Conceptual and linguistic distinctions between singular and plural generics

Sarah-Jane Leslie[1], Sangeet Khemlani[2], Sandeep Prasada[3], and Sam Glucksberg[2]

Departments of Philosophy[1] and Psychology[2], Princeton University, Princeton, NJ 08540 USA
Department of Psychology[3], Hunter College, New York, NY 10065 USA

Abstract

Prasada and Dillingham (2006, 2009) and Leslie (2007, 2008) hypothesize that 'bare plural' generics (e.g. "tigers are striped") are used to express a range of conceptually different types of generalizations. We investigate whether different syntactic forms of generics are restricted to expressing only some of these types of generalizations, and if so, which ones. In doing so, we also test the relationship between Prasada and Dillingham's categories of generalizations on the one hand, and Leslie's on the other. The findings have significant consequences for our understanding of the conceptual mechanisms that underlie generics and our ability to think generally about kinds.

Keywords: generics; concepts; singulars; generalizations; semantics

Introduction

Generics are sentences that express generalizations without the use of an explicit quantifier, for example, "dogs have four legs", "a tiger is striped", "ducks lay eggs" and "the kangaroo hops". Because generic statements provide the means for talking about whole kinds or classes of things, they provide insight into the nature of the conceptual mechanisms available for representing such multiplicities and the distinct ways in which they may be characterized in language and thought (Gelman, 2003; Gelman & Bloom, 2007; Leslie, 2007, 2008; Prasada, in press; Prasada & Dillingham, 2006, 2009)

In this regard, Prasada and Dillingham (2006, 2009) identify two types of connections between representations of kinds and properties, both of which can be expressed as 'bare plural' generics, e.g. "dogs have four legs" and "barns are red". *Principled connections* involve properties that are determined by the kind of thing something is (e.g. having four legs for a dog). *Statistical connections* involve properties that are not determined by the kind of thing something is, but that are highly prevalent connections to the kind, e.g., being red for a barn. Principled connections are proposed to support formal explanations (Fido has four legs *because* he is a dog), normative expectations (Fido *should* have four legs and has something wrong with him if he doesn't), and the expectation that the property will generally be highly prevalent (most dogs have four legs).

Leslie (2007, 2008) argues for a related, though different, classification of generics. She identifies three different types of generics, which she calls *characteristic, majority,* and *striking*. Her category of characteristic generics maps closely onto Prasada's notion of a principled connection, though without the requirement that the property be expected to be prevalent among the members of the kind. In particular, Leslie's theory allows for 'minority' characteristic generics such as "ducks lay eggs", "lions have manes", and "cardinals are red", which are true even though only a minority of the kind (i.e. the mature members of one gender) actually possess the relevant property. Her second category of generics – majority generics such as "barns are red" – can, for our purposes, be mapped directly onto Prasada's category of statistical connections. Leslie also introduces a third category that predicates especially striking – often horrific or appalling – properties of the kind. Such generics, Leslie notes, can be true even though very few members of the kind in question actually have the property. Examples of striking property generics include "mosquitoes carry malaria" and "sharks attack bathers", which strike us as true even though very few mosquitoes actually carry malaria, and very few sharks ever attack bathers.

Like Prasada and Dillingham, Leslie argues that generics offer a window onto our thinking about kinds in general terms. In particular, she argues that generics express *cognitively primitive generalizations*. She argues that our cognitive system has a basic and primitive mode of generalizing information, and that generics allow us to give voice to these generalizations. They are language's way of allowing us to communicate these conceptually fundamental generalizations (Leslie, 2007, 2008). If generics do indeed reflect our fundamental way of thinking about kinds – as Leslie, Prasada, and others such as Gelman (2003) suggest – then they represent an important topic for psychological research.

Prasada and Dillingham (2006, 2009) report a variety of empirical tests that distinguish between their categories of principled and statistical connections. The question we begin to address in this paper concerns how Leslie's additional categories pattern with regard to these tests. In particular, we are interested to learn how Leslie's minority characteristic and striking property generics behave along the dimensions explored by Prasada and Dillingham. One's *prima facie* expectation might well be that Leslie's minority characteristics will behave rather differently than Prasada's principled connections, since the minority characteristics predicate properties that are only had by a smallish subset of the kind, whereas principled generics predicate properties that are had by any normal member of the kind. One might even expect that the majority/statistical generics would be *more* similar to the principled generics than the minority characteristics would be, since, like the principled generics, majority/statistical generics generalize properties that are prevalent amongst members of the kind. If, however, Leslie's theory is correct, then the minority characteristics should pattern much more like the principled generics do,

since they are all expressions of beliefs about what is characteristic of the kind.

We also wish to explore how Leslie's striking property generics behave with respect to Prasada's tests. Since striking generics do not predicate information that is naturally considered to be *characteristic* of the kind, we expect that they will fare differently than the characteristic and principled items, e.g., it strikes us as odd to think that mosquitoes carry malaria *in virtue* of being mosquitoes, or that their being mosquitoes *explains* why they carry malaria. We thus expect that the striking items will behave more like statistical/majority items with regard to Prasada's tests. However, Leslie's theory posits a relation between characteristic property generics and striking property generics. She hypothesizes that, in order for us to accept a striking property generic, we must believe that the members of kind are, by their nature, *disposed* to have the property. Thus, on her view, we accept "mosquitoes carry malaria" only because there is something about mosquitoes that *disposes* them to carry the virus. In light of this connection, it is possible that striking property generics will do somewhat better on Prasada's tests than the majority/statistical items (Prasada, in press).

We are currently conducting a series of experiments to test these predictions, and we report the first two experiments of the series here. These two experiments are concerned with the distribution of acceptability of Leslie's categories across different syntactic forms. Generics in English come in three distinct syntactic forms. (1)-(3) below exemplify these three forms:

(1) Tigers are striped
(2) A tiger is striped
(3) The tiger is striped

These three different forms of generics are known as *bare plural (BP) generics*, *indefinite singular (IS) generics*, and *definite singular (DS) generics* respectively. Bare plural generics have received the most attention, and are also the main focus of Prasada's and Leslie's work.

Linguists and philosophers have noted that some statements that are perfectly acceptable in bare plural form seem a little odd in definite or indefinite singular form (Lawler, 1973; Burton-Roberts, 1977; Carlson, 1977; Krifka et al 1995). The three sentences in the triple (1)–(3) above all sound perfectly natural to our ears, but this is not so for the triples (4)–(6) and (7)-(9) on their generic interpretations:

(4) Barns are red
(5) ?A barn is red
(6) ?The barn is red
(7) Sharks attack bathers
(8) ?A shark attacks bathers
(9) ?The shark attacks bathers

While the BP generics (4) and (7) sound perfectly natural, the IS and DS versions seem somewhat unnatural. One is tempted to interpret them as saying something about a particular barn or a particular shark, rather than saying something about barns and sharks in general. Prasada and Dillingham (2009) found that people generally did not like statistical items in IS form and Prasada and Dillingham (2006) report an unpublished experiment that found this to be the case for the DS form.

The IS form is of the most theoretical interest to us, because it is generally agreed among linguists and philosophers of language that the IS is felicitous only when the relation between the subject and the predicate is in some sense "necessary", "essential" or "inherent" (Lawler, 1973). We believe that the correct way to cash out this intuition in psychological terms is to understand the IS form as 'selecting' only those generalized properties that are characteristic of the kind – that is, only those connections that are principled (Prasada, in press; Leslie, in preparation). Thus it is of significant theoretical interest to learn whether people accept minority characteristics in IS form, since this would suggest that the connection between kinds and these less prevalent properties should nonetheless be counted as principled. The DS form is, unfortunately, poorly understood, so it is difficult to draw strong theoretical conclusions from a study of it. We hope, though, that the data we present here concerning the DS will contribute to a better future understanding of this elusive form.

We predicted that we would confirm Prasada and Dillingham's finding that principled/non-minority characteristic generics fare well in IS and DS forms, and that statistical/majority generics would do less well. We further predicted that Leslie's minority characteristic generics would be judged to be acceptable in both IS and DS forms, while the striking property generics would not. Since previous work (Khemlani, Leslie, Glucksberg, & Rubio-Fernandez, 2007; Leslie, Khemlani, & Glucksberg, submitted) has found that people agree to striking and majority BP generics less often than they agree to characteristic generics, our studies were designed to compare people's rating of BP generics to their ratings of IS generics (Experiment 1) and DS generics (Experiment 2), so as to control for the possibility of globally lower ratings for striking and majority generics.

Experiment 1: Bare plural vs. indefinite singulars

We asked a sample of 25 volunteers on the Internet to judge how natural it was for bare plural and indefinite singular statements to be understood as generic assertions.

Method

Design. We presented the four different types of predicates, as described above, one statement at a time. We also presented statements that were unequivocally incompatible with generic interpretations, e.g., 'A kangaroo was hopping in my backyard,' but instead tended to receive a specific interpretation. Statements appeared in either bare plural form ('Xs are Ys') or indefinite singular form ('An X is a Y'), generating a 5 (predicate-type: characteristic, majority, principled, striking, and specific) x 2 (statement-type: bare plural vs. indefinite singular) repeated measures design.

Participants. 25 volunteers participated in the study over the Internet through Amazon's Mechanical Turk system for human interface tasks. All spoke English as their first language and none had participated in experiments concerning generics before.

Procedure and Materials. Participants were asked to judge how natural it was to use each of the ten different types of assertions to generally characterize the kind they referred to. For a given assertion such as 'A lion roars', participants were given the prompt: 'How natural would it be to use this sentence to characterize lions in general?' They took the study over the Internet using an experiment interface written in Ajax, and registered their response by selecting from a 7-point Likert scale (+3 = very natural, 0 = neutral, -3 = very unnatural). They received 10 items of each type of predication; half were presented in bare plural form and half in indefinite singular form. They also received 5 practice trials to familiarize themselves with the scale. Each participant received the items in a different random order.

Results and Discussion

As a manipulation check, we included statements that were intuitively not natural ways to express genericity such as 'squirrels are in my backyard' (bare plural form) or 'a squirrel is in my backyard' (indefinite singular form). Participants responded as expected, and rated specific statements as natural on only 20% of trials (see Table 1). The forms of the sentences did not yield differential responses; participants judged bare plural specific statements as naturally expressing a generic only 21% of the time and indefinite singular statements as doing so 20% of the time (Wilcoxon test, $z = .45$, $p = .66$). In general, bare plurals received higher naturalness ratings than did indefinite singulars. Principled generics were rated higher than were characteristic generics, with majority and striking predicate types rated even lower. These differences were assessed via a 5 x 2 within-subjects ANOVA, which yielded a significant main effect of predication type, $F(4, 100) = 87.17$, $p < .0001$, a significant main effect of statement type, $F(1, 24) = 6.77$, $p < .05$, and a significant interaction, $F(4, 100) = 4.25$, $p < .005$. Mean ratings of generic naturalness express a continuous measure that does not take into consideration the semantic values of the points on the scale, i.e., naturalness, neutrality, and unnaturalness.

Table 1: Mean ratings of generic naturalness as a function of statement and predicate type in Experiment 1.

	Statement type	
Predicate type	**Bare plural**	**Indefinite singular**
Principled	2.46	2.14
Characteristic	1.93	1.72
Majority	0.58	-0.22
Striking	0.28	-0.24
Specific	-1.38	-1.15

That is, it may be meaningful that participants yield more natural than neutral responses for certain predications. To examine such patterns, we analyzed participants' responses categorically. Points on the Likert scale were collapsed such that -3 to -1 denoted responses in which participants believed the assertion was not naturally used to characterize the category in general; point 0 on the scale denoted the case in which the participants could not tell whether the assertion was naturally a generic or not; and points +1 to +3 on the scale denoted the case in which participants believed that

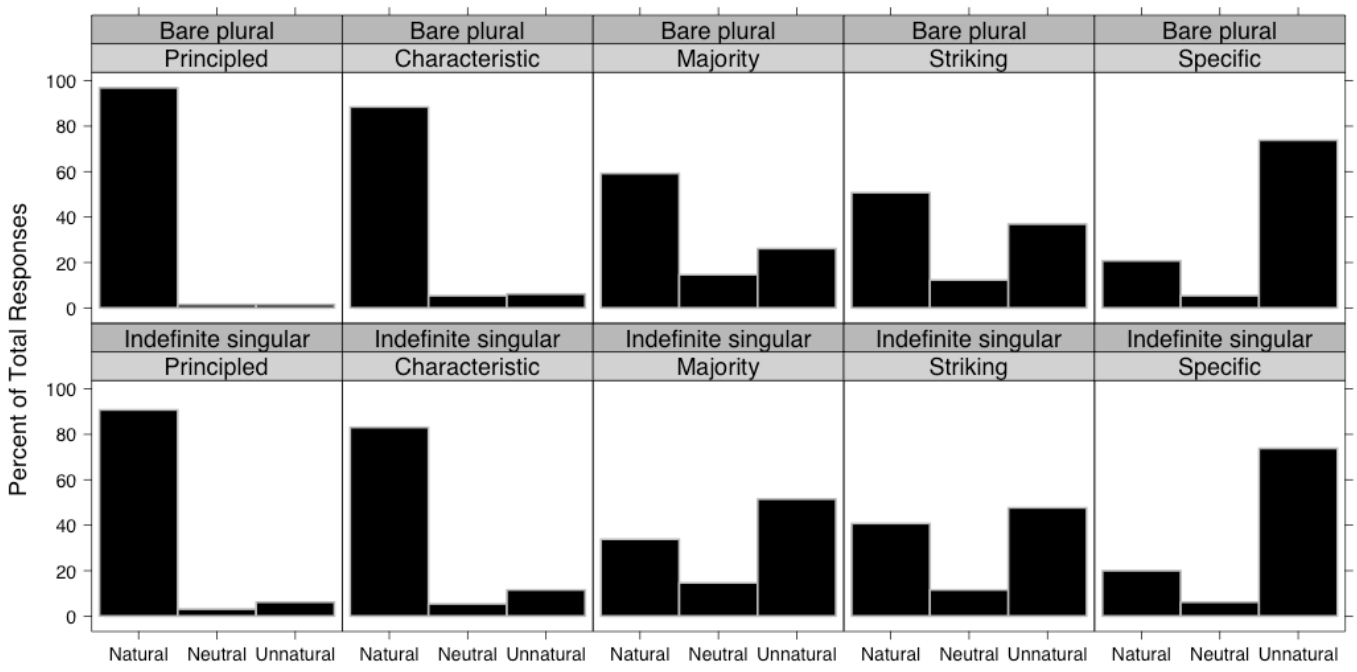

Figure 1. The distribution of responses in Experiment 1 as a function of predicate type and statement type.

the assertion could take on a generic interpretation. The distributions of the categorical responses as a function of statement and predication types are shown in Figure 1. We then made comparisons across pairs of responses to determine whether a certain statement and predicate type yielded a different pattern of responses than another by comparing the differences between naturalness responses and unnaturalness responses for pairs of interest.

Principled and characteristic predications. Participants judged principled (e.g., 'tigers have stripes') and characteristic (e.g., 'ducks lay eggs') statements as naturally expressing a generic on 94% and 87% of trials, respectively (Wilcoxon test, $z = 2.27$, $p < .05$). Principled statements were judged marginally more natural as generics when they were in bare plural form than when they were in indefinite singular form (97% vs. 91%, Wilcoxon test, $z = 1.80$, $p = .07$). Characteristic statements were not reliably judged more natural in bare plural form than in indefinite singular form (88% vs. 83%, Wilcoxon test, $z = 1.58$, $p = .11$). Naturalness judgments on principled and characteristic statements were not reliably sensitive to sentential form, and these statements were judged as natural on the preponderance of trials.

Majority and striking predications. Majority and striking predications were judged as naturally expressing a generic on 47% and 46% of trials respectively (Wilcoxon test, $z = .47$, $p = .64$). Majority statements were judged as more natural in bare plural form than in indefinite singular form (59% vs. 34%, Wilcoxon test, $z = 3.25$, $p < .005$). Likewise, striking statements yielded a similar pattern of responses; they were judged more natural in bare plural form, but the difference between the two sentential forms was marginal (51% vs. 41%, Wilcoxon test, $z = 1.81$, $p = .07$). As Figure 1 shows, participants tended to rate majority and striking statements as naturally expressing a generic on most trials when the statements appeared as bare plurals (59% and 51% respectively), but did not do so when the statements appeared as indefinite singulars (34% and 41% respectively).

These data suggest that principled and characteristic generic assertions tend to be rated as naturally expressing generalizations irrespective of statement type, i.e., as bare plurals or as indefinite singulars. In contrast, majority predications tended to be rated as less natural, but with the bare plural form rated as significantly more natural than the indefinite singular. Finally, striking predications were also rated as less natural than principled and characteristic predications in general, with a marginal preference for the BP form over the IS form. These findings support our predictions, including our hypothesis that the difference between how the striking items were rated in BP vs. IS form would be less than the difference for the majority items perhaps because striking generics are accepted only if the corresponding *disposition* is characteristic of the kind (Leslie, 2007, 2008; Prasada, in press).

We turn now to definite singular forms to investigate whether a similar pattern would hold there.

Experiment 2: Bare plural vs. definite singular

We asked a sample of 25 volunteers on the Internet to judge how natural it was for a series of bare plural and definite singular statements to be interpreted as a generic.

Method

Design. The experimental design was the same as that used in Experiment 1: a 5 (predicate-type: characteristic, majority, principled, striking, and specific) x 2 (statement-type: bare plural vs. definite singular) repeated measures design.

Participants. 25 volunteers on Amazon's Mechanical Turk system served as participants. All spoke English as their first language.

Procedure and Materials. The procedure and materials were analogous to those used in Experiment 1, but instead used definite singulars instead of indefinite singulars.

Results and Discussion

As in Experiment 1, specific predicates were rated as unnatural general assertions, indicating that the participants were rating the items appropriately (see Table 2). Participants responded to the specific predications (which served as a manipulation check here as in Experiment 1) as predicted, and rated specific statements as natural on only 23% of trials. Participants judged bare plural specific statements as naturally expressing a generic 21% of the time and definite singular statements as doing so 26% of the time (Wilcoxon test, $z = 1.59$, $p = .11$).

Table 2: Mean ratings of generic naturalness as a function of statement and predicate type in Experiment 2.

	Statement type	
Predicate type	**Bare plural**	**Definite singular**
Principled	2.25	1.99
Characteristic	2.12	1.62
Majority	0.68	0.11
Striking	0.28	-0.32
Specific	-1.22	-1.05

Principled generics were rated higher than were characteristic generics, with majority and striking predicate types rated even lower. These differences were assessed via a 5 x 2 within-subjects ANOVA, which yielded a significant main effect of the type of predication, $F(4, 100) = 54.44$, $p < .0001$, a significant main effect of the type of sentence, $F(1, 25) = 6.06$, $p < .05$, and a significant interaction, $F(4, 100) = 2.82$, $p < .05$.

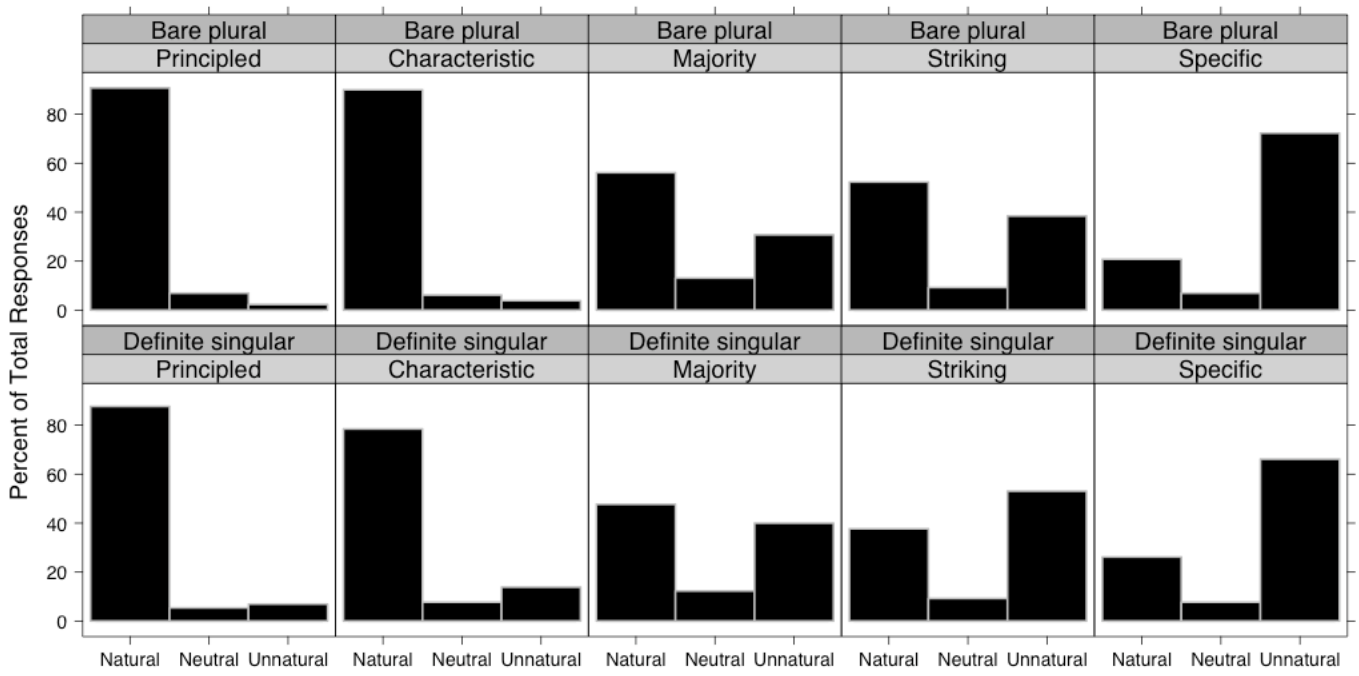

Figure 2. The distribution of responses in Experiment 2 as a function of predicate type and statement type.

As in Experiment 1, participants' answers were coded into natural, neutral, and unnatural response categories. These data are summarized in Figure 2. We again examined relevant pairwise comparisons to assess the effects of sentential form.

Principled and characteristic predications. Participants judged principled and characteristic statements as naturally expressing a generic on 89% and 84% of trials respectively (Wilcoxon test, $z = 2.92$, $p < .005$). Principled statements were not judged reliably more natural as generics when they were in bare plural form than when they were in definite singular form (91% vs. 88%, Wilcoxon test, $z = .68$, $p = .50$). Characteristic statements were marginally more natural in bare plural form than in definite singular form (88% vs. 83%, Wilcoxon test, $z = 1.94$, $p = .05$). As in Experiment 1, naturalness judgments on principled and characteristic statements were not reliably affected by sentential form, and these statements were judged as natural on most trials.

Majority and striking predications. Majority and striking predications were judged as naturally expressing a generic on 52% and 45% of trials, respectively (Wilcoxon test, $z = 1.63$, $p = .10$). Majority statements were not reliably judged as more natural in bare plural form than in definite singular form (56% vs. 48%, Wilcoxon test, $z = 1.27$, $p = .20$). Striking statements yielded a similar pattern. They were judged more natural in bare plural form, but here the difference between the two sentential forms was reliable (52% vs. 38%, Wilcoxon test, $z = 2.38$, $p < .05$). As Figure 2 shows, Experiment 2 replicated the pattern found in Experiment 1: participants rated majority and striking statements as naturally expressing a generic on most trials when the statements appeared as bare plurals (56% and 52% respectively), but did not do so when the statements appeared as definite singulars (48% and 38% respectively).

As expected, principled and characteristic items were rated highly in both BP and DS form, with the DS form rated slightly less well than the BP form. The striking items were rated as less natural overall, and received significantly lower ratings when they appeared in the DS form, as compared to the BP form. We were surprised, though, to find that the majority items were *not* rated significantly lower in the DS form. Our participants did not rate items such as "the barn is red" as less natural on its general interpretation than items such as "barns are red".

General Discussion

Our findings by and large supported our predictions, with one exception. We had expected that principled and characteristic items would do well in all three forms, though perhaps with the BP form being slightly preferred. Our findings did indeed support this prediction. The theoretical importance of this result is that they suggest that the same connection type underlies principled and characteristic items despite the fact that the former involve highly prevalent properties while the latter involve properties that characterize only a minority of instances. These data may suggest that, contrary to Prasada and Dillingham's (2006, 2009) proposal, principled connections may not license statistical expectations. The minority characteristic predicates used here do characterize principled subsets of the kinds in question for which we do have statistical expectations, e.g. male lions are generally expected to have a mane). However, it would be a mistake to think that the minority characteristic items express only restricted generalizations over one gender. Khemlani, Leslie, and Glucksberg (2009) report evidence at odds with such a suggestion (for theoretical considerations against this view see Leslie, 2007, 2008). The minority characteristic generics

express generalizations concerning the entire kind, even though they are made true by only a subset of it.

We also predicted that the striking and majority items would do significantly less well in IS form, though perhaps with the striking items doing slightly better than the majority ones. We found that majority items were indeed rated significantly lower in IS form than BP form, and that the striking items were rated marginally lower in IS form. We had expected a reliable difference in ratings for the striking items because sentences such as "a shark attacks bathers" seem less natural than "sharks attack bathers". However, we had also noted the possibility that the striking items would fare a little better than the majority items in IS form, since striking property generalizations depend indirectly on principled information concerning dispositions. Overall, the data from the IS study supports the hypothesis that the IS form selects generics which express principled/characteristic information concerning the kind (Leslie, in preparation; Prasada, in press).

In the DS form, however, striking items were rated significantly less natural. We were most surprised to find, though, that our majority items were not reliably rated as less natural in the DS form. There was a trend towards their being rating as less natural, but it was not even marginally significant. We are somewhat puzzled by this, since "the barn is red" seems to us a much more awkward way of expressing a generic than "barns are red", and we do not have a good explanation of this finding at present. The DS form has received the least attention of the three forms, and is not well enough understood for us to frame a hypothesis here. We hope our data will contribute to a future understanding of the DS form.

One notable feature of the data is how much lower the majority and striking items were rated overall. We are hesitant to read much into this finding, however, since other studies have found a high rate of agreement to statements in those forms (Khemlani et al., 2007; Leslie et al., submitted). Our question in particular may have promoted a differential treatment of the items, since it asked people to rate how natural it would be to use the sentence "to characterize Ks in general," where 'Ks' denotes the relevant kind. The mention of "characterizing Ks" may have biased our participants toward the principled/characteristic items. As Leslie's term suggests, these generics predicate properties that are characteristic of the kind, and not merely accidentally associated with the kind, as is the case with the majority/statistical items. Further, the mention of "in general" may have elicited lower ratings for the striking items, since they predicate properties that do not hold of the kind *in general*, but only of a small minority of the kind. For these reasons, we hesitate to ascribe any significance to the fact that majority and striking items received lower ratings in general here. These factors would not have affected the difference in ratings of the *form* of the generic, however, which is our major concern here.

This study constitutes one of the few empirical investigations of the different generic forms. As such, it provides important constraints on the conceptual mechanisms that may underlie distinct forms of generics, and suggests that minority characteristic items share some representational properties with principled items, despite their prima facie differences. Leslie (in preparation) and Prasada (in press) hypothesize that the IS form is primarily restricted to characteristic/principled predications, and our data are consistent with this hypothesis. In the case of the more daunting DS, however, the overwhelming attitude among theorists has been *hypotheses non fingo*, and so we can neither confirm nor refute any accounts of the definite singular generic.

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