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Developmental changes in the understanding of generics ☆

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Abstract

Generic sentences (such as "Birds lay eggs") are important in that they refer to kinds (e.g., birds as a group) rather than individuals (e.g., the birds in the henhouse). The present set of studies examined aspects of how generic nouns are understood by English speakers. Adults and children (4- and 5-year-olds) were presented with scenarios about novel animals and questioned about their properties, using generic and non-generic questions. Three primary findings emerged. First, both children and adults distinguished generic from non-generic reference, interpreting generics as referring to kinds. Thus, under certain contexts children and adults accepted that "Dobles have claws" even when all the dobles in the available context were clawless. Second, adults further distinguished properties that are inborn from those that are acquired. Inborn properties were judged to be predicated of a generic kind, even when all available instances have lost the property, but this was not the case for acquired properties. Third, children did not distinguish inborn from acquired properties. These data suggest the existence of developmental changes in conceptual or semantic understanding, and are interpreted in light of recent theories of psychological essentialism.

Keywords: Concepts; Generics; Children; Essentialism

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1. Generics and the nature of concepts

In 1961, the children's author known as Dr. Seuss wrote a story called "The Sneetches", about a kind of animal (the Sneetch), some of which are born with stars on their bellies (Geisel, 1961). In the story, the entire social organization of Sneetches centers around the presence or absence of this inborn feature: Sneetches with stars feel superior and socialize only with one another; those without stars feel left out and dejected. Then a character, Sylvester McMonkey McBean, arrives with a machine that can add stars to the bellies of Sneetches that do not have any. The star-less Sneetches eagerly pay money to acquire stars. Now everyone has stars! The interesting point from a psychological perspective is that, despite their perceptual identity, the two groups remain clearly distinct. The ones who originally had stars are enraged that they now look identical to those who had stars added, and pay dearly to have their stars removed so they will look different again. And so on. This story rests on the Kripkean intuition (Kripke, 1980) that just because the groups are defined initially as "those with stars" and "those without", someone can remain a member of a group regardless of whether or not he or she currently has stars.

The present paper examines this intuition in both adults and preschool-aged children. Can a kind in some sense retain a property, even in the face of evidence that individual members of that kind lack the property? And under what circumstances are properties attributed to a kind? For example, in the case of the Sneetches, is the fact that the stars were inborn relevant? We examine these issues by examining how children and adults interpret bare plural generic constructions – henceforth *generics* – such as "Birds lay eggs". Following the work of Prasada and colleagues (1999, 2000; Prasada and Dillingham 2006), we suggest that the understanding of such constructions can provide some insight into the nature of concepts.

Relatively little research has examined the developing understanding of generic constructions. This is in contrast to the large body of research exploring how children understand the role of count nouns ("This is a dog") and proper names ("This is Fido") in making reference to individuals or sets of individuals. But generic sentences are of special interest because they refer to kinds (e.g., dogs generally; Carlson, 1977). Indeed, kind representations are arguably what most scholars have in mind when they study categorization, and are the basis of much of human reasoning, including inductive generalizations (Gelman, 2003; Medin, 1989; Murphy, 2002; but see Sloutsky, 2003).

Whereas sentences such as "All birds lay eggs" and "Some birds lay eggs" both involve the attribution of properties to individual birds, generics such as "Birds lay eggs" involve attribution of properties to the category (or kind) of birds. Because of this, generics have an interesting property – they can express facts that are true of the kind even if they are not true of most of the individual members of the kind. The sentence "Birds lay eggs" is true even though most birds cannot lay eggs (e.g., males and juveniles); such a sentence expresses something like the (true) proposition: "Birds are the kinds of animals such that the mature female lays eggs" (Shipley, 1993). Importantly, however, not every property that is true of some category

members can be expressed generically. For example, ''Birds are female'' is false (even though every egg-laying bird is also female).

It becomes an interesting question, then, which properties can be expressed by generics. Intuitively, at least some generics express properties that are particularly enduring and central to a category (Lyons, 1977). This notion is elaborated by Prasada and Dillingham (2006) in terms of ''principled connections''. Principled connections imply that we have a normative expectation that category members *should* possess the property and that category membership can be used to explain the presence of the property (Tweetie lays eggs *because* Tweetie is a bird). In a series of experiments, Prasada and Dillingham (2006) elegantly demonstrate the existence of principled connections in adults' commonsense reasoning about generic sentences. For example, adults endorse statements such as the following:

''Dogs, by virtue of being the kinds of things they are, are four-legged''.
''[That has 4 legs] because it is a dog''.
''Dogs, by virtue of being dogs, should have four legs''.

Nonetheless, Prasada and Dillingham also find that not all generics express principled connections. Consider examples such as ''Barns are red'', ''Platypuses live in Australia'', or ''Dinosaurs are extinct'': all of them are perfectly good generics, as they express true generalizations about the kinds, but they do not express essential properties, nor even principled connections. Instead, they express statistical regularities (most barns are red). And in fact, adults judge many generics to be statistical in nature, thus *not* endorsing statements such as the following (Prasada & Dillingham, 2006):

''Barns, by virtue of being the kinds of things they are, are red''.
''[That is red] because it is a barn''.
''Barns, by virtue of being barns, should be red''.

Although Prasada and Dillingham demonstrated that adults interpret some generics as embodying a principled connection (''Dogs are 4-legged'') and others as embodying just a statistical connection (''Barns are red''), they did not determine the factors that lead to one or the other interpretation. The present studies examine one such factor. Specifically, we predicted that hearing that an animal is *born* with a physical property would be sufficient to prime the interpretation that a principled connection holds. In particular, even if the animal loses the property in question, the kind would still possess the inborn property (e.g., ''Star-bellied Sneetches [as a kind] have stars on their bellies, even though these Star-bellied Sneetches do not''). Inborn, characteristic physical properties are particularly good candidates for having a principled connection to a kind, because of the relative stability and unmodifiability they imply. Dogs are born 4-legged, thus apparently reflecting a fixed genetic blueprint. In contrast, the redness of barns would appear to be a rather arbitrary convention that could be overturned, given changes in barn design.

How does this understanding emerge in the course of development? At this point, we know little about children's semantic interpretation of generic sentences. For

example, we do not yet know whether or not children interpret generics as expressing principled connections, in any context. However, there is suggestive evidence for an early grasp of generics. Children as young as $2\frac{1}{2}$ years use generics, and they do so more often when talking about animals than about artifacts (Gelman, 2003). This domain difference is consistent with independent evidence that animal kinds are more richly structured than artifact kinds (in their internal and non-obvious properties; Keil, 1989) and therefore may either be more readily construed as kinds or may have more properties that can be attributed to them.

Comprehension studies (Graham & Chambers, 2005; Hollander, Gelman, & Star, 2002) also find that preschool children interpret generics and non-generics differently. In particular, 4-year-olds know enough about generics to distinguish them from sentences with "all" and sentences with "some". They are more likely, for instance, to say "yes" to "Do girls have curly hair?" than to "Do all girls have curly hair?" (distinguishing generics from "all") and are more likely to say "yes" to "Are fires hot?" than to "Are some fires hot?" (distinguishing generics from "some"). Finally, Gelman and Raman (2003) found that children as young as $2\frac{1}{2}$ years of age treat non-generics as referring to items in the available context, but generics as referring to kinds. On one item, when they saw a picture of a pair of penguins and heard, "Here are two birds. Now I'm going to ask you a question about the birds: Do the birds fly?", children typically said "no" (focusing on the birds in the current context). In contrast, when they were shown the same picture and heard, "Here are two birds. Now I'm going to ask you a question about birds: Do birds fly?" children typically said "yes" (focusing on the generic class of birds).

These results suggest that even children appreciate that generics refer to kinds as distinct from individuals, on tasks that require them to use or interpret familiar nouns. However, children may have done so based on memorizing particular uses they have heard in the past. In order to determine whether children have a more general understanding of generic meaning, it would be important to examine whether children can do so for novel nouns. For instance, prior studies have not examined whether children understand that a generic of the form "Xs have Y" can be true even if all Xs in the available context do not have Y. Nor have prior studies examined whether children (or adults for that matter) are sensitive to the relatively essential nature of a property – namely, whether it is inborn or superficial – in their use or interpretation of generics. This issue is important for providing insight into the conceptual implications of generics in early language use.

These gaps in the literature are what we explored in the following experiments. In particular, we exposed children and adults to scenarios about novel animals, such as "dobles" that do or do not have claws. The scenarios varied on two factors: property origins (either present from birth or acquired artificially) and property retention (either maintained or lost in the sample). We then asked them about the truth of both non-generic statements (e.g., "Do my dobles have claws?") and generic statements (e.g., "Do dobles have claws?").

For non-generics, property maintenance should be fully determinative and property origins irrelevant. When asked a question such "Do my dobles have claws?", the

answer should rest, obviously enough, on whether or not the animals described as dobles have claws. The origin of the claws should be irrelevant.

In contrast, for generics, there are three interpretable patterns of response:

(a) Generics might be interpreted no differently from non-generics. That is, whether or not the property is displayed in the sample will determine whether or not participants endorse a property. When asked "Do dobles have claws?" respondents will simply look to see if the dobles in the picture have claws, and answer accordingly. This would provide no evidence for either a kind/individual distinction or for any version of principled connections between a generic and a property.
(b) A second possibility is that, on hearing generics, participants will endorse properties that are not present in the available instances, as long as they believe them to be true of the larger kind. When asked "Do dobles have claws?" respondents will say "yes" if there is evidence that dobles more generally have claws. Whether or not the animal currently has claws should be irrelevant. This would suggest that there is an early-emerging distinction between properties held by a kind and by available members of a kind. But it would not provide evidence for a psychological distinction between innate and artificially-acquired properties.
(c) A third possibility is that, in addition to (b) above, property origins will be most relevant in deciding which properties are true of the kind. That is, when asked a question such as "Do dobles have claws?", participants will agree to it only if the animal is born with that property, not if it acquires the property through some artificial/extrinsic process. (As with (b), whether or not the animal currently has claws should be irrelevant.) This would provide the clearest evidence for a principled connection between innate properties and kinds and thus, indirectly, evidence linking generics to psychological essentialism (a possibility we discuss at greater length in the Section 5).

Experiment 1 explores these hypotheses with adults; Experiments 2 and 3 explore them with preschool children.

2. Experiment 1

2.1. Participants

Fourteen undergraduates (5 female, 9 male) enrolled in an introductory psychology course participated for course credit.

2.2. Items

Items included 8 scenarios, each describing a sample of individuals from a novel animal category, with a distinctive property (claws, stripes, fur, sparkles, orange spots, green [color], blue feet, or horns). The scenarios varied on two factors:

property origins (either present from birth or acquired artificially) and property maintenance (either maintained or lost in the sample). See Table 1 for a brief listing of all 8 scenarios, and Table 2 for the complete wording of one scenario across the four conditions.

2.3. Procedure

Adults were tested individually in a quiet laboratory setting. Each participant received 8 different item sets: 2 per type, with each novel name and picture rotating through each of the 4 conditions. The novel category names that were used in the experiment included: blickets, dobles, tomas, pumes, feps, ralts, fendles, and zavs. Pictures were used to illustrate all the points in the vignette (see Figs 1–4). After each scenario, participants were asked 2 questions, in counterbalanced order (with "dobles" given in the example, though the novel word used varied across items): "Do dobles have claws?" and "Do my dobles have claws?" After each yes/no question, subjects were asked to provide a confidence rating, on a scale of 1 ("not all confident") to 7 ("very confident").

The assignment of labels to sets was randomly determined for each participant. The order of items was randomly determined for each participant, with the constraint that each half of the procedure included one example of each of the four conditions. The order in which the two yes/no questions were asked (generic first or non-generic first) was kept constant for a given participant but counterbalanced across participants.

2.4. Results

Each "yes" response was scored as 1; each "no" response was scored as 0. Scores for each of the two items within a condition were summed, and these scores are presented in Table 3. We conducted a 2 (wording: generic, non-generic) × 2 (origins: internal, external) × 2 (property: maintained, lost) ANOVA, with number of "yes" responses as the dependent measure. There was a main effect of wording, $F(1, 13) = 6.30$, $p < .03$, indicating more "yes" responses for non-generic than generic questions. There was a main effect of property, $F(1, 13) = 36.48$, $p < .001$, indicating

Table 1
Brief description of scenarios used in Experiments 1–3

Name	Property	Extrinsic origins
"blickets"	Orange spots	Putting spots on each other
"dobles"	Claws	Putting claws on
"fendles"	Green	Pouring on green paint
"feps"	Fur	Putting on fur
"pumes"	Sparkles	Rolling around in sparkles
"ralts"	Blue feet	Dipping feet in paint
"tomas"	Horns	Putting horns on
"zavs"	Stripes	Painting on stripes

Table 2
Sample wording of scenarios

Experiment 1:
• *Intrinsic origins/Property maintained:* These are my dobles. [picture of 4 dobles with claws] Here's how they grew. They grew up with claws. First they were born, then they got bigger, then they got bigger. [picture of a doble with claws getting bigger and bigger; in some vignettes, the animal was first shown hatching out of an egg with the relevant property already visible] Then one day they drank a yummy drink. They got very full and happy, and this is how they looked. [4 dobles with claws]
• *Intrinsic origins/Property lost:* These are my dobles. [picture of 4 dobles with claws] Here's how they grew. They grew up with claws. First they were born, then they got bigger, then they got bigger. [picture of a doble with claws getting bigger and bigger] Then one day they drank a bad chemical. They got very sick, and this is how they looked. [4 dobles with no claws]
• *Extrinsic origins/Property maintained:* These are my dobles. [picture of 4 dobles with claws] Here's what they did. They put on claws. First they were here, then they did this, then they looked like this. [picture of a doble starting out with no claws, then putting on claws, then having claws] Then one day they drank a yummy drink. They got very full and happy, and this is how they looked. [4 dobles with claws]
• *Extrinsic origins/Property lost:* These are my dobles. [picture of 4 dobles with claws] Here's what they did. They put on claws. First they were here, then they did this, then they looked like this. [picture of a doble starting out with no claws, then putting on claws, then having claws] Then one day they went out in the sunshine. They got very hot and sweaty, and this is how they looked. [4 dobles with no claws]

Experiment 2:
"This island has lots of dobles on it. Let me tell you about dobles. Here's how dobles get claws – they grow up with claws. First they are born, then they get bigger, then they get bigger. One day some dobles drank a yummy drink. They got very full and happy, and this is how they looked. Now I'm going to ask you a question about dobles: Do dobles have claws? Now I'm going to ask you a question about these dobles: Do these dobles have claws?"

Experiment 3:
"This island has lots of dobles on it. Let me tell you about my dobles. Here's how my dobles get claws – they grew up with claws. First they were born, then they got bigger, then they got bigger. One day my dobles drank a yummy drink. They got very full and happy, and this is how they looked. Now I'm going to ask you a question about dobles: Do dobles have claws? Now I'm going to ask you a question about these dobles: Do these dobles have claws?"

more "yes" responses when properties were maintained than lost. There was also a main effect of origins, $F(1, 13) = 166.57$, $p < .001$, indicating more "yes" responses for internal vs. external origins.

These main effects were subsumed under two interactions: generic × property, $F(1, 13) = 57.78$, $p < .001$, and generic × origins, $F(1, 13) = 44.07$, $p < .001$. The generic × property interaction indicated that whether the property was maintained or lost made a significant difference for non-generic questions only, $p < .001$, Bonferroni's. In contrast, the generic × origins interaction indicated that origins were relevant for both generic and non-generic questions ($p < .001$ for generics; $p < .05$ for non-generics), but that origins had twice as large an effect for generics.

Confidence ratings. Confidence ratings (ranging from 1 = "not at all confident" to 7 = "very confident") were averaged across the two items within a condition, and these scores are presented in Table 4. We conducted a 2 (wording: generic, non-generic) × 2 (origins: internal, external) × 2 (property: maintained, lost) ANOVA, with number of "yes" responses as the dependent measure. None of the main effects

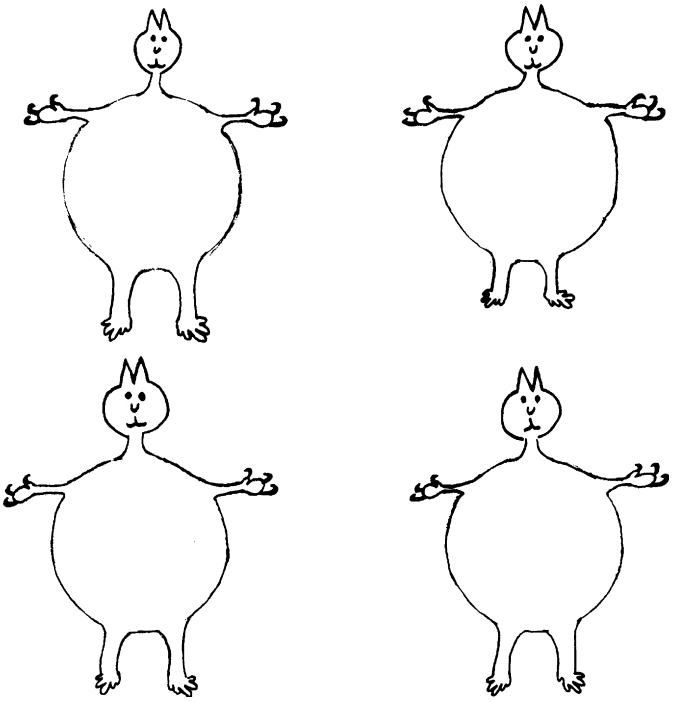

Fig. 1. Sample picture of 4 "dobles" with claws.

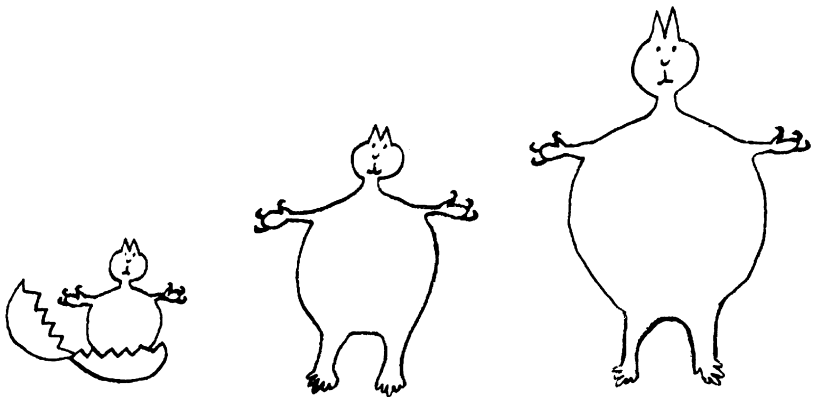

Fig. 2. Sample picture of "dobles" born with claws (intrinsic origins).

or interactions was statistically significant. Consistently across all conditions of the experiment, adults reported great confidence in their responses, in each cell exceeding 6 on a 7-point scale.

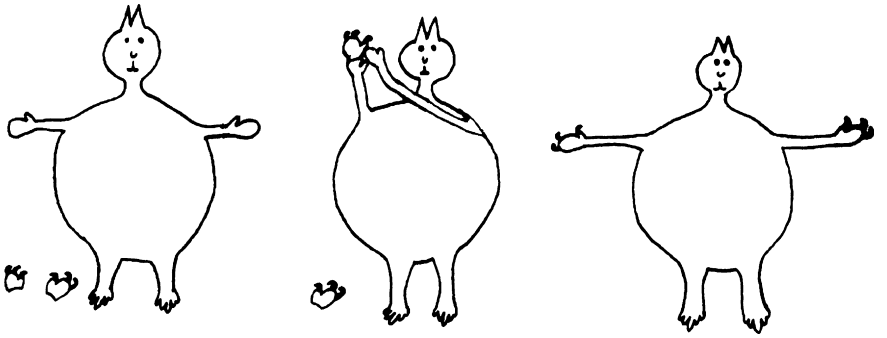

Fig. 3. Sample picture of "dobles" acquiring claws (extrinsic origins).

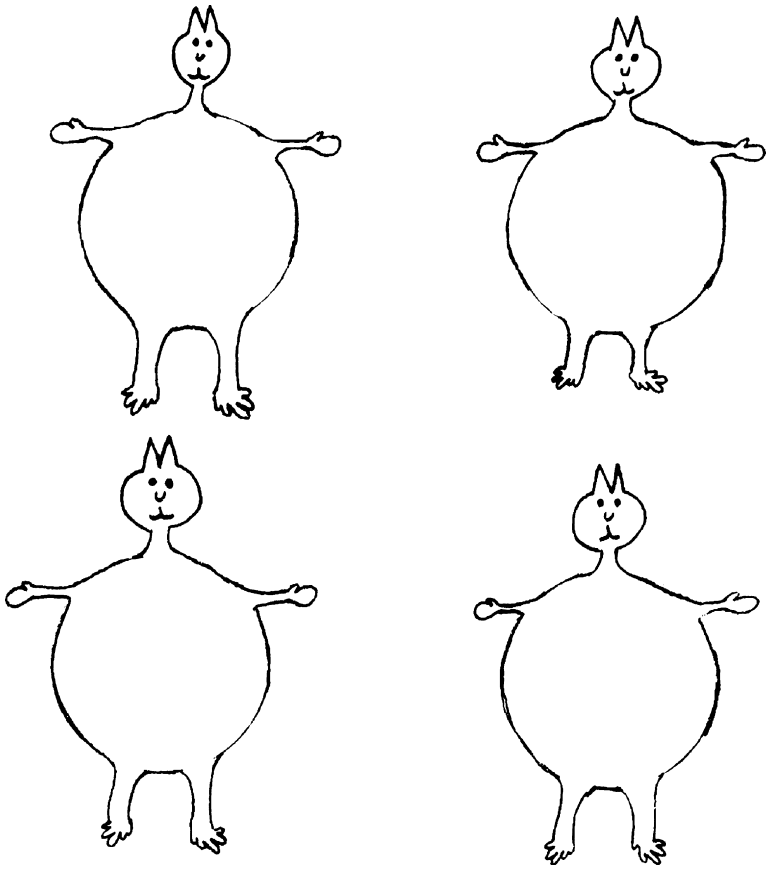

Fig. 4. Sample picture of 4 "dobles" with no claws.

Table 3
Subjects' mean number of "yes" responses (SDs in parentheses)

	Experiment 1: Adults		Experiment 2: Children		Experiment 3: Children	
	Generic ("dobles")	Non-generic ("my dobles")	Generic ("dobles")	Non-generic ("these dobles")	Generic ("dobles")	Non-generic ("these dobles")
Int. Origins, Prop. Maintained	1.71 (0.61)	2.00 (0.00)	1.81 (0.60)	1.86 (0.48)	1.87 (0.50)	1.81 (0.54)
Int. Origins, Prop. Lost	1.93 (0.27)	0.79 (0.97)	1.57 (0.75)	0.62 (0.86)	1.56 (0.63)	0.69 (0.95)
Ext. Origins, Prop. Maintained	0.00 (0.00)	1.71 (0.47)	1.90 (0.30)	1.95 (0.22)	1.62 (0.81)	1.81 (0.54)
Ext. Origins, Prop. Lost	0.00 (0.00)	0.29 (0.61)	1.43 (0.81)	0.57 (0.81)	1.31 (0.87)	0.50 (0.82)

Table 4
Experiment 1, adults' confidence ratings (on a scale of 1–7)

Origins: *Properties*:	Internal Maintained	Internal Lost	External Maintained	External Lost
Generic ("Do dobles have stripes?")				
Means	6.39	6.07	6.39	6.29
SDs	1.02	0.94	0.81	0.89
Non-generic ("Do my dobles have stripes?")				
Means	6.82	6.54	6.29	6.25
SDs	0.37	0.69	0.85	0.96

2.5. Discussion

When asked to evaluate a non-generic statement, such as "Do my dobles have claws?", adults focused primarily on whether the dobles currently had this property, and paid little attention to origins. In contrast, when asked to evaluate a generic statement, such as "Do dobles have claws?", adults focused only on origins, and said "yes" only if dobles inherently have claws – regardless of their current status. We suggest that adults' interpretation of generics can be interpreted as demonstrating that adults expect principled connections between a kind and a property when that property is inborn. Given the high confidence ratings (greater than 6 on a 7-point scale), we can reasonably infer that adults' responses reflected firm commitments to the interpretations they provided.

In addition to providing a basis of comparison with the generic responses, the non-generics provide an important control. Specifically, participants in the *non-generic* condition readily endorsed the property with extrinsic origins (e.g., they said "yes" to "The dobles have claws" even when the dobles had put the claws on themselves). This result shows that the origins effect in the generic condition (i.e., more "no" responses when the property had extrinsic origins) was *not* because such properties were somehow less good exemplars of the property. Having claws that are

worn like gloves is still interpreted as ''having claws''; feet dipped in blue paint still are interpreted as ''blue feet''. Only when the wording was generic did the extrinsic origins of the property become a problem.

The results of Experiment 1 raise the question of whether young children share these intuitions. Experiments 2 and 3 examine this issue.

3. Experiment 2

3.1. Participants

Twenty one children participated, 10 girls and 11 boys, ranging in age from 4;6 to 5;9 (mean age 5;1). Children were recruited from local preschools in a university town.

3.2. Procedure

Children were tested individually in a quiet room near their classroom. As in Study 1, each participant received 8 different item sets: two per type, with each novel name and picture rotating through each of the 4 conditions. The novel category names were identical to those used in Study 1. The same pictures were used to illustrate the vignettes.

This study differed in five ways from Experiment 1, so as to make it simpler and more accessible to young children. First, we started off by asking children 4 simple warm-up questions (e.g., ''Is this a house?'', ''Are these mittens?''), 2 of which would appropriately receive a ''yes'' and 2 of which would appropriately receive a ''no''. (All the children answered these questions correctly.) Second, we showed children a picture of an island and said, ''I'm going to tell you about a beautiful island, way far away. It has all kinds of different animals on it. I'm going to tell you about the different kinds of animals''. Then, for each item, we first explained that the island had ''lots and lots of X (e.g., dobles) on it''. We did so to ensure that children did not believe that our sample of four were all that there was.

Third, the wording of the non-generic reference was changed from ''*my* dobles'' to ''*these* dobles''. This change was made to highlight the distinction between generics and non-generics, as it was felt that ''these'' more clearly and unambiguously signals that one is referring to a subset rather than the kind as a whole. Fourth, when teaching about the property origins, we taught children about origins for the category as a whole. For example, we told children ''Here's how dobles get claws'', – not ''my dobles'' or ''these dobles''. This was done to clarify that the origins process was alike for members of the kind. See Table 2 for an example item. Finally, children were not asked to provide confidence ratings, as these are difficult to elicit from such young participants.

The assignment of labels to sets was randomly determined for each participant. The order of items was randomly determined for each participant, with the constraint that each half of the procedure included one example of each of the four

conditions. The order in which the two yes/no questions were asked (generic first or non-generic first) was kept constant for a given participant but counterbalanced across participants.

3.3. Results and discussion

For the main task, each "yes" response was scored as 1; each "no" response was scored as 0. Scores for each of the two items within a condition were summed, and these scores are presented in Table 3.

We conducted a 2 (wording: generic, non-generic) × 2 (origins: internal, external) × 2 (property: maintained, lost) ANOVA, with number of "yes" responses as the dependent measure. There was a main effect of wording, $F(1, 20) = 16.61$, $p = .001$, indicating higher "yes" responding for generics than non-generics. There was a main effect of property, $F(1, 20) = 56.45$, $p < .001$, indicating more "yes" responses when the property was maintained than when it was lost. There was also a wording × property interaction, $F(1, 20) = 23.88$, $p < .001$. For both generics and non-generics, endorsement was higher when the property was maintained than when it was lost, $p < .01$ by Bonferroni's, but the effect was larger for non-generics than for generics. Put slightly differently, the wording effect was significant only when the property was lost in the sample, $p < .001$ by Bonferroni's, and not when the property was maintained. In contrast to the adults, for children there were no significant effects or interactions involving origins.

In sum, while children's responses to the non-generic questions were fundamentally identical to those of the adults, their responses to the generic questions differed, as they showed no evidence of sensitivity to origins. Yet this does not mean that children were insensitive to what generics imply. Children recognized that a property can be lacking in current sample, but still generically true of the kind.

One problem, however, is that in this study (unlike Experiment 1) origins information was provided about the kind as a whole ("Here's how *dobles* get claws"). This may have led children to say "yes" to the generic questions, because that initial statement about origins presupposes that dobles have claws. In order to provide a stronger test, we conducted a further experiment in which the origins information was predicated of a subset of the category.

4. Experiment 3

4.1. Participants

Sixteen children participated, 6 girls and 10 boys, ranging in age from 4;6 to 5;5 (mean age 4;9). None had participated in Experiment 2. All were recruited from local preschools in a university town.

4.2. Procedure

The procedure was identical to that of Experiment 2, except that the origins information was provided about "my dobles", so that the information did not imply that the animals possess the property (generically). See Table 2 for the wording for a sample item.

4.3. Results and discussion

For the main task, each "yes" response was scored as 1; each "no" response was scored as 0. Scores for each of the two items within a condition were summed, and these scores are presented in Table 3.

We conducted a 2 (wording: generic, non-generic) × 2 (origins: internal, external) × 2 (property: maintained, lost) ANOVA, with number of "yes" responses as the dependent measure. There was a main effect of wording, $F(1, 15) = 9.78$, $p < .01$, indicating more "yes" responses for generics than non-generics. There was also a main effect of property, $F(1, 15) = 24.22$, $p < .001$, indicating more "yes" responses when the property was maintained than when it was lost. Finally, there was a wording × property interaction, $F(1, 15) = 18.58$, $p = .001$. As in Study 2, this indicated that for both generics and non-generics, endorsement was higher when the property was maintained than when it was lost, $p < .05$ by Bonferroni's, but the effect was larger for non-generics than for generics. Put slightly differently, the wording effect was significant only when the property was lost in the sample, $p < .001$ by Bonferroni's, and not when the property was maintained. In contrast to the adults, for children there were no significant effects or interactions involving origins.

In sum, in Experiment 3, as in Experiment 2, children display no sensitivity to property *origins* in determining that a property can be said to apply to a kind. But they do distinguish between generics and non-generics: Whereas non-generics express the presence or absence of properties as currently displayed, generics express potential properties even if not currently displayed.

5. General discussion

Not surprisingly, when asked whether a sample of individuals from a category has a particular property ("Do these dobles have claws?") both children and adults respond based on whether or not those specific individuals have the property. What is more interesting is that when questioned in a subtly different way, using a generic construction ("Do dobles have claws?"), children and adults ignore the characteristics of the specific set of individuals, and respond based on what they have been told (or what they have inferred) about the category. In other words, even for young children, generics are not about the here-and-now. Children understand that the truth of generic statements does not depend on the specific instances available. Hence even children distinguish between properties that individuals possess versus

properties that are true of the category in general. Moreover, they do so for novel categories and labels with which they have only minimal prior experience.

A further finding is that adults place special significance on property origins. Adults in Experiment 1 accept a generic statement as true if the property is described as intrinsic or innate, but not if it was acquired. Thus for adults, generics are used to express deep (intrinsic, innate) properties that are associated with a category – regardless of whether the property is currently present. This does not imply that generics are used *only* to express such properties. As we have seen from Prasada and Dillingham (2006), generics can also be used to express statistical associations (e.g., Barns are red) that are neither intrinsic nor innate. Nonetheless, information that a property is innate and true of a sample is sufficient for adults to judge the property as generically true of the kind.

We suggest that adults' interpretation of generics can be interpreted in light of recent claims about psychological essentialism. The theory of psychological essentialism proposes that people assume that categories have two aspects – the superficial features that members of a category tend to share and a deeper underlying reality that is constitutive of category membership (e.g., Bloom, 2000; Gelman, 2003; Medin & Ortony, 1989). Tigers, for instance, are understood as both having a certain characteristic appearance and behavior, and sharing some deeper "essence" – perhaps encoded at the level of DNA – that makes them tigers. Arguably, the sorts of principled connections that are expressed by certain generic constructions (including generic statements referring to inborn properties) correspond to those properties that are true by dint of the categories' essence. Hence, given that adults agree, for instance, that "Dobles have claws" is true – even though it is clear to them that this claim is not true of the sample of dobles presented to them – it would suggest that certain properties of a category (in this case, having claws) have a psychologically privileged status.

Two brief caveats: these principled properties are linked to essences, but they are not themselves essences. For example, having claws is not a causal essence of being a doble, any more than laying eggs is a causal essence of being a bird. Moreover, it should be clear from the above discussion that generics do not express sets of necessary and sufficient features ("sortal essentialism", Gelman & Hirschfeld, 1999), as they do not typically express properties that are true of all or only members of the category. Rather, to the extent that they reflect essentialist assumptions, it is "causal essentialism"; that is, essences are thought of as features that give rise to other, more superficial, properties.

In contrast to the adults, the children in these studies did *not* take into consideration property origins. We consider three explanations here for this developmental difference: it may be rooted in semantics, in conceptual representation, or in the task itself.

One possibility is that children have a different semantic understanding of generics, such that they do not interpret them as reflecting the same sorts of properties as adults do. On this view, it may be that both children and adults think that inborn properties are more central than extrinsic properties to category membership, a view supported by the fact that young tend to treat category-typical properties as inborn

(Gelman & Wellman, 1991; Hirschfeld, 1996; Taylor, 1996). However, generics may be interpreted differently over development, with young children thinking of generics as expressing regularities of *any* sort, but adults thinking of generics as expressing relatively more essential properties.

A second account of the age difference is that children and adults understand the generic construction in much the same way, but differ in how they mentally represent categories. Psychological essentialism has two related though separable assumptions: (a) a kind assumption, that people treat certain categories as richly structured "kinds", 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 (Gelman, 2003).

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.[1] Developmentally, a notion of kind may precede a notion of essence. This might explain the results in the current studies: both children and adults interpret generics as referring to kinds; adults furthermore interpret generics as referring to an inborn essence. If this interpretation is correct, then it would also imply that children's data are most consistent with a non-causal account such as that of Prasada and Dillingham (2006), whereas the adult data seem to be most consistent with a causal account of essentialism, as argued by Bloom (2000) and Gelman (2003).

This theory might be *too* minimal, however. While it is consistent with the results from the experiments reported here, other research suggests that children of the ages studied here do expect that superficial properties are not fully determinative of category membership (hence implying the importance of deeper properties). For instance, they understand that a porcupine that is transformed so as to look like a cactus is still, in fact, a porcupine (Keil, 1989), and that two novel objects can be members of the same category even if they look different, so long as they share the same internal properties (Gelman, 2003).

Another possible conceptual difference is that both children and adults assume that categories have essences, but that the adult notion is more biological than the child's. Thus, even if children do adhere to causal essentialism about certain kinds by preschool age (Gelman, 2003), conceptual change would be needed to identify the mechanisms that might underlie causal essentialism. Indeed some researchers have argued that children do not appreciate the importance of innate features until at least 7 years of age (Solomon, Johnson, Zaitchik, & Carey, 1996; Springer & Keil, 1989; but see Gelman & Wellman, 1991; Hirschfeld, 1996; Taylor, 1996).

[1] A kind assumption is similar to Strevens' (2000) suggestion that people naturally 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. But while Strevens sees this as an alternative to essentialism, we believe that it overlaps with causal essentialism in emphasizing that people treat surface features as caused and constrained by deeper features of concepts. In other words, we view the kind assumption as being richer than category representations as usually discussed in the concept literature (in which a category is any way of treating discriminably different items as alike).

What mechanism might children have in mind, if not a biological one? Both children and adults treat intention as relevant when naming artifact categories (Bloom, 1996, 2000, 2004; Diesendruck, Markson, & Bloom, 2003; Gelman & Bloom, 2000) – it might be that children differ from adults in that they are more prone to think that intention can be relevant to the essence of a *biological* kind. Under this account, when told a story about a strange kind of animal, adults view inborn properties as more related to the essence than properties imposed by external agents, whereas young children include the intentional acts of an agent as relevant to the essence of a kind. (This account makes the following prediction: if the animals got their claws *by accident* and then lost them, young children would say "no" when asked: "Do dobles have claws?")

A third possibility is that the complexity of these vignettes underestimated children's sensitivity to property origins. Studies 2 and 3 were designed to be simple and straightforward, and indeed children answered sensibly on the non-generic items (indicating that they had no overall difficulty interpreting the questions). However, it may be that the use of novel categories was too challenging for young children. In future work it would be interesting to examine these issues with familiar categories, to reduce the information-processing demands.

At this point, we cannot identify the source(s) of the developmental difference, but further research would be informative. Future research could also examine the cues that adults use to decide that a property is intrinsic. For example, the distinction between innate and acquired properties confounds two factors: the innate properties were both biologically acquired and present at birth, whereas the acquired properties were both artificially acquired and present later in life. One could devise scenarios that disentangle these two factors: an animal for which the target property is biological but late-emerging (e.g., horns that appear in adolescence), or one for which the target property is artificially acquired but in infancy (e.g., white spots that an animal gets from rubbing against the inside of its shell before hatching). Another issue to consider is that several of the current properties are familiar in the context of other categories (e.g., having claws is a property of cats). This prior knowledge alone is unlikely to account for the results obtained with adults, who treated a given property differently, depending on the origins specified in the experimental scenarios. Nonetheless, it would be revealing to employ this paradigm to investigate the more general question of which sorts of properties get linked to a category in an intrinsic way.

A final point is methodological. As noted before, much of the debate over the nature of children's concepts, and about essentialism more specifically, has centered on questions of categorization and naming. No clear consensus has emerged from this research, in large part because – under any account – appearance and category membership are strongly correlated, and hence experiments that seek to pull them apart run into methodological and interpretive difficulties (Bloom, 2000). The study of generic constructions appears to hold promise as a new tool for exploring the nature of concepts, in both adults and children (see also Prasada & Dillingham, 2006).

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