already sorted out and ready to receive labels, the language they are exposed to might shape the concepts subsequently acquired (e.g., Imai & Mazuka, 2003; Soja, Carey, & Spelke, 1991).

This scenario raises the question of what would have led to the divergent patterns of naming in the first place. A tempting answer is that it would be some sort of differences in the concepts held by speakers of different languages. To avoid circularity, it is necessary to postulate conceptual differences existing for reasons independent of language. The likely source would be cultural differences as just discussed. If independent reasons exist, though, it is not clear why language should be invoked as a causal agent in any conceptual differences across speakers of different languages or any word-concept correspondences across languages.

An alternative way of thinking about the origin of cross-linguistic differences allows the possibility that languages shape concepts while avoiding this trap. This version entails that word meanings in a given language are shaped by forces independent of the conceptual representations of its own users. Specifically, at the birth of a language speakers would develop some words, presumably at least in part to express notions of importance to them. However, some elements of arbitrariness in the early development will exist, such as whether the language encodes path or manner in its verbs, simply because a finite set of words can capture only a fraction of the richness of human experience. As the language continues to evolve, a variety of external forces such as contact with other languages could subsequently alter the set of words available in a domain and the meanings associated with each word. (We will elaborate on this idea in the second section of the chapter.) The words

passed down to the next generation would thus have significant elements of arbitrariness relative to the particular concepts that spawned the earliest bits of the language. The process of word learning would then itself shape the concepts of the next generation, maintaining a tight mapping between words and concepts in each generation, even as the language continues to evolve. Furthermore, because each language will evolve on its own path, and because convergence in communication systems requires contact between agents using the system (e.g., Barr, 2005), communities of language users that are not in close contact with each other will develop different concepts tied to their own language.

One problem with this scenario is that if we allow for continued drift in word meanings over time, there must be some set of words at a given moment that does not map closely onto the concepts of the current speakers. That is, the tight mapping cannot hold for all word–concept pairs. There is no obvious way to identify the cases in which we should expect the close mapping to hold and in which not. Still, it seems undeniable that as children learn each word, they must learn what dimensions are relevant to its use and how the values on those dimensions contrast with other words in the semantic field (e.g., Clark, this volume). It also seems inevitable that using a word requires accessing that knowledge and attending to the relevant dimensions. Will this directing of attention alter nonlinguistic representations such that there often, if not always, develops a tight mapping between a concept and a word meaning? We suggest that there are several reasons why word learning and use will not necessarily lead to a tight mapping.

First, what is not captured in a given language in its lexical contrasts may be salient for nonlinguistic reasons. Humans develop an understanding of their world not just to talk about it but to move around in it physically and accomplish goals from obtaining food and water to reproducing to creating art and making scientific discoveries. If languages encoded only distinctions key to successful navigation within a culture, then these patterns might be expected to strongly guide and map onto the conceptual distinctions that humans would develop. But if there are significant elements of arbitrariness in the development of naming patterns—the assumption necessary for this version of tight mapping to have force—these patterns may at times be poor guideposts for developing an understanding of the world. English speakers do not lexically distinguish male from female cousins, as speakers of some other languages do, but they still need to choose gender-appropriate birthday gifts for their cousins. Speakers of any language would interact with a jar of peanut butter, a container of yogurt, and a Coke bottle in much the same way in order to extract their contents, and they would drink from cups, mugs, and glasses similarly. The differing patterns of linguistic groupings for these objects across languages (Kronenfeld, Armstrong, & Wilmoth, 1985; Malt et al., 1999) seem to provide no useful information to guide these interactions. To the extent that members of the different cultures actually do need to learn slightly different ways of accomplishing their goals—perhaps because they have different implements for scooping peanut butter or yogurt—these differences concern the current status of the speaker's world. Because the linguistic arbitrariness, by definition, is not determined by current cultural conditions, the cultural differences are not likely to be reflected in any useful way in the naming patterns learned.

Second, the linguistic categories of a language can sensitize an observer to the existence of contrasts, but they do not by themselves reveal what distinctions are being labeled. Appreciating the distinctions requires learning about the entities themselves. Languages make many distinctions that their speakers do not appreciate nonlinguistically. For instance, adult Americans are familiar with words such as *elm*, *maple*, *sycamore*, and *beech*, and *sparrow*, *finch*, *dove*, and *jay*, but most cannot explain the differences among their referents (nor link the names to appropriate referents) (Dougherty, 1978; Wolff, Medin, & Pankratz, 1999). Wolff et al. (1999) found that despite a high frequency of use of

genus-level tree terms in the early 1800s, English speakers' knowledge of trees declined sharply in the next 100 years. Subsequent generations appeared to pay less attention to distinctions among trees even though the language they inherited from previous generations made available a rich set of distinctions. Interactions with the world, not only the pattern of word use in the language spoken, give rise to individuals' knowledge of trees and birds.

Third, it is often an oversimplification to suggest that because some conceptual distinction is not encoded in a parallel way across languages, the linguistic attention drawn to it must vary. For instance, although Chinese does not have a subjunctive mood to express counterfactuals, it does have other ways of expressing states counter to reality (Au, 1983). Likewise, although a Spanish speaker may have only one verb, *saltar*, to encode the differing motions labeled *hop* and *jump* in English, Spanish speakers can readily disambiguate by specifying additionally *en un pie* ["with one foot"] or *en dos piernas* ["with two legs"] or the like. In such cases it can still be argued that although both languages can express the notion, it is easier or more often done in one language than the other, which may lead to greater salience or more habitual use of the concepts. In other cases, though, this argument is less persuasive. For instance, as we demonstrate later, Japanese has only a small number of single-word verbs for manners of locomotion, whereas English has a larger set (*stroll*, *saunter*, *stomp*, *march*, *hop*, *jump*, etc.). Does that mean that Japanese speakers are less likely to notice differences among the gaits used for human locomotion? In fact, Japanese uses other devices including "mimetics" to express manners of moving. Mimetics are expressions that have a nonarbitrary relation to their referent; their sound in some way gives clues to the nature of the referent. Japanese infants learn verbs consisting of mimetics faster than verbs with a purely arbitrary phonological relation to referents (Imai, Kita, Nagumo, & Okada, 2008). Thus, even though the expression may seem to be more complex, it cannot be concluded that the expression is more awkward for native speakers to learn or use, nor that speaking the language will necessarily result in less salience of the element of experience. In addition, one element of a language may discourage attention to some aspect of experience while a different element encourages it. Lucy (this volume) suggests that English-speaking children will be sensitized to the shape of objects (relative to Yucatek children) because English nouns are extended on the basis of shape, whereas Carroll and Casagrande (1958) suggested that English-speaking children will be insensitive to the shape of objects (relative to Navaho children) because English has no morphemes encoding object shape attached to verbs. Taking into account both aspects of English, it is unclear what level of attention English-speaking children should pay to object shape. Each child is, of course, subject to the potential influence of every dimension of their lexical and grammatical systems, and the impact on cognition any element could have in isolation may be mitigated by the impact of other elements of the language system.

Finally, it must logically be true that any useful conceptual distinction that *is* directly reflected in language had to have been noticed by humans before the words labeling that distinction came about. The existence of a lexical distinction cannot be a prerequisite for appreciating a distinction in the world. The fact that nonhuman animals can make many discriminations in their world likewise indicates that language cannot be a prerequisite to appreciating many distinctions. In both cases, attention to distinctions is most likely shaped by the utility or consequences of making them, and sensitivity to some discriminations that have had value over evolutionary history may even be hard-wired into their brains. Given that human language may have emerged as recently as 30,000 years ago (Crystal, 1987) and the genus *Homo* is believed to have diverged from its relatives approximately 2 million years ago, such sensitivities may be entirely independent of language.

Although these arguments make the case that language need not inevitably shape conceptual representation, there is evidence favoring the possibility that it does so in some

cases. It is beyond the scope of this article to review the extensive body of literature evaluating this possibility. Some of this research is reviewed in this volume; see also Gumperz and Levinson (1996) and Gentner and Goldin-Meadow (2003) among others. In some domains in which effects of language on nonlinguistic representations have been found, the exact interpretation of the effects remains up in the air. For instance, the presence and strength of language effects on color perception seem to vary depending on the hemisphere to which the stimulus is presented and the speed at which responding occurs (suggesting that the effects may require engaging the linguistic system at the time of stimulus processing; see Regier et al., 2009; Roberson & Hanley, this volume), and some languages have shown gender effects while others have not (Vigliocco, Vinson, Paganelli, & Dworzynski, 2005). Regardless, there may be cases in which language does shape concepts in an enduring fashion, with the effect not dependent on engaging language at the moment of stimulus processing. Emotions, for instance, are abstract, and the direct experience of them is (by definition) a feeling rather than a reflective thought. The interpretation of emotional reactions may be heavily guided by parent–child discussions of them during the early years of development (Laible & Song, 2006), and so the particular distinctions among emotions that an adult notices may be shaped by the terms that his or her language offers for framing those interpretations. Nevertheless, other evidence suggests that such enduring effects do not occur in all domains. In the next section, we will discuss some evidence for the observation that, in accordance with our arguments, words do not inevitably create a tight mapping between themselves and conceptual representations.

Conclusions about the Tight Mapping Possibility We have considered three possible scenarios in which there would be a tight mapping between words and concepts. One posits universal concepts producing universal word meanings. This one can be confidently discarded on the basis of data showing that word meanings are far from consistently shared across languages. A second scenario posits culturally diverse concepts leading to diversity of word meaning. Although this scenario may account for some cases of linguistic diversity, it does not seem to give a useful account of a substantial body of observed cases. Only one possible version of tight mapping makes sense from the perspective of allowing patterns of word meaning and word use to vary in ways not directly predicted by cultural conditions of current speakers—the version in which languages vary for reasons independent of current cultural conditions and then shape the concepts of their speakers. However, there are a number of reasons why languages might vary in such ways and yet not shape concepts, or shape them only under some circumstances, and so it is not a foregone conclusion that this version is right.

Before moving on, we note that there is one sense of the term *concept* under which words must map directly onto concepts, and cross-linguistic differences must imply corresponding differences in concepts. For speakers of English, Spanish, and French to have differing patterns of applying the words *bottle*, *botella*, and *bouteille* to objects (and so on), the knowledge that the speakers have about the meanings or uses of these words must differ in some respects. In everyday talk, one might say that the speakers differ in what their concepts of bottles are (or that the American concept of a bottle differs from the Spanish concept of a botella and the French concept of a bouteille). This terminology is also sometimes adopted in research literature (e.g., Pavlenko & Jarvis, 2001).

But this sense of *concept* entails that all differences between languages automatically yield differences in concepts. If taken as the relevant sense, there would be no need for any debate or empirical evaluation of the relation of words to conceptual representations. Indeed, if taken as the relevant sense, it would be impossible to empirically evaluate this relation, since the conclusion has been drawn before any data are collected. It is the possibility that the representations engaged in nonlinguistic cognitive processes are not inevitably tied to linguistic differences that makes

questions about the relation of language to thought interesting, important, and susceptible to scientific investigation. We therefore take the cross-linguistic differences in the knowledge associated with words in different languages as a priori evidence only for differences in *linguistic* concepts or *word meanings*, making no assumption that these linguistic concepts also constitute the stock of general purpose mental representations engaged in a nonlinguistic understanding of the world.

Loose Mapping

At the other extreme from tight mapping lies the logical possibility of a very loose mapping in which there is little relation between how people experience the world and how their language encodes it. For instance, suppose people see an important similarity among dogs, wolves, and coyotes on the one hand and cats, lions, and tigers on the other, but their language only has words for grouping animals by size and ferocity. The vocabulary places domestic cats, rabbits, and small dogs in one labeled group, large dogs and goats and sheep in another, and lions, tigers, and bears in another, making the linguistic distinctions available to them arbitrary with respect to the salient conceptual distinctions. This relation might come about if language originated with early humans under conditions quite dramatically different from those that currently prevail—culturally and possibly also in terms of perceptual and cognitive capacities—and individual languages failed to evolve as internal and external conditions did.

This scenario is unlikely on two grounds: First, languages do evolve and can reflect changing cultural conditions (as shown, for instance, by vocabulary that emerges with new technologies) even though some significant elements may be arbitrary with respect to current cultural conditions. Second, in many respects, languages seem well-suited to human experience and to conveying the ideas that humans want to convey. After all, language did evolve in order to serve communication needs, and so any language is likely to have devices reasonably well-suited to serving those needs, even if it also has some arbitrariness. For instance, humans perceive differences between objects and events, and languages commonly have ways of lexically distinguishing objects from actions. Kin relations are important in most human cultures, and languages tend to have words to distinguish among varieties of kin (mother vs. father, child vs. parent, etc.; Greenberg, 1966).

We cannot completely rule out the possibility that such correspondences come about from the other causal direction as discussed earlier—namely, that it is language that has shaped human thinking to see these distinctions as the important ones. To the extent that some of these distinctions are shared across languages, it seems more likely that the causal direction is from thought to language. Regardless of the source of the correspondence, though, it seems that the relation between language and the way humans experience the world is not completely awkward, ill-fitting, and arbitrary, and so we can set aside the extreme loose-fit possibility.

THE CONSTRAINED BUT FLEXIBLE MAPPING POSSIBILITY

Our preceding discussion suggests that the extreme loose mapping possibility, in which an arbitrary relation is pervasive and there are few or no constraints on the relation between language and thought, can be discarded. It also suggests that the tight mapping possibility in the form of a causal influence from universal thought to universal language can be discarded, based on overwhelming evidence for linguistic diversity. The tight mapping possibility in the form of a causal influence from culturally variable thought to linguistically variable language has some plausibility, but it seems inadequate as a full explanation of the relation between words and thought. The tight mapping possibility in the form of a causal influence from language to thought is also viable, but, as we have argued, for a variety of reasons it is not inevitably the correct description of the relation. In this section, we first review evidence suggesting that

at least in some domains, there is some dissociation between how people think about a domain and how they label it. In other words, the mapping between words and understanding of the world is not always very tight. We then ask, if the mapping is nevertheless constrained in some way that creates some shared tendencies across languages, what do the constraints consist of? Finally, we ask, given constraints, why is there also diversity in how words relate to the world? Where and why does it emerge? Answers to these questions will help illuminate the true nature of the mapping between knowledge of the world and knowledge of words, which we argue is loose enough to allow for considerable flexibility in the relation between them but nevertheless constrained in significant ways.

Dissociations between Experience and the Expression of Experience

If there is consistently a tight mapping between words and concepts, there should be a correspondence between how people talk about a given domain and measures of their nonlinguistic understanding of the domain. Malt et al. (1999) evaluated the relationship between the two for 60 ordinary household storage containers, for speakers of American English, Argentinean Spanish, and Mandarin Chinese. They examined the perceived similarity among the objects as a measure of how people thought about the objects and the relations among them. They also assessed which objects in the set were called by the same name for each language, to determine which objects are linguistically grouped together. There was a surprising degree of divergence in naming patterns. For instance, English speakers put most objects into one of three categories of roughly equal size (*bottle*, *jar*, and *container*) whereas Spanish speakers called 28 of them by a single name (*frasco* or its diminutive, *frasquito*) but used an additional 14 names to partition the rest. Chinese speakers preferred the same name for 40 of the objects, and used only four additional names for the remaining 20 objects. The differences across languages consisted of more than just minor boundary variations around shared prototypes. The categories of the different languages were not always formed around the same prototypes, and in some cases the category memberships across the languages cross-cut each other substantially (Malt, Sloman, & Gennari, 2003a).

In contrast to the cross-linguistic differences in naming, similarity judgments were remarkably consistent across speakers of the three languages. The correlations of similarity matrices between each language group (English–Spanish, Spanish–Chinese, and Chinese–English) were all above 0.90, and analyses using the Cultural Consensus Model (Romney, Weller, & Batchelder, 1986) to assess agreement in naming versus similarity using a common measure confirmed that between-group differences were significantly larger for naming than for similarity. Furthermore, to the extent that there were differences in perceived similarity, these were not systematically related in any detectable way to the differences in naming patterns. For this domain, then, it seems that knowledge of words and knowledge of the world are less tightly linked than the tight mapping possibility posits. Somehow, languages can come to have different patterns of encoding the objects in words even though individual speakers of the languages may perceive and understand their properties in much the same way.

Other data also show a similar outcome for common objects. Ameel et al. (2005) replicated AQ1
Malt et al.'s (1999) findings by comparing Belgians who speak Dutch with Belgians who speak French. This replication shows that when different languages are spoken by people sharing essentially the same culture, their patterns of naming can still diverge, even though their perception of the similarities among the objects is in close correspondence. Kronenfeld et al. (1985) examined similarity and naming judgments for a smaller set of drinking vessels for speakers of English and Hebrew, and likewise found shared perceived similarity but substantially differing groupings by name.

Studies of other domains suggest that dissociations are not limited to the object domain. Munnich, Landau, and Dosher (2001) noted that English makes an obligatory distinction

between situations involving support (labeling *on*) and ones not involving support (receiving labels such as *above* or *in front of*), whereas this distinction is optional in Japanese and Korean. They found comparable memory for the spatial locations of objects despite the differing naming patterns. Similar outcomes have been found for simple motion events such as a person moving into or out of a room. English speakers tend to encode the manner of motion in the main verb of a clause and the path of motion in adverbial phrases (e.g., *She is walking/running/limping out of the room*). Spanish speakers often encode path of motion in the main verb (the equivalent of *She is exiting the room*), and less commonly they mention manner in an adverbial phrase (Talmy, 1983, 1985; Slobin, 1996a). Gennari, Sloman, Malt, and Fitch (2002) found that despite the expected differences in descriptions of action film clips, speakers of English and Spanish had similar confusions between clips on an old–new memory task. Papafragou, Massey, and Gleitman (2002) obtained similar results comparing English to Greek, a language that follows the Spanish pattern. Papafragou, Massey, and Gleitman (2006) further found that Greek speakers increased mention of manner for events in which the manner could not readily be inferred, suggesting that they were monitoring manner information even when the typology of their language did not compel them to express it. Papafragou, Hulbert, and Trueswell (2008) also found that when speakers of English and Greek inspected short video motion events with the instruction to remember them, they showed indistinguishable patterns of eye movements during the event. Once the movement stopped, speakers of English actually paid more attention to path than manner but speakers of Greek did not differ in attention to the two elements. This outcome suggests that English speakers may have been encoding into memory the element that their language did not readily capture in an internal linguistic summary. It seems that speakers of different languages experience the elements of simple motion events independently of their linguistic likelihood of encoding manner.

So, cross-linguistic variability in naming in the face of shared nonlinguistic responses occurs for several different domains. Consistent with our earlier argument, they suggest that cultural differences are not necessarily the source of the disparate word meanings and naming patterns that speakers of different languages have. There is no obvious link between broad cultural differences among our Chinese, American, and Argentinean participants, or among the Americans, Israelis, and Japanese of Kronenfeld et al. (1985), and the groups' varied linguistic partitioning of object stimuli. Furthermore, the French- and Dutch-speaking Belgians of Ameel et al. (2005) show that people may share largely the same culture but maintain differences in their naming patterns. And if members of the cultures see the similarity among the entities in much the same way, then there is little basis for postulating specific differences in the cultural construals of those entities that could lead to differences in how they are partitioned by name. In addition, and importantly, considering the data from the other causal direction, the results indicate that the words of a language do not necessarily create a tight link to the way people perceive or understand entities in a domain. The particular pattern of naming that speakers use does not, at least in the domains studied, fix their perception of the similarity among the entities in the domain.[1] The data argue against the more viable versions of the tight mapping possibility as an across-the-board account of how knowledge of words relates to knowledge of the world.

Constraints

So, it seems that language does not inevitably create a tight mapping to conceptual understanding of objects, and conceptual understandings are not inevitably the source of the specific configuration of lexical categories in a language. Yet, as we have discussed, it also seems that the meanings associated with words of languages are in some way reasonably well shaped to convey the ideas that humans want to convey, and some shared tendencies in naming patterns across languages have been identified. There must be some

kind of causal, although imperfect, relation between conceptual representations and the development of patterns of naming. How might whatever correspondences do exist come about? As we suggested, there may be some culture-specific correspondences that arise from the need to communicate certain distinctions of particular importance to a culture, and there may be a contribution of cross-culturally shared needs, goals, feelings, and so on. Further, pan-human basic cognitive and perceptual capacities might segment the world for speakers of all languages in comparable ways by creating special sensitivities to some distinctions, and the world might also present itself to the human observed packaged in chunks so salient that given shared perceptual and cognitive capacities, all humans recognize these chunks. However, there has been little past evaluation of these potential sources for shared tendencies. The best developed is perhaps Kay and McDaniel's (1978) argument for the contribution of pan-human perceptual capacities to universally perceived nonlinguistic color categories (though an alternative explanation has since been proposed; Regier, Kay, & Khetarpal, 2007). In the research we now discuss, we focus on asking whether there is also a contribution from structure in the world and whether certain shared cross-cultural communication needs might complement structure in creating similarities in the mappings across languages.

Locomotion on a Treadmill As we noted earlier, direct experience in the world is a source of much knowledge. Some of that experience may present itself to the observer in ways that make certain distinctions particularly salient. Anthropologists Hunn (1977) and Berlin (1992) made such an argument for structural constraints on the labeling of plants and animals across cultures. Drawing on analyses from biology, they suggested that at the level of the biological genus, properties of plants and animals occur in clusters, and there are distinct gaps between clusters. Thus canines share certain sets of characteristic features, felines share others, equines share others, and so on, and there are few or no animals in between these clusters that have properties coming from two or more of the clusters (see also Rosch, 1978). People will perceive these property clusters, and their labeled distinctions will tend to map onto the clusters. As a result, people from many cultures in disparate parts of the world, and speaking different languages, will tend to label the same distinctions among plants and animals.

We further investigated the possibility of structural constraints on naming by examining lexicalization of part of the domain of human locomotion (walking versus running). For plants and animals, people living in different places speaking different languages are exposed to different members of the domain, which allowed Berlin and Hunn only indirect assessments of the consistency of labeled groupings across cultural groups by comparing each culture's groupings to biological taxonomies. In contrast, people in different parts of the world, speaking different languages, will be exposed to many of the same gaits. Although locomotion is not immune to cultural variation (Devine, 1985), human bodies are capable of a number of different basic gaits regardless of culture (such as those labeled in English as *walk*, *run*, and *hop;* e.g., Alexander, 2002), and so speakers of different languages should see or engage in many of them universally. In particular, for the current study, what is crucial is that people of all cultures will have been exposed to both walking and running, and, since these are the primary gaits used in daily life, they should all find these gaits salient.

For locomotion, as for plants and animals, an independent analysis of the domain structure exists. This structural description is given by the biomechanical analysis of human gaits (e.g., Alexander, 2002; Bennett, 1992). Some salient parts of the domain are described as highly structured, with strong clusters of exemplars having sharp discontinuities between them. In particular, in walking, the legs act like a pendulum around a fulcrum point and one foot is always in contact with the ground. Running has an impact-and-recoil motion, and there is a point in each stride in which neither foot is in contact with the ground. Due to the

dynamics of motion, there are abrupt transitions from one gait to another rather than gradual shifts through intermediate versions. Studies of English speakers observing locomotion on a treadmill demonstrate that the abrupt discontinuity in biomechanical properties of walking versus running is reflected in English naming, which shows uniform responses of *walk* up to a certain speed and then uniform responses of *run* (Diedrich & Warren, 1995).

Taking into account this pan-human exposure to two salient gaits, and the structural distinction between the gaits (which may be apparent in an individual's own motor experience as well as in the perceptual experience of observing gaits executed by others), we can ask whether these discontinuities in the locomotion stimulus space are consistently drawn in the naming of gaits across languages.

We studied speakers of English, Spanish, and Japanese. [See Malt, Gennari, Imai, Ameel, Tsuda, and Majid (2008) for a report of the study that also includes Dutch data added after the preparation of this chapter.] English and Spanish are both in the Indo-European family, but English is largely Germanic and Spanish is in the Romance branch. Modern English does have considerable Romance influence in its vocabulary, but its manner verb lexicon is generally Germanic in origin. Japanese is most often classified as belonging to the Altaic family (Crystal, 1987). As relatively unrelated languages, any similarities in naming patterns across these three languages are unlikely to be due to shared linguistic histories.

Furthermore, English is a language that is characterized as a manner verb language, in which verbs frequently express manner, whereas Spanish more commonly uses verbs that express path of motion (Talmy, 1983, 1985; Slobin, 1996a). In Japanese, verbs tend to express path or path plus ground/trajectory (Muehleisen & Imai, 1997). Languages that more often encode path in the main verb do have some manner verbs in their vocabulary, however. This trio of languages allows us to investigate the extent to which the manner verbs that do exist in such languages encode the same distinctions lexicalized in a language in which mention of manner within the main verb is more common. In this portion of the locomotion domain, experienced with high frequency and in cross-culturally similar ways, if the biomechanical discontinuity is salient, then all languages may develop manner verbs marking the same distinction between walking and running regardless of verb typology.[2]

We filmed a student locomoting on a treadmill that varied systematically in speed and slope. There were three slope levels: flat, a slight slope, and a steeper slope. Within each slope, we started at the slowest speed possible and increased it by one treadmill unit at a time until it became too difficult for the student to remain on the treadmill. This process resulted in nine clips on the flat surface, eight on the slight slope, and seven on the steeper slope, for a total of 24 clips. The clips were embedded in a web page in random order, each followed by "What is the woman doing? She is. . ." or its translation into Spanish or Japanese as appropriate. Participants watched each clip and answered the question by typing a word or phrase into a response box on the web page. A portion of the English language version of the experiment is illustrated in Figure 2.1. Participants were native, largely monolingual speakers of their language (recruited in the United States for English speakers, Argentina for Spanish speakers, and Japan for Japanese speakers).

Because our interest for the current purpose is in thinking about the relation between nonlinguistic experience of the world and the meanings captured in individual words, we focus here on the head verb of each response produced. This focus is not to say that speakers of these languages are unable to, or unlikely to, differentiate the gaits linguistically in other ways when they do not have a unique verb for a manner of motion. Modifiers may be attached to verbs, or other descriptive phrases may occur within a sentence to distinguish among motions. On-going analyses are examining these other expressions of locomotion.

We tabulated the frequency of the verbs produced to each clip by speakers of each language and then focused on the use of verbs that were the dominant (i.e., most frequent)

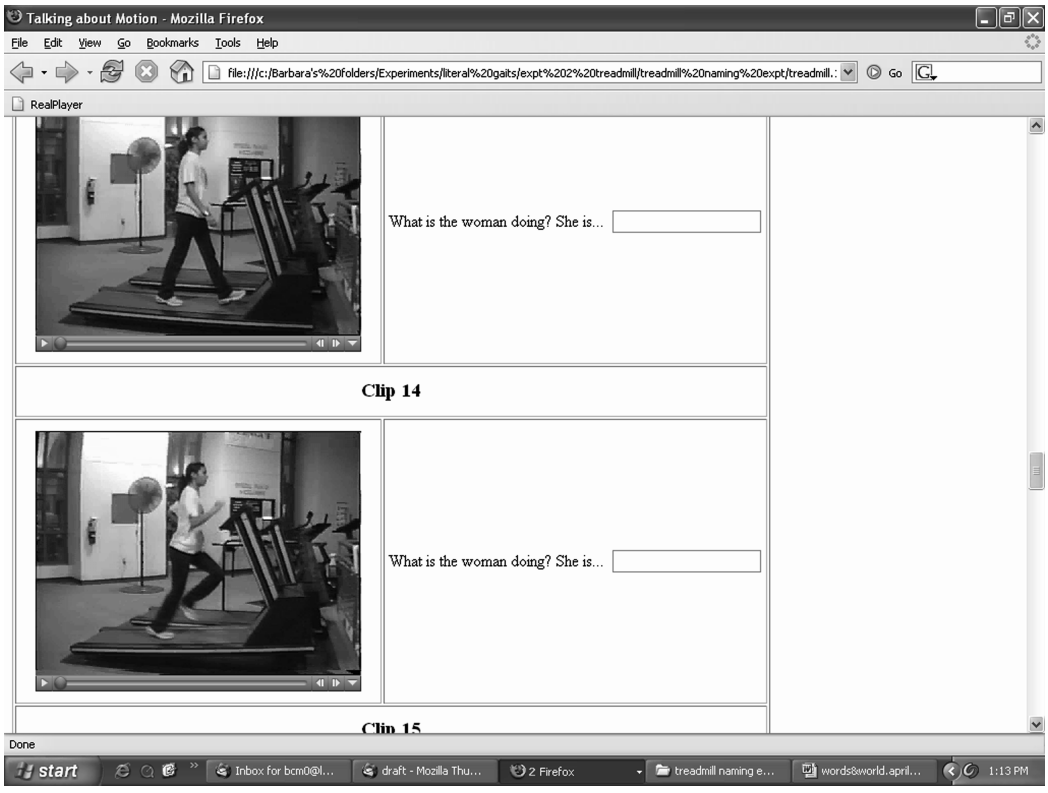

FIGURE 2.1. Sample of web page presenting treadmill clips to participants. The top clip is on the flat surface at speed 2; the second clip is on the slight slope at speed 7.

response for at least one clip. If speakers use terms in a way that observes the structural discontinuity, we would expect that verbs will be applied to clips in a categorical, not graded, fashion, and each language should have terms used in a complementary distribution that is paralleled by the other languages.

What we found is shown in Figures 2.2 and 2.3. Verb distributions were not graded. For each language, speakers switched from one set of names to another in an all-or-none fashion. Furthermore, speakers of all three languages made their transitions from one set of terms to another at exactly the same points in the stimulus continuum; these points correspond to the biomechanical discontinuities in the movements produced. And Japanese and Spanish users made this distinction with unique, single-word manner verbs just as did English speakers, despite the fact that they speak languages that do not, overall, encode manner in the verb of a sentence nearly as often as English does. This result provides strong evidence that there can be mappings from the world to words that are shared based on a shared perception of structure in the world.

Interestingly, as the figures make clear, there are nevertheless some differences between the languages. English and Spanish speakers had a term limited to slow running exemplars (*jogging* and *trotando*, respectively). The distribution of these terms relative to *running* and *corriendo* is graded; use of *jogging* and *trotando* gradually drops off as *running* and *corriendo* increase over the speed manipulation. English speakers also sometimes used *sprinting* for the fastest gaits. The graded nature of the trade-off along the speed dimension here reinforces the conclusion that

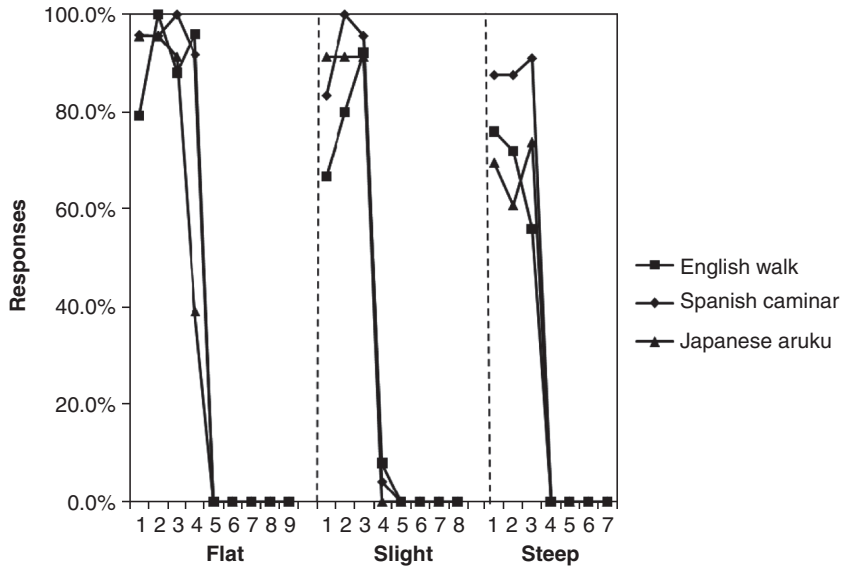

FIGURE 2.2. Distribution of responses to treadmill clips for terms encompassing biomechanical walking.

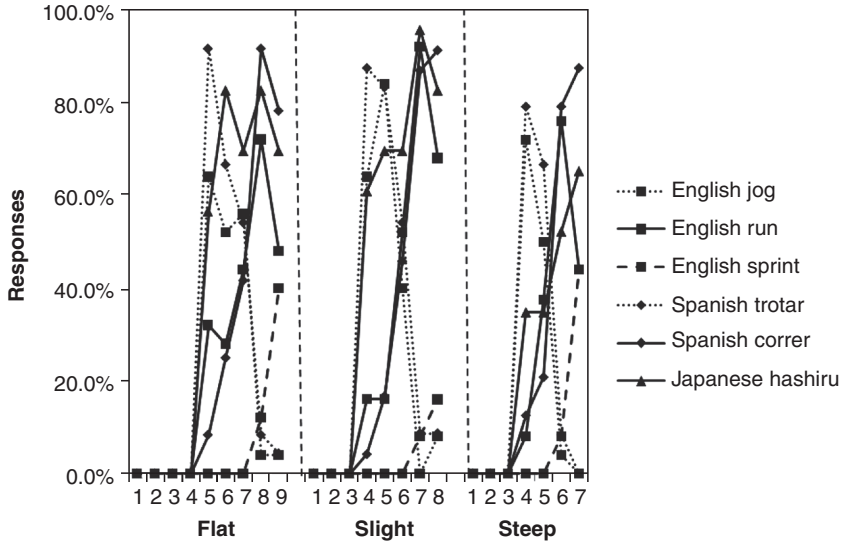

FIGURE 2.3. Distribution of responses to treadmill clips for terms encompassing biomechanical running.

the contrasting, all-or-none, trade-off in labels when crossing the biomechanical gait boundary does reflect a perception of the discontinuous nature of the stimulus space.

In sum, in this case where the world presents strong structure, and for a portion of the domain that is presumably important across cultures and is experienced in similar ways, the three languages made the same distinctions with manner verbs despite their differing linguistic histories and verb typologies. The verbs *walk* and *run* (with varied spellings) appear in English as early as the 1300s and were used in discourse contexts similar to their modern uses (Oxford English Dictionary, 1989). *Caminar* has its origins in pre-Roman Celtic vocabulary,

and *correr* came into Spanish from Latin (Real Academia Española Staff, 2001). *Aruku* and *hashiru* are represented in Japanese by characters that are Chinese in origin, but the words themselves may have predated the Chinese influence, which began in the sixth century AD. With such varied origins and long trajectories over which the meanings could evolve, it is particularly remarkable that the current uses of the words so closely match in observing the distinction between biomechanical gaits. It appears that structure in the world, when observed in a domain that is common and presumably important, constrains the mapping between words and the world.

Flexibility

The preceding data demonstrate how the mapping between experience and words to label it may be constrained by salient structure in a domain or portion of it. At the same time, we found some differences between the languages even in this domain, and, as we have discussed earlier, overall, there is considerable diversity in patterns of naming of various domains across languages. Some substantial portion of this diversity is not related to current cultural differences in any obvious way. Why does diversity arise even with the constraints that structure in the world may provide? A key observation, we believe, is that the kind of strong structure in the world that the walk–run biomechanical distinction presents is often not present. In many domains or parts of those domains, the distribution of properties across entities in the domain is much less tightly clustered. For instance, for artifacts such as the common household containers we have studied, new objects can be created with all sorts of combinations of values on dimensions ranging from size to shape to type of opening to use. Even in cases such as spatial relations, where the location of one object with respect to another is limited by the laws of physics, there may be no major discontinuities across the possible relations that would cause all languages to group the same ranges of relations together by name. In such cases, there is greater room for other factors to influence how the domain or part of a domain is lexically divided.

One factor that can create diversity across languages is the variable salience of entities to members of a culture due to the particular needs or interests of the culture. As we have noted, such variation may drive different languages to develop vocabulary in a domain to different extents, as seems to happen for color or wine terminology. Also, because people in different cultures may experience somewhat different entities as the manifestation of a domain (or similar entities but with different frequencies), the meanings associated with words are likely to be influenced by what is present or common to them. What is prototypical of a lexical category in one culture may be peripheral in another (e.g., Schwanenflugel & Rey, 1986).

Other factors may result in diversity that is not tightly linked to current cultural differences. As we touched on before, cultures evolve over time, and so the lexical distinctions in a language at a given time may be, in part, a product of past cultural needs, goals, interests, or experiences rather than current ones. The word meanings of a language themselves are also in a constant state of evolution (e.g., Hock, 1996; Traugott & Dasher, 2005), for reasons partially distinct from cultural goals, interests, or needs. Contact between different languages can introduce new words into a domain in a language, causing previously existing ones to expand, contract, or otherwise modify their meaning and patterns of application in ways that might differ from another language. For instance, English distinguishes between the live animal, *pig*, labeled by a word of Germanic origin, and the food, *pork*, the latter term having entered English from French (similar to the situation for *cow* vs. *beef*; Hock, 1996), whereas for chicken and fish, English makes no such distinction. Dutch, however, has only a single word for a pig and its flesh, following the pattern for chicken and fish (E. Ameel, personal communication).[3] Likewise, meanings may shift as words come to have new pragmatic functions in a language. For instance, a word such as *lady*, originally used only for women of the

highest social standing, may begin to be applied to women of lesser standing out of politeness and thus eventually lose or even reverse its original status implication (Keller, 1994). A word such as *woman*, which may have previously contrasted with *lady*, might then expand to encompass those previously known as *lady*, or perhaps even become the signifier of higher status. And the meanings at any one time are a function of not only the forces that shape meanings but also of the particular input (the previously existing words and structures available in the language and their associated meanings) on which those forces operate, making the development of these meanings a dynamic process subject to multiple grammatical and pragmatic constraints (Keller, 1994; Traugott & Dasher, 2005). As a result, even two languages with similar characteristics spoken by members of similar cultures at some moment in history might have different patterns of lexicalizing a domain if the evolutionary paths of their vocabulary for the domain differed (see Roberson & Hanley, Chapter 9, this volume, for a related argument for color terms).

Other linguistic factors from outside the realm of semantics per se may also shape how a domain is segmented by name. These are differences in the syntax and morphology of languages. For instance, languages that have gender marking systems are forced to make a lexicalized distinction between male and female cousins (e.g., *primo* vs. *prima* in Spanish; *cousin* vs. *cousine* in French), whereas languages without gender marking need not make that distinction. In our container data, we noted that Spanish speakers made more lexical distinctions among containers than English or Chinese speakers did. Spanish morphology makes it easy to form single-word names for containers by adding the *-ero*/*-era* and *-or* suffixes to root words (e.g., *talquera* for an object holding talc; *roceador* for an object for spraying), and this feature may contribute to the substantially larger number of lexical distinctions that exist in Spanish. In a related vein, diversity among languages in how manner and path of motion are expressed in words may stem at least partly from other differences in the morphosyntactic devices they make available for encoding the semantic ingredients common to all representations of motion events (Levin, Beavers, & Tham, 2004; see Wolff et al., 2009, for another compelling example of this sort of influence). Thus multiple interacting forces working over the course of a language's history are likely to shape the lexical resources available to speakers of a language at any point in time, independent of the particular interactions with the world speakers have or culturally shaped ways they may learn of thinking about a domain.

Locomotion on a Walkway The domain of locomotion allows us to test several ideas about where cross-linguistic diversity comes from. In a second study on naming of locomotion, we examined naming of a wider range of gaits produced under more natural conditions. One important idea to test, in the long run, is that where structure in the stimulus input is less clear, there is more opportunity for diversity among languages in naming patterns. Because the literature on biomechanical qualities of human gait focuses primarily on walking and running, however, we do not have as useful an objective indicator of where the most major structural discontinuities in a larger range of motions lie. Jumping and hopping have been referred to as separate gaits (Alexander, 2002). It is less clear whether there are multiple correlated properties that separate running from skipping, for instance, or whether the distinctions lie in fewer dimensions. We are currently collecting similarity judgments on the larger set of gait exemplars used in this study to establish what people see as the major physical similarities and dissimilarities among the stimuli. We can use those judgments to make predictions about where weaker structure is likely to lead to greater cross-linguistic diversity. For now, one prediction we can evaluate is that diversity should be greater within a gait than between gaits. The data from Study 1 that we discussed are consistent with this prediction. We can use the greater range of variations in the current stimulus set to further test this idea.

A second idea that can be tested in this study is that correspondence should be greater among the languages for the more central portion of the domain. Different types of locomotion are of substantially differing degrees of centrality to human experience. Regardless of culture or location, most of the time when a person observes or engages in human locomotion, the event will be of walking, and sometimes it will be of running. Much less often it will be of hopping, skipping, jumping, etc. Thus for all cultures, the need to make reference should be greatest for the more central parts of the domain (walking and running), and less so for the more peripheral parts of the domain (hopping, skipping, jumping, etc.).[4] If centrality to a culture's gait options (and attendant degree of need or likelihood of wanting to express an experience in language) affects what distinctions languages encode in their lexicon, we should expect a high degree of uniformity in drawing the distinction between walking and running across languages. What distinctions are lexically encoded in unique verbs for the more peripheral gaits should be more susceptible to variability brought about by the various other forces that shape lexicalization patterns over a language's history.

This domain also allows us to test further whether the differences between languages in how commonly manner is expressed in the verb can influence how a domain is lexicalized. Languages that less often express manner because the verb often encodes path instead may develop fewer verbs to encode manner distinctions overall (Slobin, 2004), despite the fact that they do make the important walk–run distinction. We therefore examined the data to determine if Spanish and Japanese speakers would produce fewer manner verbs than English speakers in naming these more varied gaits.

The gaits filmed came from two sources. One was a list of all the manner of motion verbs in English (provided to us by Dan Slobin). We had a student act out each of the verbs that named ways of moving forward, backward, or sideways bipedally or on one foot (eliminating many on his list such as *barge*, *bolt*, *bound*, *bump*, and *burst*, which seem to capture elements of movement such as speed, suddenness, or gracefulness but not gait per se). We selected for the final set of clips those that seemed visually distinct from one another. (For instance, the filmed versions of *trudge* and *plod* differed little, if at all, so we kept only one.) We also had informants from Japan and Argentina videotape culturally relevant movements not covered by the English terms. These included several distinctive military march-type movements, two traditional Japanese styles of walking, and two modern Argentinean styles of walking. The student who served as actor for filming the rest of the gaits viewed them and reproduced the actions on the walkway along with the rest of the gaits. The final stimuli consisted of 36 clips illustrating variants of gaits such as walking, running, marching, and jumping. Figure 2.4 illustrates several of the motions filmed.

As before, the clips were embedded in a web page that allowed participants to watch each one and then type in what they thought they would call the motion. Participants were native, largely monolingual speakers of the three languages (recruited in the United States, Japan, and Argentina) who had not participated in the treadmill study. As before, we tabulated the frequency of the verbs produced to each clip by speakers of each language and then focused on the use of verbs that were the dominant (i.e., most frequent) response for at least one clip.

Table 2.1 presents the most frequent response to each clip for each of the three languages, along with the proportion of responses it accounted for. (If no term accounted for at least one-third of responses to a clip, the response is listed as "mixed.") As before, we report main verbs without modifiers. In two cases, the Japanese dominant response was a verb formed from a noun plus light verb (*ashibumi-suru* and *sukippu-suru*); these are conventional verbs in Japanese. To make similarities and differences among the languages more apparent, the clips are grouped according to their dominant English name; we can then see to what extent the Spanish and Japanese distributions of names match the English and each other. As in Study 1, terms in all three languages segregated a variety of

FIGURE 2.4. Sample clips from the walkway study.

pendulum-based limb motions from bounce-and-recoil motions. Thus this basic gait distinction is lexically observed across the more stylistically varied versions of the two gaits used in this study. This result supports the conclusion from Study 1 that a lexicalized gait distinction is shared across languages and is based on a shared perception of structure that exists in the world.

In contrast to the treadmill experiment, however, there is one stimulus (labeled "trot" in Table 2.1) in this portion of the domain in which the responses are variable rather than all-or-none (and, for Japanese speakers, the term associated with other walking clips dominated whereas for English and Spanish, a term associated with running clips dominated). Inspection of the motion involved reveals why this response pattern occurs. The movement is essentially pendulum based with one foot in contact with the ground at all times (as in other movements called by walking terms), but it has more knee bending at one point in each pace and therefore a bouncier quality than other motions called by walking terms (see Fig. 2.5). Responses reflect the mixed features of the stimulus.

We had predicted that diversity should be greater within a defined gait than between gaits because the structural differences creating variations of a gait will be much less sharp and perceptually less salient. For instance, languages should differ more in marking variations within the biomechanical category of walking than they do in marking the distinction between walking and running. The data support this suggestion. Japanese never applied their main walking term to walking backward, but Americans and Argentineans did with a high level of consistency. Japanese speakers never applied their main walking term to walking in place, although both Americans and Argentineans sometimes did. On

TABLE 2.1. Dominant Responses in English, Spanish, and Japanese and the Percentage of Participants Who Produced Each Response for 36 Examples of Locomotion on a Walkway[a]

	English		Spanish		Japanese	
Clip Name	Dominant Verb	Dominance (%)	Dominant Verb	Dominance (%)	Dominant Verb	Dominance (%)
Shuffle	Walking	0.50	Caminando	0.86	Aruku	0.92
Stroll	Walking	0.70	Caminando	0.91	Aruku	0.88
Trudge	Walking	0.50	Caminando	0.91	Aruku	0.80
Noh	Walking	0.40	Caminando	0.68	Aruku	0.68
Slink	Walking	0.80	Caminando	0.91	Aruku	0.88
Stride	Walking	0.43	Caminando	0.90	Aruku	0.80
Ghetto walk	Walking	0.43	Caminando	0.80	Aruku	0.64
Lumber	Walking	0.93	Caminando	1.00	Aruku	0.88
Strut	Walking	0.66	Caminando	0.86	Aruku	0.92
Heels Argentinean	Walking	0.80	Caminando	0.77	Aruku	0.72
Walk backward	Walking	0.93	Caminando	0.95	Aruku	0.48
Clomp	Walking	0.60	Caminando	0.95	Aruku	0.84
Pigeon toed	Walking	0.77	Caminando	0.76	Aruku	0.68
Heels	Walking	0.80	Caminando	0.67	Aruku	0.64
Walk in place	Walking	0.43	*Mixed*	0.32	Ashibumi-suru	0.60
Trot	Jogging	0.33	Trotando	0.50	Aruku	0.44
Jog	Jogging	0.70	Trotando	0.86	Hashiru	0.32
Run fast	Running	0.67	Corriendo	0.95	Hashiru	0.56
Run in place	Running	0.53	Trotando	0.68	*Mixed*	0.12
Goose step	Marching	0.43	Marchando	0.86	Aruku	0.32
March Japanese	Marching	0.67	Marchando	0.67	Aruku	0.32
March American	Marching	0.80	Marchando	0.76	Aruku	0.44
March Argentinean	Marching	0.48	Marchando	0.67	Aruku	0.36
March in place	Marching	0.83	Marchando	0.82	*Mixed*	0.08
Jump	Jumping	0.52	Saltando	0.73	*Mixed*	0.16
Jump in place	Jumping	0.67	Saltando	0.95	*Mixed*	0.28
Hop	Hopping	0.70	Saltando	0.68	*Mixed*	0.28
Hop in place	Hopping	0.73	Saltando	1.00	*Mixed*	0.28
Skip	Skipping	0.93	*Mixed*	0.23	Sukippu-suru	0.84
Tiptoe	Tiptoeing	0.37	Caminando	0.95	Aruku	0.68
Stomp	Stomping	0.45	Caminando	0.57	Aruku	0.68
Gallop	Galloping	0.45	*Mixed*	0.27	*Mixed*	0.12
Leap	Leaping	0.40	Saltando	0.36	*Mixed*	0.16
Sneak	Creeping	0.40	Caminando	0.77	Aruku	0.48
Power walk	Power walking	0.40	Caminando	0.86	Aruku	0.68
Step sideways	*Mixed*	0.07	*Mixed*	0.25	*Mixed*	0.28

[a]The dominant response is listed as "mixed" if fewer than one-third of participants produced the same name. "Clip name" is an experimenter-given description of the clip.

the other hand, Americans rarely used their main walking term for three other clips for which Spanish and Japanese speakers readily did. Americans used the names *tiptoe*, *creep*, and *stomp*, respectively, for these more than any other name, but with a low degree of consensus. It appears that Spanish and especially Japanese treat forward movement as a more central part of the meaning of their walking term than English does, whereas English may tolerate more variation in path of movement but less in details of the style. Also, all three languages used their main walking term for some actions that varied from a strictly pendulum motion, but there was variation in which ones they extended the term to. Japanese speakers used their main walking term

FIGURE 2.5. The "trot" stimulus.

for two forms of marching and for stomping, and Spanish speakers did just for stomping—actions involving more pronounced knee bends—but English speakers did not. Again, the Spanish and Japanese terms in particular seem to allow variation from the prototypical movement in their use. Spanish and Japanese speakers were substantially less willing than the English speakers to apply their main running term to running in place.

We had predicted that the languages would agree more in the composition of the lexical categories covering the more central, commonly experienced, portion of the domain (walking and running) than the more peripheral, lower frequency portion (other gaits). We evaluated this prediction by first separating the clips into those that showed conformity to the biomechanical definitions of walking or running and those that showed other types of gaits. This resulted in 15 clips being classified as belonging to the central part of the domain (13 walking clips and two running clips). The remaining 21 clips were considered to be the peripheral part of the domain and included actions such as those described in English as *marching*, *hopping*, *skipping*, and *jumping*, and actions performed in place or moving sideways or backward.

We then examined the naming pattern in each language by determining, for each pair of clips, whether they received the same or a different dominant name in that language (that is, were placed in the same lexical category). So, for instance, if Clips 1 and 2 were called *walk* by Americans and Clip 3 was called *run*, then Clips 1 and 2 were counted as having been placed in the same lexical category, Clips 1 and 3 were counted as having been placed in different ones, and Clips 2 and 3 were also counted as being in different ones. We could then compare the languages to see to what extent they showed similar patterns of placing clips into the same or different lexical categories. We coded pairs with a shared category as "1" and those with different categories as "0" and correlated the resulting arrays between each pair of languages, looking separately at the clips in the central portion and those in the peripheral portion. For clips in the central portion, the average correlation between languages was 0.83; for clips in the peripheral portion, it was only 0.31. Each pair of languages individually showed greater agreement in the central than the peripheral portion. This analysis thus supports the contention that languages will tend to diverge more in naming for stimuli that receive less attention and where lexically encoding certain observable distinctions may be less important.

We also predicted that English, as a manner verb language that frequently encodes manner of motion in the main verb, would show greater lexical differentiation of the gaits than would Spanish (a path verb language) and Japanese (a path-and-ground language), but that in particular the difference would be greater in the more peripheral part of the domain. We evaluated this possibility by counting the number of verbs that were dominant for at least one stimulus, for each language. For English speakers, four different verbs emerged as dominant for at least one clip apiece in the central portion (*tiptoe*, *walk*, *jog*, and *run*) and an additional nine did in the peripheral portion (*hop*, *skip*, *jump*, *march*, *gallop*, *creep*, *leap*, *stomp*, *and power-walk*). For Spanish speakers, three were dominant in the central portion (*caminar*, *trotar*, *correr*) and only two additional verbs emerged as dominant in the peripheral portion (*marchar* and *saltar*). Clearly, Spanish speakers made many fewer discriminations via unique verbs than English speakers did, and the difference appears primarily for the less common gaits.

[As noted earlier, this observation does not mean that Spanish speakers are incapable of expressing finer distinctions among the gaits. For instance, although having only a single verb, *saltar*, that was applied to gaits that Americans called *hop*, *skip*, *jump*, and *leap*, Spanish speakers often used additional descriptors such as *en un pie* (= on one foot) or *con los dos pies juntos* (= with both feet together) to describe the gaits more fully.]

Japanese presented a particularly interesting case. Japanese speakers had only two dominant verbs in the central portion (*aruku* and *hashiru*) of the domain, and two others occurred as dominant within the clips, *ashibumi-suru* and *sukippu-suru*.[5] The contrast with English in the extent of diversity within the dominant verbs for these clips is thus even more striking than for Spanish. However, it is not that Japanese speakers failed to discriminate among the actions in their verbs. Rather, Japanese affords speakers a variety of different ways of encoding motion in verbs. For instance, almost 25% of all responses were various noun + light verb (*suru*) combinations, but these were formed from a variety of nouns including loan words as well as traditional Japanese words, producing low consensus in the main verb of responses. Japanese, then, is even sparser than Spanish in the existence of high-consensus verbs for drawing distinctions in the peripheral part of the gait domain, but this sparseness is compensated for, and in fact possibly due to, the availability of a variety of ways for conveying manner of motion in a verb phrase.

The data from this study are consistent with suggestions we put forward about where flexibility enters into the mapping between knowledge of the world and knowledge of words. Where structure in the world is less clear, there are more opportunities for languages to diverge in their patterns of lexically grouping stimuli. Where structure matters less because less attention is paid to some portion of the domain, there is likely to be more diversity. And independently existing characteristics of languages may influence the development of vocabulary in a domain. In the case of these data, it seems that not only may the often-discussed manner-path difference among languages influence the development of manner verbs used with consistency by speakers, but so may the availability of other options for expressing manner distinctions. In fact, a larger point here may be that there is a trade-off between the degree to which languages have acquired large stocks of unique vocabulary words for specific motions versus have developed ways of expressing subtleties of meaning through morphological and syntactic complexity. English has an extremely large number of vocabulary words overall as a result of the many different languages that have contributed to it (e.g., Crystal, 2003), and so it encodes many distinctions in single-word lexical items. On the other hand, Spanish and Japanese are languages with greater morphological and syntactic complexity (Talmy, 1983, 1985) and so may tend to encode more distinctions via multiword phrases. If salient or commonly mentioned phenomena are most likely to be encoded simply by virtue of their frequent use (Bybee, 2003), these differences among the languages may become most apparent in those domains or parts of a domain in which structural distinctions are less striking or less frequently talked about.

IMPLICATIONS AND CONCLUSIONS

In the preceding section, we discussed evidence indicating that there can be a dissociation between how people think about objects in a domain and how they label them, in at least some cases. In other words, the mapping between words and experience of the world is not always very tight. We proposed some mechanisms by which the mapping might be partially constrained but yet at the same time flexible, and we presented data consistent with this proposal. Given this evidence, and our discussion of the tight and loose mapping possibilities that preceded it, what conclusions are suggested about the mapping between knowledge of the world and knowledge of words?

First, the way that people think about some domain or portion of it—in terms of what they see as the important distinctions within

it, and what they might indicate belong together or share the greatest similarity in a laboratory task—may at times correspond very well to the way that the words of their language group things. In such cases, we can say that there is indeed a tight mapping between words and concepts. The presence of such a correspondence can be anticipated by the presence of significant discontinuities or structural distinctions in the stimulus array. Where there is such strong structure, languages will tend to correspond to one another in the way they lexically divide the domain. Correspondences that come about for this reason do not indicate that language has shaped thought. Rather, they indicate that the world has shaped thought, which in turn has shaped language.

Second, the way that people think about some domain may at other times not correspond well to the way that the words of their language groups things. In such cases, we can say that there is a loose mapping between words and concepts. The presence of such looseness can be anticipated by the presence of weak or little structure in a stimulus array, which leaves the evolution of vocabulary for the domain susceptible to a range of other influences. The same set of influences will have the potential to shape the vocabularies of every language, but the impact of each factor and the outcomes that result will be highly variable from language to language because of the multiple interactions among factors and the way that the state of a language and culture at one moment feeds into outcomes at the next moment in the language's evolution. The evidence that we presented for the influence of these multiple factors in the gait data did not directly provide evidence that the resulting patterns of naming are dissociated from how speakers of the languages think about the domain. However, other studies we discussed demonstrated clearly that such dissociations can occur. Furthermore, such dissociations make sense from the perspective of the arguments we raised earlier about why language may not always be the determinant of how people think about some things, including the myriad ways that people learn about some parts of the world aside from language, and the fact that attention to certain distinctions or lack thereof must be shaped in part by the utility of making such discriminations for functioning in the world.

In light of these two points, we cannot conclude that the mapping between words and concepts is best characterized either as tight across the board or as loose. Our proposal of a constrained but flexible mapping allows for the existence of both possibilities while providing some suggestions about when each might come about. We now consider some broader implications of our perspective.

The Importance of Working out Causal Paths

We began this chapter by considering the widely held view that words map onto coherent packets of nonlinguistic knowledge constituting concepts, and we raised the puzzle of how such a close mapping could come about in light of recent research demonstrating pervasive cross-linguistic differences in how people talk about the world. If linguistic diversity is paralleled by conceptual diversity, where do the parallels come from? If concepts are the causal agent, we run up against the problem that the differing cultural needs, conditions, and experiences of current speakers do not seem to explain many of the types of differences that occur across languages, and conversely, shared linguistic patterns are exhibited by speakers of the same language who live under widely varying cultural conditions. Perhaps language is the causal agent instead. But, we noted, under this hypothesis it is necessary to explain what causes the languages to be different in the first place. Suggesting that the answer is different concepts held by speakers of the languages leads to circularity. A better alternative is to consider that arbitrary linguistic differences arise through mechanisms independent of conceptual differences. Once it is acknowledged that these differences are arbitrary with respect to how people go about interacting with the world, though, it is apparent that these differences might not be useful for guiding the way people think about the world, and that other

sources of information for how to think about the world may dominate, in at least some domains.

The different scenarios we have sketched out may not be the only ones available to help explain what the relation is between words and concepts. However, we think it is an important exercise to try to be explicit about what the story is for how linguistic diversity comes about. It is also important to be explicit about how that story relates to what is known about cultural differences and the types of conceptual differences they may lead to, as well how it relates to the particular instances of linguistic diversity that have been observed. A clear account of how linguistic diversity arises and what aspects of word meanings vary across languages will provide clues to the causal relationship between language and thought. If there are viable alternatives to the possibilities we have raised, making them explicit should yield further insights about the relations.

Diachronic as Well as Synchronic Processes Are Relevant

One point that our suggested account of the relations makes salient is that the origins of linguistic diversity observed at any point in time may be due to events long past such as language contact and the shaping of word meanings through the entry of new lexical items into the vocabulary, as well as historic cultural practices or conditions not directly reflected in current lifestyles. Psychologists are interested in the mental representations and processes of individuals and how they are shaped over the course of an individual's development, and so they have naturally tended to take a synchronic perspective on the language–thought relationship. That is, they have assumed that the word–concept mappings held by individuals arise through processes occurring at a given moment or within the individual's lifespan, without regard to larger historical context. From this perspective, it is natural to assume either direct causation (in one direction or the other) between the word knowledge and conceptual knowledge held by individuals, or else an independence between them. Each of these possibilities leaves some portion of the empirical evidence about patterns of word use, concepts, or the relation between them in individuals impossible to explain. Taking a longer-term view of how differences among languages arise permits breaking out of the paradoxes that arise under a completely synchronic approach. Adding the diachronic perspective helps explain why current patterns of word use can differ from those an individual speaker would impose on a domain if she or he were simply given an array of exemplars of the domain and the task of grouping them to assign to lexical items (see Slobin, 2001, for a related argument concerning grammaticalization), and why, in turn, these patterns of word use may not always be effective in shaping the perception of the domain.

Language as a Window into the Mind

Chomsky (1968) considered language to be a window into the mind and linguistics therefore a branch of cognitive psychology. Pinker (2007) echoes this sentiment in referring to language as a window into human nature, and cognitive linguists make a similar assumption (e.g., Lakoff, 1987). Chomsky's original comments concerned how syntax and the possibility of a universal grammar could provide insights into the architecture of the mind, revealing universal capacities such as the all-important ability to handle recursion. Pinker (2007) and cognitive linguists, however, go beyond syntax to argue that metaphors and even the meanings of individual words and paradigms of meanings in a language's repertoire reveal something fundamental about cultures and individuals. These views are not based on the idea that language shapes thought but rather assume the alternative version of causation: The way people think is reflected in the words of the language they speak. The words are an external manifestation of the internal workings of the mind. This view assumes the synchronicity of the causal link between concepts and words, whereas we have argued that the link may be more distant and mediated by nonconceptual influences. If our view is right,

word meanings may still be useful in understanding the nature of the human mind, but the understanding of what it is that they reveal may need to be more nuanced.

Implications for Language Learning

The perspective we have advocated also helps to make sense of an apparent paradox in language learning that is posed by our data on common nouns and on verbs of locomotion. Gentner (1982) has noted that nouns are represented in children's early vocabulary to a much greater extent than verbs are, and this tendency holds across languages. She (1982, 2003, 2005) argues that concrete nouns are easy to learn because they refer to entities easily segregated from their background. She points out that, on the other hand, to understand a verb, a child has to determine which elements of a scene are encoded into the verb, and this varies from language to language—it might be the manner, path, figure, or ground of the action (Talmy, 1983, 1985), or some combination. In this way, the meanings of verbs are more linguistically embedded than the meanings of nouns, and their meanings are more language specific. Consistent with this conclusion, Gleitman (1990) argues that verb meanings may be inferred more from the argument structures in which they occur within discourse than from direct experience.

But the data we have presented make two points that at first glance might seem contradictory to this line of reasoning about why nouns should be easier to learn than verbs. First, we found that the sets of objects referred to by common nouns vary substantially across languages (and hence the meaning associated with the nouns presumably does too), and those sets are not well predicted by perception of similarity among the objects. Thus the meanings of concrete, common nouns are not necessarily so readily derived by observation of the world. Indeed, Andersen (1975) and Ameel, Malt, and Storms (2008) demonstrate that children learning their native language do not fully converge on adult usage for common nouns until age 12 years or beyond. Second, we found that the usage patterns of several verbs of locomotion (and hence presumably the meaning associated with the words) were quite strongly shared across three disparate languages, and this shared nature is well predicted by structure presented to the observer by the world. Thus our data suggest that (some) concrete noun meanings can be relatively difficult to derive from observation and (some) verb meanings may be relatively easy.

We suggest that our data are fully compatible with Gentner's proposal if a distinction is made between early and later aspects of word learning. Gentner has focused on how readily individual referents of a word can be segregated from the backgrounds against which they are embedded. Here, the learning challenges may be as she describes: The notion that nouns label whole objects may be simple to grasp (Markman, 1990), and identifying the individual object encoded by a noun in a given context may be perceptually and conceptually a simple task (Hollich, Golinkoff, & Hirsh-Pasek, 2007). Thus understanding what kind of mapping exists between nouns and referents, and acquiring prototypes providing an initial fast mapping of meaning (Carey, 1978) to concrete nouns, may be relatively easy to achieve. Meanwhile, figuring out whether the input language has a bias to encode manner, path, or some other element of meaning in its verbs may take more work, and segregating that component from other cooccurring aspects of an observed action in progress may be perceptually and/or conceptually much trickier. However, grasping what the basic nature of the mapping for a grammatical category is and identifying some initial referents of words to provide a rudimentary sense of meaning are only part of the job. The children must ultimately infer the broader conditions of applicability of the word that allow them to use the word for referents besides the one(s) initially observed (see also Ameel et al., 2008; Imai, Haryu, Okada, Li, & Shigematsu, 2006; Saji, Saalbach, Imai, Zhang, Shu, & Okada, 2008). As we have seen, the forces that interact over a language's evolution to determine the extension of a word can conspire to create simpler or more complex patterns of use, and the degree of complexity need

not correspond neatly to the noun–verb distinction. (See Golinkoff, Chung, Hirsh-Pasek, Liu, Bertenthal, Brand, Maguire, and Hannon, 2002, for evidence that 3-year-old children readily perceive and label gait differences represented only by point-light displays; see also Ma, Golinkoff, Hirsh-Pasek, McDonough, and Tardiff, 2009.) Fully understanding how the child's knowledge of the world comes to be translated to knowledge of words may require considering two aspects of the task: the relation of the concepts being acquired by the child to the words they are learning to use and the nature of the full target word use. The first considerations may be most revealing for understanding earliest word use and the second for understanding the process of achieving fully mature use of the words.

Nonlinguistic Knowledge: Concepts or Something Else?

To this point, we have mostly used standard terminology and asked about the relation between language and concepts or conceptual representations. Indeed, we began this chapter by raising the standard assumption that words map onto coherent packets of nonlinguistic knowledge constituting concepts. But the perspective we have argued for suggests that the traditional way of talking about the relation of language to nonlinguistic knowledge may benefit from some adjustment. Words may package together certain elements of nonlinguistic knowledge for communicative purposes (so, hearing or using the word *bottle* evokes one subset of knowledge and hearing or using *jar* evokes a partially different subset), but if it is granted that the words do not necessarily dictate the shape or content of nonlinguistic representation, it may be useful to set aside the idea that such representations come in packets worthy of the name *concepts*. For domains in which the stimulus space is not highly structured, the nonlinguistic knowledge may not have any inherent boundaries or coherent packets that resemble what is traditionally thought of as concepts. [It may be word use itself that creates the impression that it does (Sloman & Malt, 2003; Malt & Sloman, 2007).] It may be more useful to think about the nonlinguistic knowledge in terms of smaller components or features (which may constitute "primitives" such as manner and path of motion; e.g., Parish-Morris, Pruden, Ma, Hirsh-Pasek, & Golinkoff, Chapter 11, this volume) and to consider separately to what extent there are correlations among the features and to what extent languages package these features together. With this more fine-grained notion of representation less tightly tied to word use, it is easy to imagine, for instance, how different tasks may tap different elements of the representations, producing experimental results that vary in the extent to which linguistic performance and nonlinguistic performance mirror each other (Gennari et al., 2002; Saalbach & Imai, 2007). Greater progress in understanding the mapping between knowledge of the world and knowledge of words may come from looking beyond how words relate to "concepts" per se.

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Notes

1. Some studies have found that linguistic factors influence similarity judgments (e.g., Gennari et al., 2002; Saalbach & Imai, 2008). We do not suggest that such influences can never be found (see also the discussion in the text), but rather that they are not an inevitable consequence of a causal relation between language and thought. The appearance of such effects may depend on particular task demands.
2. Note that our goal here is not to examine the manner-path distinction per se, nor its pattern of use in language production, as some past studies have done. Instead, we take advantage of this well-documented typological difference to ask: *When* languages make manner distinctions, what is the nature of their lexical categories for manner, and does their typological status as a manner or path verb language imply an answer to this question?
3. An example of how borrowings get adopted with different results in different languages is as follows: French *boeuf* came into English as *beef*, distinguished from *cow*, which presumably was then elaborated into *beefsteak* for a specific cut of beef and then borrowed back into French as *bifteck*, also for a specific cut of beef. *Bifteck* or *beefsteak* was then borrowed into Dutch to create *biefstuk*, but Dutch already had a specific term for the meat of cows, *rundvlees* (as well as a less commonly used term, *koeievlees*, which compositionally means "cow meat," Ameel, personal communication) and perhaps, as a result, *biefstuk* in Dutch refers to the flesh of any animal, not just that of cows.
4. If some forms of locomotion are typical, it could be argued that they should be unmarked and therefore less likely to receive lexical status. However, any trend in this direction is likely outweighed by the absolute likelihood of the different motions. For instance, an English speaker is more likely to say *I walked to the library* than *I skipped* simply because it would be very rare for the form of locomotion to be skipping. English word frequency counts indicate that *walk* and *run* have a much higher frequency in text than *hop*, *skip*, and *jump* (Baayan, Piepenbrock, & Gulikers, 1995).
5. Japanese does have several other single-word locomotion verbs that did not emerge as dominant for our particular clips, such as *tobu*, which is used for leaping actions.

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