

## Feature centrality: Naming versus imagining

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Being white is central to whether we call an animal a “polar bear,” but it is fairly peripheral to our concept of what a *polar bear* is. We propose that a feature is central to category naming in proportion to the feature’s category validity—the probability of the feature, given the category. In contrast, a feature is conceptually central in a representation of the object to the extent that the feature is depended on by other features. Further, we propose that naming and conceptual centrality are more likely to disagree for features that hold at more specific levels (such as *is white*, which holds only for the specific category of *polar bear*) than for features that hold at intermediate levels of abstraction (such as *has claws*, which holds for all bears). In support of these hypotheses, we report evidence that increasing the abstractness of category features has a greater effect on judgments of conceptual centrality than on judgments of name centrality and that other category features depend more on intermediate-level category features than on specific ones.

The features of a concept differ in their importance in determining whether an instance is a member of a category. Parentage is more important than appearance in determining whether something is a horse (Keil, 1989), and whether something is made of glass is more important than its shape in determining whether it is called a glass or a cup (Kronenfeld, Armstrong, & Wilmoth, 1985). We call such scales of relative importance *centrality*. The main purpose of this paper is to demonstrate that the features that are central for determining the name of an object are not always the features that are central for determining how we think about the object. Naming and thinking about objects impose systematically different demands on the importance that we assign to the objects’ various aspects. More specifically, we describe a condition distinguishing features that show convergence in centrality judgments between naming and conceiving from features that show divergence.

Naming has long been known to place special demands on people, demands that are not necessarily reflected in thought. For example, the naming of everyday objects is sensitive to speakers’ communicative intent (Brown, 1958; Clark & Marshall, 1981). The purpose of linguistic cate-

gories is to help us establish common ground with others—in particular, to identify objects and their properties. This purpose can differ from those of other conceptual tasks. For example, imagining an object might serve a teacher’s purpose of highlighting the internal structure of objects of that type. All such purposes could elicit their own, distinct centrality scales. The specific symbols used to represent variables in an equation might be important for naming it, whereas the relations among the variables might be more important for imagining how to solve it. Therefore, we should expect differences between the featural centralities revealed by naming and by nonlinguistic tasks. Indeed, linguistic categorization and nonlinguistic similarity tasks do cause people to put objects together in different ways (Kronenfeld et al., 1985; Malt, Sloman, Genari, Shi, & Wang, 1999).

The observation that naming is more closely tied to identifying an object, and conceiving more to the object’s internal structure, has led us to the hypothesis that judgments of name centrality and conceptual centrality will converge when the features that identify an instance also play central roles in its internal structure and will diverge when identification features are more peripheral. To measure name centrality, we use judgments of the appropriateness of a name for an object with the target feature missing. To measure conceptual centrality, we use a task that requires access to knowledge not only about an object’s features, but also about how those features depend on one another. In particular, we ask people to judge how easily they can imagine an object with the target feature missing. We will show that this task demands the construction of a representation of the object that satisfies the critical structural relations present in the object category. We suspect that people tend to use visual imagery to ac-

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S.A.S. was supported in part by NIMH Grant MH51271 to Barbara Malt and S.A.S. and in part by a grant from Brown University. W.-K.A. was supported by National Science Foundation Grant NSF-SBR 9515085. We thank Barbara Malt and two anonymous reviewers for their comments on a previous draft and Roman Taraban for asking the penetrating question that sparked this research. S. A. Sloman can be contacted at the Department of Cognitive & Linguistic Sciences, Brown University, Box 1978, Providence, RI 02912 (e-mail: steven\_sloman@brown.edu). W.-K. Ahn can be contacted at the Department of Psychology, Yale University, P.O. Box 208205, New Haven, CT 06520-8205 (e-mail: ahn@pantheon.yale.edu).

comply with the task, but this has no bearing on our hypothesis. We hypothesize that the measures of naming and of conceptual centrality will converge at an intermediate level of categorization—a level often corresponding to Rosch, Mervis, Gray, Johnson, and Boyes-Braem's (1976a) "basic level"—and will diverge at more specific ones. Before spelling out why we predict that these measures will dissociate with varying level of abstraction, we will detail what we mean by naming and conceptual centrality. Subsequently, we will report tests of our hypothesis.

### Name Centrality

The name centrality of a category feature refers to the feature's power to determine the appropriateness of a category label for an object. Having light-colored hair determines whether someone can appropriately be called "blond," and having four doors is central to whether a car can appropriately be called a "four-door sedan." Exceptions can be imagined (a natural blond might dye his or her hair), but the general tendency stands: Cooperative conversation and reference demands that an object referred to by the term *blond* have, or appear to have, or once have had, or have under some special conditions, light-colored hair.

To obtain estimates of a feature's name centrality, we follow Medin and Shoben (1988) in asking participants about an object that is missing that feature. For example, for the label *robin* and the feature *can fly*, we obtain an estimate of name centrality by asking "Suppose an object is in all ways like a robin except that it cannot fly. How appropriate would it be to call this object a robin?"

We propose that a cooperative answer to this question takes into account what a listener will infer if told that this is a robin. Presumably, a listener would infer that the object can fly with a level of certainty approximately proportional to the probability that robins actually can fly. By virtue of providing a label, the speaker is telling a hypothetical listener what to expect of this object. In particular, the speaker is providing probabilistic information about the object's features (cf. Anderson, 1991). So an adequate interpretation of the question is to report a value of name appropriateness that is negatively related to an estimate of the probability of the feature in the category, or what is often called *category validity*. One way for people to arrive at an estimate of category validity is to generate a sample of instances of category *X* (e.g., *robins*) and to estimate the proportion of those instances that have feature *Y* (e.g., *that can fly*). A representative sample would provide for the most accurate estimates; but people may answer the question by using the availability heuristic (A. Tversky & Kahneman, 1973), and hence estimates may be biased. In any case, we propose that judgments of name centrality should be correlated with judgments of category validity.

One consequence of our proposal is that name centrality should be highest in the extreme case of a necessary feature. If a feature always obtains in the presence of an object, the feature is necessary for the object, cat-

egory validity is perfect, and name centrality judgments should be maximal. *Four door* should be judged maximally name central for four-door sedans because it is necessary (strictly speaking, a *four-door sedan* must have four doors). Similarly, if *x* is an American, *x* has U.S. citizenship, and so U.S. citizenship should be name central for the category *American*. In sum, we propose that a feature is central in category naming to the extent that the probability of the feature given the category is high. Below, we test an implication of this proposal.

### Conceptual Centrality: Mutability

Another sense of centrality is conceptual. A feature is central to an object because the feature brings coherence to the mental representation of the object. Having internal organs is central to our concept of *mammal* because we use internal organs and their relations to other mammalian features to make sense of the life cycle, appearance, and activity of mammals (Keil, 1989). Elsewhere, we have used the term *mutability* to refer to measures of conceptual centrality (Sloman, Love, & Ahn, 1998). Features differ by degrees of mutability, the most central being the most immutable. A feature is mutable of an object to the extent that the feature can be mentally transformed without altering the object's mental representation. Tails are mutable with respect to the category of cats because we can easily mentally transform our notion of cat to something that is the same in all respects to cat except that it does not have a tail while we are still thinking about cats.

In previous work, our operationalization of mutability has used a variety of convergent measures. A feature is immutable with respect to an object to the extent that people (1) claim that they would be surprised to encounter the object without the feature; (2) claim that imagining the object without the feature is difficult; (3) rate the object without the feature as atypical of the object category; (4) rate the object without the feature as dissimilar to an ideal instance of the object category; and (5) require time to mentally transform the object to one that does not have the feature (a measure that does not involve a rating). Sloman et al. (1998) and Love (1996) demonstrated convergence among these measures by showing that they were highly correlated. For instance, people's ratings on the following questions about an apple all had roughly equal rankings relative to ratings on analogous questions about other features of apple: (1) How surprised would you be to encounter an apple that did not grow on trees? (2) How easily can you imagine a real apple that does not grow on trees? (3) How good an example of an apple would you consider an apple that does not ever grow on trees? Moreover, the measures did not correlate with other kinds of featural measures. Ratings of centrality did not correlate with ratings of feature salience, such as a feature's degree of prominence (How prominent in your conception of an apple is that it grows on trees?), nor with ratings of feature diagnosticity, like *cue validity*, the probability of the category given the feature (Of all things that grow on trees, what percentage are apples?).

