Graded Genericity

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Abstract Any adequate semantics of generic sentences (e.g., "Philosophers evaluate arguments") must accommodate both what we call *the positive data* and *the negative data*. The positive data consists of observations about what felicitous interpretations of generic sentences are available. Conversely, the negative data consists of observations about which interpretations of generic sentences are *un*available. Nguyen argues that only his pragmatic neo-Gricean account and Sterken's indexical account can accommodate the positive data. Lee and Nguyen have advanced the debate by arguing that the negative data is a problem for both Nguyen's and Sterken's accounts; these two accounts seem to incorrectly predict that generics have felicitous interpretations that they, in fact, fail to have. In this paper, we advance this debate—and, more generally, the task of developing an adequate formal semantics of generics—by arguing that a neglected class of theories are compatible with both the positive data and the negative data. Specifically, we argue that treating the generic operator GEN as a relative gradable expression with a positive, upper- and lower- bounded scale helps accommodate the positive data and the negative data. While developing this view, we show how several previously developed semantics of generics may systematically accommodate both sets of data. One broad contribution of this paper is to show that, while they generate important desiderata, the positive and negative data cannot determine a unique semantics for generics. A further contribution of this paper is to highlight previously unnoted ways in which degree semantics may inform semantic theories of generic meaning.

Keywords generics; bare plurals; gradability; probability; typicality; normality

1. Introduction

Generics—such as "Dogs bark", "Parents owe much to their children", and "Racist institutions are common"—pervade everyday conversations and express significant generalizations.[1] However, there is no consensus on the semantics of generics. What philosophers and linguists do generally agree on is syntactic: generic sentences carry a two-place generic operator GEN.[2]

Nguyen (2020) has recently challenged most of the theories on generics by arguing that while GEN gives rise to a wide range of quantificational forces—what we will call *the positive data*—most theories of GEN fail to explain this data. He argues that only Sterken's (2015a) indexical view and his Neo-Gricean pragmatic view are compatible with the positive data. Lee and Nguyen (2022) consider more data on the limitations on generic interpretation—what we call *the negative data*—and argue that Sterken's and Nguyen's views are both empirically inadequate; they each fail to explain the negative data. Instead, Lee and Nguyen (2022) offer a refined version of the indexical view to accommodate the positive data and the negative data. If their semantics is the only empirically adequate one, we must accept it.

However, we argue that a neglected class of theories can capture both the positive data and the negative data. In particular, viewing GEN as a relative gradable expression (e.g., "tall", "long") with a positive, upper- and lower- bounded scale has the following two explanatory virtues:

(a) It explains the positive data (i.e., the flexibility of generic interpretation), and

(b) It explains the negative data (i.e., the limitations on generic interpretation)

[1] Bare plurals are commonly employed to convey generic meanings. But generics can take various forms. Some feature a mass noun in the subject position (e.g., "Candy rots teeth"). Some involve a singular definite noun (e.g., "The whale is a mammal"). Some contain a singular indefinite noun (e.g., "A madrigal is polyphonic"). In this paper, we will focus on bare plurals.

[2] Schubert & Pelletier 1987, 1989; Krifka et al, 1995; Asher & Morreau, 1995; Pelletier & Asher, 1997; Eckardt, 1999; Cohen, 1996, 1999a,b, 2001a,b, 2004; Leslie, 2007, 2008, 2012, 2014; Nickel; 2009, 2016; Sterken, 2015a,b; Tessler & Goodman, 2019; van Rooij & Schulz, 2020; Lee & Nguyen, 2022.

The idea that GEN is like a relative gradable expression is inspired by Cohen (1996, 1999a, 2001a,b, 2004), Tessler & Goodman (2019), and van Rooij & Schulz (2020), among others. Our contribution is that this idea can be used to help explain the positive data and the negative data, once we impose a constraint on the type of scale GEN takes. In particular, GEN takes a positive lower- and upper-bounded, uni-dimensional scale. We will consider probability, typicality, and normality scales as concrete examples, and then show how they can explain the positive data and the negative data. The main upshot of our findings is that while the positive and negative data provide some important constraints on semantic theorizing about generics, they do not suffice to show that any particular semantics is correct. Other desiderata must also be appealed to in order to persuasively defend a particular semantics.

We also believe that our findings have broader implications for the literature on the semantics of generics. In particular, the idea that GEN must take a positive, lower- and upper-bounded uni-dimensional scale is a novel claim. If our arguments succeed, this claim generates a new desideratum that semantic theories about generics must capture. Indeed, perhaps our most novel contribution is to suggest previously unnoticed ways in which degree semantics can illuminate generic meaning. And while we are content here to show that several existing accounts—or at least close relatives of them—can readily capture this desideratum, we suspect that future work on generic scale structure can set new informative constraints on semantic theories of generics.

2. The Positive Data

Generics have attracted considerable attention from both philosophers and linguists. But constructing systematic semantic theories for generics has proven to be a challenging undertaking.

This difficulty arises largely because generics can be used to express propositions with radically different quantificational forces: universal quantificational forces (e.g., "all", "almost all"), modalized universal quantificational forces (e.g., "all … can", "ideally, all", "under normal circumstances, all"), proportional quantificational forces (e.g., "most", "many"), and quasi-existential quantificational forces (e.g., "a few"). Nguyen (2020) calls this data *The Variety Data*, but we will call it *The Positive Data*:

The Positive Data[3,4]

(1) [A few] mosquitoes transmit malaria.

(2) [Many] barns are red.

(3) [All] prime numbers are odd.

(4) [Under normal circumstances, almost all] ravens are black.

(5) [Necessarily, all] round squares are round.

(6) [Ideally, all] boys don't cry.

(7) [All] orange crushers [can] crush oranges.

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[3] When no specific context is explicitly given, we consider typical contexts as the starting point. According to Bach (2002) and Bach (2005), when an explicit context is absent, speakers assess sentences by imagining a typical context.

[4] Below are sample lexical entries for the quantifiers in the positive data, defined in terms of frequency:

$[\![\text{“all”}]\!]^c = \lambda F.\ \lambda G.\ \frac{\#(F\&G)}{\#F} = 1$

$[\![\text{“almost all”}]\!]^c = \lambda F.\ \lambda G.\ \frac{\#(F\&G)}{\#F} \geq n_c$, where n_c is some contextually given number very close to 1 (e.g., 0.9).

$[\![\text{“most”}]\!]^c = \lambda F.\ \lambda G.\ \frac{\#(F\&G)}{\#F} > 0.5.$

$[\![\text{“many”}]\!]^c = \lambda F.\ \lambda G.\ \frac{\#(F\&G)}{\#F} \geq 0.3.$

$[\![\text{“a few”}]\!]^c = \lambda F.\ \lambda G.\ \frac{\#(F\&G)}{\#F} \geq n_c$, where n_c is some contextually given number very close to 0 (e.g., 0.01).

Only the unbracketed material is overtly pronounced. The bracketed material indicates the quantificational force of what is asserted. For example, (1) reports that one can utter "Mosquitoes transmit malaria" to mean that a few mosquitoes transmit malaria. The positive data shows that generics are compatible with a wide range of quantificational forces. However, Nguyen (2020) argues that most theories of generics are not flexible enough to capture the positive data.[5] He argues that only his radically pragmatic account and Sterken's (2015a) indexical account are compatible with the positive data.

On Sterken's (2015a) indexical account, GEN is an indexical over quantifiers. The semantic value of GEN can potentially encompass any quantifiers including "a few", "many", "most", and "all". Thus, Sterken's view can easily accommodate the positive data.

On Nguyen's pragmatic account, there is no need to posit GEN to explain the positive data. All bare plurals are semantically incomplete in the sense that they do not express complete propositions. They only express *propositional radicals*. Nguyen remains undecided whether the logical form of "Fs are Gs" is either "[Fx][Gx]" or "Ux[Fx][Gx]". The first logical form is that of an open sentence lacking any quantifier. The second logical form is that of a quantified sentence in which a variable is bound by the syntactically real but semantically null operator U in the quantifier position. Either way, its quantificational force should be supplemented through a

[5] Nguyen (2020) briefly considers some proposed semantics and rejects them. To summarize: Against Cohen (1999b), who holds an account on when "Fs G" is true (on one proposed reading) if most Fs G, Nguyen observes that "Primes numbers are odd" is false even if most prime numbers are odd. Against Nickel (2016), who roughly holds the view that "Fs G" is true just in case there is a way of being a normal F such that all Fs that are normal in this way G, Nguyen observes that generics are sometimes not about what is normal for a kind. Against Liebesman (2011), who holds that all generics are direct kind predications, Nguyen objects that this view cannot give any explanation for the positive data. (Why does it only take a few individual mosquitoes to transmit malaria for the kind *Mosquito* to inherit the property of transmitting malaria and all individual prime numbers to be odd for the kind *Prime number* to inherit the property of oddness? Moreover, how can this inheritance relation, which Liebesman (2011) claims is within the purview of metaphysics, be context-sensitive?) Finally, against Leslie (2007), Nguyen endorses Sterken's (2015b) objection that Leslie's disquotational semantics cannot explanatorily predict context-sensitivity.

pragmatic mechanism—such as Bach's (1994) impliciture, Recanati's (2004) free enrichment, Sperber and Wilson's (1986) explicature. Speakers should pragmatically complete a propositional radical to assert something with a generic. On this picture, the speaker's communicative intentions determine what is added to propositional radicals.

Thus far, we have considered the positive data and how it can be accommodated on Sterken's and Nguyen's accounts. Before moving on to the next set of data, let us consider one possible objection against the positive data. One might challenge the positive data by claiming that the positive data is not about a semantically uniform phenomenon. For example, according to Almotahari (2024), bare plurals can be an elided form of an ordinary universal quantifier such as "all" or "all the". Consider the following conversation:

A: What distinguishes all the green bottles in the bin from the clear ones?

B: Green bottles have narrow necks.

We will grant that the most natural interpretation of B's response is that *all the* green bottles *in the bin* have narrow necks.[6] One might infer that bare plurals can carry either GEN or an unpronounced universal quantifier such as "all", "all the", or "every". If so, then the universal quantificational forces in the positive data plausibly arise from an ordinary universal quantifier rather than GEN. There would be no need for the semantics of GEN to explain bare plurals with universal quantificational force.

However, there is an important difference between the universal quantificational forces expressed by GEN and the universal quantificational forces expressed by ordinary universal quantifiers. While ordinary universal quantifiers carry a domain restriction device (Stanley &

[6] An anonymous reviewer finds B's reply to be odd, and perhaps even infelicitous. Of course, if B's reply is indeed infelicitous, that would better support our view that the universal quantificational force of some (seemingly) generic utterances is not to be explained by a covert universal quantifier.

Szabó 2000; Kratzer 2021), generics do not. Imagine a situation where a student is gazing at a blackboard filled with numbers, with the specific task of identifying prime numbers among the displayed numbers. In this situation, "All prime numbers are odd" can be used to convey the proposition that all prime numbers *on the blackboard* are odd. On the other hand, consider the bare plural "Prime numbers (as such) are odd" with the addition of "as such" to help facilitate its generic reading (Almotahari, 2024). This sentence can be used to express a proposition with universal quantificational force, but the universal quantificational force expressed by GEN is unrestricted. For evidence that GEN does not take restricted universal quantificational force, note that "Ducks are female" is infelicitous, which is inexplicable if it can mean *all female* ducks are female (Leslie 2007, p. 376). This argument about quantifier domain restriction suffices to show that covert universal quantifiers cannot explain the relevant data.

3. The Negative Data

Both Sterken's (2015a) and Nguyen's (2022) accounts successfully capture the positive data. However, Lee and Nguyen (2022) present data—what we call *the negative data*—that poses problems for both Nguyen's and Sterken's accounts. This data indicates that Nguyen's and Sterken's accounts are too flexible, overgenerating true generics:

The Negative Data[7]

[7] The following are sample lexical entries illustrating the quantifiers used in the negative data:
$[\![\text{“not all”}]\!]^c = \lambda F.\ \lambda G.\ \frac{\#(F\&G)}{\#F} < 1$
$[\![\text{“not many”}]\!]^c = \lambda F.\ \lambda G.\ \frac{\#(F\&G)}{\#F} < 0.3$.
$[\![\text{“few”}]\!]^c = \lambda F.\ \lambda G.\ \frac{\#(F\&G)}{\#F} < n_c$, where n_c is some contextually given number very close to 0 (e.g., 0.01).
$[\![\text{“no”}]\!]^c = \lambda F.\ \lambda G.\ \frac{\#(F\&G)}{\#F} = 0$.
$[\![\text{“at most half”}]\!]^c = \lambda F.\ \lambda G.\ \frac{\#(F\&G)}{\#F} \leq 0.5$.

(1*) [#Few] mosquitoes transmit malaria.

(2*) [#The] barns are red.

(3*) [#Not all] prime numbers are odd.

(4*) [#At least five] ravens are black.

(5*) [#Necessarily, no] squares are round.

(6*) [#All] girls [except Mary] cry.

(7*) [#Exactly five] orange crushers [can] crush oranges.

The "#" indicates that the depicted reading is unavailable. For example, (5*) reports that one cannot utter "Squares are round" to mean that no squares are round. The negative data shows that not all quantificational forces are compatible with generics. Both Nguyen's and Sterken's accounts may be flexible enough to accommodate the positive data, but they are too unconstrained to accommodate the negative data.

Sterken's (2015a) account does not explain the negative data. According to Sterken (2015a), GEN is an indexical over quantifiers. The negative data suggests that GEN cannot be used to express quantificational forces such as those of "few", "no", "not all", "at least five", "at most half", "exactly five", and so on. Nevertheless, Sterken does not provide a satisfactory explanation for why GEN cannot encompass these quantifiers as its values. That is, it remains unexplained why GEN can express the quantificational forces in the positive data such as those of "a few", "many", "most" and "all" but cannot express the quantificational forces in the negative data such as those of "few", "no", "not all", "at least five", "at most five", "exactly five".

$[\![\text{“exactly five”}]\!]^c = \lambda F.\ \lambda G.\ \#(F\&G) = 5.$
$[\![\text{“at least five”}]\!]^c = \lambda F.\ \lambda G.\ \#(F\&G) \geq 5.$
$[\![\text{“at most five”}]\!]^c = \lambda F.\ \lambda G.\ \#(F\&G) \leq 5.$

In a similar vein, Nguyen's (2020) pragmatic account has difficulty in explaining the negative data. If the quantificational forces of generics are provided through a pragmatic process such as free enrichment, there seems to be no reason why generic sentences cannot be enriched so as to express the quantificational forces in the negative data. The readings in (1*)–(7*) are, in some possible contexts, (considered to be) true and informative. If so, then the pragmatic account seems to incorrectly predict that these readings are in principle available.

Any empirically adequate account of generics must accommodate both the positive data and the negative data. To accommodate both the positive data and the negative data, Lee and Nguyen (2022) develop a refined version of the indexical approach, according to which GEN is an indexical over quantifiers, carrying the semantic constraint that the semantic value of GEN is upward monotone and non-symmetric. In this paper, we will identify a neglected class of theories that are compatible with both the positive data and the negative data. More specifically, we argue that viewing GEN as a relative gradable expression with a positive, upper- and lower-bounded scale can also accommodate both the positive data and the negative data. However, it would be worth noting that it is not one of our aims to argue that this approach is the only account that can capture the positive data and the negative data. The main aim of this paper is to show the need to construct a semantics that accommodates the positive data and the negative data, and to motivate a novel way of capturing them in a degree-theoretic framework.

4. GEN as a Relative Gradable Expression

In this paper, we defend the *conditional* claim that if GEN is treated like a relative gradable expression, then we can capture the positive and negative data. Although it is *not* our primary aim to argue that GEN is like a relative gradable expression, we believe that there is independent reason to believe that GEN is like a relative gradable expression. More specifically, in this section, we will discuss the following two questions: (i) What are some reasons to treat GEN as a relative gradable expression? (ii) If GEN is like a relative gradable expression, what type of scale does it take?

Let us begin with the first question. Although the semantic interpretation of GEN is contentious, the consensus among philosophers of language and linguists is that GEN is a two-place operator that functions like adverbs of quantification (Schubert & Pelletier, 1987; Krifka et al, 1995; Leslie, 2008; Leslie & Lerner 2022). Adverbs of quantification include “generally”, “typically”, “usually”, “always”, “sometimes” and so on. These adverbs can be divided into two kinds: one that allows for degree modification (e.g., “generally”, “typically”, “usually”) and one that does not (“always”, “sometimes”). For example, while “generally” can be modified by degree modifiers (e.g., “more generally”, “as generally as”, “very generally”, etc.),[8] “always” cannot (e.g., *“more always”, *“as always as”, *“very always”). This suggests that adverbs of quantification are not semantically uniform. That is, some adverbs of quantification are gradable while some are not.[9] Since GEN has been likened to gradable adverbs of quantification such as “generally”, “typically”, and “usually”, if GEN belongs to the same category as “generally”, “typically” and “usually”, it seems reasonable to think that GEN is gradable as well.

If GEN is like a relative gradable expression, it shouldn’t be surprising that GEN receives the same semantics as relative gradable expressions. In the standard semantics for gradable

[8] This data shows that some adverbs of quantification pass the standard tests for being gradable expressions. Since these adverbs pass these tests, we have strong evidence that they are gradable. For more details on these tests, see Wellwood (2019).

[9] Similarly, quantificational determiners are not semantically uniform. While “many” allows for degree modification—e.g., “as many as”, “how many”, “very many” (as in “There aren’t very many parks in town”)—“all” and “some” do not allow for degree modification. This suggests that “many” is gradable while “all” and “some” are not.

expressions (Kennedy 1999, 2007; Heim 2000; Lassiter 2011, 2017), the sentence "Bill is tall" is analyzed as meaning that *Bill's height meets some contextual threshold for tallness*.[10] In a similar vein, "GENx(Fx)(Gx)" can be analyzed as meaning that F and G's degree *on the relevant scale* meets some contextual threshold for generalization. However, there is an important gap in this analysis. That is, we need to fill in the analysis by determining what scale GEN takes. This naturally leads us to the second question "If GEN is like a relative gradable expression, what type of scale does it take?" We will discuss this issue in the remainder of this section.

Relative gradable expressions can be divided into two kinds, depending on the type of scale they take: (i) uni-dimensional expressions that are associated with a particular scale (e.g., "tall", "long", "likely"), and (ii) multi-dimensional expressions that can take various scales simultaneously (e.g., "smart", "identical", "good"). What type of scale does GEN take if it is like an adverb of quantification such as "generally" and so a gradable expression? We answer that GEN should be treated as a uni-dimensional gradable expression. This is because GEN does not pass the standard tests for multi-dimensionality. Consider the following data:

Two Tests for Multi-Dimensionality (Sassoon, 2013; Lassiter, 2017)

(8) a. #Bill is tall and he is not. (uni-dimensional)

b. Mary is smart and she is not. (multi-dimensional)[11]

[10] More specifically, the sentence "Bill is tall" is analyzed as meaning that Bill's height meets some contextual threshold for tallness, provided that the threshold is significantly greater than the average height of the comparison class (if a comparison class is contextually provided). For example, in a context in which the speaker is talking about basketball players, "Bill is tall" is true just in case Bill's height meets some contextual threshold, provided that the threshold is significantly greater than the average height of basketball players. However, in this paper, we will not consider relativization to comparison classes.

[11] To help hear (8b) as felicitous, imagine a context in which it is not clear which kinds of intelligence are most relevant. (Lassiter (2017, p. 244) uses a similar strategy to argue that "Mary is more clever than Bill and she is not" can be felicitous.) Consider an example. Suppose that Mary is a mathematical prodigy but prudentially irrational. Furthermore, suppose that a historian friend of yours, who has just met Mary, asks

c. #Mosquitoes transmit malaria and they don't.

d. #Sea turtles live long and they don't.

(9) a. #In all/most/three/some respects, Bill is tall. (uni-dimensional)

b. In all/most/three/some respects, Mary is smart. (multi-dimensional)

c. #In all/most/three/some respects, mosquitoes transmit malaria.

d. #In all/most/three/some respects, sea turtles live long.

First, one can utter (8b) to communicate that there is a relevant kind of smartness on which Mary is smart and a relevant kind of smartness on which she is not. For example, perhaps she is a mathematical prodigy but is prudentially irrational, lacking common sense. But we cannot use (8a) to communicate that there is a relevant kind of tallness on which Bill is tall and a relevant kind of tallness on which he is not. (8c) and (8d) suggest that generics pattern like uni-dimensional gradable expressions such as "tall". Secondly, while multi-dimensional expressions can take modifiers like "with respect to" or "in all/most/three/some respects", uni-dimensional expressions cannot. (9c) and (9d) also suggest that generics pattern like uni-dimensional expressions.[12]

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you privately whether Mary is smart. You can felicitously reply by uttering (8b) in order to assert, roughly, that Mary is smart overall on only some reasonable weightings of respects in which one can be smart. Interestingly, it is much harder to hear an analogous interpretation for (8a) even though "tall", like "smart", is a gradable adjective. Hence, we judge that (8a) is, at the very least, more marked than (8b). In any case, we and the three native English-speaking informants we have consulted unanimously find (9b) to be felicitous but (9a) to be infelicitous. So even if one disagrees with the contradiction test for multidimensionality that we apply in (8a)-(8d), the "in multiple respects" test that we apply in (9a)-(9d) surely succeeds as a test of multidimensionality. And this latter data suggests that if GEN is gradable, it is a uni-dimensional gradable expression. We thank an anonymous reviewer for encouraging us to further discuss the contradiction test used in (8a)–(8d).

[12] What about generics with multi-dimensional relative expressions in scope position? For example, consider "Philosophers are smart". That generic can be felicitously conjoined with either "and are not smart" or "in all/most/three/some respects". However, this result is unsurprising since we already know that "smart" is multi-dimensional. The infelicity of (8c), (8d), (9c), and (9d) suffice to show that if GEN is a relative gradable expression, it is a uni-dimensional one. These are better test cases because "transmit malaria" and "live long" fail to be multi-dimensional relative gradable expressions in the first place.

Another distinction for relative gradable expressions is the distinction between a positive and a negative gradable expression (Kennedy, 2007. p.33). Many gradable adjectives, though not all, are found in antonymous pairs. Examples include "tall"/"short", "full"/"empty", "wet"/"dry", and so on (Kennedy, 1999, 2007). Gradable adjectives like "tall", "full", and "wet" are called *positive* and measure increasing degrees of a property. If Ann is taller than Betty, then Ann has more height than Betty. That is, Ann's height is greater than Betty's height (i.e., Ann's height $>$ Betty's height). On the other hand, gradable adjectives like "short", "empty", "dry" are called *negative*, and measure decreasing degrees of the same property. If Ann is shorter than Betty, then Ann has less height than Betty. That is, Ann's height is *not* as great as Betty's height (i.e., Ann's height $<$ Betty's height). Scales can be represented as an ordered pair consisting of a set of degrees and an ordering on it (Kennedy 2007, fn.29). If so, positive and negative scales can be understood as having different orderings on the same set of degrees. For example, the scale of "tall" can be represented as $\langle D_{height}, \prec \rangle$, where $\prec$ is an ascending order on the degrees of heights. "Ann is taller than Betty is" means that Ann is more highly ranked than Betty in an ascending order of heights. So, it means that Ann's height is greater than Betty's height. On the other hand, the scale of "short" can be represented as $\langle D_{height}, \succ \rangle$, where $\succ$ is a descending order on the same domain. "Ann is shorter than Betty is" means that Ann is more highly ranked than Betty is in a descending order of heights. So, it means that Ann's height is smaller than Betty's height. In the literature, GEN has been associated with probability, typicality, and normality scales. Since "probable", "typical", and "normal" are *positive* gradable expressions while their antonyms "improbable", "atypical" and "abnormal" are negative gradable expressions, this suggests that if GEN is a gradable expression, it is a *positive* gradable expression.

If GEN is a uni-dimensional, positive gradable expression, exactly what kind of scale is it associated with? We will consider three families of proposals addressing this question: probability (Cohen, 1996, 1999a, b, 2001b, 2004; Tessler & Goodman, 2019), typicality (van Rooij & Schulz, 2020), and normality (Schubert & Pelletier, 1989; Asher & Morreau, 1995; Pelletier & Asher, 1997; Eckardt 1999; Nickel, 2009, 2016). The following are formalizations for each scale:

(10) Probability: P(G/F). (Cohen, 1996, 1999b, 2001b; Tessler & Goodman, 2019)

(11) Typicality: $\frac{P(G/F)-P(G/\neg F)}{1-P(G/\neg F)}$, where (i) $P(G/F) > P(G/\neg F)$. (van Rooij & Schulz, 2020)[13]

(12) Normality: $a_c \times P(G/Actual{:}F) + b_c \times P(G/Ideal{:}F)$, where $a_c + b_c = 1$. (Bear & Knobe, 2017)[14]

Based on (10)–(12), the following candidate definitions of GEN can be given:

The Definitions of GEN

(10*) $[\![GEN]\!]^{c,g,w} = \lambda F_{<\varepsilon,t>}.\ \lambda G_{<\varepsilon,t>}.\ P(G/F) \geq \theta_c$

(11*) $[\![GEN]\!]^{c,g,w} = \lambda F_{<\varepsilon,t>}.\ \lambda G_{<\varepsilon,t>}.\ \frac{P(G/F)-P(G/\neg F)}{1-P(G/\neg F)} \geq \theta_c$, where $P(G/F) > P(G/\neg F)$

(12*) $[\![GEN]\!]^{c,g,w} = \lambda F_{<\varepsilon,t>}.\ \lambda G_{<\varepsilon,t>}.\ a_c \times P(G/Actual{:}\ F) + b_c \times P(G/Ideal_{g(w)}{:}\ F) \geq \theta_c$, where $a_c + b_c = 1$

[13] (11) is a simplified version of van Rooij and Schulz's proposal without taking into account the value function and alternative-sensitivity.
[14] (12) is inspired by Bear and Knobe's (2017) discovery that people's notion of what is normal is influenced by both what they believe to be descriptively average and what they believe to be prescriptively ideal. But they are not officially committed to this formalization.

ε is a neutral semantic type for either *e* (i.e., the semantic type for entities/individuals) or *s* (i.e., the semantic type for situations). Following Lewis (1975), Cohen (1999a), and Fara (2006), we assume that GEN can freely quantify over either individuals or situations. If GEN quantifies over situations, generic sentences have habitual readings. If GEN quantifies over individuals, then they have individual (or I-generic) readings. (10*)–(12*) say that "GENx(Fx)(Gx)" is true just in case F and G's degree *on the probability/typicality/normality scale* meets some contextual threshold for generalization.[15]

According to the above definitions of GEN, GEN is associated with a particular kind of scale, as "tall" is associated with just a height scale. However, the three kinds of scales do not necessarily have to compete. GEN might be context-sensitive in the sense that it can freely take any of the three kinds of scales. Consider the gradable adjective "long" that can measure either a temporal or spatial dimension, depending on context. On this view, the definition of GEN can be given as follows:

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[15] In degree semantics, gradable adjectives (e.g., "tall") express mappings from *individuals/entities* to degrees on a scale (Kennedy 2007). However, there have been attempts to extend this approach. For example, Wellwood (2019) argues that gradable adverbs (e.g., "fast" in "Ann ran faster than Bill did") express mappings from *events* to degrees. Lassiter (2017) argues that modal adjectives (e.g., "likely", "good", "necessary") express mappings from *propositions* to degrees. In this paper, we argue that GEN maps *two properties* to a degree on a scale. The logical form of a generic is often analyzed as GENx(Fx)(Gx). Given this logical form, if GEN is treated as a gradable expression, it would be natural to treat GEN as expressing a measure function mapping two properties to a degree. Let e be the semantic type for entities, t the semantic type for truth values and d the semantic type for degrees. Suppose also that GEN is associated with the normality scale. Then, the lexical entries for "tall" and GEN can be given as follows:
$[\![\text{“tall”}]\!]^c = \lambda x_e.\ \text{tall}(x)$ (⟨e,d⟩-type)
$[\![pos_{GA}]\!]^c = \lambda g_{<e,d>}.\ \lambda x_e.\ g(x) \geq \theta_c$ (⟨⟨e,d⟩ ⟨e,t⟩⟩-type)
$[\![\text{GEN}]\!]^c = \lambda F_{<e,t>}.\ \lambda G_{<e,t>}.\ \text{Normality}(F, G)$ (⟨et, ⟨et, d⟩⟩-type)
$[\![pos_{GEN}]\!]^c = \lambda g_{<et,<et,\, d>>}.\ \lambda F_{<e,t>}.\ \lambda G_{<e,t>}.\ g(F, G) \geq \theta_c$ (⟨⟨et, ⟨et, d⟩⟩ ⟨et, ⟨et, t⟩⟩⟩-type)
Following Kennedy (2007) and Lassiter (2017), we can posit a silent morpheme for gradable adjectives pos_{GA} to derive the positive form of "tall" (with no overt degree modification) as in "Bill is tall". θ_c is a free variable for thresholds whose value is supplied by context c. Similarly, we can posit a silent morpheme for GEN pos_{GEN} to derive the quantificational meaning of GEN. On this view, the lexical entries for GEN as a quantifier (10*)–(12*) can be understood as an elliptical form of pos_{GEN}(GEN). For more compositional details, see Kennedy (1999, 2007), Lassiter (2017) and Wellwood (2019).

The Definition of Context-Sensitive GEN

(13) $[\![\text{GEN}]\!]^c = \lambda F_{<\varepsilon,t>}.\ \lambda G_{<\varepsilon,t>}.\ g_c(F, G) \geq \theta_c$, where g_c is uni-dimensional, positive, and upper-and lower-bounded.

g_c is a free variable for measure functions whose value should be supplied by context c. It comes with uni-dimensionality, positivity, and upper- and lower- boundedness as presuppositions or definedness conditions.[16] Since probability, typicality, and normality scales satisfy these presuppositions, GEN might take one of those scales as its value. Note, however, that (13) is schematic; we do not claim that GEN can take *all* scales that satisfy these presuppositions. We are open to the possibility that there may be additional constraints on GEN.

It may be interesting to inquire whether GEN is associated with a particular kind of scale (cf., "tall") or it is context-sensitive (cf., "long"). However, for the purposes of this paper, we do not have to take a stand on this issue. Rather, we will focus on how, using the three kinds of scales as concrete examples, the constraint that the scale of GEN is positive, and upper- and lower-bounded can be used to explain the positive data and the negative data.

[16] As noted in fn.15, in degree semantics, GEN can be understood as expressing a measure function mapping two properties to a degree on a scale. If so, following Kennedy (1999, 2007) and Lassiter (2017), we can posit the positive morpheme *pos* to derive its quantificational meaning ($\langle$et, $\langle$et ,t$\rangle\rangle$-type) as follows:
$[\![\text{GEN}]\!]^c = \lambda F_{<e,t>}.\ \lambda G_{<e,t>}.\ g_c(F, G)$, where g_c is uni-dimensional, positive, and upper- and lower- bounded. (($\langle$et, $\langle$et, d$\rangle\rangle$-type))
$[\![pos_{GEN}]\!]^c = \lambda g_{<et,<et,\,d>>}.\ \lambda F_{<e,t>}.\ \lambda G_{<e,t>}.\ g(F, G) \geq \theta_c$. (($\langle\langle$et, $\langle$et, d$\rangle\rangle$ $\langle$et, $\langle$et, t$\rangle\rangle\rangle$-type)
On this view, the lexical entry for context sensitive GEN can be understood as an elliptical form of pos_{GEN}(GEN). On this picture, the scale is introduced by GEN and the threshold is introduced by the positive morpheme for GEN.

5. Explaining the Positive Data and the Negative Data

5.1. Probability

Let's first consider the probability scale. The idea that generics state probabilities goes back to Cohen (1996, 1999b, 2001b). Cohen (2001b) views GEN as a quantificational determiner such as "most". On his view, a generic of the form "GENx(Fx)(Gx)" has ambiguous readings, and is true iff the probability of G given F is bigger than 0.5 (on the absolute reading) *or* the probability of G given the union of alternatives, $\cup$A (on the relative reading). Let "ALT(Φ)" be a set of alternatives to Φ. Then, the alternative set for a generic "Fs G" is defined as A = {F′ ∧ G′| F′ ∈ ALT(F) & G′ ∈ ALT(G)}. Given this, GEN is defined as follows:

(14) "GENx(Fx)(Gx)" is true iff $P(G/(F \wedge \cup A)) > \rho$, where:

(i) $\rho = 0.5$ (absolute reading), or

(ii) $\rho = P(G/\cup A)$ (relative reading).

Cohen assumes that ALT(F) includes F (i.e., F ∈ ALT(F)). So, (F ∧ $\cup$A) is equivalent to F. Thus, "GENx (Fx)(Gx)" is true on the relative reading iff $P(G|F) > P(G|\cup A)$. For example, let's consider "Scandinavians win the Nobel Prize in literature". Cohen proposes that ALT(Scandinavian) = {Scandinavian, English, French, . . .} and ALT(win-lit-Nobel) = {win-lit-Nobel, ¬win-lit-Nobel}. Since A = {Scandinavian & win-lit-Nobel, Scandinavian & ¬win-lit-Nobel, English & win-lit-Nobel, English & ¬win-lit-Nobel, …}, $\cup$A = {Scandinavian ∨ English ∨ French ∨ …}. Thus, "Scandinavians win the Nobel Prize in literature" is true on the relative reading iff P(win-lit-Nobel/Scandinavian) > P(win-lit-Nobel/person).

However, Cohen's account does not capture (3) from the positive data. That is, Cohen's account incorrectly predicts that in a typical context, "Prime numbers are odd" is true. Most prime numbers are odd. That is, the probability of being odd given being a prime number is bigger than

0.5. So, “Prime numbers are odd” is true on the absolute reading. On the other hand, suppose that ALT(Prime number) = {Prime number, Non-prime number} and ALT(odd) = {odd, even}. Since A = {Prime number & odd, Prime number & even, Non-prime number & odd, Non-prime number & even}, $\cup$A is the set of natural numbers. So, “Prime numbers are odd” is true on the relative reading iff P(odd/prime number) > P(odd/natural number). Thus, on Cohen’s account, “Prime numbers are odd” is true on either the absolute or relative reading. However, in a typical context, this generic sentence can be used to assert, falsely, that *all* prime numbers are odd. Cohen’s account, then, is not flexible enough to capture this interpretation.

On the other hand, Tessler and Goodman (2019) treat generics as analogous to a gradable adjective like “tall” and propose a simple semantics for GEN:

(15) “GENx(Fx)(Gx)” is true iff $P(G/F) \geq \theta_c$, where θ_c is a contextually determined threshold such that $0 < \theta_c \leq 1$.

On their view, generics are not ambiguous (contra Cohen), and the threshold for GEN is context-sensitive. Context is formalized as prior background knowledge about different kinds of properties (Tessler & Goodman, 2019, p.397). Although Tessler and Goodman do not discuss the example “Prime numbers are odd”, they can propose that the threshold for this sentence is set to 1 in a typical context because, according to our intuitive theories about mathematical properties, mathematical properties allow for no exceptions. We concede that, to fully develop a gradable approach to generics, we need to provide an explanation of how the threshold for GEN is contextually determined. But what’s important for the purpose of this paper is whether (15) is flexible enough to allow for the quantificational forces in the positive data and constrained enough to exclude the quantificational forces in the negative data. Thus, we will remain neutral on questions like what context consists of and how the threshold is determined by context.

The definition (15) can be used to explain the positive data, because the threshold θ_c is allowed to vary with context. The quantificational forces in the positive data are all *positive* in the sense that they say that a probability meets some threshold. For example, GEN has universal quantificational force (e.g., "all") or something equivalent when the threshold is set to 1. GEN has quasi-existential quantificational force (e.g., "a few") when the threshold is set to a very small number such as 0.01. GEN has a proportional quantificational force (e.g., "many", "most") when the threshold is set to an intermediate number such as 0.5. The quantificational forces in the positive data can be interpreted in terms of probability as follows:

Lexical Entries for the Quantificational Forces in the Positive Data

(16) a. $[\![\text{"all"}]\!]^c = \lambda F.\ \lambda G.\ P(G/F) = 1.$

b. $[\![\text{"almost all"}]\!]^c = \lambda F.\ \lambda G.\ P(G/F) \geq 0.9.$

c. $[\![\text{"most"}]\!]^c = \lambda F.\ \lambda G.\ P(G/F) \geq 0.5+\epsilon.$[17]

d. $[\![\text{"many"}]\!]^c = \lambda F.\ \lambda G.\ P(G/F) \geq 0.3.$

e. $[\![\text{"a few"}]\!]^c = \lambda F.\ \lambda G.\ P(G/F) \geq 0.01.$

The force of "all" corresponds to the threshold 1, the force of "most" corresponds to some threshold just above 0.5, and the force of "a few" corresponds to some very low number that is

[17] Due to the density of the real numbers, there is no real number *r* greater than 0.5 that should be fixed as a constant threshold for "most". We doubt this complication seriously threatens the plausibility of our proposal. For convenience, we appeal to infinitesimals in our lexical entry for "most". For a brief discussion of infinitesimals in philosophy and mathematics, see Marquis (2006), who tells us that "infinitesimals [are] back with a vengeance" (p.395) within contemporary mathematics—nonstandard analysis and synthetic differential geometry in particular—even if there is some reason to be optimistic that "it will always be possible to eliminate them" (p.395). But *even if* mathematics can be done without infinitesimals, it is unclear why we should therefore be unhappy to appeal to them in semantics when it is theoretically convenient and useful to do so.

non-zero. Thus, it should be straightforward how, according to the gradable approach employing the probability scale, GEN can be used to express the quantificational forces in the positive data.

Furthermore, the definition (15) explains the negative data as well. Many of the quantifiers in the negative data are *negative* in the sense that they say that a probability does *not* meet some threshold. However, according to (15), "GENx(Fx)(Gx)" says that the probability of G given F meets some contextual threshold. So, GEN cannot be used to express negative quantificational forces such as those of "not all", "not many", "few", etc. Also, since generics concern probabilities, they are not suitable for expressing propositions with cardinal quantificational forces such as those of "exactly five", "at least five", "at most five", or propositions that involve the definite determiner "the". Furthermore, according to (10*) and (15), GEN is a two-place operator, making it unsuitable for expressing the three-place operator expressed by "all…except…". Below are some sample lexical entries for the quantificational forces in the negative data. It should be obvious from these lexical entries why, according to (10*) and (15), GEN cannot be used to express the quantificational forces in the negative data.

Lexical Entries for the Quantificational Forces in the Negative Data

(17) a. $[\![\text{“not all”}]\!]^c = \lambda F.\ \lambda G.\ P(G/F) < 1.$

b. $[\![\text{“not many”}]\!]^c = \lambda F.\ \lambda G.\ P(G/F) < 0.3.$

c. $[\![\text{“few”}]\!]^c = \lambda F.\ \lambda G.\ P(G/F) < 0.01.$

d. $[\![\text{“no”}]\!]^c = \lambda F.\ \lambda G.\ P(G/F) = 0.$

e. $[\![\text{“all…except…”}]\!]^c = \lambda F.\ \lambda H.\ \lambda G.\ P(G/F\&\neg H) = 1$

f. $[\![\text{“exactly five”}]\!]^c = \lambda F.\ \lambda G.\ \#(F\&G) = 5.$

g. $[\![\text{“at least five”}]\!]^c = \lambda F.\ \lambda G.\ \#(F\&G) \geq 5.$

h. $[\![\text{“at most five”}]\!]^c = \lambda F.\ \lambda G.\ \#(F\&G) \leq 5$.

At this point, one might point out that the positive data suggests that GEN can express not only the contents of simple quantifiers (e.g., “all”, “many”, “most”) but also those of modalized quantifiers (e.g., “all normal”, “all ideal”). To accommodate this worry, proponents of the probability approach might argue that there is an ambiguity in probability.

For example, Tessler and Goodman (2019) argue that there are two kinds of prevalences: objective and subjective. Indeed, they explicitly recognize these two classes of prevalences in their discussion of the habitual “Mary handles mail from Antarctica”. Intuitively, “Mary handles mail from Antarctica” can be true even though nobody has sent mail to Mary’s office from Antarctica and so Mary has never had the opportunity to handle mail from Antarctica. Tessler and Goodman state that there is “an important ambiguity in…[their] uncertain threshold model…the prevalence [can] represent the actual, objective frequency in the world…or a subjective, predictive degree of belief in the head” (Tessler & Goodman, 2019, p.400). The actual, objectual probability measures the number of past occurrences where Mary has handled mail from Antarctica. On the other hand, the predictive probability measures the number of future occurrences where Mary will handle mail from Antarctica.

However, Tessler and Goodman’s suggestion does not fully capture the range of modalized quantifiers GEN can express. Consider a hypothetical scenario in which a plant species, dubbed “orange crusher”, is recently discovered. Orange crushers bear resemblance to Venus fly traps and are capable of effortlessly crushing an orange when given one. Intuitively, “Orange crushers crush oranges” can be true, even in situations where no orange crushers have ever crushed an orange and never will. (Perhaps, orange crushers will soon become extinct). For instance, imagine a situation where some biologists are, for amusement, categorizing species based on their members' ability to reliably crush oranges when provided with one. In this context, "Orange crushers crush oranges" can be interpreted as most orange crushers have a disposition to crush oranges in appropriate circumstances—e.g., when healthy and given an orange. However, on Tessler and Goodman's (2019) account, "Orange crushers crush oranges" cannot be true in the above scenario. This is because no orange crushers have crushed an orange (i.e., the actual, objectual probability is zero) and no orange crushers will ever crush an orange (i.e., the predictive probability is zero). So, the statement is incorrectly predicted to be false.

However, we believe that the idea that there is an ambiguity in probability is on the right track to capture that GEN can express both simple quantificational forces and modalized quantificational forces. We propose that there are two different kinds of probabilities: statistical and ideal. The actual, statistical probability measures how many actual Fs are G and can be represented as P(G/Actual:F), where Actual is a function that takes the property F and produces the set of actual Fs. The ideal probability measures how many ideal Fs are G and can be represented as P(G/Ideal:F), where Ideal is a function that takes the property F and produces the set of ideal Fs. According to Kratzer's (1991, 2012) modal semantics, which is the dominant paradigm in the semantics for modals, modals are relativized to two contextual parameters: the modal base f and the ordering source g. The modal base f, which is a set of possible worlds, determines the preliminary domain, and the ordering source g imposes an ordering on the worlds in the modal base. Similarly, we can think of Ideal as relativized to F and g. On this picture, F, which is a set of entities, provides the preliminary domain, and the ordering source g, which is a set of properties,[18]

[18] Properties are understood as sets of entities.

imposes an ordering $\geq_{g(w)}$ on the individuals in F. The ordering $\geq_{g(w)}$, Actual, and Ideal, can be formally defined as follows:

(18) Actual: F = $\{x \mid x \in F$ & x is at the actual world @$\}$

(19) a. For any x, y in F, $x \geq_{g(w)} y$ iff $\{\phi \in g(w) \mid y \in \phi\} \subseteq \{\phi \in g(w) \mid x \in \phi\}$

b. $\text{Ideal}_{g(w)}$: F = $\{x \mid x \in F \ \& \ \forall y \in F\ [y \geq_{g(w)} x \rightarrow x \geq_{g(w)} y]\}$

$\geq_{g(w)}$ is a relation between two individuals. "$x \geq_{g(w)} y$" can be read as *x is at least as close to the ideal given by g(w) as y is*. x is at least as close to the ideal given by g(w) as y iff x satisfies all properties in g(w) that y satisfies. "$\text{Ideal}_{g(w)}$: F" denotes the set of entities in F that are maximally ranked by g(w). In other words, it picks out the most ideal entities of the domain F relative to g(w).

The ideal probability can be used to explain a wide range of GEN's modalized quantificational forces. When GEN has a modal reading, their modal flavor is determined by the ordering source g(w). The ordering source g(w) may or may not be empty. If it is empty, then GEN picks out all possible entities with the property F. We believe that mathematical, logical, and definitional generics usually take an empty ordering source, so GEN picks out all *possible* objects of the kind in question such as "Squares are four-sided" (mathematical generic statement), "Objects are self-identical" (logical generic statement), and "Bachelors are male" (definitional generic statement), etc.[19] If the ordering source is not empty, GEN picks out the relevant kind of ideal objects. We believe GEN can take various ordering sources including causal (e.g., "Children from Rainbow Lake are left-handed"), dispositional (e.g., "Orange crushers crush oranges"), inertial (e.g., "Sea turtles live long") and normative (e.g., "Friends don't let friends drive drunk")

[19] Note that it is possible, although unusual, for (ostensibly) mathematical, logical, and definitional generics not to have universal quantificational force. For example, Sterken (2015a, p.22) observes that "Prime numbers are odd" can, in some unusual contexts, be true. In those contexts, this generic means, roughly, that most prime numbers are odd.

ordering sources. Based on the discussion so far, the simple and modalized quantificational forces in the positive data can be interpreted in terms of probability as follows:

Lexical Entries for the Simple and Modalized Quantificational Forces in the Positive Data

(20) a. $[\![$“all (actual)”$]\!]^{c,g,w}$ = λF. λG. P(G/Actual:F) = 1.

b. $[\![$“almost all (actual)”$]\!]^{c,g,w}$ = λF. λG. P(G/Actual:F) ≥ 0.9.

c. $[\![$“most (actual)”$]\!]^{c,g,w}$ = λF. λG. P(G/Actual:F) ≥ 0.5+ϵ.

d. $[\![$“many (actual)”$]\!]^{c,g,w}$ = λF. λG. P(G/Actual:F) ≥ 0.3.

e. $[\![$“a few (actual)”$]\!]^{c,g,w}$ = λF. λG. P(G/Actual:F) ≥ 0.01.

(21) a. $[\![$“all (ideal)”$]\!]^{c,g,w}$ = λF. λG. P(G/$\text{Ideal}_{g(w)}$:F) = 1.

b. $[\![$“almost all (ideal)”$]\!]^{c,g,w}$ = λF. λG. P(G/$\text{Ideal}_{g(w)}$:F) ≥ 0.9.

c. $[\![$“most (ideal)”$]\!]^{c,g,w}$ = λF. λG. P(G/$\text{Ideal}_{g(w)}$:F) ≥ 0.5+ϵ.

d. $[\![$“many (ideal)”$]\!]^{c,g,w}$ = λF. λG. P(G/$\text{Ideal}_{g(w)}$:F) ≥ 0.3.

e. $[\![$“a few (ideal)”$]\!]^{c,g,w}$ = λF. λG. P(G/$\text{Ideal}_{g(w)}$:F) ≥ 0.01.

5.2. Typicality

Next, let us move on to the typicality scale. van Rooij and Schulz (2020) borrow a notion of typicality in cognitive psychology to define the meaning of GEN. (11) is a simplified version of van Rooij and Schulz’s (2020) proposal for typicality. van Rooij and Schulz’s (2020) original proposal includes a value function Value(G) and is formalized as follows:

(22) $\frac{P(G/F)-P(G/\neg F)}{1-P(G/\neg F)} \times \text{Value}(G)$, where (i) $P(G/F) > P(G/\neg F)$, and (ii) Value (G) ≥ 1.

Value (G) measures the *intensity* of the property G, representing something like the utility, fear, or joy of having the property G (van Rooij & Schulz, 2020).[20] For example, when G is a dangerous property such as carrying the West Nile virus, Value (G) will be very high. Also, van Rooij and Schulz (2020) assume that Value (G) must be at least as great as 1. However, one distinctive feature of the typicality scale, in contrast with the probability scale, is that the typicality scale has no natural upper bound. The threshold for probabilities is between 0 and 1, so the probability scale is upper- and lower-bounded. On the other hand, since Value (G) is at least as great as 1, there is no upper bound for typicality. If so, one might wonder which type of scale is more appropriate to capture the positive data and the negative data. We argue that a scale with an upper bound should be preferred over one without an upper bound. We do so because if a scale is upper-bounded and so there is a maximum degree in a scale, this maximum degree naturally corresponds to the universal quantificational force that—as the positive data shows—generic quantification can have.

However, this is not an insurmountable objection against the typicality approach. Proponents of the typicality scale can respond to this objection by deleting Value (G), in which case the typicality scale is identified with (11), which is $\frac{P(G/F)-P(G/\neg F)}{1-P(G/\neg F)}$. On the gradable approach employing the typicality scale, a generic sentence's truth conditions can be given as follows:

(23) "GENx(Fx)(Gx)" is defined iff (a) $P(G/F) > P(G/\neg F)$

if defined, is true iff (b) $\frac{P(G/F)-P(G/\neg F)}{1-P(G/\neg F)} \geq \theta_c$

The intuitive idea behind (23) is that, a generic "Fs G" is true iff being G is a representative property of Fs. And, for typicality theorists, that is true, roughly, iff being G is typically associated

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[20] The term $\frac{P(G/F)-P(G/\neg F)}{1-P(G/\neg F)}$ is intended to measure how representative, or contrastively (proto)typical, the property G is for Fs, collectively speaking. We discuss this term further below after introducing a more satisfactory analysis in (22). At this point in the main text, our main point is just that Value(G) must be eliminated if we desire a semantics that can give universal quantificational force to GEN.

with Fs, where typicality is understood contrastively. For example, paradigmatic typicality theorists argue that psychological findings suggest "typical members of a category…have features that *distinguish* them from members of other categories; as such they highlight, or exaggerate, real differences between groups" (van Rooij and Schulz 2020, p. 94). So, for "Fs G" to be true, being G must be a contrastively typical, or representative, feature of typical Fs. Put succinctly, "a generic of the form '*Gs* are *f*' is true if *f* is a representative feature for *G*" (van Rooij and Schulz 2000). It is worth emphasizing that typicality and representativeness are understood contrastively here; in this sense, it is possible for property G to be representative for Fs if no non-Fs are G and only a minority of Fs are G (and thus most Fs are not G).

(23) is intended to formalize these ideas. The presupposition (23a), which states that $\mathrm{P(G/F)} > \mathrm{P(G/\neg F)}$, encodes the claim the Fs are relatively likely—when compared to non-Fs—to be G. The at-issue content (23b), which states that $\frac{\mathrm{P(G/F)}-\mathrm{P(G/\neg F)}}{1-\mathrm{P(G/\neg F)}} \geq \theta_c$, claims that the *relative difference* of Gs among Fs and Gs among non-Fs must be higher than the contextually determined threshold θ_c.[21] This threshold θ_c determines, intuitively, how representative being G must be for Fs in order for "Fs G" to be true; it sets a lower bound on representativeness. The term $\frac{\mathrm{P(G/F)}-\mathrm{P(G/\neg F)}}{1-\mathrm{P(G/\neg F)}}$ measures, roughly, how representative the property G is for Fs. This term, assuming (23a) is satisfied, must be greater than 0. $\frac{\mathrm{P(G/F)}-\mathrm{P(G/\neg F)}}{1-\mathrm{P(G/\neg F)}} = 0$ when P(G/F) = P(G/¬F). But this is

[21] van Rooij and Schulz (2020) attribute the concept of relative difference to Sheps (1958). van Rooij and Schulz (2020, p.95) appeal to relative difference to capture observations, from associative learning psychology, concerning how the absolute values of P(G/F) and P(G/¬F) influence association formation even when we hold the difference between them constant. For example, P(G/F) should, all other things being equal, influence association formation more than P(G/¬F). For instance, all other things being equal, a stronger association between Fs and Gs—the content of which is roughly that (relatively many) Fs G—should exist when P(G/F) = 0.9 and P(G/¬F) = 0.8 than when P(G/F) = 0.5 and P P(G/¬F) = 0.4. Yet, in both cases, their absolute difference, or P(G/F) − P(G/¬F), is the same, namely 0.1.

impossible if (23a) is satisfied. Thus, $\frac{P(G/F)-P(G/\neg F)}{1-P(G/\neg F)} > 0$. And its maximum value is 1, which occurs when P(G/F) = 1 and so $\frac{P(G/F)-P(G/\neg F)}{1-P(G/\neg F)} = 1$; in that case, all Fs are G and so (23b) predicts, plausibly enough, that G is a maximally representative, or contrastively typical, property of Fs (van Rooij and Schulz 2020, p. 103). Therefore, when the presupposition (23a) is satisfied, $0 < \frac{P(G/F)-P(G/\neg F)}{1-P(G/\neg F)} \leq 1$. The analysis in (23) is therefore both lower- and upper-bounded.

The numerator in (23b), $P(G/F) - P(G/\neg F)$, measures the "contingency" of being G on being F. This concerns how much being G correlates with being F as opposed to being non-F. The intuitive thought behind this part of (23b) is that if Fs are much more likely to be G than non-Fs, then that is a powerful—though perhaps defeasible—consideration for thinking that being G is a representative, distinctively typical, property of Fs. Therefore, having the numerator being $P(G/F) - P(G/\neg F)$ makes it, all other things being equal, easier for a generic to be true according to (23) when Fs are more likely to be G than non-Fs are. The denominator in (23b), $1 - P\left(\frac{G}{\neg F}\right)$, allows for the absolute difference between P(G/F) and P(G/¬F) to make a desired contribution to how representative the property G is for Fs. We can gloss over these details because they are not crucial for present purposes; however, interested readers may consult van Rooij and Schulz (2020, fn.17 and pp.95–97) for further details.

What's important for the purposes of this paper is that (23) can be used to explain the positive data and the negative data. The quantificational forces in the positive data can be interpreted in terms of typicality as follows:

Lexical Entries for the Quantificational Forces in the Positive Data

(24) a. $[\![\text{"all"}]\!]^c = \lambda F.\ \lambda G.\ \frac{P(G/F)-P(G/\neg F)}{1-P(G/\neg F)} = 1$.

b. ⟦"almost all"⟧^{c} = λF. λG. $\frac{P(G/F)-P(G/\neg F)}{1-P(G/\neg F)} \geq 0.9$.

c. ⟦"most"⟧^{c} = λF. λG. $\frac{P(G/F)-P(G/\neg F)}{1-P(G/\neg F)} \geq 0.5$.

d. ⟦"many"⟧^{c} = λF. λG. $\frac{P(G/F)-P(G/\neg F)}{1-P(G/\neg F)} \geq 0.3$.

e. ⟦"a few"⟧^{c} = λF. λG. $\frac{P(G/F)-P(G/\neg F)}{1-P(G/\neg F)} \geq 0.01$.

Let's first consider a case in which the threshold is set to 1. In such a case, "GENx(Fx)(Gx)" is true just in case P(G/F) = 1. This captures the cases where GEN expresses universal quantificational force. Secondly, let's consider a case in which the threshold is set to an arbitrary number n such that 1 > n > 0. Let *a* be $P(G/\neg F)$ and *b* be $P(G/F)$. If so, "GENx(Fx)(Gx)" is true just in case $\frac{b-a}{1-a} \geq n$. This condition is equivalent to $b \geq n + a(1-n)$. Since $a(1-n)$ must be positive, this condition requires b to be at least as great as n. That is, this condition requires that $P(G/F) \geq n$. For example, if the threshold is set to 0.5, the truth of a generic sentence requires that $P(G/F) \geq 0.5$. This seems to capture the cases where GEN expresses quantificational forces analogous to that of "most".

Furthermore, according to (23), "GENx(Fx)(Gx)" is true just in case F and G's degree of typicality meets some contextual threshold. So, it naturally explains the negative data as well. The negative quantifiers in the negative data say that F and G's degree of typicality does *not* meet some threshold. So, GEN cannot be used to express negative quantificational forces such as those of "not all", "not many", "few", etc. Also, there is no obvious way for GEN to express the contents of quantifiers of exception such as "all…except…" or cardinal quantifiers such as "exactly five", "at least five", "at most five".

5.3. Normality

Lastly, let us consider the normality scale. (12), which we repeat below, takes its inspiration from Bear and Knobe's (2017) notion of normality, and says that what is normal is a weighted sum of the statistical average and the ideal:

(12) Normality: $a_c \times P(G/Actual{:}F) + b_c \times P(G/Ideal{:}F)$, where $a_c + b_c = 1$.

The weight of each element, that is "a_c" and "b_c", represents how important that element is to the generalization judgment in a context. a_c is the contextually determined weight of the descriptive average, and b_c is the contextually determined weight of the ideal. And a_c and b_c must add up to 1. On the gradable approach employing the normality scale, a generic sentence's truth conditions can be given as follows:

(25) "GENx(Fx)(Gx)" is defined iff $a_c + b_c = 1$

if defined, is true iff $a_c \times P(G/Actual{:}\ F) + b_c \times P(G/Ideal_{g(w)}{:}\ F) \geq \theta_c$

As discussed in Section 5.1., P(G/Actual: F) is the probability of G given actual Fs, and $P(G/Ideal_{g(w)}{:}\ F)$ is the probability of G given ideal Fs. On (25), a generic "Fs G" is true iff sufficiently normal Fs are G, where what counts as sufficiently normal is provided by the contextually determined threshold θ_c. And as suggested above, normality is given by the weighted sum $a_c \times P(G/Actual{:}\ F) + b_c \times P(G/Ideal_{g(w)}{:}\ F)$.

One distinctive feature of the normality scale is that the actual, statistical probability and the ideal probability are represented on a single, hybrid scale, so that these two kinds of probabilities can be treated as a special case of normality. The simple quantificational forces in the positive data (i.e., (20)) can be derived when the value of "a_c" is 1. The modalized quantificational forces in the positive data (i.e., (21)) can be derived when the value of "a_c" is 0 and so the value of "b_c" is 1.

Furthermore, (25) naturally accounts for the negative data. According to (25), "GENx(Fx)(Gx)" is true iff the degree of normality of F and G meets some contextual threshold. So, GEN is ill-suited to expressing the negative quantificational forces in the negative data such as those of "not all", "not many", "few", etc., because the negative quantifiers indicate that the degree of normality of F and G does *not* meet some threshold. Also, according to (25), GEN does not have a straightforward way to express the contents of quantifiers of exception such as "all…except…" or cardinal quantifiers such as "exactly five", "at least five", "at most five".

Thus far, we have seen how (25) can be used to capture the positive data and the negative data. Before closing the section, let us mention one interesting feature of the normality scale: the context may supply intermediate weights for the evaluation of a generic "Fs G". This may be useful to explain the following observation: "Russians win at poker" seems to have a reading on which it is true only if sufficiently many actual Russians (regularly) win poker games *and* they do so not by sheer luck, but by some special causal mechanism (e.g., relatively high skill or rates of cheating). This generic is false if no Russians ever win at poker or there is no special, non-accidental causal explanation for why Russians win at poker.

Suppose that "Russians win at poker" is uttered in a context c such that $a_c = b_c = 0.5$ and $\theta_c = 0.6$. Moreover, suppose that P(*win at poker*/Actual: *Russian*) = 0.5 and P(*win at poker*/Ideal$_{g(w)}$: *Russian*) = 0.7. Then $a_c \times$ P(*win at poker*/Actual: *Russian*) + $b_c \times$ P(*win at poker*/Ideal$_{g(w)}$: *Russian*) = $0.5 \times 0.5 + 0.5 \times 0.7 = 0.6$. But then $0.6 \geq \theta_c$, since $\theta_c = 0.6$. Then according to (25), "Russians win at poker" is true in c only if both P(*win at poker*/Actual: *Russian*) and P(*win at poker*/Ideal$_{g(w)}$: *Russian*) are non-zero. Otherwise, it will be impossible for the weighted sum of these two values to be greater than or equal to $\theta_c = 0.6$. The upshot is that, in this example, (25) seems to correctly predict that "Russians win at poker" is true in context c only if some actual Russians win at poker and some causally ideal Russians win at poker.

This consideration might give us a good reason to favor the normality scale over the other two. However, for the purposes of this paper, we do not have to be committed to any particular kind of scale for GEN. Besides, GEN might be context-sensitive in the sense that it can freely take any of the three kinds of scales we have discussed. Thus, while we are sympathetic to the normality scale, we will not be officially committed to it.

6. Conclusion

Nguyen (2020) introduced the positive data and argued that only his radically pragmatic account and Sterken's (2015a) indexical account are compatible with the positive data. Lee and Nguyen (2022) provided the negative data and argued that the negative data is a problem for both Nguyen's (2020) and Sterken's (2015) accounts. In this paper, we identified a neglected class of theories that are compatible with both the positive data and the negative data. Any theory that analyzes GEN as a relative gradable expression with a positive, upper- and lower-bounded scale has the potential to explain the positive and negative data. We considered three concrete examples for the scale of GEN (i.e., probability, typicality, and normality), and showed how each of these examples can account for the positive data and the negative data. The upshot is that while the positive and negative data provide useful constraints on the semantic theories of generics that should be taken seriously, we must appeal to other desiderata in order to decide which of these theories to accept.

We, however, leave this task to future work. Here, we have only aimed to build up some of the necessary foundation for this future work on generic meaning.[22]

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