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Human locomotion in languages: Constraints on moving and meaning

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ABSTRACT

The distinctions between *red* and *yellow* or *arm* and *hand* may seem self-evident to English speakers, but they are not: Languages differ in the named distinctions they make. To help understand what constrains word meaning and how variation arises, we examined name choices in English, Dutch, Spanish, and Japanese for 36 instances of human locomotion. Naming patterns showed commonalities largely interpretable in terms of perceived physical similarities among the instances. There was no evidence for languages jointly ignoring salient physical distinctions to build meaning on other bases, nor for a shift in the basis of word meanings between parts of the domain of more vs. less importance to everyday life. Overall, the languages differed most notably in how many named distinctions they made, a form of variation that may be linked to linguistic typology. These findings, considered along with naming patterns from other domains, suggest recurring principles of constraint and variation across domains.

Introduction

To English speakers, the contrasts captured by the words *red* and *yellow*, *bowl* and *plate, arm* and *hand*, or *in* and *on* seem self-evident. This intuition of inevitability is compatible with the idea that the world contains "a series of discontinuities whose structure and content are seen by all human beings in essentially the same ways. . ." (Berlin, 1992, p. 9), and that category names label "intrinsically separate things" (Rosch, Mervis, Gray, Johnson, & Boyes-Braem, 1976, p. 383) (see also Anderson, 1991; Hunn, 1977; Rogers & McClelland, 2004).

But cross-linguistic work shows that these contrasts are not nearly as inevitable as they may feel. Languages often differ in the contrasts they lexicalize, a phenomenon documented for properties (such as colors and tastes), objects (such as plants, animals, and human-made objects), and relations (such as those captured by spatial terms and many verbs) (for review and discussion, see, e.g., Bowerman & Levinson, 2001; Malt & Majid, 2013; Malt & Wolff, 2010). Given the pervasive diversity, one could counter that the world must present few pre-existing distinctions to the observer, and differences between languages may be arbitrary and unpredictable.

Most likely, the truth lies in a middle ground. Many studies documenting variability across languages also uncover commonalities. For instance, languages tend to lexically distinguish walking from running gaits (Malt, Gennari, Imai, Ameel, Tsuda, & Majid, 2008; Vulchanova, Martinez, & Vulchanov, 2012), arms from torsos (Majid,

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Enfield, & van Staden, 2006), and red from black (e.g., Kay, Berlin, Maffi, & Merrifield, 1997). An account of how human experience in the world is mapped onto word meanings must explain both where shared tendencies come from and how variation arises. The current study contributes to such an account using the domain of locomotion, a domain useful in several ways described later.

Constraints on naming patterns: Evidence to date

Contributions of structure in the world

Most work on concepts and categorization in psychology assumes that structure in the world is the key driving force behind how word meanings develop in languages, and that similar named categories would emerge across languages (e.g., Anderson, 1991; Rogers & McClelland, 2004; Rosch et al., 1976). However, these assumptions are rarely tested. In other disciplines, however, researchers have tackled such issues directly. Anthropological research supports the idea that there are cross-cultural commonalities in named distinctions for plants and animals reflecting discontinuities in property distributions between biological genera (see Malt, 1995 for a review; see also Medin & Atran, 1999). Likewise, naming patterns for exemplars of walking and running show shared tendencies across languages that can be linked to the biomechanical gait distinction (Malt et al., 2008), and naming patterns for human body parts (Majid et al., 2006) have shared tendencies linked to segmentation points of the body. In contrast, for color, given the continuous nature of wavelengths, it seems that the input itself lacks discontinuities in structure or content that would explain observed shared tendencies in color naming. In a middle ground, Malt, Sloman, Gennari, Shi, and Wang (1999) found that for household containers, objects that clustered together in an overall similarity space tended to share a name in each language. Some objects did not fall into clusters, though, and their grouping by name differed more across languages. Together, these studies suggest that naming patterns reflect structure in input where it is present, but different domains may present different degrees of structure.

Contributions of the observer

Of course, cognitive processes intervene between world input and language output. There may be a tendency to partition domains in a way that maximizes similarity within categories and minimizes it across categories (Garner, 1974), as seems to be true for color (Jameson, 2005; Regier, Kay, & Khetarpal, 2007) and spatial terms (Khetarpal, Majid, & Regier, 2009). Within this constraint, different partitionings can be formed as long as they carve out contiguous areas of space. This observation raises the question of whether there are shared biases for using certain features to form partitionings, or whether some naming patterns reflect culture- or language-specific choices in the features used.

If there are shared biases toward certain features, one possibility is that they would be linked to how people interact with the domain. Functional or goal-related features are salient in many task contexts (e.g., Kemler Nelson, Egan, & Holt, 2004; Lynch, Coley, & Medin, 2000; Ratneshwar, Barsalou, Pechmann, & Moore, 2001). It is not clear to what extent naming patterns reflect such features. Although named categories for plants or animals in principle could be based on utility (e.g., distinguishing toxic from edible), in fact they tend to be general-purpose (e.g., distinguishing birds from fish and pines from oaks based largely on external morphological features), even in traditional non-industrialized cultures (Berlin, 1992; Hunn, 1977). Behavior and relationships to humans do sometimes come into play but infrequently (e.g., in giving a ritually significant animal a special name; Bulmer, 1967, and in the English garden distinction between *weed* and *flower* which has no botanical basis). Similarly, the work on common household objects (Kronenfeld, Armstrong, & Wilmoth, 1985; Malt et al., 1999; see also Pavlenko & Malt, 2011) suggests that languages mainly draw on combinations of size, shape, material, and other physical attributes such as presence of a handle in naming. Ameel, Malt, and Storms (2008) did, however, find some functional features, along with physical ones, in the feature sets that best predicted use of some Dutch container names. Thus, features related to human interaction, including the functions entities serve and the goals they fulfill, may have a role in naming, but when and to what extent remains unknown.

An alternative possibility is that language focuses mainly on the most temporally enduring and externally visible attributes in lexicalized distinctions, since these may be the most readily perceived. This may not serve well as a general conclusion, either, given evidence from action domains implicating more dynamic properties. Presence or absence of movement along a trajectory over time is basic to the distinction between *hold* and *carry* observed across many languages (Saji et al., 2011). Predictability of the locus of separation was the most important dimension in accounting for named distinctions in acts of cutting and breaking across languages (Majid, Boster, & Bowerman, 2008). Our past study of locomotion on a treadmill (Malt et al., 2008) began with the observation that people switch abruptly from walking to running on a treadmill without transitional states (Diedrich & Warren, 1995). Each gait is characterized by a cluster of co-occurring properties that include its characteristic energy requirements, relative phase of the feet, fraction of the stride for which a given foot is on the ground, stride frequency, and stride length (Alexander, 2002; Bennett, 1992). These property clusters create a pendulum-like motion of the legs with one foot on the ground at all times for walking, and an impact-and-recoil motion of the legs with both feet off the ground at the same time at a point in each stride for running. We found that speakers of English, Dutch, Spanish, and Japanese naming video clips of a person on a treadmill all drew a strict lexical distinction between instances of walking and running. Other overtly manifest dimensions such as speed and direction, as well as inferred dimensions such as effort and goals of the agent (e.g., relaxing, exercising, hurrying, acting purposefully), are more constant across the movement than the biomechanical properties (where, e.g., impact is followed by recoil within a single stride). These dimensions could have served as the basis for named distinctions, but there was no evidence that they did. For