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Psychological essentialism in children

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Psychological essentialism is the idea that certain categories, such as 'lion' or 'female', have an underlying reality that cannot be observed directly. Where does this idea come from? This article reviews recent evidence suggesting that psychological essentialism is an early cognitive bias. Young children look beyond the obvious in many converging ways: when learning words, generalizing knowledge to new category members, reasoning about the insides of things, contemplating the role of nature versus nurture, and constructing causal explanations. These findings argue against the standard view of children as concrete thinkers, instead claiming that children have an early tendency to search for hidden, non-obvious features.

Why do preschool children often insist that mothers can't be firefighters? Why do adults who were adopted in infancy sometimes search for their birth parents? Why do art collectors pay more money for an original painting than for an exact copy? These examples, although widely varying in content, can be understood within a framework of psychological essentialism.

Essentialism is the view that certain categories have an underlying reality or true nature that one cannot observe directly but that gives an object its identity, and is responsible for other similarities that category members share [1,2]. In the domain of biology, an essence would be whatever quality remains unchanging as an organism grows, reproduces, and undergoes morphological transformations (baby to man; caterpillar to butterfly). In the domain of chemistry, an essence would be whatever quality remains unchanging as a substance changes shape, size, or state (from solid to liquid to gas).

Essentialist accounts have been proposed and discussed for thousands of years, extending back at least to Plato's cave allegory in *The Republic*. Numerous fields, including biology, philosophy, linguistics, literary criticism, and psychology, stake claims about essentialism. Here we are concerned with essentialism as a *psychological* claim (see [Box 1](#)). Although there are serious problems with essentialism as a metaphysical doctrine, recent psychological studies converge to suggest that essentialism is a reasoning heuristic that is readily available to both children and adults [3]. This article reviews such evidence, and discusses the implications for human concepts.

Evidence for psychological essentialism

Fodor argued that essentialism is the outgrowth of modern scientific and technological knowledge, with its corresponding focus on non-obvious constructs such as genes and chromosomes [4]. Children provide a critical test case of this idea precisely because they lack detailed scientific knowledge. If essentialism requires knowledge of modern science and technology then it should emerge relatively late in development. By contrast, if essentialism can be found in preschool children then this would imply that the doctrine is likely to have a more fundamental basis.

What would be evidence for essentialism, in children or adults? Medin and Ortony suggest that essentialism is a 'placeholder' notion: one can believe that a category possesses an essence without knowing *what* the essence is [2]. For example, a child might believe that there exist deep, non-visible differences between males and females, but have no idea just what those differences are. The essence placeholder would imply that categories permit rich inductive inferences, capture underlying structure (in the form of causal and other non-obvious properties), have innate potential, and have sharp and immutable boundaries. I have detailed at length elsewhere the evidence that preschool children expect certain categories to have all of these properties [3]. It is beyond the scope of this article to review the full range of evidence here. However, I briefly summarize below some of the major findings.

Inductive potential

Induction is the capacity to extend knowledge to novel instances, for example, inferring that a newly encountered mushroom is poisonous on the basis of past encounters with other poisonous mushrooms. This capacity is one of the most important functions of categories [5]. Categories serve not only to organize the knowledge we have already acquired but also to guide our expectations. Young children's category-based inferences are consistent with essentialism in two respects. First, children readily infer properties that concern internal features and non-visible functions from one category member to another. Second, children draw inferences even when category membership competes with perceptual similarity.

Figure 1 provides an example from a set of studies conducted some years ago by Gelman and Markman [6,7]. The leaf (Figure 1a) and the leaf-insect (Figure 1c) have overall similarity: both are large and green, with striped markings, and share overall shape. However, if told the category membership of each of the three items – (a) 'leaf',

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Box 1. Defining essentialism

The words 'essence' and 'essentialism' are used loosely by a range of scholars to mean a wide range of things. Three factors jointly serve to map out the various types of essentialism [43].

Where is the essence located?

Is it in the world (*metaphysical essentialism*) or in human representations (*representational essentialism*)? The former is a philosophical position concerning objective reality; the latter addresses how people construe reality (in their belief systems, language, and cultural practices). Essentialism faces difficulties as a characterization of the natural world [2]. Social categories, such as race and caste, have no true underlying essence [17,21]. Biological species also are without an essence because they evolve and are population-based rather than reflecting properties inherent in each individual [44,45]. Furthermore, whereas essentialism implies that there is a single appropriate classification for each organism, there might in fact be numerous valid classifications [46]. The essentialist view therefore seems to be a human construction rather than a perceived reality.

What is the ontological type of an essence?

Is it *sortal* (serving to define categories), *causal* (having consequences for category structure), or *ideal* (having no real-world instantiation)?

The sortal essence is the set of defining characteristics that all and only members of a category share. On this view the essence of a grandmother would be the property of being the mother of a person's parent (rather than accidental properties such as having gray hair). The viability of this account has been called into question by models of concepts that stress the importance of probabilistic features, exemplars, and theories in concepts [38].

The causal essence is the substance, power, quality, process,

relationship, or entity that causes other category-typical properties to emerge and be sustained, and that confers identity. For example, the causal essence of tigers might be something like tiger DNA, which is responsible for various observable properties that tigers have. The cluster of properties 'striped, ferocious, and large' is not a causal essence of tigers, despite being true of all (or most) members of the category, because the properties lack causal force.

The ideal essence is assumed to have no actual instantiation in the world. For example, on this view the essence of 'goodness' is some pure quality that is imperfectly realized in real-world instances of people performing good deeds. Plato's cave allegory, in which what we see of the world are mere shadows of what is real and true, exemplifies this view. The ideal essence contrasts with both the sortal and the causal essences, which concern qualities of real-world entities.

What degree of specificity is entailed?

Are essences *specific* (their particulars known and identified) or *placeholder* (their particulars unknown and perhaps unknowable)? Specific essentialism posits that a category essence is known and contributes to the meaning and use of a category label (e.g. H₂O for water), whereas placeholder essentialism suggests that a person believes that there is *some* causal essence that holds a category together, without knowing just what that essence is (e.g. that all samples of water share some inherent, non-obvious property). Although placeholder essentialism would typically be insufficient to determine word extensions, it has implications for people's beliefs regarding the depth and stability of a concept.

In this article, the focus is on representational, causal, placeholder essentialism.

(b) 'bug', (c) 'bug' – and asked to draw novel inferences about the leaf-insect, children rely on the category membership conveyed by the label. Once children learn a new fact about one member of a category, they generalize the fact to other members of that category, even if the two category members look substantially different. This effect holds up for animals (*bird, fish, rabbit*), for natural substances (*gold, cotton*), and for social categories (*boy, girl, smart, shy*) [8,9]. It is found when using three-dimensional objects as well as drawings [10]. The effect is found with adults as well as children [6,11]. Even 1- and 2-year-old children draw category-based inferences about atypical instances [12,13]. Thus, the appreciation that words can signal non-obvious properties seems in place at the very start of word learning.

By 4 years of age, children display subtlety and flexibility regarding when they do and don't make category-based inductive inferences [3]. They do not use a simple matching strategy, in which they extend properties only when two items share identical labels. The effect emerges not only with familiar labels, although not

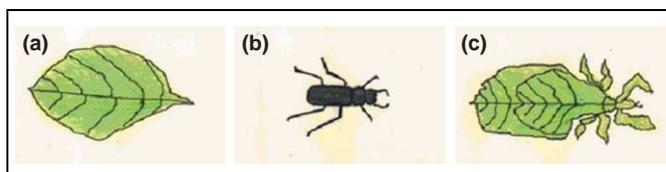


Figure 1. Sample item set used in studies with preschool children [6,7]. The item sets were constructed so that overall similarity (in shape and color) was pitted against shared category membership. This set comprised (a) a leaf, (b) a beetle, and (c) a leaf-insect. When 3- and 4-year-old children heard labels for these items ('leaf', 'bug', and 'bug', respectively), they were more likely to extend new information on the basis of shared label than on the basis of overall similarity.

uniformly with all labels. The explanation that accounts most satisfactorily for the varied patterns of data is that children assess the extent to which entities are members of the same category (often conveyed via a label or phrase, although not necessarily), and independently assess the extent to which the property in question is a relatively enduring (versus temporary or accidental) feature (but see [14] for debate). Category-based induction results only when the entities belong to a category and the property is relatively enduring. When other causal mechanisms are known and available, however, category-based induction seems to be less frequent [5].

Innate potential

One of the most important kinds of evidence for essentialism is the belief that properties are fixed at birth, that is, that an organism displays innate potential. Details vary, but the basic paradigm to test this notion is as follows: children learn about a person or animal that has a set of biological parents, but is switched at birth to a new environment and a new set of parents. Children are then asked to decide whether the birth parents or the upbringing parents determine various properties.

For example, in one item set, children learned about a newborn kangaroo that went to live with goats, and were asked whether it would be good at hopping or good at climbing, and whether it would have a pouch or no pouch [15]. Preschool children typically reported that it would be good at hopping and have a pouch. Even if it cannot hop at birth (because it is too small and weak), and is raised by goats that cannot hop, and never sees another kangaroo, hopping is inherent to kangaroos. Therefore this property

will eventually be expressed. Although there is debate as to when precisely this understanding emerges [16], on a conservative estimate it appears by about 6 years of age, and in some studies as early as age 4 years. This is so when children reason about animal categories, plant categories, and social categories [3,17,18]. Intriguingly, for some categories children are more nativist than adults. For example, 5-year-olds predict that a child who is switched at birth will speak the language of the birth parents rather than the adoptive parents [19]. The degree to which a nativist bias is expressed varies across cultures, but Torguud adults in Western Mongolia [20], adults in India [21], Vevo children in Madagascar [22], and Itzaj Maya adults and children in Mexico [23] all display a nativist bias.

Underlying structure

Underlying structure can be seen in the importance children grant to causality, and to non-obvious features. By 2 years of age children view causes as vital to what something is. Features that are causes are more core than non-causal features [24]. Causes are more important than mere associations; causes are also more important than effects [25]. Furthermore, features that are causally coherent (meaning that they fit together in an explanatory framework) are weighted more heavily than features that are equally available but not participating in a network of causal explanations. Recent work with adults details more formally the importance of causality in adults' concepts [26,27].

Causality is further central to children's categories in that children provide consistent, domain-specific causal explanations for the properties that members of a category share. Even 3-year-olds attribute an animal's actions to the animal itself, rather than to an external force (inherent cause) [28]. By 4 years of age, children appeal to 'energy' as a causal force [3,29]. By 8 years of age,

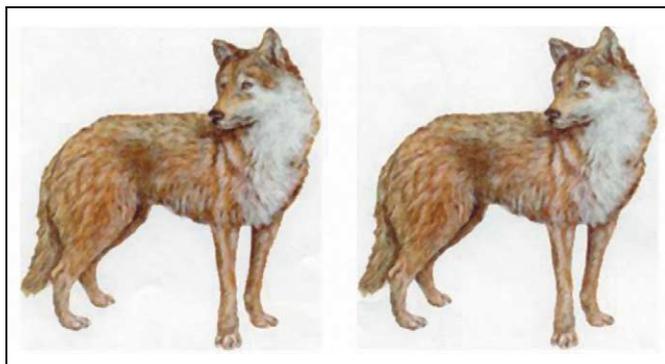


Figure 2. Sample item used to study what procedures children deem relevant when determining ambiguous category membership (Lizotte and Gelman, reported in [3]). Five-year-olds and college students saw a series of trials depicting a pair of items that looked nearly identical. They were told that the two items differed in some respect (e.g. one was a dog and one was a wolf; or one was an animal and one was a toy), and that their job was to figure out which item was which. They were asked to decide (yes/no answers) whether checking any of the following would be informative procedures: insides, origins/parentage, behaviors, or age. The results indicated that children and adults believe that the items can be distinguished by a wide range of means: not just by external behaviors but also by internal properties and origins. Five-year-olds and adults reported that origins and insides are important clues as to which of two seemingly identical animals is a dog or a wolf, although it is unlikely that they could say specifically how the insides of dogs and wolves differ.

children attribute actions and growth to an animal's 'insides'.

Children also privilege internal, non-obvious properties in their categories (see Figures 2 and 3). By 4 or 5 years of age, children often recognize that an animal cannot be transformed into another kind of thing (for example, a raccoon cannot become a skunk). Instead, category membership is stable over striking transformations [15,30]. Also, non-obvious properties, especially internal properties, appear to be salient to young children and are privileged in their determinations of what things are [15]. This finding appears not only among middle-class children in the US, but also in middle-class and Favela-dwelling children in Brazil [31].

Summary

The studies reviewed here suggest that both preschool children and adults from a variety of cultural contexts expect members of a category to be alike in non-obvious ways. They treat certain categories as having inductive potential, an innate basis, stable category membership, and sharp boundaries between contrasting categories. These beliefs are not the result of a detailed knowledge base, nor are they imparted directly by parents [32], although language might play an important indirect role (see Box 2). Instead, they appear early in childhood with relatively little direct prompting.

What psychological essentialism implies about children

Childhood essentialism poses a challenge to more traditional theories of children's concepts, which have emphasized their focus on superficial, accidental, or perceptual

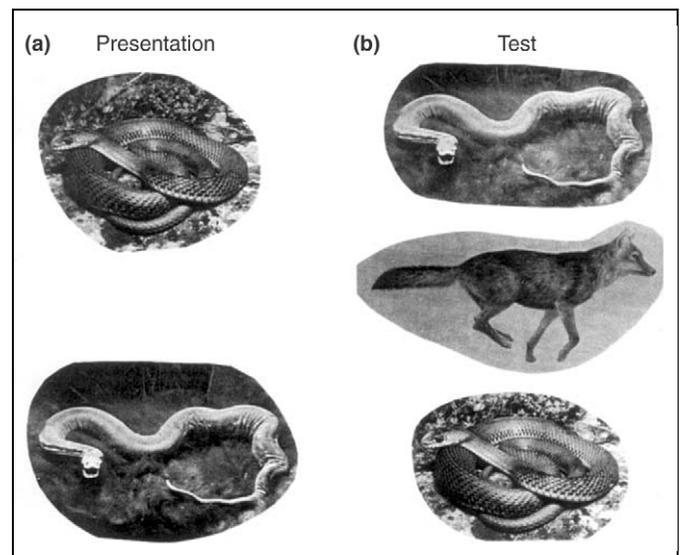


Figure 3. Sample items used in a study examining the role of internal parts in directing children's word learning [31]. (The original items were in color.) (a) Brazilian and US 4-year-old children learned a new word referring to a novel sub-type of a familiar category; for example, 'zava' for the snake in the bottom panel of (a), and were then asked to find the snake(s) and the zava(s) from among the three pictures in (b). Children who heard that the two animals in (a) shared internal similarities (e.g. have the same kind of bones, blood, muscles and brain) were more likely to learn the new word correctly (as a sub-type of snake) than children in a control condition who heard that the two animals shared superficial similarities (e.g. are the same size, and live in the same zoo in the same kind of cage). Children in the control condition were instead more likely to interpret the two labels (e.g. snake and zava) as mutually exclusive. Reproduced with permission from [31].

Box 2. Language and essentialism

The language that is used to express membership in a category can influence children's judgments about that category. *Count nouns* imply that a category is relatively more stable and consistent over time and contexts than adjectives or verbal phrases. For example, in one study [47], 5- and 7-year-old children first learned about a set of individuals with either a count noun ('Rose is 8 years old. Rose eats a lot of carrots. *She is a carrot-eater.*') or a verbal phrase ('Rose is 8 years old. Rose eats a lot of carrots. *She eats carrots whenever she can.*'). They were then probed for how stable they thought this category membership would be across time and different environmental conditions (e.g. 'Will Rose eat a lot of carrots when she is grown up?' 'Would Rose stop eating a lot of carrots if her family tried to stop her from eating carrots?'). Children who heard the count noun were more likely than children who heard the verbal phrase to judge that the personal characteristics would be stable over time and

adverse environmental conditions. (For other examples of noun-labeling effects, see also [12,13,48–50].)

Generic noun phrases express essential qualities and imply that a category is coherent and permits category-wide inferences [51]. When 4-year-old children hear a new fact in generic form (e.g. 'Bears have three layers of fur'), they treat this fact as typically true of most or all category members [52]. Generic nouns are plentiful in the speech that children hear [32,53], and children are highly sensitive to cues that mark genericity [54–56].

Additionally, there are language-specific devices that convey essentialism. For example, young Spanish-speaking children make inferences about the stability of a category based on which form of the verb 'to be' is used to express it (*ser* versus *estar*; [57]). Although it is unlikely that language is the source of psychological essentialism, it provides important cues to children regarding *when* to treat categories as stable and having an intrinsic basis [3].

features. At the extreme, Piaget and his colleagues suggested that children are incapable of forming 'true' concepts [33]. Likewise, many scholars have proposed one or another developmental dichotomy: from concrete to abstract, from surface to deep, from perceptual to conceptual. On the contrary, there are remarkable commonalities between the concepts of children and those of adults. Some scholars still maintain that developmental dichotomies might exist earlier in development (e.g. from 1–2 years, instead of from 5–7 years [34], but see [35]).

However, essentialism does not posit that perceptual features or similarity are unimportant to early concepts. Even within an essentialist framework, appearances provide crucial cues regarding an underlying essence. Similarity appears to play an important role in fostering comparisons between representations and hence discovery of new abstractions and regularities [36]. Rather than suggesting that human concepts overlook perception or similarity, essentialism carries with it the assumption that a category has two distinct, although interrelated, levels: the level of observable reality and the level of explanation and cause.

It is this two-tier structure that might serve to motivate further development, leading children to develop more sophisticated understandings. Most developmental accounts of cognitive change include something like this structure, such as equilibration, competition, theory change, analogy, or cognitive variability (see [3] for review). In all these cases, as with essentialism, children consider contrasting representations. When new evidence conflicts with the child's current understanding, this can lead the child gradually to construct new representations. Indeed, targeted interventions that introduce a non-obvious similarity between dissimilar things can lead to dramatic change in children's concepts [37]. Perhaps not surprisingly, then, children look beyond observable features when trying to understand the categories of their world. In positing a reality beyond appearances, the search is on for more information, deeper causes, and alternative construals.

What psychological essentialism implies about concepts

There is an idealized model of categorization that has formed the basis for much work in psychology. Standard

theories of concepts have been based on considering which known properties are most privileged, and in what form. By contrast, essentialism tells us that known properties do not constitute the full meaning of concepts. Concepts are also open-ended. They are in part placeholders for unknown properties.

Historically, it has often been assumed that there is a single, unitary process of categorization [38]. Yet essentialism makes clear that categorization cannot be said to be a single thing. Categorization serves many different functions, and we recruit different sorts of information depending on the task at hand. Rapid identification calls for one kind of process; reasoning about genealogy calls for another. Task differences yield different categorization processes [39]. Even when the task is restricted to object identification, people make use of different sorts of information depending on the task instructions [40]. Two separate categorization procedures, rule application and judging similarity to an exemplar, can readily apply to the same categories, although they activate different neural regions in the adult brain [41]. Domain is also an important consideration. Although essence-like construals can be found in concepts of artwork and artifacts [42], essentialism is found most often with natural kinds and certain social categories. Categories such as *penguin* or *apple tree* imply inherent non-obvious properties, inductive potential, and innate commonalities not found with categories like *window* or *crayon*.

Because essentialism is found early in childhood, all of the points discussed above must be operating in quite basic and fundamental ways. In other words, we cannot simply assume that these are frills added on top of basic or standard categorization.

Conclusion

Recent work has shown that preschool children treat a variety of natural categories as having substantial inductive potential, innate properties, and underlying structure. Related to this, there are several important aspects to children's concepts from very early in life, including placeholder notions, theory-based properties, category and task variability, and interdependence of categorization and other cognitive processes. More generally, these findings overturn assumptions about what is

Box 3. Alternative accounts

Although the data reviewed in this article are consistent with psychological essentialism in children, they fall short of providing direct evidence. Children do not explicitly articulate an essentialist perspective, and the word 'essence' probably does not enter the vocabulary until well into school-age years. Nor can we say with any precision what the essence of, say, a dog or a tree is to a child. Perhaps, then, essentialism is unnecessary, and we should instead refer to the component phenomena discussed earlier (e.g. categories have inductive potential; causal features are central to categories).

One reason to frame these results in terms of essentialism is parsimony: a range of phenomena that co-occur within a relatively brief developmental span seem to be instantiations of a single broader principle. This argument, however, requires a closer empirical foundation. More fine-grained analysis will be needed to discover how tightly linked these various phenomena are, both in adult cognition and in development (see [58] for an excellent start). A second consideration is the existence of explicit essence formulations among adults in varied cultures [3]. By treating people's implicit construals as essentialist, a common framework covers both the explicit and the implicit phenomena.

Even if essentialist phenomena can reasonably be considered interrelated, this does not mean that the concept is indivisible. Indeed, psychological essentialism appears to have two related although separable assumptions: (a) a *kind* assumption, that people treat certain categories as richly structured 'kinds' with clusters of correlated properties; and (b) an *essence* assumption, that people believe a category has an underlying property (essence) that cannot be observed directly but that causes the observable qualities that category members share.

The major difference between kind and essence is that the latter

incorporates the former and adds to it the idea that some part or quality (i.e. the essence) *causes* the properties shared by the kind. In the literature, the two notions have often been treated as interchangeable. However, categories can be bound together in crucial ways without considering the causal basis of the kind. In an important argument, Strevens [59] suggests that the data taken as evidence for psychological essentialism could instead be accounted for if people simply assume that there are causal laws connecting kind membership with observable properties. He terms such causal laws 'K-laws' (kind laws), and his alternative formulation the 'Minimal Hypothesis'. Strevens's account, although eschewing essentialism, overlaps with the current model in emphasizing that people treat surface features as caused and constrained by deeper features of concepts.

Developmentally, a notion of kind might precede a notion of essence. Evidence for use of kinds is present by age 2 years (in children's inductive inferences), but evidence for appeal to an essence (e.g. with the switched-at-birth method) has so far not appeared below age 4 years. An important direction for future research would be to use converging methods to try to distinguish 'kind' from 'essence' at different points in development. Nonetheless, something more than the Minimal Hypothesis might be required to account for essentialist-like behavior in children aged 4 years and over [60].

There are additional issues that are beyond the scope of this article but nonetheless important to mention. Some scholars have argued that essentialism cannot account for a variety of experimental findings with adults [61–64]. For example, the extent to which different liquids are judged to be water is independent of the extent to which they share the purported essence of water, H₂O. Whether these findings undermine (or even conflict with) psychological essentialism is a matter of current debate [3,39].

Box 4. Questions for future research

- How coherent are essentialist beliefs? Do different strands (e.g. nativism, inductive potential, boundary intensification) all 'hang together', or do they develop piecemeal? Is there a single essentialist 'stance' [65], or is it the amalgamation of a variety of other tendencies [3]?
- Why do children (and adults) essentialize? Some existing proposals include the following: an innate, domain-specific module for reasoning about biological species [23]; a domain-general consequence of sortals and count nouns [44]; the convergence of a variety of other early-emerging capacities needed for conceptual growth in childhood [3].
- We know that non-verbal and preverbal organisms categorize [34], but do non-verbal and preverbal organisms also treat categories as having a non-obvious basis? If so, how could we tell? If not, why not?

- How does essentialism change with the acquisition of more detailed scientific knowledge? Does essentialism disappear with the acquisition of a scientific theory, or do the two frameworks co-exist in adult reasoning? Lay adults' conceptual difficulties with evolutionary theory and genetics argue against true conceptual reorganization [66].
- Can certain inputs reduce children's reliance on essentialism? If so, of what sort?
- Are there stable individual differences in essentialism, and if so, what is the source of such differences [67,68]? Are individual differences in essentialism related to individual differences in stereotyping? How does essentialism differ from other related notions, including stereotyping and entitativity [69]?
- Is essentialism found in the same way and to the same extent across cultures, or is there systematic variation [70]?

simple or basic in human concepts. I have provided a framework of 'psychological essentialism' to account for these data (although see Box 3 for alternative accounts and debates). Ongoing research examines developmental antecedents in infancy, how best to understand the relation between perceptual and conceptual information in children's categories, and modeling these representations in formal terms [24,26,27] (see Box 4).

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References

- 1 Locke, J. (1671/1959) *An Essay Concerning Human Understanding* (Vol 2), Dover

- 2 Medin, D.L. and Ortony, A. (1989) Psychological essentialism. In *Similarity and Analogical Reasoning* (Vosniadou, S. and Ortony, A. eds), pp. 179–195, Cambridge University Press
- 3 Gelman, S.A. (2003) *The Essential Child: Origins of Essentialism in Everyday Thought*, Oxford University Press
- 4 Fodor, J. (1998) *Concepts: Where Cognitive Science Went Wrong*, Oxford University Press
- 5 Medin, D.L. et al. (2003) A relevance theory of induction. *Psychon. Bull. Rev.* 10, 517–532
- 6 Gelman, S.A. and Markman, E.M. (1986) Categories and induction in young children. *Cognition* 23, 183–209
- 7 Gelman, S.A. and Markman, E.M. (1987) Young children's inductions from natural kinds: the role of categories and appearances. *Child Dev.* 58, 1532–1541
- 8 Heyman, G.D. and Gelman, S.A. (2000) Preschool children's use of novel predicates to make inductive inferences about people. *Cogn. Dev.* 15, 263–280
- 9 Heyman, G.D. and Gelman, S.A. (2000) Preschool children's use of traits labels to make inductive inferences. *J. Exp. Child Psychol.* 77, 1–19
- 10 Deák, G. and Bauer, P.J. (1996) The dynamics of preschoolers' categorization choices. *Child Dev.* 67, 740–767

- 11 Yamauchi, T. and Markman, A.B. (2000) Inference using categories. *J. Exp. Psychol. Learn. Mem. Cogn.* 26, 776–795
- 12 Jaswal, V.K. and Markman, E.M. (2002) Children's acceptance and use of unexpected category labels to draw non-obvious inferences. In *Proceedings of the 24th Annual Conference of the Cognitive Science Society* (Gray, W. and Schunn, C. eds), pp. 500–505, Erlbaum
- 13 Graham, S.A. et al. (2004) Thirteen-month-olds rely on shared labels and shape similarity for inductive inferences. *Child Dev.* 75, 409–427
- 14 Sloutsky, V.M. (2003) The role of similarity in the development of categorization. *Trends Cogn. Sci.* 7, 246–251
- 15 Gelman, S.A. and Wellman, H.M. (1991) Insides and essences: early understandings of the nonobvious. *Cognition* 38, 213–244
- 16 Solomon, G.E.A. (2002) Birth, kind, and naive biology. *Dev. Sci.* 5, 213–218
- 17 Hirschfeld, L. (in press) Children's understanding of racial groups. In *Children's Understanding of Society* (Barrett, M. and Buchanan-Barrow, E., eds), Psychology Press
- 18 Giles, J.W. (2003) Children's essentialist beliefs about aggression. *Dev. Rev.* 23, 413–443
- 19 Hirschfeld, L.A. and Gelman, S.A. (1997) What young children think about the relation between language variation and social difference. *Cogn. Dev.* 12, 213–238
- 20 Gil-White, F.J. (2001) Are ethnic groups biological 'species' to the human brain? *Curr. Anthropol.* 42, 515–554
- 21 Mahalingam, R. (2003) Essentialism and beliefs about gender among Aravanis, the 'not-men' of Tamil Nadu. *Sex Roles* 49, 489–499
- 22 Astuti, R. (2001) 'Are we all natural dualists?: a cognitive developmental approach. The Malinowski Memorial Lecture. *J. R. Anthropol. Inst.* 7, 429–447
- 23 Atran, S. et al. (2001) Folkbiology doesn't come from folkpsychology: evidence from Yukatek Maya in cross-cultural perspective. *J. Cogn. Cult.* 1, 3–42
- 24 Gopnik, A. et al. (2004) A theory of causal learning in children: causal maps and Bayes nets. *Psychol. Rev.* 111, 3–32
- 25 Ahn, B. et al. (2000) Causal status effect in children's categorization. *Cognition* 76, B35–B43
- 26 Rehder, B. and Hastie, R. (2004) Category coherence and category-based propriety induction. *Cognition* 91, 113–153
- 27 Ahn, W. et al. (2000) Causal status as a determinant of feature centrality. *Cogn. Psychol.* 41, 361–416
- 28 Gelman, R. (2002) Animates and other worldly things. In *Representation, Memory, and Development: Essays in Honor of Jean Mandler* (Stein, N. et al., eds), pp. 75–87, Erlbaum
- 29 Inagaki, K. and Hatano, G. (2002) *Young Children's Naïve Thinking About the Biological World*, Psychology Press
- 30 Keil, F. (1989) *Concepts, Kinds, and Cognitive Development*, MIT Press
- 31 Diesendruck, G. (2001) Essentialism in Brazilian children's extensions of animal names. *Dev. Psychol.* 37, 49–60
- 32 Gelman, S.A. et al. (1998). Beyond labeling: the role of parental input in the acquisition of rightly-structured categories. *Monographs of the Society for Research in Child Development* Serial No. 253, Vol. 63, No. 1
- 33 Inhelder, B. and Piaget, J. (1964) *The Early Growth of Logic in the Child*, Norton
- 34 Rakison, D.H. and Oakes, L.M. (2003) *Early Category and Concept Development: Making Sense of the Blooming, Buzzing Confusion*, Oxford University Press
- 35 Keil, F.C. et al. (1998) Two dogmas of conceptual empiricism: implications for hybrid models of the structure of knowledge. *Cognition* 65, 103–135
- 36 Namy, L.L. and Gentner, D. (2002) Making a silk purse out of two sows' ears: young children's use of comparison in category learning. *J. Exp. Psychol. Gen.* 131, 5–15
- 37 Opfer, J.E. and Siegler, R.S. Revisiting preschoolers' living things concept: a microgenetic analysis of conceptual change in basic biology. *Cogn. Psychol.* (in press)
- 38 Murphy, G.L. (2002) *The Big Book of Concepts*, MIT Press
- 39 Rips, L.J. (2001) Necessity and natural categories. *Psychol. Bull.* 127, 827–852
- 40 Yamauchi, T. and Markman, A.B. (1998) Category learning by inference and classification. *J. Mem. Lang.* 39, 124–148
- 41 Smith, E.E. et al. (1998) Alternative strategies of categorization. *Cognition* 65, 167–196
- 42 Gelman, S.A. and Bloom, P. (2000) Young children are sensitive to how an object was created when deciding what to name it. *Cognition* 76, 91–103
- 43 Gelman, S.A. and Hirschfeld, L.A. (1999) How biological is essentialism? In *Folkbiology* (Medin, D.L. and Atran, S. eds), pp. 403–446, MIT Press
- 44 Mayr, E. (1991) *One Long Argument: Charles Darwin and the Genesis of Modern Evolutionary Thought*, Harvard University Press
- 45 Sober, E. (1994) *From a Biological Point of View*, Cambridge University Press
- 46 Dupré, J. (1993) *The Disorder of Things: Metaphysical Foundations of the Disunity of Science*, Harvard University Press
- 47 Gelman, S.A. and Heyman, G.D. (1999) Carrot-eaters and creature-believers: the effects of lexicalization on children's inferences about social categories. *Psychol. Sci.* 10, 489–493
- 48 Walton, G.M. and Banaji, M.R. Being what you say: the effect of essentialist linguistic labels on preferences. *Social Cogn.* (in press)
- 49 Waxman, S.R. (2003) Links between object categorization and naming: origins and emergence in human infants. In *Early Category and Concept Development: Making Sense of the Blooming, Buzzing Confusion* (Rakison, D.H. and Oakes, L.M. eds), pp. 213–241, Oxford University Press
- 50 Xu, F. (2002) The role of language in acquiring object kind concepts in infancy. *Cognition* 85, 223–250
- 51 Prasada, S. (2000) Acquiring generic knowledge. *Trends Cogn. Sci.* 4, 66–72
- 52 Gelman, S.A. et al. (2002) Children's use of generics in inductive inferences. *J. Cogn. Devel.* 3, 179–199
- 53 Gelman, S.A. et al. Mother-child conversations about gender: understanding the acquisition of essentialist beliefs. *Monogr. Soc. Res. Child Dev.* (in press)
- 54 Gelman, S.A. and Raman, L. (2003) Preschool children use linguistic form class and pragmatic cues to interpret generics. *Child Dev.* 74, 308–325
- 55 Pérez-Leroux, A.T. et al. (2004) Learning definite determiners: genericity and definiteness in English and Spanish. *Boston University Conference on Language Development*, (Suppl. online: <http://www.bu.edu/linguistics/APPLIED/BUCLD/supp.html>)
- 56 Hollander, M.A. et al. (2002) Children's interpretation of generic noun phrases. *Dev. Psychol.* 38, 883–894
- 57 Heyman, G.D. and Diesendruck, G. (2002) The Spanish ser/estar distinction in bilingual children's reasoning about human psychological characteristics. *Dev. Psychol.* 38, 407–417
- 58 Haslam, N. and Ernst, D. (2002) Essentialist beliefs about mental disorders. *J. Soc. Clin. Psychol.* 21, 628–644
- 59 Strevens, M. (2000) The essentialist aspect of naive theories. *Cognition* 74, 149–175
- 60 Ahn, W. et al. (2001) Why essences are essential in the psychology of concepts. *Cognition* 82, 59–69
- 61 Malt, B.C. (1994) Water is not H₂O. *Cogn. Psychol.* 27, 41–70
- 62 Sloman, S.A. and Malt, B.C. (2003) Artifacts are not ascribed essences, nor are they treated as belonging to kinds. *Lang. Cogn. Process.* 18, 563–582
- 63 Braisby, N. et al. (1996) Essentialism, word use, and concepts. *Cognition* 59, 247–274
- 64 Braisby, N. (2001) Deference in categorization: evidence for essentialism? In *Proceedings of the 23rd Annual Conference of the Cognitive Science Society* (Moore, J.D. and Stenning, K. eds), Erlbaum
- 65 Keil, F. (1994) The birth and nurturance of concepts by domains: the origins of concepts of living things. In *Mapping the Mind: Domain Specificity in Cognition and Culture* (Hirschfeld, L.A. and Gelman, S.A. eds), pp. 234–254, Cambridge University Press
- 66 Evans, E.M. (2001) Cognitive and contextual factors in the emergence of diverse belief systems: creation versus evolution. *Cogn. Psychol.* 42, 217–266
- 67 Haslam, N. et al. (2002) Are essentialist beliefs associated with prejudice? *Br. J. Soc. Psychol.* 41, 87–100
- 68 Giles, J.W. and Heyman, G.D. (2003) Preschoolers' beliefs about the stability of antisocial behavior: Implications for navigating social challenges. *Social Devel.* 12, 182–197
- 69 Yzerbyt, V.Y. et al. (2004) *The Psychology of Group Perception: Perceived Variability, Entitativity, and Essentialism*, Psychology Press
- 70 Nisbett, R.E. et al. (2001) Culture and systems of thought: holistic versus analytic cognition. *Psychol. Rev.* 108, 291–310