12 Two insights about naming in the preschool child

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Psychological models often assume that young children learn words and concepts by means of associative learning mechanisms, without the need to posit any innate predispositions. For example, Smith, Jones, and Laudau (1996) propose that children learn concepts by hearing specific linguistic frames while viewing specific object properties. The environment provides all the information that children need; the conjunction of sights and sounds is proposed to be sufficient to enable children to construct word meanings. On their view, children make use of “associative connections and direct stimulus pulls,” which Smith et al. dub “dumb attentional mechanisms.”

In this chapter I suggest that this empiricist learning model is insufficient to account for two early-emerging insights that children possess about the nature of naming. These insights are: (1) Essentialism: certain words map onto non-obvious, underlying causal features (e.g., dogs are alike in internal and subtle respects, even if they look quite different on the surface), and (2) Genericity: certain expressions map onto generic kinds (e.g., DOGS as an abstract category) as opposed to particular instances (e.g., one or more specific dogs). I will discuss empirical studies with preschool children to support the contention that essentialism and genericity emerge early in development, and that neither insight is directly taught. I will also explore the question of whether these insights can be derived wholly from a direct reading of cues that are “out there” in the world, and conclude that they cannot. I then explore the implications of these findings for innateness. Specifically, both essentialism and genericity provide cues regarding plausible candidates for innate conceptual knowledge in children.

1 Empiricist models of concepts

In an influential paper, Smith, Jones, and Landau (1996) suggest that "associative connections and direct stimulus pulls ... underlie children's novel word interpretations" (p. 145-146). They go on to explain that language-learning children "repeatedly experience specific linguistic contexts (e.g., 'This is a _________' or 'This is some ___________') with ... specific object properties ... (e.g., shape or color
plus texture"). For example, a child can learn the distinction between count and mass nouns by noting that count nouns are uttered in the presence of consistent shapes (e.g., "This is a book" in the presence of rectangular solids; "This is a banana" in the presence of crescents) whereas mass nouns are uttered in the present of consistent colors and textures (e.g., "This is some rice" in the presence of white, sticky stuff; "This is some sand" in the presence of tan, granular stuff). By tracking the empirical regularities of linguistic form and perceptual cues, children learn familiar words and build up expectations about novel words.

In support of these arguments, the input children hear seems to provide a rich source of data regarding such linkages between object shape and count nouns. For example, the first count nouns that children learn tend to refer to categories for which shape is a salient dimension, suggesting that the input children hear focuses heavily on shape-based count nouns. Furthermore, attention to shape appears to undergo a characteristic developmental time-course in which it grows more powerful as children acquire more experience with their own language -- therefore suggesting that it may be the outcome rather than the source of word learning. Exposure to different language inputs results in somewhat different word-learning biases, also implicating experience as an important influence on children's early assumptions about word meaning. Relatedly, experimental manipulation of the input by teaching shape-based nouns results in stronger noun-learning in early childhood (Smith, 2000).

From a theoretical perspective, this empiricist position has several intuitive appeals. It promises to provide a mechanistic model for how development takes place, it would make use of well-known psychological mechanisms, and it has generality that could account for a broad range of data. Furthermore, findings focused on other phenomena demonstrate the power of statistical learning procedures for rapid learning even in infancy (e.g., Saffran, Aslin, & Newport, 1996). Statistical learning procedures are important -- but are they the full story for how children learn word meanings?

One reason to suspect that statistical learning procedures cannot provide a complete answer to the problem of word-learning, is that non-associational information powerfully influences children's word learning at an early age. Numerous studies demonstrate the importance of the child's construal of the social context in determining the nature of early word meanings (Tomasello & Akhtar, 2000; Diesendruck & Markson, 2001; Baldwin, 1993; Woodward, 2000). For example,
temporal contiguity between word and object is less important than direction of the
speaker's gaze. Even young 2-year-olds make use of subtle pragmatic information
(such as whether the speaker's actions are intentional or accidental) to guide their
interpretation of novel words.

Booth and Waxman (2002) have also demonstrated that conceptual
information (in the form of verbal descriptions) powerfully influence children word
extensions. In two experiments, three-year-old children received a word-extension
task with simple abstract objects, in which the objects were described as having either
animal-relevant properties (e.g., “This dax has a mommy and daddy who love it very
much. … when this dax goes to sleep at night, they give it lots of hugs and kisses”) or
artifact-relevant properties (e.g., “This dax was made by an astronaut to do a very
special job on her spaceship…”). Children sorted the objects differently, depending on
the conceptual information provided in the story. The data strongly argue against the
idea that children automatically activate purely perceptually based associations
between the presence of eyes and the dimension of shape.

Smith et al. have also argued that young children have difficulty mapping
words onto higher-level conceptual information, such as function, but more recent
studies demonstrate that preschool children – in some studies as young as 2 years old
– can take function into account in early naming (Kemler Nelson, Frankenfield,
Morris, & Blair, 2000).

Keil, Smith, Simons, and Levin (1998) provide a cogent critique of the
empiricist view. They point out that associative learning models require constraints on
the properties to be associated (Goodman, 1972; Murphy & Medin, 1985), and that no
one has yet articulated a plausible account of how the perceptual system would
provide such constraints. They also point out that in some cases children possess
abstract expectations before a concrete knowledge base (Simons & Keil, 1995).

The current argument extends these critiques by providing two specific
examples of early capacities or expectations young children have about naming.
Although naming is a domain that has been taken as an example par excellence for the
power of empiricist models, it falls short in some crucial ways. The problems with
empiricist accounts of acquisition in these examples raises the question of what is
innate, which I take up in the final section of the chapter.
Two insights about naming

When thinking about word learning, what typically comes to mind is the simple case of learning to label a single object with a count noun. It is this sort of context for which the associative learning models have most success. When one examines children's early word learning, however, one immediately sees that the problem is more complex. Children are learning not just nouns, but also verbs (Tomasello & Merriman, 1995). Children are learning not just to label shapes, but also to take into account speakers' intentions (Tomasello & Akhtar, 2000; Bloom, 2000). And the concepts to which nouns refer include more than available percepts.

There are at least two ways that words convey concepts that are not directly observable -- even for young word-learners. First, words can map onto non-obvious, underlying features. And second, words can map onto abstract kinds (not just specific, individual instances). I will characterize each of these insights below, referring to the first as essentialism, and referring to the second as genericity. Neither insight is directly or explicitly provided in the input, and it would appear that neither insight is derived from "dumb attentional mechanisms." This will then raise the question of how children acquire these insights. I will suggest that there are domain-general innate distinctions or biases that give rise to these understandings.

Essentialism: An Overview

Essentialism is a term that has been used broadly in different disciplines, with widely varying meanings. Medin (1989) draws an important distinction between metaphysical essentialism (a claim about the structure of the world) and psychological essentialism (a claim about human beliefs); my focus is psychological essentialism. I use the term "essentialism" to refer to a three-part belief: (a) that certain categories are "natural kinds": real (vs. artificial), discovered (vs. invented), and stable or unchanging, (b) that some unobservable part, substance, or quality (the essence) causes observable similarities,¹ and (c) that many everyday words map onto this real-

¹ There is some debate as to how strongly people adhere to a single essence, whether this essence needs to be an internal aspect of the entity as opposed to relational, and how articulated this aspect is. See Wilson, 1999; Strevens, 2000. I think these are constructive debates, though irrelevant for current purposes.
world structure. When we learn words such as dog, oak-tree, gold, or schizophrenic, we believe that we are learning something about real kinds in the world.

Fodor (1998) suggested that essentialism is the outgrowth of modern science. As people gain more knowledge about the world, they understand it at a deeper, less obvious level. They learn about modern technology and concepts that provide access to the rich internal structure of animals: microscopes, X-rays, DNA, and modern scientific taxonomies (e.g., whales are mammals, not fish). Perhaps all of this information accounts for why people assume there are hidden properties shared by members of a category.

Children provide a critical test case for studying the origins of essentialism, precisely because they lack detailed scientific knowledge. If essentialism requires knowledge of modern science and technology, then it should emerge late in development, only after the acquisition of detailed biological knowledge. However, if preschool children essentialize, then we would have to look elsewhere to explain this early appreciation. Furthermore, if children can look beyond the obvious in their classifications, it would also pose a challenge to standard claims about children's thinking as concrete, perceptual, focused on the obvious, and so forth (Siegler, 1998; Piaget, 1970), and would challenge long-held assumptions about the nature of early concepts.

What would be evidence for essentialism, in children or adults? Medin and Ortony (1989) suggest that essentialism is a "placeholder" notion -- one can believe that categories possess an essence without knowing what the essence is. For example, a child might believe that there exist deep, non-obvious differences between males and females, but have no idea just what those differences are. If essentialism is a placeholder notion, then the evidence for essentialism will be indirect. Figure 1 illustrates this notion. The essence placeholder would imply that categories are immutable, have sharp boundaries, permit rich inductive inferences, capture non-obvious properties, have some underlying causal force, and have innate potential.

Elsewhere I have detailed at length the evidence that preschool children expect certain categories to have all of these properties (Gelman, 2003). I will not have space to review all the evidence in this chapter. However, I summarize below some of the major points from two of these essentialist implications: inductive potential and innate potential. Additional claims regarding essentialism that will not be covered here include: (i) children treat certain categories as immutable; (ii) children treat certain
categories as having relatively sharp boundaries; (iii) non-obvious properties are central to certain of children's categories; (iv) causal properties are central to certain of children's categories.

-------------------- Insert Figure 1 about here ---------------------

3.1 Inductive potential.
One of the major essentialist assumptions is that category members share more than surface similarities; they also have important non-obvious properties in common. We see this with children's inductive inferences. One experimental paradigm provides children with item sets in which category membership conflicts with outward appearances. Figure 2 provides an example. The blackbird and the bat are overall more similar: both are black, with outstretched wings. However, if told the category membership of each item ("bird," "bat," "bird") and asked to draw novel inferences about the blackbird, children rely on category membership as 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), for gender (boy, girl), for traits (smart, shy). (See Gelman, 2003.)

-------------------- Insert Figure 2 about here ---------------------

These results are not due to a simple reliance on matching labels, as children rely on information about kind membership (not names per se). When the labels are distinct but refer to the same kind (e.g., "puppy", "baby dog"), children still use kind-membership as the basis of non-obvious inferences. Conversely, when the labels are identical but fail to refer to kinds (e.g., "sleepy," "wide awake"), then children ignore the labels in their inferences. Recent studies show that even 1- and 2-year-old children draw category-based inferences (Jaswal & Markman, 2001; Graham, Kilbreath, & Welder, 2001). Thus, the appreciation that words can signal non-obvious properties seems in place at the very start of word learning.
3.2 Innate potential

One of the most important kinds of evidence for essentialism is the belief that properties are fixed at birth, and even passed down from parent to child. We can refer to this as "innate potential." There is now a sizeable database of studies examining children's beliefs about innate potential. Details vary, but the basic paradigm is the same. Children learn about a person or animal that has a set of biological parents, and then is switched at birth to a new environment and a new set of parents. The question is, which do children think is more important: birth parents or upbringing? For example, in one item set, Henry Wellman and I told children about an infant kangaroo that went to live with goats: would it be good at hopping or good at climbing? would it have a pouch or no pouch (Gelman & Wellman, 1991)?

Overall, when one poses this sort of question to children, they show a powerful nativist bias. This is so when children reason about animal kinds, plant kinds, racial identity, and gender-linked properties. Intriguingly, children tend to be more nativist than adults (Taylor, 1996). 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 (Hirschfeld & Gelman, 1997).

3.3 Summary

A range of studies using varied methods suggest that preschool children expect members of a category to be alike in non-obvious ways. They treat certain categories as "natural kinds": with inductive potential, an innate basis, immutable kind membership, and sharp boundaries between contrasting categories.

4 Where does essentialism come from? Some negative conclusions

Where does essentialism come from? I first draw four negative conclusions to this question, by considering and then rejecting four accounts that fail to match the available evidence. Specifically, essentialism is not simply derived from the structure of the world, it does not reflect a particular cultural stance, it is not explicitly taught by parents, and it cannot simply be deduced by language use. All of these negative conclusions would seem to suggest that some form of essentialism is spontaneously emerging in children. In the following section, I will consider the nature of this early predisposition.
4.1 Structure of the world?

Essentializing extends to social categories that are constructed and have no true underlying essence (Hirschfeld, 1996; Gil-White, 2001). Essentializing of race, caste, and occupation are not grounded in an accurate biological description of the world (Mahalingam, 1998). Even when considering biological species, essentialism seems to misstate the evidence. Biological species evolve, they are not immutable (Mayr, 1982); they are population-based rather than reflecting properties inherent in each individual (Sober, 1994; Wilson, 1999), and rather than their being a single, real classification of species, there may be numerous valid classifications, each of which captures some cluster of relevant properties (Dupré, 1993). The essentialist view therefore seems to be a human construction rather than a perceived reality (see also Kornblith, 1993).

4.2 Particular cultural input?

It is also not the case that essentialism results from the particular cultural milieu of the typical experimental subject (middle class, educated, U.S.). Recent work suggests essentializing in a broad range of samples, including Favela-dwelling children in Brazil (Diesendruck, 2001), Torguud adults in Western Mongolia (Gil-White, 2001), Vezo children in Madagascar (Astuti, Solomon, & Carey, 2003), and Itzaj Maya adults and children in Guatemala (Atran, Medin, Lynch, Vapnarsky, Ek’, & Sousa, 2001). More work is needed to examine different cultures; certainly one cannot conclude universality on the basis of sampling a handful of cultures. Another caveat is that there is cultural variation in which categories are essentialized, especially evident in variation in construal of human kinds (Bloch, Solomon, & Carey, 2001; Chandler, 2001). Nonetheless, the variety of contexts in which essentialism emerges suggests that essentialism is relatively "easy to think."

4.3 Explicit instruction by parents?

How do children learn about essentialism? Children's fiction contains a rich source of essentialist stories (e.g., Ugly Ducking), but it also contains a rich source of anti-essentialist stories (e.g., Horton Hatches an Egg). Moreover, it is unclear whether children incorporate fictional input into their construals of the real world. Presumably certain sorts of input from fiction are buffered from beliefs about reality (e.g., that
animals can talk, as seen in many storybooks and cartoons). Therefore, it is crucial to see how parents talk to children outside of storybooks or other mass media.

My collaborators and I set out to examine the nature of the input in a context that should strongly encourage talk about essences (Gelman, Coley, Rosengren, Hartman, & Pappas, 1998). Parent-child dyads received a picturebook reading task, where each page depicted several animals or objects in a realistic setting. Notably, each page displayed appearance-reality contrasts: two horses and a zebra; two bats and a bird; and so on. We videotaped the sessions, and transcribed and coded the videotapes.

It was clear that the pages did set up the desired contrast between appearance and reality, as children often mislabeled the pictures. The key question was how parents explained these contrasts to children. Most important for current purposes, parents provided very little in the way of explicit input concerning the non-obvious basis to category membership. Table 1 lists the mean percentage of properties of a given type that parents provided: using "all" as a universal quantifier to signal that a property was true of an entire kind; reference to insides; reference to kinship; and reference to appearance-reality conflicts. As can be seen, all of these explicit essentialist statements were exceedingly rare, and most were no more common for animals than for artifacts. The only property that parents expressed with any frequency concerned appearance-reality distinctions. Even here, however, the appearance-reality discussions did not provide explicit lessons in essentialism, but rather indirectly alluded to the notion that appearances might be deceiving. For example:

Child:  That’s kangaroo. [pointing to aardvark]

Mother: Well, that looks like a kangaroo but it’s called an aardvark.

Child:  Aardvark.

What is striking about this otherwise commonplace exchange is that the child readily accepts the mother's relabeling, without any elaboration or explanation. Altogether, parental input seems rather minimal and indirect, even in a highly educated sample with much category knowledge.

----------------------- Insert Table 1 about here ---------------------
4.4 Provided by language use?

Some have proposed that essentialism can be deduced by language use: hearing the word "bird" for a wide variety of dissimilar birds (hummingbirds, eagles, ostriches) signals to the child that something other than surface similarity must bind these instances together (Mayr, 1991; Hallett, 1991). On this view, language has a powerful causal force in implying essentialism to children. Certainly children respond differently to tasks in which language is or is not used (Waxman & Markow, 1995; Markman & Hutchinson, 1984; Gelman & Markman, 1986; Xu, 1999). Moreover, hearing a label for a concept does provoke a more essentialist construal (e.g., "carrot-eater" implies a more stable, immutable category than "someone who eats carrots whenever she can"; Gelman & Heyman, 1999).

However, one problem with assigning too central a role to language is that names need not -- and do not -- automatically cue essentialism, in children or adults. Children learn homonyms (Lily as a name vs. lily as a flower) and non-kind terms, both adjectives (sleepy) and nouns (passenger; pet). When learning novel words, children do not automatically assume that the words are kind-referring, if perceptual cues compete (Davidson & Gelman, 1990). One striking example of children's willingness to interpret a word for two dissimilar things as homonyms rather than essentialist similarities came from my daughter, who at about age 3-1/2, remarked: "Isn't it funny -- 'chicken' sounds just like 'chicken'" -- not realizing that the bird and the food were indeed manifestations of the same kind!

These examples suggest that language may be an important cue regarding when to essentialize, but is not the mechanism by which essentializing emerges to begin with. If sameness of naming is to convey underlying sameness, children must first have the capacity to understand that appearances can be deceiving. Armed with such an understanding, naming practices could provide important information to children about the structure of concepts. However, that initial understanding must already be in place in order for children to benefit from naming.

4.5 Summary

Essentialism appears to be an early predisposition, not supplied by the structure of the world, the logic of language, or parental instruction. Certainly aspects of the world, of language, and of cultural teachings get incorporated into essentialist understandings,
but the conclusion I reach is that essentialism is fundamentally a construction of the human mind (see also Kornblith, 1993).

5 Genericity: An Overview

I turn now to a second insight that preschool children have regarding naming. This is an appreciation that nouns can be used not only to refer to particular or indefinite instances, but also to generic kinds. To appreciate the distinction, consider "My bat lives in this cave" vs. "Bats live in caves." The first (non-generic) refers to a particular bat; the second (generic) refers to bats as an abstract kind. Generic noun-phrases are also known as kind-referring expressions (Carlson & Pelletier, 1995).

Genericity relates to essentialism in two respects. First, both generics and essentialism reflect how people construe categories, and particularly categories referred to by count nouns. Second, generic language may foster essentialist thought, by expressing inherent properties that members of a category have in common. When a child hears "Birds fly south for the winter," she is learning a property that is not simply accidentally true of a subset of birds, but rather something that is inherently true of birds as a class. Furthermore, generics may imply that members of a category cohere, regardless of property content. Even when the property expressed is highly familiar (e.g., "Birds fly"), the generic form of the noun phrase may emphasize the coherence of the category in question.

Recent studies from my lab suggest that generics are frequent in the speech that children hear (Gelman, Coley, et al., 1998; Pappas & Gelman, 1998; Gelman & Tardif, 1998), and that children both produce and understand generics at an early age. One set of analyses rests on longitudinal studies of eight children followed over the ages of 2-4 years, during in-home, real-life interactions (thanks to the CHILDES database; MacWhinney & Snow, 1990). In this project, nearly 45,000 child noun phrases were analyzed, and we are in the process of analyzing as many adult utterances. The eight children we studied produced over 3,000 generic noun phrases during the sessions recorded. At every age (2, 3, and 4 years), every child we studied produced generics. By age 4 years, generics constituted nearly 4% of children’s total utterances—a high rate, comparable to that of children’s talk about mental states and processes (Bartsch & Wellman, 1995). Detailed analyses of parent-child conversations reveals that children initiate generic talk a good portion of the time, even at preschool age (Gelman, Goetz, & Sarnecka, in prep.). That is, for each generic
that was produced, we traced backward to determine who first introduced the topic, and who first introduced the topic generically. Children frequently took the lead in initiating a generic level of talk.

Importantly, children are not simply adept at producing generics; they comprehend them appropriately as well. 4-year-olds appreciate that generics are generally true of a category but allow for exceptions (Hollander, Gelman, & Star, 2002). Thus, children do not confuse generics with either indefinite noun phrases (e.g., “some”) or universal quantifiers (e.g., “all”). Like “all,” generics are appropriate for category-wide generalizations (e.g., “(All) fires are hot”). Yet like “some,” generics are appropriate for properties true of a subset (e.g., “(Some) girls have curly hair”). Generics differ from non-generics in content as well as scope: they more typically express actions and less typically express physical appearances, compared to non-generics (Hollander et al., 2002). Children’s generics are also distributed differently from non-generics in the focus of conversation concerning important social categories.

Cross-culturally and cross-linguistically, we found very similar patterns in Chinese as in American children, and even in the “home sign” gestures of deaf children without a conventional language (Gelman & Tardif, 1998; Goldin-Meadow, Gelman, & Mylander, 2003). We selected Mandarin because it does not include several of the cues that are so central to generic identification in English, including articles, plurality, and tense. Therefore, whereas in English we distinguish between “The duck is waddling” (non-generic) and “Ducks waddle” (generic), in Mandarin both ideas could be expressed with the same sentence. Despite radically different linguistic models for the expression of generics across these three groups (including no conventional model for the children producing home signs), the patterns of use are remarkably similar. In all the groups, generics disproportionately refer to animals and people, even controlling for the amount of overall talk about each domain, thus suggesting that generics more readily map onto essentialized categories.

Another important point is that children more broadly extend a generically-learned property to other items of the same category than a non-generic property (Gelman, Star, & Flukes, 2002). In a series of studies, we taught children novel facts about a series of animals, in 1 of 3 forms: generic (e.g., “Bears like to eat ants”), indefinite (e.g., “Some bears like to eat ants”), and universal quantifier (e.g., “All bears like to eat ants”). Hearing the facts in generic form led to inferences that were
broad (unlike indefinites) but allowing for exceptions (unlike universal quantifiers). Thus, children’s patterns of inductive inference are influenced by hearing generic language. This finding has potentially far-reaching implications, given the frequency of generics in parental speech.

Children are highly sensitive to the formal linguistic and contextual markers of generics, acquiring them by 3 years of age (Gelman & Raman, 2003). For example, if shown a picture of two penguins, preschool children interpret “Do birds fly?” differently from “Do the birds fly?” Simple presence or absence of the article “the” has powerful implications for the interpretation children assign. Generics draw children’s attention away from the particulars in the context, and bring to mind the larger category. Moreover, children use not just formal linguistic cues, but also contextual cues. For example, the very same sentence, “Do they have short necks or long necks?”, is interpreted differently, depending on whether it is prefaced by a picture of TWO short-necked giraffes and the sentence, “Here are two giraffes” (thereby leading to the answer “short necks”), or whether it is prefaced by a picture of ONE short-necked giraffe and the sentence, “Here is a giraffe” (thereby leading to the answer “long necks”). In the former case, children interpret the sentence as referring to the giraffes in the picture (non-generically), but in the former case, children interpret the sentence as referring to giraffes as a generic kind. Altogether, this work suggests that preschool children exploit multiple sources of information (including formal morphosyntactic cues, contextual cues, and theory-based knowledge) to solve the problem of generic language.

Despite preschool children’s early appreciation for generics, there are also important developmental changes in the preschool years. Generics are almost non-existent in productive speech before about age 2½. Between the ages of 2-4, there is a dramatic increase in the frequency of generics, even controlling for amount of non-generic talk, and even when we focus only on those children who already have command of the formal linguistic markers (e.g., articles, plurality, tense; Gelman, 2003). The cues that children use to recognize generics change with age: 2-year-olds use formal linguistic cues only (e.g., differentiating “dogs” from “the dogs”), whereas 3-year-olds additionally use context (e.g., whether the linguistic form matches or mismatches the non-linguistic context; Gelman & Raman, 20xx). Finally, the scope of generics changes as well: 3-year-olds fail to differentiate generic questions from questions involving “all” or “some”, whereas 4-year-olds make a 3-way distinction
between generics, “all”, and “some”. Interestingly, however, the patterns of response to generic questions does not change from ages 3 to adulthood; rather, 3-year-olds’ problem involves treating both “all” and “some” as if they too were generics (Hollander, Gelman, & Star, 2002).

6 How are generics acquired?

From an acquisitional standpoint, generics pose in bold relief the induction problem discussed by Pierce, Goodman, Quine, and others. First, the generic concept is never perceptually available to the learner. Thus, when one hears "dogs," the generic category of dogs can never be displayed or pointed to. At most a subset of the category may be visible, but never the entire kind. Note that this is a more basic problem than even Quine proposed. With Quine's gavagai example, perceptual displays are always ambiguous and open to alternative construals (thus a point to a rabbit need not imply the entire rabbit, but at least the entire rabbit is visible and could be linked to the act of naming ["Gavagai!"]). With generics, perceptual displays can never display the referent (even ambiguously). Second, the semantics of generics are potentially confusing because they refer to a category as a whole but also allow for exceptions (e.g., "Boys play with trucks" is not invalidated by counter-examples). Third, the formal cues to genericity are varied, and provide no one-to-one mapping between form and meaning. To elaborate: generics can be expressed with multiple forms in English:

- bare plural: Dogs are mammals.
- indefinite singular: A dog is a mammal.
- definite singular: The dog is a mammal.
- definite article plus adjective: The elderly need better health care.

Interestingly, for three of these four examples, the same noun phrase can also be used non-generically:

- bare plural: Dogs were playing frisbee in the park yesterday.
- indefinite singular: A dog is barking outside my window.
- definite singular: The dog next door dug up an old bone.

Thus, children cannot simply learn that a fixed linguistic form has generic meaning. They must use context effects to figure out the intended scope of a noun phrase in context (see Gelman, in press, for detail).

One further illustration underscores the complexity of the mapping problem:
• Do you like the mango? (non-generic, specific)
• Do you like mango? (generic)
• Would you like mango? (non-generic, indefinite ['some'])
• Would you like mango, if you were a monkey? (generic)

Whether or not the noun phrase includes the determiner is not decisive, nor is the verb decisive. It is the combination of the determiner and the verb that is important. However, even here the formal cues are not entirely decisive, as can be seen when we consider “Would you like mango, if you were a monkey?” (in which “mango” could have a generic reading, even though the first portion is identical to the non-generic indefinite sentence). Thus, even when consider all formal cues simultaneously, they are insufficient to determine with any certainty whether a noun phrase is generic or not.

If generics were to be acquired by means of "dumb attentional mechanisms," then one would need to identify a small set of formal linguistic properties that are consistently linked to a set of perceptual properties that would cue a generic interpretation. Yet as I've tried to sketch out, there is no small set of formal linguistic cues, and there are no perceptual instantiations of generic concepts.

I propose that generics are a default interpretation for children (Gelman, in press). Generics are not marked by means of clear or unambiguous cues. Instead, in many languages, generics are the unmarked (or relatively less-marked) form: an interpretation reached when the sentence lacks determiners, tense, aspect markings, number, or any other cue that an utterance is linked to a specific time or place. This is certainly true for both English and Mandarin. There are many devices in language for indicating that something is particular, and it would be extraordinarily difficult (perhaps impossible) to enumerate them all. These include (but are not limited to): form of the determiner; precise number; deictics (including pointing); tense. All of these devices serve to locate an utterance within an identifiable context (this place, that time, those entities). Generics contrast with specific utterances in that they cannot be pinned down to a context – they hold generally over time and situations. Thus, there is not a limited set of features or contexts that correspond to the set of generic utterances. Rather, I hypothesize that language-users assume that an utterance is generic unless that interpretation is blocked.
The implications of this view for acquisition are as follows. In learning generics (at least in English), the child’s task is not to acquire a particular form, nor to map one formal set of cues onto a set of properties in the world (à la Smith, Jones, & Landau, 1996). Rather, the child’s task is to filter out the specific. This can be done most successfully by considering multiple cues, given the breadth and variety of means of indicating specificity. Thus, my position is that acquisition of the generic system in English requires a theory-driven assessment of when an utterance picks out specific referents, and when an utterance does not. (See also Downing, 1996, for further arguments that generics are a default.)

6.1 Summary
Children learning English readily produce and understand the distinction between generic noun phrases and non-generic noun phrases, despite the lack of clear formal linguistic cues marking the distinction, and despite the impossibility of instantiating entire kinds in the real world.

7 Failure of empiricist models to account for early essentialism and early generics
To review, evidence from both essentialist reasoning and genericity provide challenges to the empiricist view that concept learning consists entirely of relating perceptual features in the input to elements of speech. For essentialism, the problem with the "dumb attentional" model is two-fold: that essentialism entails thinking about non-obvious or non-perceptual features, and that children do not receive explicit instruction in any case. For genericity, the problem is also two-fold: that generic kinds (the referents to generic noun phrases) cannot be displayed or presented in perceptual form, and that the linguistic input is ambiguous.

This is not to say that environmental cues or statistical learning mechanisms are irrelevant or unimportant. Such cues and mechanisms may be central -- when taken in conjunction with other conceptual underpinnings. For example, naming practices seem to provide important information regarding when to essentialize. Providing a noun label encourages the belief that a novel category is stable and resistant to change (Gelman & Heyman, 1999), and providing a generic encourages drawing inferences from a category (Gelman, Star, & Flukes, 2002). For generics, children's interpretation in English may be guided by parents' frequent practice of
using plural nouns in the presence of a single exemplar to figure out that what is meant is something other than the individual in context (Pappas & Gelman, 1998). However, the question is whether such learning mechanisms are sufficient to build essentialism or genericity within the first 2 or 3 years of life. At present, such cues seem insufficient to generate the patterns of conceptual understanding we see by preschool age.

8 What is innate?
Preschool children appreciate two insights about naming: that certain words capture non-obvious properties and map onto essentialized kinds, and that words can refer to generic kinds as well as individuals. Empiricist models do not fully account for either capacity. What then can we conclude about the nature of innate knowledge?

One approach would be to assume that essentialism is the result of innate domain-specific knowledge: If the form of knowledge is domain-specific, than the mechanism itself is domain-specific. For example, essentialism is applied to animals more than artifacts, and generics are applied more to animals than artifacts, so essentialism and genericity could be domain-specific expressions of a folk-biology module. An example of this position can be found in the writings of Atran, Estin, Coley, and Medin (1997), Gil-White (2001), and Pinker (1997), each of whom propose that people have an innate folk-biology module that results in essentializing of animal kinds and related categories.

One appeal of such a position is that essentialism seems to fit better with categories of animal kinds than categories of artifacts (Gelman, 2003). Another appeal is that this provides a potential reason why people essentialize, in evolutionary adaptationist terms. However, this interpretation also faces some empirical problems. Children and adults treat a variety of non-biological entities as having underlying, non-obvious commonalities: including both non-biological human kinds (including race; Hirschfeld, 1996) and non-biological natural substances (e.g., gold, water; Gelman & Markman, 1986; but see Malt, 1994). Although one might argue that human kinds could be part of folk biology, or included on the basis of analogy to animals (e.g., Gil-White, 2001; but see Hirschfeld, 1996), it seems implausible to suggest that inanimate natural substances could be part of a folk biology.

A further potential problem is that we see essence-like (though not essentialist) constructs outside the realm of biology, including: contagion and contamination (e.g.,
Hitler's sweater; Rozin & Nemeroff, 1990), fetishes (e.g., Jacqueline Onassis's fake pearls were sold at auction for many times more than their material worth), and judgments of authenticity (e.g., an original Picasso is worth so much more than a reproduction). In such cases, people seem to believe that something non-obvious underlies surface appearances, and that origins are especially important. I stop short of calling these examples of essentialism (though see Bloom, 2000). But as a working hypothesis, one might speculate that some general capacities underlie both essentializing and these other intuitions. Whatever prompts these intuitions is probably not a strictly biological capacity, for then it would not readily apply to such entities as sweaters, jewelry, or paintings. (See Gelman, 2003, for further elaboration of this point.)

In contrast, I suggest an alternative position: that domain-specific effects, in both essentialism and generics, may emerge from domain-general causes (see also Keil, 1994; Smith, 2000). This possibility is sketched out below.

8.1 Essentialism results from a conspiracy of domain-general predispositions

Rather than being a single predisposition, essentialism may emerge from a cluster of other early-emerging skills that are fundamental to early cognition. Studies of early development suggest that young children have a variety of domain-general skills by 2 years of age (or earlier) that are relevant to forming information-rich categories. Each of these capacities individually has functional significance in development, and each has implications for some aspect of the essentialist phenomena I have sketched out earlier.

- **Appearance-reality distinction.** A prerequisite to essentialist understanding is a distinction between appearance and reality. Specifically, an appearance-reality distinction seems necessary for thinking about non-obvious properties, for accepting category anomalies (e.g., that a bat is not a bird), and for distinguishing what something “is” from what it “is like.” Although it is not until about four years of age that children can reflect on the appearance-reality distinction in a metacognitive way (Flavell, Flavell, & Green, 1983), a basic appreciation seems well in place much earlier. The two-year-old’s capacity to accept her mother’s word that a pterodactyl is a dinosaur, not a bird, is evidence of this core understanding. Basic appreciation of an appearance-reality distinction would be important and useful to a broad range of
concerns, not just essentialism but also reasoning about a range of human interactions and physical events.²

- **Induction from property clusters.** People may assume (implicitly) that property clusters attract other properties. The more commonalities you have learned about a category in the past, the stronger your inferences about that category are in the future. Conversely, a category that lacks such property clusters will not be expected to attract new properties. This core assumption could grow into categorical realism, the belief that the world consists of natural kinds. It would favor essentialism for categories that have demonstrated inductive potential (e.g., basic-level object kinds) but not for, say, superordinate categories (tools), or single properties with little inductive potential (striped things). This assumption might also contribute to domain differences, given the richer property clusters for natural kinds versus simple artifacts (Gelman, 1988; Boyd, 1999, Keil, 1989; Kornblith, 1993). However, the assumption need not be domain-specific in its basic architecture.

  To be clear: the suggestion here is not simply that categories permit induction (although they do). Instead, people generate the second-order inference that categories permit even more inductions into the future, including as-yet-unknown properties. This appreciation seems to be in place even before children learn language (Baldwin, Markman, & Melartin, 1989).

- **Causal determinism.** Causal determinism is the assumption that properties and events are caused. In the case of natural events, causal determinism means that events without external cause demand some sort of mediating, inherent cause. The power of causal determinism for essentialism is in generating a search for hidden, non-obvious, as-yet-unknown properties. A number of scholars have suggested that children early on adhere to something like causal determinism (Brown, 1990; Bullock, Gelman, & Baillargeon, 1982; Gelman & Kalish, 1993; Shultz, 1982). Recent evidence provides some compelling demonstrations of how this might work in detail.

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² An unresolved question is why appearance-reality distinctions are available to young children in certain contexts before they pass appearance-reality tasks of the sort tested by Flavell and colleagues. One possibility is that the Flavell et al. tasks are especially challenging because they require both appearance and reality to be kept in mind simultaneously. Alternatively, perhaps children achieve a mentalistic understanding of the appearance-reality distinction first in the context of language interpretation (see Sperber & Wilson, 2002; Happé & Loth, 2002, for related claims; thanks to Peter Carruthers for suggesting this possibility).
(Gopnik & Sobel, 2000). Of interest for the current context, causal determinism would seem to apply broadly across domains (e.g., in understanding mechanical devices as well as natural kinds). Where it could engender domain-specific reasoning would be with the different causal relations entailed in natural kinds vs. artifacts. Whereas many artifact features can be attributed to an external agent (e.g., the person who made a chair gave it four legs), many natural kind features cannot be so attributed, and so would lead to positing non-obvious causal forces (e.g., there is no person who gave a dog four legs).

- **Tracking identity over time.** Recognizing offspring, tracking relative position in a social hierarchy, even thinking about ownership all require that one recognize the same object over time. The capacity to track identity over time is therefore broad and early-emerging. It is crucial to reasoning about object permanence and object identity, even for preverbal infants (Baillargeon, 1993; Spelke, Kestenbaum, Simons, & Wein, 1995; Xu & Carey, 1996). By preschool age children can track the identity of individuals when applying proper names (Gutheil & Rosengren, 1996; Hall, 1996; Sorrentino, 2001). What is crucial to determining individual identity is historical path, not the physical properties that were present at the original naming.

The centrality of this concept for essentialism is potentially profound. Tracking an individual over time requires the insight that a thing can retain identity despite outward changes in appearance (the appearance-reality distinction again). For example, as an animal grows, it changes dramatically. This capacity also seems implicated in reasoning about kind essentialism. Indeed, kind essentialism seems in some ways an extension of the insights about individual identity (Kripke, 1972; Schwartz, 1979). Just as an individual remains the same over outward variations, so too are members of a kind the same as one another despite outward variations. Just as the identity of an individual is decided by consulting the historical record, so too is the identity of a living kind decided by consulting its origins (namely, parentage).

- **Deference to experts.** I also suggest that children honor a tacit division of linguistic labor, in which they defers to others as the ultimate arbiter of correct naming. Children can consult experts (such as parents) to find out what something truly should be called (see Putnam, 1973). This principle dovetails with the appearance-reality distinction, as it entails a willingness to suspend the evidence of
our own eyes: “That looks like a bird to me, but you say it’s a dinosaur – so it must be a dinosaur.”

Adults defer to experts in matters of naming natural kinds (Malt, 1990; but see Kalish, 1995), and children do so even more strongly (Kalish, 1998). As we have seen, children readily accept experimenter-provided labels, even when such labels are surprising and counter-intuitive (e.g., Gelman & Markman, 1986). Children also distinguish names made up on the spot from conventional names (Sabbagh and Baldwin, 2001). It would be interesting to know the depths and origins of children’s deference to experts. Does it extend across the board in all knowledge domains, perhaps as a result of children’s genuine ignorance about most things, or is it particularly strong in the case of naming? Are young children most open to expert knowledge, because they are themselves least knowledgeable? Or does deference to expert knowledge grow as children become more aware of their own limitations?

Each of the core capacities described above is plausibly an early-emerging (perhaps innate) propensity in human infants. Each of the core capacities also appears to be domain-general in scope. Yet each of these capacities has special implications when applied to the domain of natural kinds.

8.2 Generics are domain-general, but interact with how readily one construes things as kinds vs. individuals in different domains

A similar argument can be made regarding generics. Generics are grammatical and appropriate for any domain, including both animals and artifacts (e.g., ”Dogs bark”; ”Refrigerators are heavy”). Yet a striking feature of both parental and child generics is that they are domain-specific, appearing significantly more frequently for animals than artifacts (Gelman, 2003). Domain-specificity in children emerges as soon as children start to produce generics, between 2 and 3 years of age (Gelman, 2003). Domain differences in maternal usage obtain even when one controls for familiarity of the category, similarity among category members, thematic relatedness among category members, and amount of maternal talk (Gelman et al., 1998). The domain differences are also unlikely to be attributable to lack of sufficient knowledge about the artifacts (see Gelman et al., 1998, for argument), although this issue requires more systematic study.

Why, then, do animals elicit so many more generics than artifacts? We interpret this result as reflecting conceptual differences between animal and artifact
categories. If mothers construe animal kinds as more richly structured than artifact kinds (with deeper commonalities and greater coherence), they may more easily conceptualize animals as category members. In other words, the larger category to which an animal belongs may be relatively more salient. Although people can think about any object both as a category member and as an individual, the relative emphasis may vary by domain. Once again, what emerges early is a domain-general understanding (that entities can be construed either as individuals or as kinds), which gets instantiated to differing degrees in different domains.

9 Conclusions
In this chapter I have sketched out two insights children achieve at an early age regarding naming: that words can refer to essentialized kinds, and that generic kinds can be distinguished from individuals. In contrast to developmental theories that portray children as focused on concrete, observable properties that are present in the "here-and-now" of the child's immediate context, these early acquisitions highlight young children's capacity to think about non-obvious, underlying, abstract entities. These early understandings also pose challenges to the idea that children acquire language wholly by means of "dumb" attentional mechanisms linking observable features of the world to regularities in the language stream. Associative learning processes undoubtedly contribute to learning in many realms of thought, but appear to be insufficient for essentialism and genericity.

Both understandings also appear to be domain-specific: children essentialize animal kinds more readily than artifact categories, and generics are used more frequently for animal than artifact categories. However, I argue against the conclusion that children therefore possess an innate, domain-specific folk-biology module. Instead, the data are consistent with the idea that children have an early, domain-general set of understandings that interact with domain differences to result in the concepts children display.

Acknowledgements
This research was supported by NICHD grant HD36043.
References


Table 1. Parental input concerning essentialism: Mean percentage of properties (from Gelman, Coley, Rosengren, Hartman, & Pappas, 1998)

<table>
<thead>
<tr>
<th>Properties</th>
<th>Animals</th>
<th>Artifacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;All&quot; as referring to entire category</td>
<td>0.18</td>
<td>0.00</td>
</tr>
<tr>
<td>Insides</td>
<td>0.00</td>
<td>0.58</td>
</tr>
<tr>
<td>Kinship</td>
<td>0.07</td>
<td>0.00</td>
</tr>
<tr>
<td>Appearance-reality conflict</td>
<td>1.36 *</td>
<td>0.65 *</td>
</tr>
</tbody>
</table>

* indicates significant domain difference
Figure 1.2. Implications of essentialism.
Figure 2. Sample item (from Gelman & Markman, 1986).