

Kalish, C. W. (2007). Pragmatic and prescriptive aspects of children's categorization. in C. Kalish & M. Sabbagh (Eds.) *Conventionality in cognitive development: How children acquire shared representations in language, thought, and action. New Directions in Child and Adolescent Development*, No. 115, 39-52. San Francisco: Jossey-Bass.

Headnote:

Categorization judgments may be right or wrong and more or less useful. When a child calls a whale “a fish, “ is she making an error, or just describing a interesting similarity? This essay explores the challenges children face in learning to conform to conventions governing categorization.

The uncertain, unsettled condition of this science of Cetology is in the very vestibule attested by the fact, that in some quarters it still remains a moot point whether a whale be a fish. In his System of Nature, A.D. 1776, Linnaeus declares, "I hereby separate the whales from the fish." But of my own knowledge, I know that down to the year 1850, sharks and shad, alewives and herring, against Linnaeus's express edict, were still found dividing the possession of the same seas with the Leviathan.

Mellville, *Moby Dick – or The Whale*, Chapter 32

Introduction

Categorization is an enormously powerful and flexible cognitive ability. To categorize is to make a connection from one individual or class to another. That connection allows knowledge about familiar cases to be applied to unfamiliar ones. Recognizing that some animal is like a dog allows prediction about its properties and behaviors. Beyond this very general characterization, accounts diverge. In part the diversity of theories reflects the diversity of modes or applications of categorization; to categorize something may involve assigning an identity (“this is a dog”), applying a label (call something a “dog”), or simply noticing a resemblance (this is like a dog). Some accounts of categories emphasize the flexibility and contextual dependence of the connections made. Others emphasize the stable structures underlying the relations observed. Often accounts of categorization are divided into those that are “similarity-based” and those that are “rule-based”. This characterization, although useful for some purposes, implicates many dimensions of difference. One of these dimensions is the degree to which categorization is conventionalized.

For the purposes of this essay, to describe some domain as “conventionalized” means there are prescriptive standards, norms, governing practices in the domain. There are correct and incorrect ways of doing it (whatever “it” is). There is also the further sense that norms are socially constructed (see below). However, it is the prescriptive aspect of conventions that will be the focus here. To what degree is categorization conventionalized? If categorization is “rule-based” then it seems prescriptive: There are right and wrong ways to classify. On the other hand similarity-based categories seem less conventional. Contextual, ad hoc, or similarity-based categorization lacks the normative aspect; categorization is pragmatic or descriptive. The purpose of this chapter is to develop the distinction between pragmatic and prescriptive categorization.

As the contrast between similarity- and rule-based accounts of categorization is particularly significant in the developmental literature, an important set of empirical questions concern just how children come to appreciate the prescriptive structure of categories. Existing research presents an ambiguous picture. Sometimes children appear more pragmatically focused than adults, sometimes it seems young children are more attentive to prescriptive considerations. Recognizing that categories involve both pragmatic and prescriptive aspects carries implications for accounts of category learning. This essay suggests that an important problem facing children, or other novices, is identifying when they are getting pragmatic information and when prescriptive.

Pragmatic Categorization

One way to view categorization is as a relative similarity judgment. To categorize a particular individual as a dog is to decide that it is similar to some representation of the category (e.g., to a prototype or stored exemplars). Similarity is always a matter of degree. Some individuals will be more like dogs than others (Rosch, 1975). There is not a sharp boundary between things that are and are not members of the category: Everything is a dog to some degree. Although similarity-based accounts are often associated with a reliance on perceptual attributes (everything looks like a dog to some degree), there is nothing distinctive about non-perceptual attributes. Larry Barsalou (1993) provides a series of famous examples of ad hoc, or goal-derived categories. “Things to take out of a burning house” need not share any perceptual qualities. Barsalou (1993) also notes the extreme contextual sensitivity of shared category membership. Inside of a burning house, family photos, a cell phone, and the pet canary become similar: The relation between these items is salient and they share category membership. Outside of a burning house it is less clear why the objects would ever be treated as similar. The dimensions along which similarity may be judged are near infinite. For example a poodle may be a dog (because it is similar to known dogs), but so can a capitalist, an unattractive person, or a friend. Categorization based on similarity is a matter of degree and varies contextually.

A categorization decision may reflect the judgment (often implicit) that objects are “similar enough” to be usefully grouped together. Categorization involves focusing on particular dimensions and degree of similarity; selecting some perspective on an object or objects. Under this account, the choice of perspective is pragmatic (Kalish, 2002). It is

often useful to mentally relate cats, canaries, goldfish, and dogs. At other times it is coyotes, wolves, and hyenas that are appropriately categorized with dogs: It depends on the dimensions of similarity one wants to attend to and indicate. The criteria for successful categorization are pragmatic. Does it work to treat some object as a member of a given category? For example, the similarity between dogs and canaries usefully suggests that stores with canary food might also sell dog food. The similarity between dogs and canaries is less useful in predicting which kind of food will be good for a dog. Utility, like similarity, is a variable criterion. Should a whale be categorized with fish, a tomato with fruit, and Pluto as a planet? Depending on one's goals and purposes, maybe or maybe not. The categorization judgment is not so much a judgment of fact as a judgment of utility. To categorize a whale with fish may lead to some erroneous conclusions, it may not work very well. But no categorization will always allow perfect prediction. Poor categorization decisions are inapt or inefficient, not false. Put slightly differently, similarity-based accounts capture a pragmatic or functional mode of categorization.

Prescriptive Categorization

An alternative account holds that categorization judgments concern matters of fact; it is either true or false that a particular individual is a member of a given category. The intuition is that there are criteria for category membership. Traditional accounts held that the criteria were sets of necessary and sufficient conditions. In most cases, though, it is not possible to identify the defining attributes for categorization judgments. Still, people may believe there are such criteria (Medin & Ortony, 1989). The mode of categorization here is not pragmatic, but prescriptive. We can be wrong or right about categories. Our everyday categorization decisions may be based on imperfect information, but those decisions can (at least in principle) be evaluated against the true criteria. To the extent that our categorization judgments diverge from the true criteria, we are making errors. The basis for the prescription is not utility but truth. It may be more useful to treat whales as fish, but that does not make it true that whales really are fish. Conversely, there may be no practical significance (e.g., a layperson's distinction between species of tree, (Putnam, 1982) also Clark, this volume), but still an intuition that there is a correct and incorrect way to categorize. This mode of categorization involves assigning identities (what something is) rather than merely noting similarities (what something is like).

The true criteria that ground prescriptions about categories are often characterized as essences. Essences may be of two types, nominal or real (Locke, 1961/1690). Nominal essences are rules about how things are properly labeled or accorded status. As norms of language, nominal essences are truly conventional- established by some linguistic community. Thus in some communities jade may be appropriately labeled and categorized along with other gems. Other communities may not accord this status; jade is just a mineral like any other. Real essences reflect the actual structure of the world, independent of human convention. That there are "really" two different minerals commonly called "jade" (nephrite and jadeite) is a discovery we make. One distinction is that an individual speaker/categorizer can be mistaken about nominal essences (e.g., can be wrong that jade is/is not a gemstone) but a linguistic community cannot be. Both

individual speakers and entire linguistic communities can be mistaken about real essences (e.g., be wrong that all jade is the same kind of mineral). The rules or prescriptions regarding proper categorization can be socially constructed or empirically discovered.

Modes of Categorization

Categorization is neither solely pragmatic nor solely prescriptive. Sometimes we care about what is useful, sometimes what is true. There are different circumstances or modes of categorization. A mode of categorization is akin to a register in language (Halliday, 1978). The way language is used, and the criteria for evaluating language as appropriate or inappropriate, vary with context. The language of a joke is different from the language of a scientific report, or an intimate conversation. The same idea holds for categorization. Noticing a similarity is different than hypothesizing about underlying causal structure. “Categorization” covers a number of activities with different goals and criteria (as does “language”). The critical point is that different modes may be more or less subject to prescriptive constraints. For example, we do not judge that someone is “wrong” if they notice some non-conventional resemblance between two objects (e.g., a screwdriver is like a chisel). Using one thing as another (chiseling with a screwdriver) may be “not the right way to treat it” but is not strictly an error. Prescriptive constraints are somewhat stronger for applications of labels, but there are many circumstances in which we are accepting of novel usage (e.g., calling a screwdriver a “chisel”). Claims about what something “really is” seem most limited by prescriptive criteria; at least under some accounts, to decide a screwdriver really is a chisel is to make a factual mistake (Bloom, 1996). Each of these behaviors (noticing resemblance, generalizing function, labeling, identifying) is properly described as categorizing, they are different modes of categorizing. Exactly how people balance pragmatic and prescriptive bases for categorization is a largely unexplored question.

The idea that there are different modes of categorization with different emphases on pragmatic and prescriptive considerations has important implications for acquisition and development. Learning to categorize is more than learning particular attributes and associations, it also requires learning the significance of those attributes and associations. Sometimes experience will indicate the prescriptively correct way to categorize. For example, a child might be told, “That’s a screwdriver, not a chisel.” That experience is informative both about pragmatic concerns (e.g., affordances) and about prescriptions (e.g., proper label). Other experiences (e.g., observing an object successfully or unsuccessfully chiseling) need not convey anything prescriptive. This is an important dimension of experience to keep straight. For example, functional categorizations are not evidence for prescriptive. Observing someone chisel with a screwdriver is not the same as being told “this is a chisel.” Some modes of categorization have more prescriptive implications than others.

How do children come to appreciate when categorization is flexible and pragmatic, and when categorization is conventionalized and prescriptive? On the one hand, children are frequently in the position of being corrected and guided in their categories and labels. As they are neither fully-fledged members of their linguistic communities, nor in possession

of adult knowledge of facts about the world, young children may tend to expect there are criteria against which categorization may be evaluated, right and wrong ways of grouping. On the other hand, children's thinking is often characterized as similarity-based. Young children are keeping track of various associations (including those between labels and objects) and building expectations about likely co-occurrences (Smith, Jones, & Landau, 1996). Infants' very early categorization activities do not seem to involve prescriptive criteria. Appreciation of prescriptive criteria must emerge at some point. There are different theoretical perspectives on the significance of prescriptive criteria for categories in children's thinking. The empirical findings are also equivocal.

Pragmatic and Prescriptive Categories in Children' Thinking

Children's thinking is often characterized as unsystematic and ad hoc. Early accounts of categorization emphasized these qualities (Piaget, 1959; Vygotsky, 1962). Young children do not systematically apply rules for categorizing, but rather group things according to shifting associations (Blaye & Bonthoux, 2001). Over- and under-extensions of words can be interpreted in a similar way. When a child calls the moon a "ball" he or she may be reporting a subjective impression (the moon is like a ball) rather than attempting, and failing, to adhere to some conventional usage (Hudson & Nelson, 1984). Young children have been said to have difficulty distinguishing between characteristic and defining features of categories (Keil & Batterman, 1984). Thus features that determine correct categorization are not distinguished from those that are merely typical associates of membership (e.g., being male and being adult are equally important for being an uncle). However, this conflation could make just the opposite point: Characteristic features are taken as significant for determining correct classification.

Another motivation for expecting that young children might be less attentive to prescriptive norms of categorization is a version of the pretense/reality confusion. Pretense is a non-serious mental state, not subject to prescriptive evaluation (i.e., is neither true nor false (Gopnik, 1993).¹ It may not be clear to young children when categorization is meant as serious. To pretend a dog is a footstool, to call it a "footstool," to use it as footstool, and to really believe it is a footstool involve subtle variations in attitude. At least in some cases, activities that adults see serious changes of fact (renaming, changing ownership) are judged as akin to pretense by preschool-aged children (Kalish, Weissman, & Bernstein, 2000). Similarly, young children seem to have different intuitions about the prescriptive significance of ascriptions of function. Adults and older children make a clear distinction between the proper function of an artifact (what it is really, properly, for) and affordances (what something can be used for); the latter are more akin to pretend functions. Preschool-aged children seem to have a less sharp distinction. They are less subject to functional fixedness, more willing to use objects in non-standard ways (German & Defeyter, 2000), and more flexible in how they will assign proper functions (German, this volume). Young children state that the uses to which a naturally occurring object may be put are what that thing "is for" (Kelemen, 1999) suggesting they see the designation as less serious than do adults (though the

different implications of functional designations for children and adults have not been well explored).

An alternative perspective is that young children's categorization is inflexible; they recognize only one way things may be grouped. The classic example is the difficulty of cross-classification. Once a set of objects are classified one way (e.g., by shape) children have difficulty re-classifying (e.g., by color; Zelazo & Resnick, 1991). Categories are often understood as mutually exclusive. A person identified as a mother cannot also be a teacher (Watson, 1984). The same principle may underlie labeling. Once an object has a label, children are said to assume that label is the only (correct) way to identify it (Markman & Wachtel, 1988). Children also have difficulty with figurative uses of language. Understanding metaphor or irony requires appreciating that the utterance is not evaluable against standard prescriptive criteria; it is not meant seriously (Winner, 1988).

Research on psychological essentialism also suggests that young children see categorization as more constrained than do adults. Essentialism implies that category identity is objectively determined; either things share essences or they do not. Preschool-aged children may expect that the categories they encounter in language and practice reflect real natural kinds (Gelman & Kalish, 1993). The extent to which essentialism characterizes adult thinking is a matter of some debate (Sloman & Malt, 2003; Strevens, 2000). There is at least some evidence that adults have a functional or pragmatic view of categories. The ways things are grouped reflect particular interests or goals and people with different goals may, legitimately, categorize differently (Kalish, 2002). Relative to adults, young children are less likely to accept alternative categorization strategies. People in another culture who judge that a lion is the same kind of thing as a dog rather than a cat are wrong from a child's perspective, but different from an adults' (Kalish, 1998). Similarly, young children are often realists about names, asserting there is an objective basis for the labels applied to particular objects (Homer, Brockmeier, Kamawar, & Olson, 2001).

The existing literature suggests that young children's categorization cannot be characterized absolutely pragmatic or absolutely prescriptive. Moreover, recent research on the principle of conventionality in naming suggests that quite young children are adept at coordinating both pragmatic and prescriptive considerations. On the one hand language is a functional tool for managing interactions; what matters is that language users manage to communicate and achieve goals (Tomasello, 1999). On the other hand language is a prescriptive conventionalized system; there are correct and incorrect ways of using language. If two people encounter a novel object they may adopt and use an arbitrary label for that object. The label adopted, however, is not necessarily the correct or conventional one. Recent research suggests that quite young children appreciate both this flexible and conventional aspect of labeling. Children will use an arbitrary label provided by an ignorant speaker, but will not use that label with other speakers and will adopt a new label when they have evidence it is the conventional one (Sabbagh & Baldwin, 2001). Clark (this volume) notes that children interpret recastings of their utterances as implicit corrections ("This is the way to say that"). At the same time, children would seem to appreciate that their non-standard usages are often functional in achieving

communicative goals. Idiosyncratic uses of language may persist. Moreover, although language is rule-governed, it is also flexible enough that there will be many equally correct ways to achieve some communicative goal. Children do not learn to exactly mimic previously successful utterances. Rather they learn a set of conventions governing the expression of pragmatic goals.

One interpretation of the developmental differences is that children and adults disagree about modes of categorization. It is not that young children are generally more or less pragmatic or prescriptive than adults, but that they have different intuitions about how these constraints apply in particular circumstances. For example, if young children consistently adopted an intermediate mode of categorization they would sometimes appear to be overly flexible (too pragmatic) and sometimes overly restrictive (too prescriptive). We know very little about how children interpret different kinds of categorization problems. Perhaps young children do not distinguish between different modes and apply the same pragmatic and prescriptive criteria to all acts of categorization? Brian Viola and I have begun exploring this question by looking at children's intuitions about alternative ways of categorizing.

Distinguishing Modes of Categorization

This study illustrates the idea of modes of categorization with respect to cross-classification. A traditional question might be whether there are developmental differences in appreciating that the same stimulus may be categorized in multiple ways. Our question focused on the contexts in which multiple categorizations occur. Do children accept multiple ways of classifying in some contexts but not others, and do their intuitions coincide with adults'? In particular we focused on the significance of categorizers' goals and interests. In what contexts or modes do people with diverse goals form different categories and in what modes do they form the same categories despite different goals?

Participants in the study were introduced to a set of animals and a set of tools. Each set could be partitioned along two two-valued dimensions (2X2 structure). The animals were kangaroo-like (hopping) mountain dwellers and monkey-like (climbing) forest dwellers. Cross-cutting the "species" category was a temperament dimension; some animals had exposed claws and fanged-grimaces and were described as meaner than others who had smiling expressions and were described as nicer. The tools varied on functional affordances (sharp thin blade for digging, thick rounded bottom for pounding) and material (metal or stone). Pictures of all items were constructed to roughly equate the perceptual salience of the two dimensions. Items were not explicitly labeled (only referred to as animals or tools). Attributes were presented as predicates (e.g., "likes to climb trees", "made of metal"). Participants were 14 four- to five-year-olds and 18 seven- to eight-year-olds.

Participants heard two stories with different goal structures for each set of items. For animals, one story involved a zoo-keeper who wanted to collect and display forest animals. The other story described a pet-store owner who was interested in animals that

would make good pets. For artifacts, the characters were a construction worker with a digging project, and a museum worker who collected metal objects. Stories were presented one at a time in counter-balanced order.

The task involved judging the categorization behavior of the story characters. We probed several different modes of categorization, ranging from largely pragmatic to largely prescriptive. Each question began by identifying one of the items and asked which other item would be treated in the same way. Responses were forced-choices between items matching on one of the two dimensions. The first question described an item the character had and asked which other item the character would also want (e.g., the pet store owner has a nice hopping animal, which other will she also want in her store? A nice hopping animal or mean climbing animal?). The second question asked about labeling. How would the character extend a novel label applied to one of the items? The third question asked about similarity; Which other item would the character say is most like a given item? This question was followed with a question about identity. Are the two items identified as most similar thought to be “really the same kind of thing?”

A straightforward way to analyze performance is to look at how often participants judged that the same object would be categorized differently in the two stories. Figure 1 shows the proportion of cases in which characters with different goals were expected to categorize according to those distinctive goals. Older participants distinguished each of the four categorization modes: They were more likely to judge that characters would want different things than that they would label differently; more likely to expect different labeling than different similarity judgments; and more likely to expect different similarity judgments than different identity judgments (all comparisons $p < .05$, Wilcoxon tests). Younger children also discriminated between the categorization modes: though the comparison between labeling and similarity judgments was not statistically significant, both were intermediate between wanting and kind identity judgments ($p < .05$, Wilcoxon tests). This analysis suggests that older children were making a more fine-grained distinction between categorization modes than were younger children. Moreover, there is some suggestion of an inversion. Older children thought characters were more likely to make the same similarity judgment than to extend labels in the same way. Young children showed a trend in the opposite direction.

The data also speak to the ambiguity described in the research literature: At times young children appear more flexible in their categorization than do older, at times it is the reverse. Younger children were significantly more likely than older children to expect variation in identity judgments, $U(18, 14) = 99$, $p < .05$). Older children were more likely to accept variation in what characters would than were younger children, $U(18, 14) = 80$, $p < .05$). Depending on which mode is involved older children may be more or less focused on people’s pragmatic categorization goals than younger children.

This preliminary study suggests two conclusions. First, young children are fairly adept at appreciating when people might use different strategies for categorizing. They were able to match a person’s goals to the attributes of objects that were most relevant to satisfying those goals. They did this both across individuals (zookeeper vs. pet store owner) and

within individuals across problems (which two animals to keep in the store vs. which two have the same insides). At the same time, they also appreciated some limits on the influence of goals. Even though the pet-store owner was most concerned with animals' dispositions, she would not necessarily call two animals with the same disposition by the same name, or judge them to be of the same kind. One interpretation is that children appreciate there are motives for categorizing that go beyond the pragmatic. In categorizing or labeling people also have the goal of being consistent with conventional or prescriptive criteria, of being right.

Conclusions: How should a thing be categorized?

Children are born with at least some biases and expectations that guide them in ordering their experience. At the same time, much of their knowledge of categories must be gained from experience. In building a system of categories there are two sets of considerations to attend to. First there is the problem of identifying useful patterns; which collections of attributes are predictive of which other attributes? Associations are relevant to pragmatic concerns with prediction and utility. For someone interested in feeding a collection of animals the association between sharp teeth and carnivorous diet is significant and provides a more or less effective way of categorizing the individuals. At the same time there is the problem of learning a system of kinds: What sorts of things are there in the world? There is a defined set of categories and prescriptive criteria for membership. One can be correct or incorrect identifying an animal as an herbivore. Although these two considerations often converge, they do not always do so. That some attribute is predictive or useful does not always mean that it indicates a real kind (what some object "really is"). Identifying the category identity of an object is not always useful in predicting its important attributes. The challenge facing the category learner is balancing and distinguishing these two aspects. When is experience informative about pragmatically significant associations, and when is experience informative about prescriptive kind identity?

One way identify real kinds is to make assumptions about content. Learners may expect that certain attributes are more significant than others. For example, origins and internal parts may be critical for identifying kinds of living things, creator's intent is critical for identifying kinds of artifacts. Intuitions about essential properties may derive from experience of significant associations (Rogers & McClelland, 2004). Alternatively, people may have intuitive theories which provide expectations about inductive potential. For example, shared origins and internal parts would be indicative of shared kind for living things because kinds based on these properties have the greatest (potential) predictive power (Gelman, 2003; Keil, 1989; Markman, 1989). The predictive power of a system of categories may be actual, or potential. However, in both cases the claim is that pragmatic (what is predictive?) and prescriptive (what is it really?) coincide. But is this really the case?

Inductive significance and potential are very difficult to assess. For most people's intents and purposes it is probably more common and useful to generalize from birds to bats, from fish to whales, or from vegetables to tomatoes. The correct category may not be the

most functional one, even potentially. The potential significance of a category depends on the contexts one will face. Most people are likely to interact with living things based on non-essential properties.ⁱⁱ This is clearly the case for artifacts. As recent studies have shown, people accept that the functional properties of an artifact (what it does or can do) may diverge from its true identity. For example, a malformed cup is still a cup, even though it is useless (Kemler Nelson, Herron, & Morris, 2002) because someone made it to be a cup. It is difficult, thought, to see the inductive potential of categories based on creator's intent. Really, what difference does it make what the creator intended? The thing still won't hold water. Making a judgment about the sheer number of inferences that may be drawn does not seem to characterize (all) we are doing when we categorize something.

Inductive power is not sufficient. A system of kinds, principles for identifying what something really is, depends on prescriptive norms (Kalish, 1998). The basis for the norms may be natural. Kinds may be expected to conform to the way the world really is, and we have experts to figure out the right ways to categorize. The basis for other categorization norms may be conventional. Some authority stipulates what counts (21-year-olds are adults, a fair ball hit out of the park is a home-run), and categorization should conform to that decision. Inductive potential may (partially) motivate establishment of the norms, but that one way of categorizing is the most useful is neither necessary nor sufficient for it being the right way. Minimally, we have to ask, "Useful to whom?" (Kalish, 2002). For example, the considerations that make it more useful to categorize tomatoes with fruit, or pandas with raccoons are not available to most of us (see Clark, this volume). These are expert concerns and criteria. Yet for at least some modes of categorization, expert interests become the norm. It is not whether some way of categorizing is most useful to me that determines its correctness, but rather, whether it is most useful to some authority. Thus learning how to categorize is a somewhat more complicated problem than it might appear. Children cannot simply keep track of inductive success, or even inductive potential.

In learning the pragmatic and prescriptive features of categories it is critical to be sensitive to different registers or modes of categorization. Seeing two objects used in the same way, observing some common features, learning they receive the same label, and hearing them called the same kind all convey different information. In studying how children acquire categories we should ask how and when children are sensitive to these differences: How do they identify when experience is relevant to pragmatic (predictive) and when to prescriptive (what something is) categorization?

The problem of learning how to categorize is an instance of the more general problem of learning about prescriptions. As all the papers in this volume point out, in different ways, it is problematic to move from experience of what is to representations of what ought to be. The frequency of some behavior or outcome (e.g., one object being used or named like another) and the utility of the behavior are not infallible guides to correct behavior. Categorization is an interesting case because it so often, and importantly, characterized as a descriptive process. What matters is learning the associations between features of experience (Rogers & McClelland, 2004). However, there is also the prescriptive goal of

keeping one's representations consistent with real and/or socially-constructed systems of categories. In learning to categorize, as in many other aspects of life, what is useful is not always right, and what is right is not always useful.

Notes:

ⁱ Interpersonal pretense is subject to a conventional evaluation. Two people pretending may agree how a certain object is to be treated. See Rackozy, this volume.

ⁱⁱ In this light, recent work on nature experts is informative. People who live and/or work close to nature often use ecological relations as bases for inductive generalizations, rather than taxonomic relatedness (Medin & Atran, 2004). Yet, these experts do seem to take taxonomic properties as constitutive of shared kind. However, it is not clear that we have the necessary studies to distinguish pragmatic and prescriptive categorization.

References

- Atran, S. (1995). Causal constraints on categories and categorical constraints on biological reasoning across cultures. In Anonymous (Series Ed.), Eds.), & D. Sperber & D. Premack (Eds.), *Causal cognition: A multidisciplinary debate. Symposia of the fyssen foundation* (pp. 205-233). New York, NY, USA: Clarendon Press/Oxford University Press.
- Barsalou, L. W. (1993). Flexibility, structure, and linguistic vagary in concepts: Manifestations of a compositional system of perceptual symbols. In A. F. Collins, S. E. Gathercole & et al. (Eds.), *Theories of memory* (pp. 29-101). Hillsdale, NJ, England: Lawrence Erlbaum Associates, Inc.
- Blaye, A., & Bonthoux, F. (2001). Thematic and taxonomic relations in preschoolers: The development of flexibility in categorisation choices. *British Journal of Developmental Psychology*, **19**, 395.
- Bloom, P. (1996). Intention, history, and artifact concepts. *Cognition*, **60**, 1-29.
- Gelman, S. A. (2003). *The essential child: Origins of essentialism in everyday thought*. Oxford; New York: Oxford University Press.
- Gelman, S. A., & Kalish, C. W. (1993). Categories and causality. In R. Pasnak & M. L. Howe (Eds.), *Emerging themes in cognitive development*, (pp. 3-32). New York: Springer-Verlag.
- German, T. P., & Defeyter, M. A. (2000). Immunity to functional fixedness in young children. *Psychonomic Bulletin & Review*, **7**, 707.
- Gopnik, A. (1993). How we know our minds: The illusion of first-person knowledge of intentionality. *Behavioral & Brain Sciences*, **16**, 1-14, 29-113.
- Halliday, M. A. K. (1978). *Language as social semiotic: The social interpretation of language and meaning*. London: Edward Arnold.
- Homer, B. D., Brockmeier, J., Kamawar, D., & Olson, D. R. (2001). Between realism and nominalism: Learning to think about names and words. *Genetic, Social, & General Psychology Monographs*, **127**, 5.
- Hudson, J., & Nelson, K. (1984). Play with language: Overextensions as analogies. *Journal of Child Language*, **11**, 337.
- Kalish, C. W. (1998). Natural and artifactual kinds: Are children realists or relativists about categories? *Developmental psychology*, **34**, 376-391.
- Kalish, C. W. (2002). Essentialist to some degree: Beliefs about the structure of natural kind categories. *Memory & Cognition*, **30**, 340-352.
- Kalish, C. W., Weissman, M., & Bernstein, D. (2000). Taking decisions seriously: Young children's understanding of conventional truth. *Child Development*, **71**, 1289-1308.
- Keil, F. C. (1989). *Concepts, kinds, and cognitive development*: The MIT Press.
- Keil, F. C., & Batterman, N. (1984). A characteristic-to-defining shift in the development of word meaning. *Journal of Verbal Learning & Verbal Behavior*, **23**, 221-236.
- Kelemen, D. (1999). The scope of teleological thinking in preschool children. *Cognition*, **70**, 241.

- Kemler Nelson, D. G., Herron, L., & Morris, C. (2002). How children and adults name broken objects: Inferences and reasoning about design intentions in the categorization of artifacts. *Journal of Cognition and Development*, **3**, 301-332.
- Locke, J. (1961/1690). *An essay concerning human understanding* (Vol. III). London: J.M. Dent & Sons.
- Markman, E. (1989). *Categorization and naming in children*. Cambridge, MA: MIT Press.
- Markman, E. M., & Wachtel, G. F. (1988). Children's use of mutual exclusivity to constrain the meaning of words. *Cognitive Psychology*, **20**, 121.
- Medin, D. L., & Atran, S. (2004). The native mind: Biological categorization and reasoning in development and across cultures. *Psychological review*, **111**, 960-983.
- Medin, D. L., & Ortony, A. (1989). Psychological essentialism. In S. Vosniadou & A. Ortony (Eds.), *Similarity and analogical reasoning*. (pp. 179): Cambridge University Press.
- Piaget, J. (1959). *The language and thought of the child*. New York: Humanities Press.
- Putnam, H. (1982). *Reason, truth, and history*. New York: Cambridge University Press.
- Rogers, T. T., & McClelland, J. L. (2004). *Semantic cognition: A parallel distributed processing approach*. Cambridge, MA: MIT Press.
- Rosch, E. (1975). Cognitive representations of semantic categories. *Journal of Experimental Psychology: General*, **104**, 192-233.
- Sabbagh, M. A., & Baldwin, D. A. (2001). Learning words from knowledgeable versus ignorant speakers: Links between preschoolers' theory of mind and semantic development. *Child Development*, **72**, 1054-1070.
- Sloman, S. A., & Malt, B. C. (2003). Artifacts are not ascribed essences, nor are they treated as belonging to kinds. *Language and Cognitive Processes*, **18**, 563.
- Smith, L. B., Jones, S. S., & Landau, B. (1996). Naming in young children: A dumb attentional mechanism? *Cognition*, **60**, 243-171.
- Stevens, M. (2000). The essentialist aspect of naive theories. *Cognition*, **74**, 149.
- Tomasello, M. (1999). The human adaptation for culture. *Annual Review of Anthropology*, **28**, 509.
- Vygotsky, L. S. (1962). *Thought and language*. Cambridge, MA: MIT Press.
- Watson, M. W. (1984). Development of social role understanding. *Developmental Review*, **4**, 192.
- Wellman, H. M., & Gelman, S. A. (1992). Cognitive development: Foundational theories of core domains. *Annual Review of Psychology*, **43**, 337-375.
- Winner, E. (1988). *The point of words: Children's understanding of metaphor and irony*: Harvard University Press

CHARLES W. KALISH is Professor of Educational Psychology at the University of Wisconsin-Madison. His work addresses the development of inductive inference. He is especially interested in the role of norms in social explanation and prediction.

Figure 1: Judgments that people with different goals will categorize differently

