Generics: Cognition and Acquisition

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Introduction: The Puzzle of the Generic

Philosophers of language sometimes theorize about obscure sentences, rarely found in everyday discourse, or about the applicability of sentences to strange, unrealized possible circumstances. Ordinary speakers of English often lack clear intuitions about the truth or falsity of these sentences, and so the theorizing is based on the judgments of the select few whose intuitions are sufficiently honed.

Other times, however, one need not venture into obscurity to find a phenomenon worthy of attention. If one so chooses, one may ask any English speaker whatsoever whether sentences such as 'tigers have stripes', 'birds lay eggs', or 'mosquitoes carry the West Nile virus' are true, or whether 'mosquitoes don't carry the West Nile virus' and 'birds are female' are false. The response is invariably confident and immediate.

These simple examples present a puzzle with no simple solution. That 'tigers have stripes' is true might not seem particularly troubling; even if some tigers lack stripes, *most* tigers sport them. Examples such as 'birds lay eggs', though, indicate that it is not necessary for the truth of these sentences that the majority of the kind in question satisfy the predicate; most birds do not lay eggs, yet 'birds lay eggs' is true. Closer

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reflection also indicates that majority satisfaction is not sufficient either; most mosquitoes—99 percent, in fact—do not carry the West Nile virus, yet 'mosquitoes don't carry the West Nile virus' strikes us as obviously false.

Why should 'mosquitoes carry the West Nile virus' seem so patently true, and 'mosquitoes don't carry the West Nile virus' seem so clearly false? There are ninety-nine times as many mosquitoes without the virus than there are with it. Similarly, why should 'birds lay eggs' strike us as true, while 'birds are female' does not? After all, the egg-laying birds are, perhaps even necessarily, a subset of the female birds. These everyday sentences present the philosopher of language with a challenge: what is the basis for this odd distribution of truth-values?

The truth conditions of this class of sentences, known as *generics*, have been the subject of much debate but little successful theorizing. The puzzle of the generic does not end with its truth conditions, however. While generics have proved nigh intractable for theorists, they turn out to be a cakewalk for language learners. Young children engaged in learning their native language grasp and produce generics far more quickly and readily than they do explicitly quantified sentences. Explicit quantifiers such as 'all', 'every', and even 'some' are comparatively more difficult for young children to master. These quantifiers for which we can provide precise and concise truth-theoretic definitions pose *more* of a challenge to language learners than do these strange and elusive generics.

What is more, there is no 'generic operator' signifying that a particular sentence is a generic, and therefore possessed of these odd truth conditions. We do not say 'gen tigers have stripes' in the way we might say 'most tigers have stripes'; there is no pronounced operator associated with generics. This is no quirk of English either; no known language has a dedicated generic operator. That this is a feature shared so widely is another fact that cries out for explanation. Could this really be a mere coincidence?

The absence of a dedicated generic operator ought to make the acquisition of generics more difficult. Children are not even provided with an explicit object of study; there is no particular part of the sentence with which they could learn to associate the meaning of generics. Quantifiers such as 'all' and 'some' are not only truth-theoretically simpler; they are actually articulated! If the challenge to the philosopher of language is to explain our judgments of the truth-values of generics, then the challenge to the cognitive scientist

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is to explain how generics could be easier to master than the explicit quantifiers.

This essay aims to meet both challenges. In doing so, it develops an approach to semantics that places more emphasis on cognitive considerations than do more traditional approaches. My approach aims first and foremost to answer the question: how do human beings actually understand, produce, and acquire their languages? What are the cognitive processes that underwrite these abilities? It is with these questions in mind that I approach generics, and so the account I offer is an example of this way of doing semantics. To the extent that my account of generics is successful, I take it to provide support for the larger project of cognitively oriented semantics.[1]

I will begin by discussing the logical form of generics. My main concern in this essay will not be with the nature of their logical forms, so the discussion will be rather brief, comprising only those issues that are directly relevant to the ensuing argument. I then go on to consider prominent existing accounts of generics and argue that each faces serious difficulties. My positive account begins with the section entitled "Troublesome Generics" and is the topic of the remainder of the article.

The Logical Form of Bare Plural Generics

The examples cited above were all 'bare plural' generics. That is, the item in the sentence that received a generic interpretation was a plural common noun with no determiner or quantifier preceding it: 'mosquitoes', 'birds', and 'tigers'. Genericity manifests itself in other constructions too; indefinite singulars (e.g., 'a tiger is striped'), and definite singulars (e.g., 'the tiger is striped') can both receive generic interpretations in English. To simplify matters, for the remainder of this essay I will focus solely on bare plural generics. There are interesting questions surrounding the other two generics—the indefinite singular and

1. We could make a preliminary distinction between two tasks, which semanticists and cognitive scientists might usefully divide up between them. The first is the familiar one of articulating semantic structure in sentences of a given language so as to enable a recursive assignment of truth conditions, or alternatively propositions, to all the sentences of that language. The assignments are understood as meaning giving, and the language in question can thus be taken to be a vast paring of sentences and meanings. The second task is to explore the actual cognitive abilities of speakers in order to explain just how it is that they are able to speak the language so understood. It is this second task, as it applies to the case of generics, that I am mostly concerned with here.

the definite singular—but a discussion of them will be beyond the scope of this essay. In the interest of concise terminology, I will henceforth use the term 'generic' to mean *sentence containing a generically interpreted bare plural.* Thus I am to be understood as theorizing about this more restricted class of sentences.

Not all bare plurals receive generic interpretations in English. Consider, for example:

Tigers are striped.

Tigers are on the front lawn.

The interpretation of the first sentence is intuitively quite different from the interpretation of the second. Whereas the first expresses a claim about tigers in general, the second concerns only some particular group of tigers. In cases such as this, we say that the bare plural receives an *existential interpretation*, in contrast to a generic interpretation. This essay will be concerned only with bare plurals that are interpreted generically. For extensive discussion of existential interpretations of bare plurals, see Carlson 1977 and Kratzer 1995.[2]

While the semantic interpretation of generics is a matter of controversy, the logical form of bare plural generics is quite well understood. It is generally agreed amongst linguists that there is a two-place operator Gen that functions as an *adverb of quantification* in the sense of Lewis 1975. That is, the operator Gen is *unselective*, binding any variables that are free in the sentence. Adverbs of quantification include 'usually', 'generally', 'typically', 'always', 'sometimes', and so on. The logical forms of sentences containing adverbs of quantification are very often

2. Two tests are useful in distinguishing existential from generic interpretations. The first concerns entailment: the existentially interpreted common noun can be replaced by a common noun that picks out a superset of the former, without change in truth-value; we can replace 'tiger' with 'animal' salva veritate in 'tigers are on the lawn'. This is not so when the interpretation is generic: the truth of 'tigers are striped' does not entail that animals are striped, despite the truth of 'tigers are on the front lawn' entailing that animals are on the front lawn. The second test concerns interactions with adverbs of quantification: we cannot insert an adverb of quantification into a sentence receiving the existential interpretation without inducing a significant change in meaning. If a sentence receives the generic interpretation, however, then we can. 'Usually' is a good candidate to be inserted into sentences such as 'tigers are striped', though some "troublesome" generics, such as 'mosquitoes carry the West Nile virus', become false with the insertion of 'usually'. However, in those cases we can insert 'sometimes' with a minimal change of superficial meaning. 'Tigers are sometimes on the front lawn', however, has a distinctly different meaning from (2).

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given by a *tripartite structure* (Heim 1982; D. Lewis 1975; Kamp 1981). A tripartite structure consists of an operator—usually a quantifier—a Restrictor, and a Scope:

Quantifier $x, \ldots, z$ [Restrictor $x, \ldots, z$] [Scope $x, \ldots, z$]

The Restrictor specifies the domain over which the variables range, and the Scope specifies the property that is attributed to the relevant members of the domain. For example, we can represent 'generally tigers are striped' as:

Generally x [Tiger(x)] [Striped(x)]

If a sentence contains an adverb of quantification, then any variables in the Restrictor that would be otherwise free are bound by that adverb. But how do those variables come to be bound if there is no explicit quantificational adverb in a sentence? I will adopt the now commonplace proposal that the generic operator Gen occurs in a sentence's logical form just in case there is no explicit quantificational adverb in that sentence (Heim 1982; Kratzer 1995). Gen binds free variables in the Restrictor when no articulated adverb of quantification, such as 'generally', occurs in the sentence—that is how Gen occurs in the logical form of sentences such as 'tigers are striped', 'ravens are black', 'mosquitoes carry the West Nile virus', and so on. Gen can thus be thought of as a *default* variable-binding operator, arising only when the sentence does not contain an explicit quantificational operator.

Since the sentence 'tigers are striped' contains no explicit quantificational operator, its logical form will involve the default operator Gen. The logical form of 'tigers are striped' will be represented as:

Gen x [Tiger(x)] [Striped(x)]

More generally, the logical forms of the generics we are concerned with in this essay will belong to the following schema:[3]

3. The astute reader may have noticed that not all nonexistentially interpreted bare plural subjects can be readily assimilated into a view that posits a generic operator—how are we to treat sentences like 'dodos are extinct'? This is not an existential statement concerning just some dodos—it is more general than that—but it is also not readily understood as containing a quantifier ranging over individual dodos. Here, Krifka's (1987) distinction between I-generics (indefinite generics) and D-generics (definite generics) is particularly useful. D-generics predicate properties of

$$\text{Gen } x_1 \ldots x_n \text{ [Restrictor}(x \ldots x_n)] \; \exists y_1 \ldots y_n$$
$$[\text{Scope}(x_1 \ldots x_n, y_1 \ldots y_n)]$$ [4]

I know of no contemporary theorists that do not take this schema to underwrite the logical form of generics. There is, however, much dispute about how Gen is to be semantically interpreted, as we will see in the next section.

Thus far I have been speaking of Gen appearing in the logical form of sentences, without being explicit about how we should understand this notion of logical form. From here on in, I will understand the relevant notion of "logical form" to be the linguists' notion of LF—a psychologically real level of linguistic representation. Thus I will assume that the introduction of Gen is one of the operations the language faculty performs when formulating a sentence's LF. If one is unfamiliar with the notion of LF, the important point is simply that the emergence of Gen will be considered to be a psychologically real process.[5]

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their subjects that do not hold of *particular members* of a kind but only of a kind itself. I-generics predicate properties of their subjects that *can* hold of particular members of the kind. Examples of D-generics include 'the Dodo is extinct', 'dogs are widespread', and 'dinosaurs died out many years ago,' and examples of I-generics include all the generics we have encountered in the essay until now. D-generics have received comparatively little attention in the literature. Their subjects are taken to be referring terms that denote kinds, and little more is said than that. The logical form of 'dodos are extinct' is simply 'Extinct(d)', where 'd' picks out the kind Dodo. I will not pursue the matter of D-generics further.

4. If a variable is free in the Scope but not in the Restrictor, that variable will be bound by an existential quantifier. Thus for 'Cats have a tail' we first obtain:

$$[\text{Cats}(x)] \; [\text{Tail}(y) \;\&\; \text{Have}(x, y)]$$

Since 'y' is free only in the Scope, the Scope must undergo existential closure. 'x', however, is free in both locations and so will be bound by Gen:

$$\text{Gen } x \; [\text{Cats}(x)] \; \exists y[\text{Tail}(y) \;\&\; \text{Have}(x, y)]$$

For an extensive discussion of this phenomenon, see Kratzer 1995.

5. If one is uncomfortable with the claim that these tripartite structures arise at LF, but is nonetheless content with the claim that they arise at *some psychologically real level of linguistic representation or other,* then one may reinterpret my references to LF as references to this level of representation. Nothing I say depends on this level being LF; that the level in question is psychologically real will be sufficient for the following discussion. For expository simplicity, I will follow Heim (1982) and describe the level as LF. I must emphasize that the important features are just that this level should be linguistic—rather than conceptual—and be psychologically realized. Nothing more specific to LF needs to be assumed.

Existing Accounts of Generics

Although there is much consensus in the literature about the general outline of the logical form of generics, there is little or no consensus about the meaning of Gen. Gen is clearly not equivalent to any of the classical quantifiers such as 'all', 'most', or 'some' (Carlson 1977). 'All' is too strong; generics can remain true in the face of exceptions, while universals cannot. 'Most' is both too weak and too strong; most chickens are female, yet 'chickens are female' is false, while on the other hand 'mosquitoes carry the West Nile virus' is true, though most mosquitoes do not carry the virus. 'Some' is evidently too weak since certainly some chickens are female, but again the corresponding generic is false.

Some adverbs of quantification may seem more promising as glosses: 'generally', 'usually', and 'typically' are all successful glosses of many generics:

Tigers have stripes.

Generally, tigers have stripes.

Dogs bark.

Typically, dogs bark.

Cats have whiskers.

Usually, cats have whiskers.

In each case, the second sentence is a good paraphrase of the first. Since Gen appears to share properties with adverbs of quantification (such as being unselective), it would be appealing to locate it semantically among these other adverbs. However, there are many generics that cannot be paraphrased using 'generally', 'usually', or 'typically':

Bees are sterile (false).

Generally, bees are sterile (true).[6]

Books are paperbacks (false).

Typically, books are paperbacks (true).[7]

Sharks attack bathers (true).

Usually, sharks attack bathers (false).

6. Generally, bees are sterile; only the queen and a few males are capable of reproducing.

7. Typically, books are paperbacks; only a small percentage of books are hardcover.

Similar difficulties undermine the suggestion that Gen functions as a restricted universal quantifier meaning roughly "all normal." The most sophisticated versions of this approach are due to Asher and Morreau (1995) and Pelletier and Asher (1997), who maintain that 'Ks are F' is true if and only if for each individual K, the most normal worlds for that K, according to the ordering base, are such that that K is F. (The ordering base of worlds contains a contextually determined similarity metric on worlds.) Put in more intuitive terms, this amounts to the claim that the generic is true if and only if each K would be F under the circumstances that are "most normal" for that K. This has some appeal, but quickly runs into difficulty with gender-specific generics such as 'ducks lay eggs', and 'lions have manes'. There is nothing abnormal about being a male duck or a female lion, yet none of these creatures would have the properties needed to make the universal true except under exceptionally *abnormal* circumstances. Pelletier and Asher suggest restricting the quantifier further in these cases, claiming that the only Ks that are relevant to the truth of 'ducks lay eggs' are the female ducks, and so the truth of that generic is determined by whether female ducks lay eggs under the most normal conditions. They suggest that this sort of domain restriction is acceptable as long as the restricted domain is a subkind of the kind in question; female ducks constitute a subkind of ducks, hence the truth of the above generic. This should leave us wondering why 'ducks are female' is not true; why are we blocked from the appropriate subkind restriction in that case, but not the other? Alternatively, why is 'ducks don't lay eggs' not also a true generic? If female ducks constitute an appropriate restriction, surely male ducks do likewise; why then is 'ducks don't lay eggs' not also rendered true via restriction to the male ducks? We should also wonder what prevents 'bees are sterile' from being a true generic; do worker bees not constitute a subkind of bees? Or for that matter, why do we not accept 'marsupials are kangaroos'? Surely kangaroos count as a natural subkind of marsupials.

These accounts also encounter difficulties with generics such as 'mosquitoes carry the West Nile virus'. As we have noted, less than 1 percent of mosquitoes actually carry the virus, so it is quite an unusual and perhaps abnormal property for a mosquito to have. Certainly one should be reluctant to say that all normal mosquitoes carry the virus. Similarly, one would need quite an unusual ordering relation of worlds as more or less normal to have it turn out that the most normal state of affairs for a mosquito is one in which it carries the West Nile virus. We should also note that there is no natural subkind with which to restrict the domain here. I would suggest that no noncircular domain restriction is forthcoming for this sentence and its like.

Ariel Cohen (1996) proposes a rather different account, in which he asks us to consider the set Alt(F) for a predicate 'is F', where Alt(F) is the contextually supplied set of alternatives to 'is F'. The notion of a set of alternatives to a predicate is familiar from theories of focus semantics (see Krifka 1995). The notion is an intuitive one: the alternative to, for example, *being male* is *being female*; the alternatives to *walking to the department* are *driving to the department, taking the shuttle to the department*, and so on. The alternatives to F need not be incompatible with one another, though in many cases they will be. As Cohen understands the set of alternatives, 'is F' itself is included among Alt(F). Cohen also makes use of the alternatives to *being a K*; for example, the relevant alternatives to being a cat may be being another kind of mammal, and the relevant alternatives to being a mosquito may be being another kind of insect.

With the notion of alternatives in place, Cohen suggests a distinction between *absolute* and *relative* generics:

> Absolute generics:
>
> 'Ks are F' is true iff the probability that an arbitrary K that satisfies some predicate in Alt(F) satisfies 'is F' is greater than .5.
>
> Relative generics:
>
> 'Ks are F' is true iff the probability that an arbitrary K that satisfies some predicate in Alt(F) satisfies 'is F' is greater than the probability that an arbitrary member of Alt(K) that satisfies some predicate in Alt(F) satisfies 'is F'.

We have the restriction "satisfies some predicate in Alt(F)" in order to deal with, for example, reproduction-related generics. The alternatives to 'gives live birth' will be 'lays eggs', 'engages in mitosis', and so on. Since the males of a species will not engage in any of these alternatives, they are not considered in the evaluation of such generics as 'cats give live birth'. This account avoids the prediction that 'cats are female' will also be true since the alternative to 'is female' is 'is male', and so a broader range of Ks are considered in its evaluation. I will refer to the Ks that satisfy some predicate in Alt(F) simply as 'the relevant Ks'.

Absolute generics, then, are true if more than half of the relevant Ks satisfy the predicate in question; 'tigers have stripes' would be an example of a true absolute generic since most tigers are striped. Relative generics are true if the rate of F-ness among the relevant Ks is greater than the rate of F-ness among the relevant non-Ks.[8] 'Mosquitoes carry the West Nile virus' is thus a true relative generic; mosquitoes are far more likely than other insects to carry the virus. It is important to note that there is no explicit marking of the distinction between absolute and relative generics; there is no independent way to tell whether a generic should be interpreted as absolute or relative. Generics are not ambiguous; Cohen does not claim this, and it would not be right to claim it. For example, 'Dogs have four legs' does not have two readings, one of which is false and the other of which is true. (It is true as an absolute generic since most dogs have four legs. It is not true as a relative generic, though, since the incidence of four-leggedness among dogs is lower than among the likely alternatives to dogs, which are, presumably, other mid-sized mammals. There are almost no three-legged animals in the wild—they tend to meet quickly with sticky ends—but many pet dogs live to old age despite being short one leg.) Similarly 'mosquitoes carry the West Nile virus' is not intuitively ambiguous between a false absolute reading and a true relative reading.

If generics are not ambiguous, then each generic must either be absolute or relative. Cohen gives us no procedure to determine whether a generic is absolute or relative, but there is an implicit assumption in his discussion: namely, that if a generic is true on one of the classifications, then it belongs to that classification and is thereby true simpliciter. A generic belongs to whichever class makes it true; if neither class makes it true, then the generic is false.

Dividing generics up in this way is ingenious and captures a much broader range of data than offered by the other accounts above. As it stands, however, it is too permissive and renders too broad a range of generics true. For example:

Books are paperbacks.

Chickens are female.[9]

Bees are sterile.

Dogs have three legs.

These are all intuitively false, but are rendered true by Cohen's account—the first three being true absolute generics, the fourth being

8. Here I am conflating frequency and probability and will continue to do so. Nothing interesting hangs on the distinction here.

9. I am told that approximately 80 percent of chickens are hens.

a true relative generic since a three-legged animal is very likely to be a dog. Cohen recognizes that his account is too permissive and introduces his *homogeneity* constraint to rein in the account. The homogeneity constraint requires that the above probability conditions (exceeding .5, or exceeding that of the arbitrary alternative to the kind) should hold in *all salient partitions* of the kind. We should, of course, wonder just what constitutes a salient partition of a kind. In some cases it is rather intuitive: 'books are paperbacks' is false because the kind, Book, is naturally partitioned into paperback books and hardcover books. *Being a paperback book* occurs with the required probability in only one of the partitions (namely among the paperbacks), and not in the other (i.e., among the hardcovers).[10] Thus 'books are paperbacks' is false because it does not meet the homogeneity constraint. Similarly 'Chickens are female' is false because there is a salient partition into the female chickens and the male chickens; the generic thus violates homogeneity.

The homogeneity constraint, however, comes dangerously close to ruling out all generics that have any exceptions whatsoever. Surely any predicate 'is F' makes salient a simple two-part partition into Fs and non-Fs; why does the occurrence of the predicate itself not suffice to evoke this partition? The rate of F-ness among the non-Fs will trivially be zero; if such a partitioning is salient and permissible, generics would collapse into universals. Cohen clearly cannot *rule out* simple two-way partitions of the kind into the Fs and the non-Fs since that is exactly what occurs in the two generics discussed above. Presumably, the explanation of why 'chickens are female' violates homogeneity in virtue of the partition of the kind into female chickens and nonfemale chickens (i.e., male chickens) must rely on the idea that gender is an inherently salient partition. It is not that it is made salient by the use of the predicate 'is female'; if this was the explanation, then any predicate might make salient a

10. In Cohen (2004) he claims that the relevant partitions of the kind Book are into mystery books, encyclopedias, biographies, and so on. Homogeneity is violated because almost no encyclopedias are paperbacks, and so it is not the case that all salient partitions of the kind Book consist of more than 50 percent paperbacks. I must admit that—while I see the appeal of the homogeneity constraint—I cannot understand why Cohen thinks this is the correct explanation of the falsity of 'books are paperbacks'. Even if encyclopedias (and all other types of books) were uniformly, say, 80 percent paperbacks, surely 'books are paperbacks' would still be false. It is the existence of the nontrivial number of hardcover books that matters for the falsity of 'books are paperbacks', not how publishing houses allocate that number across genres. Homogeneity does yield a plausible explanation of why the generic is false, though, as long as we understand the partition as into hardbacks and paperbacks.

corresponding partition into the Fs and the non-Fs. But if gender is an inherently salient partition, then we would expect that 'lions have manes', 'peacocks have big blue tails', and 'cardinals are red' should all be false generics.

Cohen also argues that 'bees are sterile' is false because there is a salient partition of bees into workers, drones, and queens, and almost none of the queens are sterile. Unfortunately, the same constraint will make the true generic 'bees reproduce' false, as none of the workers reproduce. Homogeneity also does not offer a way to rule out 'dogs have three legs' as a true relative generic without also ruling out 'dogs have four legs' as a true absolute generic; any partition that is not homogeneous with respect to the first will also be nonhomogeneous with respect to the second.

The homogeneity constraint faces difficulties. The notion of a relative generic is also troublesome. The category of relative generics was introduced to deal with sentences like 'mosquitoes carry the West Nile virus'. The incidence of West Nile virus-carrying is higher among mosquitoes than among arbitrary insects, so it is a true relative generic. We should worry, though, that the possibility of relative generics opens the door too wide. Cohen's account—if it is able to capture the truth of 'dogs have four legs'—must treat 'dogs have three legs' as a true relative generic. Similarly, any time, say, a handicap or birth defect D is more frequent among one kind than all others, then 'Ks have D' will be a true relative generic. Thus, for example, 'humans are one legged,' or autistic, or blind, would be true relative generics by Cohen's lights. Cohen's theory also erroneously predicts that certain generics containing negation would be true: none of us think that 'mosquitoes don't carry the West Nile virus' is true, nor do we think that 'sharks don't attack bathers' is true, yet these should be true absolute generics on his view.

It is not even clear that we ought to treat troublesome generics as relative. Let us consider 'mosquitoes carry the West Nile virus'. We can imagine a world in which fleas also carry the West Nile virus and at a significantly higher rate than that of mosquitoes. At this point, Cohen still predicts the truth of 'mosquitoes carry the West Nile virus', since mosquitoes may still carry it at a rate higher than that of the arbitrary insect. Imagine, though, that fleas came to drastically outnumber all other insects; the rate with which the arbitrary insect carried the West Nile virus would likewise increase. (The rate at which the arbitrary insect carries the virus is determined by dividing the number of insects with the virus by the total number of insects. Increasing the flea population while keeping its high rate of virus carrying constant will, of course, increase this average.) If the flea population swelled to sufficiently immense proportions, then the rate at which the arbitrary insect carries the virus would exceed the rate at which mosquitoes carry the virus. Thus whether mosquitoes carry the virus *at a rate higher than that of the arbitrary insect* depends on these facts about relative population size. It seems, however, that whether it is true that mosquitoes carry the West Nile virus does not depend on how many fleas there are relative to other insects. One does not need to know how many fleas there are to know whether mosquitoes carry the West Nile virus.

Troublesome Generics

Let us consider the counterexamples that plague existing accounts. Many generics of the form 'Ks are F'[11] hold of a large majority of the Ks, and their exceptions are often in some way defective. Take, for example, 'tigers have four legs': it is only tigers with birth defects, or that have met with unfortunate accidents, that do not have four legs. These generics are readily handled by existing accounts. As we saw, however, there are a number of examples that spell difficulty for some or all of these accounts. These troublesome generics are either true, despite a majority of the Ks' failing to satisfy the predicate, or false, despite the majority's satisfying it. It would be desirable to understand the circumstances under which these troublesome generics arise. Is there a reasonably narrow range of features that is sufficient to identify potentially troublesome generics?

I claim that the bulk of these troublesome cases fall into one of two categories:

Type A

Bees reproduce.

Bees are sterile (false).

11. Of course there are many generics that are not of this form because, for example, a generically interpreted bare plural occurs in object position. To achieve full generality, we should speak in terms of generically interpreted material in the Restrictor satisfying the Scope, but it is cumbersome to speak in this way. In the interests of simplicity, the discussion here will be restricted to syntactically simple generics of the form 'Ks are F', where 'Ks' is the only generically interpreted material in the sentence. A successful treatment of this restricted class can, I believe, be readily extended to the broader class of sentences; however, such a discussion is beyond the scope of this essay.

Birds lay eggs.

Chickens are female (false).

OrangeCrusher 2000s crush oranges (even if no OrangeCrusher 2000 has ever been used).

Firemen fight fires (even if there are no fires).

Type B

Sharks attack bathers.

Mosquitoes carry the West Nile virus.

Tigers eat people.

Rottweilers maul children.

The patterns in the A group are best explained by first noticing that for certain types of kinds, including biological, artifact, and institutional kinds, our background knowledge leads us to have certain strong expectations concerning them. For example, we expect that biological kinds will exhibit certain characteristics, or else face extinction. The most obvious expectation of biological kinds is that reproduction will be possible. It is common knowledge that for an animal kind to survive, certain conditions must be met. We generally suppose that:

There must be both male and female members of the species.

There must be a manner in which this reproduction and subsequent gestation occurs.

There must be adult members of the species.

The young must be nourished in some way.

I suggest that generic statements that express determinate versions of these claims are true even if there happen to be a large number of exceptions. Our background assumption is that these claims are true in virtue of the kind under consideration being a successful biological kind, so it takes a very large proportion (almost 100 percent) of exceptions for us to give up these claims. Hence the apparent truth of the following, despite a large number of exceptions:

Bees reproduce.

Chickens lay eggs.

Cats suckle their young.

Conversely, generics that conflict with these presuppositions are very difficult to render true:

> Bees are sterile.
>
> Turtles die in infancy.

If, however, the number of exceptions approaches 100 percent, the statement will be taken to be true; 'mules are sterile' is such an example.

Similar effects can be seen with artifact and institutional kinds. We presume that artifacts will have a function, so generics characterizing that use are tolerant of exceptions. 'OrangeCrusher 2000s crush oranges' is such an example; the sentence strikes us as true, even if *none* have ever been plugged in and used—due, perhaps, to lack of demand for crushed oranges. Similarly, 'firemen fight fires' would remain true even if the climate had become so humid that there were never any fires to fight.

Let us turn now to Type B generics. These generics are true even though the vast majority of Ks are exceptions to the generalization. The examples in the B group have something in common: in all of them, the sentence attributes harmful, dangerous, or appalling properties to the kind. More generally, if the property in question is the sort of property of which one would be well served to be forewarned, even if there were only a small chance of encountering it, then generic attributions of the property are intuitively true. We see a similar phenomenon elsewhere in our judgments: compare the number and regularity of times one must worry to be a worrier versus the number of murders one must commit to be a murderer.[12]

It should be evident upon reflection that the criteria that govern troublesome generics reflect our psychology. This is especially evident in the B group: the more striking, appalling, or otherwise gripping we find the property predicated in the generic, the more tolerant the generic is to exceptions. For the sentences in the B group, it appears that it is sufficient for the truth of the generic that just *some* of the members of the kind have the property in question. Our judgments about the A group too, I claim, depend on our background assumptions and expectations. If a generic pertains to certain kind-relative expectations—reproduction

12. Interestingly, Larson (1998) suggests that there is a generic operator present in the logical form of attributions like 'John is a worrier' and 'John is a murderer'. If this is correct, then an account of the disparities in the required regularities would follow from the account of generics that I am proposing.

for animal kinds, function for artifact kinds, and so on—then it too is very tolerant of exceptions. As a first-pass hypothesis, we might say that if a generic expresses the manner in which an animal reproduces and nurtures its young, then it is again sufficient for its truth that *some* members of the kind satisfy the predicate. If a generic expresses the function of an artifact, then it is enough that this be the intended function of the artifact. I will call these specific kind-relative expectations *characteristic dimensions* of a kind and will return to the relation between characteristic dimensions and generics in more detail below.

If the above classification of troublesome generics is appropriate, then this suggests that our goal of understanding the quirky behavior of generics might be furthered by looking carefully into some of the relevant psychological literature. If the relation between objective statistical frequencies and the truth-values of generics is in some way mediated by psychological considerations, it would be useful to determine exactly what role these considerations are playing.

As it turns out, the above observations are not the only reasons to consider the psychological literature when studying generics. The suggestion about the importance of our psychology for the understanding of generics is reinforced when we look at the near-paradoxical nature of the *acquisition* of generics. Before considering generic acquisition, however, let us take a moment to consider another potential class of troublesome generics.

Dutch Sailors and Bulgarian Weight Lifters: An Aside concerning Logical Forms

One might worry that my classification of troublesome generics leaves out an important group. What of generics such as ‘Dutchmen are good sailors’ and ‘Bulgarians are good weight lifters’, which are supposed to be true, even though few Dutchmen are sailors, and so a fortiori few Dutchmen are good sailors (and similarly for Bulgarian weight lifters).

Historically, these observations form the basis of the “Port-Royal Puzzle,” which notes the invalidity of the following argument:

> Dutchmen are good sailors.
>
> So, Dutchmen are sailors.

This puzzle has traditionally been thought to be connected with generics—that it is one of many strange features of generics that only a few Dutchmen need to be good sailors for the premise to be true, but far more would need to be sailors (good or bad ones) for the conclusion to be true. On closer investigation, however, it is less than obvious that this puzzle has to do with the truth conditions of generics rather than the interaction of comparative adjectives and agentive nominals. Consider the following nongeneric version of the Port-Royal Puzzle:

> Barry is a good dancer.
>
> So, Barry is a dancer.

This argument is also invalid. For the premise to be true, it is sufficient that Barry exhibit talent when he dances. For the conclusion to be true, however, Barry would need to have organized his life so that dancing is his chosen vocation, or at least one of his avocations (Larson 1998). The premise may well be true even if Barry is a philosopher who dances once a year, but the conclusion cannot be true under those circumstances. This suggests that the puzzle has more to do with adjectives and agentive nominals than with generics. (An agentive nominal, for our purposes, is a nominal derived from a verb, usually by adding 'er' to the stem.)

Richard Larson (1998) considers this nongeneric version of the Port-Royal Puzzle and offers a solution to it. Following Condoravdi (1989), he proposes that, when agentive nominals are modified by adjectives, the agentive nominal occurs as a verb in the Restrictor of the sentence's logical form. It does not occur as a noun in the Scope. The logical forms of sentences such as 'Barry is a good dancer' are generalizations over events in which Barry dances:

$$Q\ e\ [\mathrm{C}(e, \mathrm{Barry})\ \&\ \mathrm{dancing}(e, \mathrm{Barry})]\ [\mathrm{good}(e, \mathrm{C})],$$

where 'C(e, Barry)' denotes a contextual restriction to relevant events involving Barry. 'Barry is a good dancer' means, on this account, something to the effect of *generally, events of Barry dancing are good qua events of dancing*. In uttering 'Barry is a good dancer', we are predicating something of events of Barry dancing, namely, that they are good qua events of dancing. We are not directly predicating of Barry the property of being a good dancer.

Since the agentive nominal is not part of what is being predicated in 'Barry is a good dancer', we would not expect the sentence 'Barry is a dancer'—in which the agentive nominal *is* part of what's predicated—to be entailed. Thus the nongeneric version of the Port-Royal Puzzle is explained.

Larson does not discuss the generic version of the puzzle, but his work extends naturally to explain it. Consider (3), for example:

(3) Bulgarians are good weight lifters.

'Weight lifter' is an agentive nominal (as is 'sailor'). Following Larson and Condoravdi, I suggest we treat 'weight lifter' as part of the Restrictor rather than the predicate. This massively reduces the number of exceptions there are to the generalization. In uttering (3), we are not generalizing over Bulgarians and claiming they satisfy 'is a good weight lifter', but rather we are generalizing over Bulgarian weight lifters and claiming that they are good at weight lifting. The Port-Royal Puzzle rests on an error about logical form. Thus I claim that once we properly understand the logical form of these claims, they are not troublesome generics.

The Paradox of Generic Acquisition

Recall from our earlier discussion that we are taking Gen, the generic operator, to be a 'default' operator that arises to bind any variables that remain free in a sentence's restrictor once all the articulated quantifiers in the sentence have bound their variables. Gen is thus a peculiar operator, occurring only when the sentence does not provide articulated quantifiers to bind all the restrictor's variables. As we have noted, this is not an idiosyncratic feature of English: Gen is not articulated in any known language (Krifka et al. 1995; Dayal 1999), and so exists only as a shadowy default operator that arises in the absence of explicit ones.

As we have seen in previous sections, the interpretation of this default operator is complex. Gen does not track straightforward statistical regularities, and if my above classification of troublesome generics is correct, it is sensitive to whether the predicated property is striking, or among characteristic features of the kind. Moreover, it appears to be a linguistic universal that the operator with these strange qualities is the default one; Gen is never articulated, so it is natural to conclude that Gen is a default operator across languages, as it is in English.

A puzzling question now arises: how does a language learner ever come to master generics? Not only is the interpretation of Gen rather complicated, the operator is not even phonologically realized. How does a language learner come to know that it is *this* particular operator with *this* peculiar meaning that binds unbound variables in the absence of other operators? The task of learning generics appears quite daunting.

Surely, one would think that explicit quantifiers such as 'every' and 'most' would be more easily acquired. For one, they are phonologically realized, and thereby present the child with an object of study, in contrast to our elusive Gen. Secondly, they have precise statistical meanings, of the sort that linguists and philosophers of language can readily seize on as semantic interpretations, and which one might imagine the language learner could quickly grasp.

For example, one might fondly imagine the child noticing that 'every A is B' is said only when the As are a subset of the Bs, while 'most As are Bs' is said as long as more than half of the As are Bs. Fair enough, but then all of a sudden our language learner encounters sentences like the previous ones, but with a blank in place of the quantifier. The child then has to learn that Mommy and Daddy refrain from uttering 'every', or 'all', or 'most', or 'usually' in circumstances where As are generally Bs, unless B is really striking, in which case it is enough that just some As are Bs, or B is a characteristic feature of As, in which case again just some is enough, except in the case of artifacts and their design, in which case no As need to be Bs—and so on. And again, the child must learn to associate this complex range of conditions with *the absence* of a quantifier or determiner.[13] The task seems practically impossible: how do we ever master this part of language?

To make matters all the more puzzling, it happens that generics are acquired quite early on. Children start using generics by two years of age, which is significantly earlier than explicit quantifiers (Gelman 2003; Roeper, Strauss, and Pearson 2006). That children *ever* master generics is perplexing; that children master them more readily than explicit quantifiers borders on the paradoxical. This is a phenomenon that demands explanation.

Semantics from a Cognitive Perspective

But why, one might ask, should we concern ourselves with the facts of language acquisition? Traditional approaches to semantics do not

13. Associations with absence are notoriously difficult for children to master. If children as old as four or five are presented with two stimuli that differ only in that one stimulus has an additional feature that the other lacks, and are reinforced only for responding to the stimulus lacking the feature, they fail, by and large, to learn the discrimination. If they are reinforced for the stimulus *with* the distinctive feature, they learn the discrimination quite rapidly; there is something especially challenging about learning associations with absences. See Sainsbury (1973) for discussion of this "Feature Positive Effect."

usually take such considerations into account. Often, semantic interpretations consist of assigning things like objects, properties, senses, or truth conditions to sentences and their parts. These more traditional approaches to semantics might be viewed as dealing with the question of how language is related to the world. This is an interesting question and has received much attention. There are, however, different questions related to meaning that we might wish to address: how do human beings actually understand their natural languages?[14] What are the mental processes that underlie our ability to comprehend and produce the sentences of our languages?

Notice that this question might remain unanswered even if one had a successful finite and recursive way of matching sentences with meanings. There is no guarantee that such a model would be the correct model of human language comprehension. A broad range of empirical data from acquisition, disorders, cognitive development, and so forth would bear on the adequacy of a given model from the psychological point of view.

These latter sorts of considerations are rarely taken into account by semanticists. If one's interest lies solely with characterizing the language-world relation, then these sort of considerations may be irrelevant. If, however, one is interested in how human language comprehension and production actually proceeds, then one would be well served to consider such data. Exactly what one should do with the data, or what a cognitively oriented semantics should look like, may not be immediately obvious. I hope that the remainder of this essay will give the reader a sense of how one might proceed.

For now, I will thus set aside the tools of formal semantics and will not directly concern myself with the relation of generics to the world. I will instead develop an account of generics that is couched in the framework of cognitive science.

Infant Generalizations

The contrast between the difficulties we would expect children to face in acquiring generic language and the apparent ease with which they

14. That this question exerts an influence on semantic research is evidenced by the pursuit of *finitely axiomatizable* language-to-world semantic theories. The motivation for requiring that semantic theories be finitely axiomatizable is primarily to explain how finite beings can understand a potentially infinite number of natural language sentences. This constraint figures in just about every contemporary semantic theory.

master it suggests that they do not learn the meaning of Gen in the manner discussed above—that is, by isolating and matching a complex set of truth conditions with the absence of an explicit quantifier. A different proposal is needed. Let us begin by making the following obvious claim: Generics express generalizations. This is intended as a weak and untendentious claim; generic sentences are not about some specific instances of the category mentioned in the Restrictor, but rather about the category in general. Now, inductive or ampliative learning—learning that goes beyond the instances with which one is presented—is central to the acquisition of knowledge throughout life. Inductive learning is what allows the child to avoid a hot stove after a single burn, the adult to avoid repeating errors indefinitely, and perhaps even the conditioned rat to flee a shock box after hearing a warning tone. Without the ability to make generalizations that go beyond particular, experienced instances and so respond accordingly to novel events and items, an animal would probably not last very long. No theorist would deny that the capacity to generalize—the capacity for inductive learning—is innately given.[15]

The capacity to generalize manifests itself early in life. Graham, Kilbreath, and Welder (2001) found that twelve- to fourteen-month-old infants are willing to generalize nonobvious properties, such as rattling when shaken, both to objects that were perceptually similar to the original item and to objects that were introduced with the same label (e.g., 'these are blicketts!'), but not to any other objects. Graham, Kilbreath, and Welder's experiment was intended to demonstrate the impact of language on infant inductive categorization tasks; the impact is striking considering that infants are only just beginning to use language at that age. It is also interesting to notice that while labeling aided the infants in generalizing to a broader range of items, they were *already* inclined to generalize to the class of perceptually similar items. Baldwin, Markman, and Melartin (1993) further found that infants as young as nine months were willing to make similar generalizations. Thus the inclination to generalize, though aided by language, does not depend on language but is, rather, an early developing, presumably innate, cognitive disposition.

This innately given cognitive disposition is surely available to infants before they have acquired language, as the study concerning nine-month-olds suggests. The disposition constitutes the human mind's *default* manner of generalizing information from a few instances to

15. Empiricist-nativist controversies often concern whether anything is innately given *apart* from this ability.

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many. Thus an interesting hypothesis presents itself: just as, at the level of logical form, Gen is a default operator, at the level of language comprehension, its contribution is to invoke the mind's default manner of generalizing the material in the Scope over the items that satisfy the Restrictor.

Recall the notion of a tripartite structure discussed earlier. These tripartite structures can be schematically represented as follows: Quantifier [Restrictor] [Scope]. The hypothesis I am suggesting is that, in the case of generics, the relation between the Restrictor and Scope is computed by means of the mind's default method of generalizing. This would stand in contrast to, for example, the computation of set-theoretic relations between the extensions of the Restrictor and the Scope. If Generalized Quantifier Theory were understood as a view about psychological processes—which it need not be—then these set-theoretic computations would be central to our comprehension of explicit quantifiers. On the view of generics here advocated, it is the innately given default mechanism of generalization that underwrites our comprehension of generics. This mechanism is invoked in understanding, evaluating, and producing generics. If a speaker's knowledge and experiences with members of a kind K leads her default mechanism to generalize the property of being F to that kind, then she will express this with the generic 'Ks are F'. Similarly, her hearer would judge the utterance to be true if, given his knowledge and experience, his default mechanism would generalize the property of being F to the Ks.

If this is how generics are grasped, the paradox of acquisition is dissolved. At the time of acquisition, the child would *already* be in possession of this default method of generalizing, complete with all its quirks. Thus the task of learning how generics should be semantically interpreted would be simplified. Once a learner is able to partition material into a Restrictor and a Scope, and understand that material (the nouns, verbs, and so on), she is equipped to understand generics—modulo the implicit knowledge that the default Gen must bind the Restrictor's free variables. But it is also quite natural to imagine that whatever operations of the language faculty are responsible for the emergence of Gen at Logical Form (LF) are part of the language faculty's innate endowment; it is hard to imagine what evidence could push a learner to adopt the practice of thus binding the restrictor's free variables. Minimally, the child's innate linguistic "knowledge"—knowledge of Universal Grammar, if one likes—must entail that an LF cannot contain free variables if it is to be interpretable. The child must then find some operator if the sentence does not provide one, and there is some elegance to the idea that this default operator has as its interpretation the child's default mode of arriving at generalizations.

As generic acquisition requires only that the child learn how her language partitions material into Restrictor and Scope, and the meaning of the nonquantificational material therein, this view *predicts* that the unarticulated generic would be acquired before the explicit quantifiers. The truth-conditionally tractable and phonologically articulated quantifiers are so because *they need to be learned*, in a way that generics do not.[16] The seeming paradox of generic acquisition is dissolved.

Defaults and Inhibitions

We are investigating the following hypothesis: the default operator Gen invokes the cognitive system's default mode of generalizing. I argued that there must be such a mode and that it operates prior to the acquisition of generics, even though the latter occurs quite early on.

If generics are understood by way of this default, we might further conjecture that the comprehension of nondefault quantifiers requires the conceptual system to override or inhibit its default operations. When the conceptual system is confronted with an LF of a tripartite nature, it must compute the relation between the Scope and the Restrictor in a way that is appropriate to the operator. In the case of generics, where the only operator is the default Gen, the least marked of operators, the relation between Restrictor and Scope is simply the relation of the latter's being generalized by the default mechanism to the former, so the evaluating conceptual system need only invoke its default method of operation. In the case of explicit, marked quantifiers such as 'all', however, the evaluating conceptual system must use a computational process other than its default; it must use one that will ensure the material in the Scope is understood as *universally* generalized to the material in the Restrictor.

We may think of the quantifiers, articulated and marked, as supplying explicit instructions to the evaluating conceptual system. For a conceptual system to perform a nondefault generalization, such as a

16. Some contemporary theorists hold that quantifiers are innate, even though they emerge later in development. I have no quarrel with this view, though I take it as self-evident that if quantifiers are innate, so are generics. See S. J. Leslie 2007 and forthcoming for more discussion of the relationship between generics and quantifiers.

universal one, it must be explicitly commanded to do so. Absent such instruction, the conceptual system simply employs its default. Chomsky (2000) suggests that similar phenomena occur elsewhere in language. Consider, for example, the sentence 'John climbed the mountain'. This is understood as meaning that John climbed *up* the mountain; to obtain the interpretation that John climbed *down* the mountain, we must explicitly use the preposition 'down'. The unmarked case 'climbed the mountain' is never interpreted as *climbed down the mountain*. This may reflect a fact about our conception of climbing, to the effect that by default we conceive of *climbing* as *climbing up*. To deviate from this default interpretation, we must use the more marked form 'climbed down the mountain', which makes use of an explicit preposition. Similarly, in the case of generalizations, the unmarked generic invokes the cognitive system's default mode of generalizing. To invoke a nondefault generalization, an explicit and marked quantifier must be used. The connection, then, between generic generalizations and unmarked surface forms is not an accidental one, but rather reflects a deep fact about human cognition. It is no coincidence that no human language has a dedicated, articulated generic operator.

We might hypothesize that part of what makes the mechanism involved in the comprehension of generics the default mechanism of generalization is that other methods of generalizing—such as that corresponding to universal generalizations—require some inhibitory processing.[17] If generics alone reflect this default mode of generalizing, whereas other methods of generalizing require inhibitory processing, then we would expect certain empirical consequences. First, we would expect that children would handle generics with greater ease than the explicit quantifiers, which would be manifested by their acquiring generics first. We might also expect that generics would show up more

17. The notion of some processes being defaults and others requiring these defaults to be inhibited or overridden is ubiquitous in cognitive science, neuroscience, and biology. The spinal column of a chicken implements processes that, by default, cause the chicken to run around aimlessly. These processes must be inhibited by the chicken's brain for the chicken to refrain from such behavior. If the chicken loses its head, then the spinal column's default mode of operation kicks in; this is the science behind the description 'running around like a chicken without a head'. Less vivid examples of inhibition and defaults can be found anywhere from cellular processes, neural networks, glandular regulatory systems, visual cognition, action-planning systems, and even at the conscious level of temptation resistance.

frequently in maternal speech.[18] Maternal speech is indeed rife with generics, suggesting that generics constitute a ready means of imparting valuable information to children. In contrast, explicit quantifiers are rarely found in maternal speech (Gelman et al. 1998). We might also expect the more surprising result that if faced with a sufficiently demanding cognitive task, young children might even interpret sentences containing explicit quantifiers as though they were generics. That is, if the processing demands of explicit quantifiers are greater, then under some circumstances, a young child may fail to implement the more demanding processes and resort to the default ones associated with generics. Thus we might find some experimental situations in which young children erroneously act as though explicitly quantified statements were in fact generics. We might also expect that adult nongeneric generalizations would, from time to time, inappropriately exhibit some characteristics of generics, especially if the information-processing demands were made great enough.

These predictions are all supported by empirical results. I will delay discussion of adult errors until the end of the essay, as it will be helpful to first characterize generic generalizations in more detail. The prediction concerning children's mistakes, however, is strongly supported by data from a recent experiment by Hollander, Gelman, and Star (2002), to which we now turn.

Hollander, Gelman, and Star recently conducted an interesting experiment that investigated young children's understanding of sentences containing 'all' and 'some' and generics. Their subjects included a group of three-year-olds, a group of four-year-olds, and a control group of adults. The participants were asked yes/no questions that were either generic or contained 'all' or 'some'; for example, a subject might have been asked 'are fires hot?' (generic), 'are all fires hot?' ('all'), or 'are some fires hot?' ('some'). (The questions were selected so that three-year-olds could reasonably be expected to know the answer; the subject matter was no more esoteric than the above example concerning the hotness of fires.) Within each category of question, there were

18. Maternal speech is the characteristic manner that mothers adopt when addressing young children and babies. Maternal speech is regarded as a specifically evolved means of communication that aids children in learning their native language and conveys information to them in ways that they most readily grasp. It is not, for example, an accidental cultural artifact.

questions concerning "wide-scope" properties that were had by all or almost all the members of the category, questions concerning "narrow-scope" properties that were had by only some members, and questions concerning irrelevant properties that were had by none (for example, 'do fish have branches?'). This last class of questions was included to ensure that the subjects were paying attention and providing sensible answers.

The experimenters found that, whereas the adults and four-year-olds distinguished their answers depending on the type of question they were asked, the three-year-olds did not. There was no statistically significant difference between the three-year-olds' answers to questions containing 'all' or 'some' or generics; the three-year-olds responded as though they had been asked only one type of question rather than three very different sorts of questions. This alone is remarkable, but the experimenters further found no significant difference across the age groups' answers to the generic question; the three-year-olds responded as though every question they were asked was a generic—even though many questions contained 'all' or 'some'. The older children and the adults differentiated between the three question types by answering the 'all' and 'some' questions differently from the three-year-olds, but the response patterns to the generic questions remained unchanged with age.

These results suggest that while three-year-olds have difficulty with questions containing 'all' and 'some', their competence with the generic questions is already close to that of an adult. Since generic questions elicit the same response patterns regardless of age, we may conclude the three-year-olds correctly understand and process generics. This alone is noteworthy; the asymmetry between the young children's competence with generics and their difficulty with 'all' and 'some' reinforces the thesis that generics are mastered much earlier in development. The data invite an even stronger conclusion, however; the three-year-olds' difficulty with 'all' and 'some' appears to take the form of assimilating these explicit quantifiers to generics. The three-year-olds did not simply lack competence with questions containing 'all' and 'some'; *they answered them as though they were generics.* Not only were these young children proficient with generics yet uncomfortable with explicit quantifiers, they actually resorted to treating the explicit quantifiers as generics.

The experimenters went on to test the three-year-olds' understanding of 'all' and 'some' under different circumstances. They showed their subjects four crayons (for example) some, all, or none of which were in a box. They then asked the children ‘are all the crayons in the box?’ or ‘are some crayons in the box?’ One might reasonably think that these circumstances would make it easier for the children to answer appropriately; they were no longer being asked about categories in the abstract but rather about concrete items before them. This second experiment thus placed the children in *lower-demand circumstances* than those of the first experiment; they were no longer expected to give answers concerning abstract generalities, and so the task carried fewer cognitive demands with it. In this lower-demand situation, the children by and large gave correct answers to the questions; they were able to treat ‘all’ and ‘some’ appropriately.

Thus three-year-olds are not *incapable* of processing ‘all’ and ‘some’, but it seems that they find them difficult to process—difficult enough that it matters for their success how demanding the task is. This is most consistent with ‘all’ and ‘some’ requiring inhibitory processing. Inhibitory processes, by their very nature, are more taxing for the conceptual system to implement than noninhibitory ones. As the demands on the conceptual system are increased, it becomes more likely that it will be overtaxed, and so fail to implement the inhibitory process, and revert to the default. The conceptual system nonetheless has the ability or *competence* to perform the inhibitory process; it simply fails to do so because it is overwhelmed.

Psychologists have held that there is a significant increase in the ability to implement inhibitory processes between ages three and four (Friedman and A. M. Leslie 2005). If I am right and explicit quantifiers require inhibitory processing, then it is no surprise that the four-year-olds succeed where the three-year-olds fail. That the three-year-olds were able to give the correct answers to a simplified task also suggests that it is not lack of competence or knowledge about the interpretation of ‘all’ and ‘some’ but rather difficulty using that knowledge in the more demanding circumstances. One should bear in mind in evaluating these data that three-year-olds are generally quite linguistically competent; these are no eighteen-month-olds, stringing together two-word sentences. The surprising data is not that they *can* correctly handle ‘all’ and ‘some’ under some circumstances, but that they *fail* to do so under others. That this difficulty consists of sometimes treating sentences with ‘all’ and ‘some’ like generics lends much support to the claim that the comprehension of generics reflects a more basic process than the comprehension of these explicit quantifiers.

The Hollander, Gelman, and Star results are exactly what one would expect if the theory I am proposing is correct.[19] While the explicit quantifiers ‘all’ and ‘some’ can be successfully processed by young children under low-demand conditions, in high-demand conditions children erroneously fall back into their default mode and act as though sentences containing ‘all’ and ‘some’ were generics. If generics do indeed express the conceptual system’s default mode of generalizing, then we would expect exactly this pattern; deviations from the default, such as are required by ‘all’ and ‘some’ require inhibitory processing, whereas the default does not. Children therefore handle generics with far greater ease than explicit quantifiers.[20]

Sesame Street provides children with a handy little jingle to aid them in understanding ‘all’, ‘some’, and ‘none’. No such jingle exists for generics. How could it? Top linguists have fallen short of adequately articulating even an extensionally adequate semantics of generics—could the *Sesame Street* writers be expected to do any better? Fortunately, this is no great loss to the show’s preschool audience; they already understand generics.

Information Gathering

Thus far I have been proposing the following solution to the paradox of generic acquisition: generics express the conceptual system’s default method of generalizing. This method is innately given—quirks and all—and is in operation long before even the earliest manifestations of language acquisition are seen. The child’s innate language endowment

19. They themselves do not consider the hypothesis that generics invoke the default mode of generalization; to the best of my knowledge this hypothesis is original to me. Hollander, Gelman, and Star do note that the children are falling back on the generic in the more difficult task, but simply state that the reason for this should be considered in future research.

20. One might wonder whether young children grasp all the troublesome aspects of generics. Perhaps these features are acquired more slowly—perhaps more slowly than explicit quantifiers are acquired. This is an empirical question, and I do not know of data that bear directly on the question at this time. However, it would not, I think, be terribly surprising to find that young children readily accept generics such as ‘ducks lay eggs’ and ‘lions have manes’, and even ‘tigers eat people’, while rejecting generics such as ‘ducks are girls’ and ‘tigers don’t eat people’. (Maternal speech, of course, contains troublesome true generics and is devoid of troublesome false ones.)

would then only need to provide the learner with three principles for the acquisition of generics to proceed:

1. All variables must be bound for an LF to be interpretable.
2. Variables that are free in the Restrictor are bound by a default operator.
3. This default operator invokes the conceptual system's default means of generalizing.

If the acquisition of generics proceeded even roughly along these lines, we can begin to see why generics are so easy to acquire; they correspond most closely to what the child already knows how to do.

This might make the life of the learner a little easier, but it still remains for us theorists to characterize this default method. If an account of generics as reflecting this default method is to have independent plausibility as an account of the conceptual system's basic means of generalizing, it would be desirable to characterize this mechanism of generalization on the basis of psychological data. Thus while I will be inevitably guided by the desire to give an account of generics, I will endeavor to approach the problem from a broader psychological perspective.

This mechanism is, by hypothesis, a basic information-gathering mechanism that underwrites much of our early knowledge of the world. Young children need information, and they need it fast; this mechanism should be as efficient as possible. An evolved mechanism such as this one could increase its efficiency by off-loading as much work as possible onto its environment. This particular mechanism is concerned with drawing inferences from particular instances of a category to novel and unobserved ones; such a mechanism could increase its efficiency by taking advantage of regularities in the world.

There are, after all, many useful regularities out there in our environment. For example, individual cats bear many similarities to one another. Cats, on the whole, eat the same things, lick themselves in the same manner, make the same noises to get our attention, move around in the same fashion, and so on. There are regularities at other levels of abstraction too; just as individual cats resemble each other in a multitude of ways, cats, dogs, and other animal kinds are also alike in many respects. They each have a characteristic diet, characteristic noises, modes of locomotion, and so on. These regularities are provided to us by our environment; an efficient information-gathering system should take advantage of them, and thereby minimize the extent to which the learner must relearn pieces of information (Shipley 1993).

If one were able to use information from related kinds to predict dimensions of regularity for novel ones, then one would be able to "fill in" the value on this dimension on the basis of limited experience with the new kind. For example, experience with meowing cats, barking dogs, and clucking chickens might indicate to a learner that animal kinds have characteristic noises associated with them. The learner, upon encountering a single croaking frog, could at least tentatively conclude that croaking is the frog's characteristic noise. Let us call these dimensions of regularity *characteristic dimensions*. Characteristic dimensions of animal kinds include perhaps noises, modes of locomotion, means of reproduction and gestation, and diet; characteristic dimensions of artifact and social kinds may include function and role respectively. An efficient information-gathering system could use information from a related category to predict characteristic dimensions of a novel one, then use even a single instance of the novel category to obtain the value of that characteristic dimension for the new category.

Macario, Shipley, and Billman (1990) found that children use precisely this sort of information in experimental tasks. In particular, they found that children use information from related categories to infer regularities about novel ones. If children are presented with a category whose members are similar along a given dimension, for example, color, they expect that novel but related categories will also have members that are similar along that dimension.[21] We might hypothesize then that part of the operation of the mechanism we are characterizing consists in inferring the existence of the characteristic dimensions of novel kinds from related kinds, then using very few instances—sometimes only one—of the novel kind to supply a value for the dimension (cf. Shipley 1993).

21. In Macario, Shipley, and Billman's experiment, children were told that Smurfette was very picky about which blocks she liked; in fact she liked only *these* blocks, where a collection of blocks that were uniform along some dimensions but not others was ostended. The ostended collection might, perhaps, consist of blocks that were all red, but were of many different shapes. The children were then shown a single block, and told that Papa Smurf liked it, and were then asked to point out what other blocks they thought Papa Smurf might like. If Smurfette's blocks were uniformly red, and Papa Smurf's single block was blue, children picked out other blue blocks for Papa Smurf. If Smurfette's blocks were uniform in shape but varied in color, then the children used the shape of Papa Smurf's block to determine which others he might like.

This hypothesis gains support from an examination of maternal speech about kinds. Novel kinds are often located as members of a superordinate kind; for example, mothers are often heard saying things like “look, it’s a prairie dog. That’s a kind of animal” (Shipley, Kuhn, and Madden 1983). If the child is disposed to reason in the manner described above, then she may conclude on the basis of her knowledge of other animal kinds that prairie dogs will have, for example, diet, noise, and locomotion as characteristic dimensions. She can then observe the single prairie dog at hand and draw (at least tentative) general conclusions about other prairie dogs.

It should be noted that this is a very powerful mechanism for induction; it draws robust inferences from very few examples. (Of course such a mechanism is vulnerable to error, as will be discussed in the next section.) Learning is facilitated in that minimal experience is needed for valuable information to be gathered. If one has a prior notion of what the characteristic dimensions of a kind are, then one’s attention may be focused on finding values for *those* dimensions, thereby filtering out less important information, and of course one may use as few as one instance of the kind to supply values for those characteristic dimensions. Thus, providing one has already located appropriate characteristic dimensions for a kind, then—modulo the remarks in the next section—one is well placed for learning inductively about that kind.

If this is a fair characterization of the relevant cognitive dispositions, then we can begin to shed some light on the troublesome generics. Recall that one of the two main classes of troublesome generics pertained to features that were intimately linked to background expectations we have of the kinds in question. For animal kinds, these features were often related to reproduction, and for artifact and social kinds, they were related to role and function (e.g., ‘OrangeCrusher2000s crush oranges’). This is perhaps because these features lie along characteristic dimensions for these kinds. We might conjecture that generalizations concerning values along characteristic dimensions are made rapidly, in the face of but a few examples, and are not readily undermined—thus it only takes a few egg-laying bees for us to judge that ‘bees lay eggs’ is true.

In her seminal article, Shipley (1993) argues that the attribution of characteristic dimensions—or “over-hypotheses,” as she terms them—plays an integral part in our inductive practices. She goes on to pose the question: what is the source of these characteristic dimensions? Shipley (ibid., 296) wonders if they emerge as knowledge becomes more organized, or if they are the outgrowth of innate dispositions, but does not suggest an answer to the question. I suspect that they are not simply by-products of organized worldly knowledge; rather, I believe they are the guiding principles behind not only the *organization* of our worldly knowledge, but even its acquisition.

Shipley does not dwell long on inductive generalizations that have more exceptions than satisfiers (e.g., 'birds lay eggs'), though she does wish to subsume them under her account. She suggests in passing that 'birds lay eggs' is best understood as *birds are a kind of animal such that the mature female lays eggs.* If the availability of such paraphrases is sufficient for the truth of a generic, then we should wonder why the truth of *birds are a kind of animal such that the egg-layers are mature females* does not imply the truth of 'birds are mature females'. (Hers is just a passing comment, though, and not intended as an account of generics, of course.) The above asymmetry, though, highlights the fact that, however characteristic dimensions arise, they do not arise from simple statistical observation of the kinds. Thus Shipley's suggestion that characteristic dimensions may arise from the organization of our worldly knowledge seems to me to fall short of a full explanation. Objective statistical facts cannot account for why our world knowledge is organized as it is; if positing previously established—through either nature or early nurture—characteristic dimensions can account for it, then this is a hypothesis that should be taken seriously as the source and explanation of this aspect of our knowledge.

I do not pretend to know the extent to which these principles are innately given and to what extent they are provided by early nurture. Perhaps maternal speech suggests characteristic dimensions to very young children by drawing implicit parallels through iteration. (We are all familiar with that particular singsong tone of voice informing the child of such parallelisms as 'cats say meow, dogs say woof, and chickens say cluck!') Minimally, though, I imagine that children are innately disposed to seek out characteristic dimensions for kinds. These dimensions—though of course not their values—will be uniform within domains of kinds, such as artifacts, animals, and social roles.

Whatever the origin of characteristic dimensions, I claim that they play a central role in our primitive generalizations, and so in our judgments of generics. They provide an outline of information to be gathered about a new kind; characteristic dimensions provide a learner with an informational template. When a value is found for a characteristic dimension of a kind, it is thereby generalized to the kind by the basic generalization mechanism, and so the generic that predicates that property of the kind is accepted. Ducks, being an animal kind, have reproduction[22] as a characteristic dimension, so the inductive learner looks for a value to fill in this dimension; even limited experience will deliver *laying eggs* as the appropriate value, and so the property is generalized to the kind, and 'ducks lay eggs' is accepted as true.

Revision and Counterinstances

As it stands, the account I have offered so far falls short of explaining our judgments of troublesome generics. If *laying eggs* is a value along the characteristic dimension of reproduction, why isn't *not laying eggs* also a possible value on that dimension? Why do the non-egg-laying ducks not provide us with equally good candidate values? Thus far we have no explanation of why this might be so.

Naturally, generalizations that are based on limited experience should be open to revision in the face of counterinstances, at least under some circumstances. It is one of the most widely noted features of generics that they tolerate exceptions; that is, Ks that are not F. A moment's reflection should convince any theorist that far more needs to be said about the toleration of counterinstances; why, for example, are male birds tolerable counterinstances to 'birds lay eggs' but not to 'birds are female'? Why does the latter sentence have an almost universal flavor to it—it would seem to require for its truth that all birds be female—while the former in no way demands that all birds be egg-layers? Why is 'mosquitoes carry the West Nile virus' intuitively true, yet 'books are paperbacks' false, when the percentage of mosquitoes with the virus is about one-eightieth the percentage of books with paperback covers?

I propose that a powerful factor here is whether the counterinstances are *positive* rather than *negative*. The distinction I have in mind is as follows: a positive counterinstance to 'Ks are F' occurs when an instance of the kind K has a concrete alternative property, that is, when it has a positive alternative[23] to the property F, whereas a negative

22. Of course young children might not understand the notion of reproduction as such, but they are aware from an early age that adult animals have babies that are members of the same kind as their parents (see Gelman 2003).

23. The notion of *alternative* that I have in mind here is similar but not identical to Cohen's notion. For my purposes, a property G is an alternative to a property F only if the two properties are incompatible. Thus *being male* is an alternative to *being female*,

counterinstance occurs when an instance simply fails to be F. Whether a counterinstance counts as positive or negative is highly dependent on the property being predicated. For example, if we are considering ‘birds are female’, then its counterinstances are positive ones; those birds that fail to be female do so in virtue of possessing the positive alternative property of being male. If instead we are considering ‘birds lay eggs’, the birds that fail to do so *simply fail to do so*. They do not lay eggs. They are merely negative counterinstances, failing to possess the property in question, without possessing a positive alternative property. If some birds were so constituted as to bear live young, these birds would be positive counterinstances; males and barren females are not.

There may be reasons to be skeptical of attempts to draw a metaphysical distinction between positive and negative properties. The distinction at hand, however, is not intended as a metaphysical distinction, but rather a psychological one. What matters is whether we take the counterinstances as negative or positive. The metaphysical basis for this distinction may be uninteresting; human perception is the important factor here.

As my reader may have guessed, this positive/negative distinction is relevant to generics in that negative counterinstances are more likely to constitute tolerable exceptions than positive ones. For a generic, such as ‘birds lay eggs’, we are pitting the positive feature of giving birth in a certain manner against the males’ and barren females’ negative feature of not doing so. This should be contrasted with ‘birds are female’, which is false, despite the egg layers being a subset of the females. The counterinstances to ‘birds are female’ are positive counterinstances; they possess the positive alternative property of *being male*. Thus ‘birds lay eggs’ is accepted as true, while ‘birds are female’ is not, at least in part because ‘birds are female’ would require us to overlook positive counterinstances, whereas ‘birds lay eggs’ does not. That the positive/negative distinction is relevant here is supported by the following thought experiment: the generalization expressed by ‘birds lay eggs’ is tenable in the face of male birds, but what if we were to learn of some female birds that bore live young? It seems natural to think that under those circumstances the generalization would be weakened to something like ‘birds lay eggs or give live birth’.

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but *carrying malaria* is not an alternative to *carrying the West Nile virus* since a single mosquito could carry both. Obviously, I do not consider *being F* to be an alternative to itself; here, I differ from Cohen.

Similarly, in evaluating generics such as 'lions have manes' and 'peacocks have fabulous blue tails', we are pitting perceptually striking positive features in the males against the effective absence of those features in the females. The females of those species are drab and unremarkable compared with the males—they effectively lack the features that the males possess, and so essentially are only negative counterinstances.[24]

It is worth considering another intuitive test here. As things stand, we are inclined to assent to 'peacocks have fabulous blue tails'. Would we be so quick to do so if the females had fabulous *pink* tails rather than brown stumps? I am inclined to think that we would then assent only to 'peacocks have fabulous pink or blue tails' and not to 'peacocks have fabulous blue tails' since such an equally striking feature had by the females is not so easily overlooked.

Generics such as 'peacocks have blue tails' and 'lions have manes' are readily judged true because the females of the species *lack* these properties; they do not exhibit competing properties, or at least the competing properties they do exhibit are quite boring and unremarkable.[25] This contrastive feature of judgments of generics has not been noted in the literature so far. That our judgment would change if *the way* in which female peacocks lack blue tails changed suggests that in making our judgments we do not consider only the members of the category that possess the feature in question, but also the ones that lack it. In particular, it is relevant *how* they lack the feature.

There is an intuitive difference between simply lacking a feature and lacking it in virtue of having another, equally memorable, feature instead. The peacock example illustrates this: as things actually stand, the unfortunate female peacocks simply lack those fabulous blue tails. Had nature been kinder to them, however, they might have had fabulous pink tails instead and would then have lacked blue tails in virtue of

24. It should be clear here why the distinction is only psychological. A stumpy brown tail is no less existent than an ornate blue one, but we pass so easily over the former it might as well not be there. As an autobiographical note, I believed that female peacocks had no tails whatsoever, before this project led me to learn otherwise.

25. I am not sure whether characteristic dimensions are playing a role here, or whether the negative/positive contrast alone is sufficient, given that the proportion of peacocks with the tails is close to half. (That is, we are not required to overlook the overwhelming majority in accepting this generic.) It is plausible to think that we expect animal kinds to enjoy some uniformity in appearance, though the dimension of appearance would have to be rather more complicated than, say, gestation, since there is much more potential for variability with appearance.

having pink tails. I suggest the following hypothesis: in making a generic judgment that Ks are F, it matters how the non-F Ks fail to be F. If they fail to be F in virtue of having an equally salient, memorable, and striking feature, the generic is unlikely to be judged true. If, however, they fail to be F in a nonstriking, uninteresting way (such as merely lacking F), then we are far more likely to judge the generic to be true.

This contrastive approach that I am advocating points toward an understanding of why some generics are judged to be false, despite the majority of the Ks satisfying the predicate:

Books are paperbacks (false).

Greyhounds are English Greyhounds (false).

Chickens are female (false).

Here, the alternatives are *not* merely the absence of the given property; there are concrete alternatives to the properties cited. When we pit one concrete property against another, the number of Ks that must be F is considerably greater. The alternatives in question here are *being hardcover*, *being an Italian Greyhound,* and *being male*. The alternatives in these cases are particularly hard to ignore. The first two properties pick out subkinds of the kind in question, and the third picks out a property such that if no chickens have it, the kind Chicken will fail to be able to reproduce. Thus we would need approximately universal satisfaction of the predicate for these to be true, which squares with intuition about these examples.

Let us combine the diagnosis that this positive/negative distinction plays an important role in our judgments of generics with the claim that generics reflect primitive facts about the cognitive system. This implies that negative facts have less psychological impact than positive ones. There is some support for this claim. In their seminal book, Nisbett and Ross (1980) argue that people are affected by information in proportion to the vividness and concreteness of that information and note that this predicts that the *absence* of an event or property should have disproportionately little impact, in virtue of such information being more easily overlooked. The authors illustrate this nicely with an example from Sir Arthur Conan Doyle's *Memoirs of Sherlock Holmes.* In "The Silver Blaze," Holmes calls Inspector Gregory's attention to "the curious incident of the dog in the night-time." Inspector Gregory (still trapped in an infantile way of thinking) replies in puzzlement, "The dog did nothing in the night-time," to which Holmes triumphantly replies, "That *was* the curious incident." The nonoccurrence of the dog's barking signaled to Holmes that the intruder must have been someone the dog knew. This conclusion had not readily presented itself to the less gifted Inspector Gregory, however, because it was inferred from a nonoccurrence rather than from an actual event. Nonoccurrences, being by their very nature nonconcrete and nonvivid, are easily overlooked.

Nisbett and Ross cite experimental evidence in support of this intuitive claim. Both humans and animals have great difficulty learning associations that involve the absence rather than the presence of features. Animals and young children have difficulty in even the simplest learning tasks if they are asked to distinguish between two stimuli that are identical save for one feature *and to respond only to the one that lacks the feature*. For example, they may be presented with two circular stimuli, one with a smaller circle in the middle, and the other without. Animals and young children can be readily taught to respond only to the stimulus containing the inner circle, but it is very difficult to train them to respond only to the stimulus that lacks the circle (Sainsbury 1973; Jenkins and Sainsbury 1970). (This is known as the Feature Positive Effect.) Adults are, of course, capable of mastering this simple task, but if the scenario is made complicated enough to be taxing, adults encounter far more difficulty with negative associations than with positive ones (Newman, Wolff, and Hearst 1980). That there is such a strong asymmetry between our abilities to grasp the two types of association—identical save for whether the stimulus to which one must respond is the positive or negative one—surely reflects an asymmetry in how we process presences versus absences. If we are not presented with a positive object for association, we have difficulty learning the association at all. Mere absences are not on a cognitive par with concrete presences.

Characteristic Dimensions Revisited

Thus far I have discussed two factors that influence our judgments of generics: the background expectations associated with kinds and the nature of the counterinstances to the generalization. Generics that pertain to background expectations are very tolerant of exceptions, at least when those exceptions simply fail to have the property in question—when they are negative counterinstances. I suggested earlier that a feature of our primitive inductive learning mechanism is that it operates by identifying characteristic dimensions of a category, then locating a value on that dimension on the basis of what is often very limited information.

I noted, though, that this observation alone cannot explain the nature of troublesome generics.

Now that we have the negative/positive distinction in hand, however, we can frame the following hypothesis: the inductive learning mechanism is strongly biased towards filling in only positive values for characteristic dimensions, and once it has done so, it readily retains the value in the face of negative counterinstances. Thus despite the large number of bees that do not lay eggs (all bees, save the queen), these bees do not possess positive properties that could supply values for this characteristic dimension. Only queen bees supply such a positive value, but since bees are an animal kind, we are eager to find a value for their method of gestation, so we seize on the only positive instances available, and conclude that bees lay eggs. This hypothesis is both formed and retained in the face of the counterinstances since they are all negative.

One might wonder whether we need to appeal to characteristic dimensions at all now that we have the negative/positive distinction in hand. Could we perhaps explain our judgments of generics on that basis alone? It would make for an elegant—though perhaps somewhat odd—account of generics if we could simply observe that when the counterinstances possess positive alternative properties, the generic is false, otherwise it is true. I do not believe such an account would be successful; it would classify some intuitively false generics as true. For example, there are some dogs with oddly shaped lumps on their backs, while the large majority of dogs simply lack such lumps. We do not, however, assent to ‘dogs have oddly shaped lumps on their backs’. The only counterinstances to the generic are negative—the counterinstances merely lack the strange lumps—yet this does not suffice to make the generic true. Thus it cannot be enough for the truth of a generic that all its counterinstances be negative; if there are a great many of those counterinstances *and the generic does not pertain to a characteristic dimension,*[26] then it will be false.

Of course there are some generics that feature properties that are neither striking (see below) nor found along characteristic dimensions of the kind. In these cases, though, we need more than just a few instances to support the generalization. Examples of such generalizations perhaps include ‘cars have radios’ and ‘barns are red’. Here it seems quite important to the truth of these generics that a large portion of the kind have the property in question; these generics will therefore

26. Or predicate a striking property—see below.

be nontroublesome. Even these generalizations, though, are subject to a negative/positive asymmetry among their counterinstances. Compare, for example, 'cars have radios' to 'buildings are less than one thousand feet tall'. The latter generalization, whose counterinstances are positive—and rather salient—strikes us as false.

Generics that do not pertain to characteristic dimensions or predicate striking properties, then, require that the majority of the kind possess the relevant property. This alone does not suffice for their truth, however; their counterinstances must also be negative. Generics that pertain to characteristic dimensions can tolerate any number of exceptions as long as they are negative. Providing that there is some available positive value for the characteristic dimension, negative counterinstances will not undermine the truth of the generic in question.

Negation and Generics

The negative/positive distinction also lets us understand the function of negations embedded in generics, a topic that has been overlooked in the literature. I know of no account that handles negation in a satisfactory way. Consider the following generics:

> Fair coins come up heads (false).
>
> Fair coins don't come up heads (false).
>
> Mosquitoes don't carry the West Nile virus (false).

It is evident from our judgments of the first two sentences in the group that we do not understand negations here as taking wide scope over the bare plural,[27] else we would judge the second sentence to be true in virtue of the first being false.

It is not immediately obvious then why 'mosquitoes don't carry the West Nile virus' is not taken to be true, once we recognize that negation does not take wide scope. We have no account so far as to why

> Mosquitoes carry the West Nile virus, and
>
> Mosquitoes don't carry the West Nile virus

27. Carlson (1977) suggests that negations take wide scope over *existentially interpreted* bare plurals, but he does not mention the interaction between generically interpreted bare plurals. I do not know of anyone who has proposed a substantive theory of the interaction of negation and generically interpreted bare plurals.

could not both be true. The first could be true because it is a striking property (see below), the second because it holds of the preponderance of mosquitoes. Cohen (1996), for example, would predict that both are true: the first is a true relative generic and the second is a true absolute generic. Understanding generics as inherently contrastive, though, points the way toward an answer. In evaluating the second of the pair, we are pitting the mere absence of a property against a very striking positive property. One way to lack the property expressed by a negated predicate will normally be to possess its positive counterpart. Since in many, perhaps all, cases we think of negated predicates as expressing mere absences and their unnegated counterparts as expressing concrete positive properties, we would require there to be basically no instances of Ks that have the positive property. This explains the apparent strength of negations embedded in generics. 'Ks are not F' carries some sense of 'Ks are never F'; this is because just a few Ks' being F is enough to make us judge the generic to be false when the contrast is between the absence of a property and its instantiation.

Striking Properties

The other main class of troublesome generics consists of generics in which the predicate expresses a property that is striking, often in virtue of being dangerous or appalling. These are the sorts of properties that one would like to know about—if there is a nontrivial chance that one will encounter something with these traits, one would be well served to have some prior warning. Such generics are extremely tolerant of exceptions; it does not appear to count against them if the vast majority of the kind does not have the property in question; that some of the kind does is sufficient.

One might be tempted to think that striking property generics are simply existentials in disguise—after all, we saw in the introduction to this article that some bare plurals are perfectly able to receive existential interpretations. Perhaps we have simply misclassified these generics. I do not believe this is the right response. 'Sharks attack bathers' seems to belong with 'dogs eat meat' rather than 'dogs are in my yard'. One might, for example, imagine a shark lover objecting to the crude generalization expressed by 'sharks attack bathers', while not disagreeing with the fact that there have been some incidents of sharks attacking bathers. This suggests that 'sharks attack bathers' does indeed receive a generic interpretation.

The entailment pattern of striking-property attributions also resembles that of generics rather than existentials. Whereas the truth of ‘dogs are on my lawn’ entails the truth of ‘animals are on my lawn’, ‘mosquitoes carry the West Nile virus’ does not suggest to most speakers the truth of ‘animals carry the West Nile virus’. We can also insert a quantificational adverb into striking-property attributions with only a small change in meaning, but cannot do so for existentials; compare ‘mosquitoes sometimes carry the West Nile virus’ with ‘dogs are sometimes on the lawn’. The latter, but not the former, means something quite different from the original adverb-free sentence. Thus these sentences with striking-property predicates have an entailment pattern like that of generics and unlike that of existentials.[28] For these reasons, I will continue to classify them as such.

As these sentences are to count as generics, a factor in our judgments must be how striking the predicated property is. It is not hard to imagine why a primitive mechanism of generalization might be biased toward emphasizing such properties. If we allow ourselves to indulge in evolutionary explanations, we might imagine that our ancestors who rushed to generalize upon seeing just one lion eat their companions fared better than those who were more cautious in their generalizing.

Of course, the mechanism does not generalize such information to *every* kind that has members possessed of these properties. As noted above, we do not accept ‘animals carry the West Nile virus’ or even ‘insects carry the West Nile virus’, even though both kinds have some members that carry it (namely those few mosquitoes). We also don’t decide that ‘accountants are murderers’ is true even though some accountants have been known to kill. The mechanism, I suggest, looks for a *good predictor* of the property in question; it avoids generalizing to overly broad kinds or to irrelevant kinds. In particular, for a kind to be the locus of a striking-property generalization, it seems that the members of the kind that lack the property must at least be disposed to have it. It is important, for example, that the virus-free mosquitoes be capable of carrying the virus. If there is no such shared disposition, the

28. Other features of the predicate here suggest that they should be considered generics rather than existentials; the predicates are “individual level” rather than “stage level.” It is widely agreed that individual-level predicates—predicates that express properties normally had by an individual for an extended part of its existence—give rise to generic interpretations, whereas stage-level predicates—predicates that express properties normally had only fleetingly—give rise to existential interpretations. See Carlson 1977 and Kratzer 1995 among others for discussion.

generalization is not made. (After watching Dr. Evil attach lasers to the heads of sea bass and set them on Austin Powers, we do not conclude that sea bass attack people. We understand that the behavior of these sea bass is traceable to Dr. Evil's intervention and is not a reflection of their nature.) And it is on the grounds that there is no disposition shared among sharks that leads them to attack us that the friends of sharks often challenge the generalization that sharks attack bathers. It is only the odd demented great white shark that ever does so, and only then because it mistakes a person for a seal. (I leave to the reader to decide for herself whether she is convinced by this.)

As before, the claim that something is a factor in our judgments of generics is lent plausibility by evidence of the factor's more general psychological impact. There is experimental evidence that indicates our disposition to generalize information in proportion to how striking it is. Rothbart et al. (1978) conducted an experiment to test the effects of striking information on our estimates of statistical frequencies. Their subjects heard brief descriptions of the behavior of fifty people, forty of whom were well behaved and ten of whom engaged in criminal activities. For half the subjects, the described criminal acts were quite horrific, consisting of crimes such as rape and murder, while for the other half, the crimes were much less disturbing—shoplifting, forgery, and the like. The subjects were then asked to estimate the frequency of criminals in the groups they had just heard about; they consistently provided higher *statistical* estimates of criminality for the more extreme group, even though the actual percentage of criminals was the same for both groups.

Statistical generalizations, like the ones made by the subjects in the Rothbart et al. experiment, are of course a type of generalization. I have argued that generics express the cognitive system's default generalizations and that other generalizations involve inhibiting or overriding this default. Since inhibitory processes can fail in high-demand situations, we should not be surprised by the Rothbart et al. findings. Their subjects were given a large amount of information to handle—fifty individual descriptions is a lot to try to recall and assess for statistical patterns—so it is reasonable to consider this a high-demand task. When faced with such a task, the cognitive system may fail to fully inhibit its default processes—in this case, the processes associated with generics. Thus if, by default, we are disposed to generalize striking information more readily than nonstriking information, then we would predict that in high-demand situations we might make overly high *statistical* generalizations concerning striking information.

Semantic Truth Conditions and Worldly Truth Makers

We have described in some detail the cognitive mechanism involved in understanding generics and have begun to see how it is related to other mechanisms via, for example, inhibitory processing. Since this mechanism is responsible for our understanding of generics, providing an account of this mechanism has also allowed us to understand the circumstances in which generics are true or false. Though there may be a further refinement or two needed, we can describe the circumstances under which a generic of the form 'Ks are F' is true as follows:

> The counterinstances are negative, and:
>
> If F lies along a characteristic dimension for the Ks, then some Ks are F, unless K is an artifact or social kind, in which case F is the function or purpose of the kind K;
>
> If F is striking, then some Ks are F and the others are disposed to be F;
>
> Otherwise, almost all Ks are F.

I would suggest that these worldly truth specifications—these descriptions of how the world must be for the sentence to be true—should not be mistaken for semantically derived truth conditions, however. To illustrate the distinction, let us assume that a dispositionalist theory of color is correct: what it is to be red is to be experienced as red by standard observers in standard conditions. We can then specify the worldly truth makers for the claim 'Bob is red'; this claim is true if and only if Bob is experienced as red by standard observers in standard conditions. This is a specification of the circumstances in the world that must obtain for 'Bob is red' to be true. Such a specification does not tell us anything about the semantically derived, compositionally determined truth conditions for 'Bob is red' however; they describe only how the world must be so as to conform to the claim.

It may well be that for Bob to be experienced as red by standard observers in standard conditions, there must exist standard observers to experience him as such. Then, metaphysically speaking, the truth of 'Bob is red' entails the existence of standard observers. It is in no way part of semantic competence to recognize that the truth of 'Bob is red' entails that there exist standard observers, however. This is not plausibly a semantic entailment, but merely a metaphysical one.

The semantic truth conditions for ‘Bob is red’ may well be no more than Red(Bob). This respects the compositional structure of the sentence; ‘Bob is red’ is a singular statement—the application of a monadic predicate to a singular term. To substitute the regimented version of the worldly truth specifications results in the following monstrosity:

‘Bob is red’ is true if and only if Gen x, y [StandardObserver(x) & StandardCondition(y)] [ExperiencesAs_In(x, Bob, red, y)]

But ‘Bob is red’ is not a generic; it is a singular statement, and its semantic truth conditions should respect that. For this reason, and others, it is very often desirable to simply disquote individual expressions when giving semantic truth conditions. Any further analysis of individual expressions very often belongs to metaphysics rather than to semantics (see King 2002 for a related, though somewhat different view).

Similarly, I am inclined to view the above truth specifications as worldly descriptions rather than semantically derived truth conditions. I propose instead that the best semantic truth conditions we can supply for generics will expose their logical forms by means of a tripartite structure, but will simply *use* the generic operator Gen (S. J. Leslie 2007, forthcoming). The worldly truth specifications provided at the beginning of this section are exactly that; they are specifications of how the world must be for a generic to be true. But just as *Bob is experienced as red by standard observers in standard conditions* was a poor candidate for the semantic truth conditions of ‘Bob is red’, the complex and disjunctive conditions listed above are poor candidates for the semantic truth conditions of generics. Just as we are best off using ‘is red’ in the truth conditions of ‘Bob is red’, we are best off using Gen in the semantic truth conditions of generics. When it comes to providing semantic truth conditions for generics, we may well be best off disquoting the generic operator Gen.

Conclusion

The central thesis of this essay is that our understanding of generics reflects our default mechanism of generalization. If this claim is correct, then we have an explanation of how children can grasp these apparently complex sentences before they grasp more theoretically tractable ones, such as those containing ‘all’. On this view, the odd features of generics are not linguistically based pieces of knowledge that the child must string together, but rather are features of the child's innately given faculty of generalization—the oddness of generics derives from the cognitive system itself.

We isolated and identified these quirky features of the default mechanism of generalization and showed how they manifest themselves in psychological behavior that is independent of generics. The notion of characteristic dimensions, for example, may be central to our capacity to gather information efficiently. The effect of how striking a property is was seen to influence adult judgments, at least in relatively high-demand situations. If generics, which are influenced by strikingness, reflect our default method of generalizing, then we would *predict* these effects in adults. Just as children sometimes fall into error by failing to fully inhibit this default process, and thereby treat 'all' and 'some' like generics, adults fall into error by also failing to inhibit this default process. When adults are asked to make statistical generalizations under sufficiently difficult circumstances, they do not manage to implement the inhibitory processes necessary to keep the generalizations purely statistical. Their statistical generalizations thus bear the mark of their default generalizations, where striking information plays a central role.

This does not, of course, mean that judgments concerning generics are erroneous. In making a generic generalization, the default process is what is required—generic generalizations are not statistical generalizations. With them, there is no normative demand to inhibit the default; rather, the default is to be embraced.

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