Explaining early generics: A linguistic model

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Preschoolers naturally form mental representations that capture generic knowledge about object kinds. These have been considered to pose a special explanatory and learning challenge. We here argue for a new deductive model of them, where (i) the representations in question have a linguistic format from the start; (ii) they are inherently structurally simpler compared to reference to individuals or quantifications; and (iii) formed in communicative contexts because communication in humans is linked to language. In this model, specific language-related resources explain the scope and limits of the forms of knowledge obtained, illustrating how language and cognition develop in tandem.

KEYWORDS
development, generics, grammar, language and cognition, quantification

1 | INTRODUCTION

While some knowledge depends on information that we can observe (e.g., This is a cat; There is a sweet in this box), other forms of knowledge appear less directly based on what is given in immediate experience. Thus, to be convinced that Cats have furry paws, it does not suffice to verify that some cats do, which strictly would only support that Some cats have furry paws. Even so, we consider Cats have furry paws to be true or assertible, whether or not All cats have furry paws. How many of them minimally need such paws, in this case, is unclear. We find it natural to say that Lions have manes, when roughly only half of all lions have manes, or that Mosquitoes carry the West Nile virus, when only very few mosquitoes carry this virus.
Generic and quantificational sentences thus both involve *generality*, but in crucially different ways and of different kinds, showing that generality as such is not the key to generics. Like quantifications, generics are about *instances* of a kind—that is, about *lions, cats*—yet, somewhat paradoxically, it appears that they are only indirectly and rather unsystematically related to information about how many of such instances have a certain property, capturing information that is intuitively more about the *kinds* themselves. In line with this status, experimental evidence from both adults (Khemlani, Leslie & Glucksberg, 2009; Prasada & Dillingham, 2009) and preschool children (Brandone, Cimpian, Leslie & Gelman, 2012; Gelman & Bloom, 2007; Gelman, Goetz, Sarnecka & Flukes, 2008; Graham, Nayer & Gelman, 2011; Hollander, Gelman & Star, 2002; Mannheim, Gelman, Escalante, Huayhua & Puma, 2010) confirms that neither of these populations interpret generic statements as equivalent to quantificational ones.

The contents of generic and specific sentences also enter memory differently, with the former recalled more easily than the latter, in English (Gülgöz & Gelman, 2015) and Spanish (Gelman, Sánchez Tapia & Leslie, 2016).

Generic knowledge is not only an early achievement but likely a universal one, independent of cultural and socio-economical context, and it is sometimes taken to even represent an initial cognitive “default,” which has to be “overridden” by quantificational and definite-specific forms of reference (*All/the cats are thirsty; This elephant is small*) (Mannheim et al., 2010). By capturing information about abstract categories viewed as kinds, such knowledge has long been thought to pose a profound learning challenge (e.g., Prasada, 2000). Such a challenge specifically arises for “bottom-up” models of learning, which derive knowledge from perceptual encounters with particulars and what can be gleaned from them by way of inductive generalizations. On such models, knowledge of particulars is the default, while generic knowledge involving kinds is the explanatory challenge: Special mechanisms have to be posited to derive such knowledge from knowledge of particulars and the necessarily limited exposures that children have to these. This challenge seems to notably increase, when we observe that generic knowledge can be formed by children from exposures to just a single instance of a general property during a demonstration, as reviewed below.

An intriguing different possibility, however, is that the situation is actually the reverse: Kinds provide a fundament for reference, while object-specific forms of reference are more derived and complex. In this case, the above challenge is set up in the wrong way, as it actually arises at the opposite end of the spectrum of forms of reference ranging from generic to specific: Specificity is the crucial explanandum. We will argue for one such alternative model here and specifically for the following points:

- Language is not speech and reference is present in the same basic linguistic format in communication with infants, long before it is visible in their speech production.
- This format inherently involves bipartite units necessarily integrating reference with predication, which in turn necessarily involves general concepts.
- Where reference is to specific individuals, it has to be explicitly restricted, which involves extra structural complexity.
- Where this restriction is missing, a structurally simpler form of reference is derived—generic reference, where common nouns normally functioning as predicates become referential items and subjects of predication themselves.
- Generics are formed in contexts of communication, but not noncommunicative contexts, because communication in humans is linked to language.
Before developing these points in detail in Sections 3–5, we start by discussing the notion of so-called nonverbal generics and motivate a linguistic model. In Section 6, we discuss potential evidence for the same forms of kind-reference in infants and toddlers. Section 7 returns to a new argument for the universality of generic knowledge mentioned above, and Section 8 concludes.

2 ARE THERE “NONVERBAL GENERICS”? 

In an important experiment by Butler and Markman (2012), four-year-old children were shown a new object and told that it was called a “blicket.” They then witnessed a nonverbal demonstration directed at them that this object had a certain property (magnetism), after which they were presented with novel objects of the same kind, again named as “blickets,” from which the magnetic property had been removed. In one of two control conditions, the action revealing the property was performed intentionally but noncommunicatively, while in the other it was performed accidentally (hence also noncommunicatively). It turned out that, in the communicative condition, the children persevered longer in their search behavior for the property in question, when confronted with the new blickets, apparently thinking that the new objects should all be magnetic.\(^1\) A similar contrast was found for three-year-olds between the communicative and “accidental” conditions (Butler & Markman, 2013). The authors interpreted this as evidence for inductive generalizations naturally taking place from single instances of a given kind to other such instances, when natural pedagogy and communication are involved.

Csibra and Shamsudheen (2015) articulate an alternative model, consistent with the causal significance of communication, but without the assumption of inductive learning from individuals. Instead, they propose that in the communicative condition, children “bind” the demonstrated property of magnetism directly to the kind rather than the individual object that they see it demonstrated on. That is, exposed to the demonstration that a particular object has a certain property, children do not form knowledge about this individual. Instead, they favor the interpretation that magnetism is a property of the object’s kind. Rather than reasoning inductively, that is, they reason deductively, along the lines of “blickets are magnetic” (premise 1), “these are blickets” (premise 2), therefore “these are magnetic” (Csibra & Shamsudheen, 2015, p. 11). Premise 1, given that the property is nonverbally demonstrated and no generic sentence was uttered, reflects the authors’ notion that the experiment demonstrates the existence of “nonverbal generics”: Children interpreted the demonstration of the property “in the same way as a linguistically conveyed generic expression (‘Blickets are magnetic’).”

Note that while on this model the generic knowledge inferred from the demonstration is said to be “nonverbal,” its representational format is posited as being equivalent to that of a generic sentence. The only difference is that the representation, in this case, is not pronounced (present in the form of speech). However, language (as an internal cognitive system) and speech (the externalization of this system through one possible sensory-motor channel) are not the same, and linguistic representations of sentences such as “Blickets are magnetic” can be formed

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\(^1\)Schulz, Standing and Bonawitz (2008) obtained a similar result for a situation where the same name (“blicket”) was used for the new objects as for an earlier set of objects, while the same exploratory behavior was not seen when the label was changed (“dax”).
cognitively, whether or not the sentences are also spoken, that is, articulated in speech. This creates a conceptual tension: What could the mental representation in question be, if it is identical to the mental representation underlying a sentence with the same form and content, yet “nonverbal”? To eliminate this tension, our first suggestion in this paper is to abandon talk of “nonverbal generics.” Instead, we propose to understand the above proposal literally: Linguistic representations are involved in the contexts in question—there is thinking in a linguistic format—whether or not generic sentences are also spoken. It is due to language that speech is represented in humans (but not dogs or parrots) at abstract levels of representation, which encode meaning as based on the specific grammatical structures involved.

The same distinction between language and speech allows us to recognize that the only sense in which infants can be “preverbal” is in the sense of being preproductively verbal. By the time that speech-motor processes kick in, language has been long unfolding. In fact, language development does not have a “start date.” Language structures social and communicative interaction from birth (Dominguez, Devouche, Apter & Gratier, 2016; Vouloumanos & Werker, 2007). It plays a crucial role in perceptual categorization and learning during the first year, prior to speech developing (Novack & Waxman, 2019; Vouloumanos & Waxman, 2014). A basic appreciation of the referential character of linguistic communication (6 months: Marno et al., 2015; Senju & Csibra, 2008; Vouloumanos, Martin & Onishi, 2014), as well as significant inroads into the comprehension of words (four months: Bergelson & Swingley, 2012; Bergelson & Aslin, 2017), are long underway by the time that first words are produced. In line with this, language is implemented in the brains of preproductively verbal infants (including neonates) in a remarkably adult-like fashion, whether looked at in terms of functional activations in response to linguistic stimuli (Dehaene-Lambertz et al., 2006), the neuroanatomy of language regions (Dubois et al., 2010), or, perhaps most strikingly, patterns of functional connectivity revealing a language network active in the resting state (Cusack, Wild, Zubiaurre-Elorza & Linke, 2018). If “preverbal” infants are only preproductively verbal but otherwise in no sense “nonverbal,” and language is integrated with cognitive and social development, it is natural to hypothesize that even the earliest forms of reference to kinds may reflect linguistic minds evolving. We consider relevant evidence from younger children and infants in Section 6.

By contrast to the above-mentioned accounts, moreover, we will further suggest that there is nothing in the notions of either communication or natural pedagogy per se, in any language-independent senses of these terms, that would have an explanatory grip on the specific representations involved, in any of the forms of reference discussed below. In particular, the fact that generics are formed in communicative contexts does not explain why they are formed. Communication can be about individuals, and in the Butler and Markman (2012) experiment, in particular, it actually seems to be. So why is the communication in this experiment not taken to be object-specific? In addition to an answer to this “why”-question, any comprehensive model of generics needs to specify a mechanism for how such generic representations are formed. “Binding” or “attaching” a property “directly to a kind” are effectively metaphors, which need to be cashed out. Such a mechanistic account also has to explain why generics have the distinctive meanings they do. This includes the fact that, although there clearly is a sense in which a generic like Tigers have stripes plainly is about individuals (namely, tigers), it is, at the same time, different from a quantification over such objects. We will return to these constraints in Section 5, where we will summarize how the model that we will now develop addresses them.
Our next step is to dissect generic knowledge into its constituent elements analytically and ask whether these are linguistic in nature. In other words, what constitutes generic knowledge, that is, which elements and structures does such knowledge, simply in virtue of its content, necessarily involve? Generic knowledge, firstly, depends on the possession of mental representations of abstract categories, such as lion, which pick out kinds. Beyond categories, generic knowledge involves the predication of a property (e.g., roaring) of such kinds or members of them, which in turn requires the category to function referentially in some way (otherwise nothing could be predicated of it). Hence, we have:

A. A given category based on a general concept (i.e., lions) is being referenced as the subject of a predication.
B. There is a second general concept (i.e., roar).
C. This second concept functions formally so as to be predicated of the referent.

Together, these elements yield the configuration Lions roar. In the absence of this type of configuration, there is no generic knowledge, though there may be other forms of knowledge involving elements of generality. For example, This is a lion involves the general concept lion; There is a lion involves an existential claim; and The lions roar or Lions roared pick out sets of lions. But none of these sentences are generics. The exact configuration Lions roar is therefore the one we need, and any complete model needs to derive it somehow, specifying a mechanism for how it is put together.

How might the elements of this configuration be made up of nonlinguistic elements? The notion of predication has been a cornerstone of theorizing about language for thousands of years. Language exhibits grammatical organization, and in every single sentence, grammar creates relations between phrases that make these phrases function referentially or predicatively on an occasion of their use. Like the logical notions of function and argument, the notions of reference and prediction are so fundamental that they can only be co-defined and do not reduce to any others. Of course, there are forms of reference available to nonhumans or infants, thus seemingly breaking the connection of reference to predication and grammar. Yet reference in nonhuman primates takes very different forms and functions than in humans (e.g., Novack & Waxman, 2019; Tomasello & Call, 2019). In neurotypical infants of 10–12 months of age, reference in the form of index-finger declarative pointing is often already used in combination with their first words, that is, in a bimodal fashion; and neither do adults tend to point silently for infants. In line with this, concurrent and longitudinal correlations between early pointing and both vocabulary and grammatical development are long-attested (Colonnesi, Stams, Koster & Noom, 2010; Goldin-Meadow & Butcher, 2003; Iverson & Goldin-Meadow, 2005). Since language evolves from day one of a human life and even before, as noted, it would amount to a category mistake to classify such early reference as “non-linguistic” or “preverbal.” Specifically, comprehension of linguistic reference is well underway by the time that infants produce these first pointing acts (Marno et al., 2015). We take these findings and conceptual considerations as supporting the view that such acts are coevolving with the language system, which by its nature is not a mono-modal system, with gesture forming a separate one in another modality. In fact, declarative gestures remain a constitutive element even in adult language, as for example in the use of deictic pronouns,
demonstrating that language is always and inherently multimodal (Mattos & Hinzen, 2015; Rossello, Mattos & Hinzen, 2017).²

More specific than the notion of “reference to kinds,” compounding the problems for conceptualizing such reference as a nonlinguistic capacity and for any nonlinguistic model of generics specifically. In particular, “reference to kinds” is not a perceptual notion (such as a perceptual category ball when invoked by a visual stimulus), and it is not a lexical notion either: Viewed as a word, lion does not refer to a kind, as examples such as This/the lion has a mane, Some lions have manes, or I saw lions show. In none of these, kind-reference of the sort seen in generics takes place, and lion functions as a predicate instead. In formal-semantic terms, it is the restrictor of a variable bound by a quantifier: Qx lion(x). Kind-reference, therefore, depends on such a noun appearing in the right grammatical configuration, which must be different from the ones in the examples just given, where the relevant noun appears as a predicate. The specificity of the structure of referential and predicative expressions required for generic reference is itself an argument for the linguistic nature of the representations involved.

These considerations support what was our starting suggestion in Section 2: To understand the representational format involved in generic knowledge, no alternative nonlinguistic, yet somehow equivalent, mental representations should be sought. This now opens the path for a mechanistic account, which we articulate in the next section. In this account, the generative engine that assembles the required representations and provides their format is language itself. Specifically, it is grammar that puts structures together in such a way that propositional meanings get encoded by words grouped into phrases, and by phrases relating to other phrases as either predicates or referential expressions. Generics are simply a special case, involving a specific grammatical configuration. Based on stored lexical concepts, and based on lexical categories that we possess, the generation in the language system of this configuration allows for the production of a potential infinity of possible generics. These are then judged to be either acceptable or not, depending on context and a myriad of factors that have already been shown to influence acceptance patterns in this domain (Cimpian, Gelman & Brandone, 2010; Gelman & Bloom, 2007).

### 4 | GENERIC KNOWLEDGE AND THE TRIANGULAR STRUCTURE OF REFERENCE

Our specific proposal for a mechanism starts from a general model of (declarative) reference in humans, more fully articulated in Hinzen (2017), Hinzen and Sheehan (2015), and Martin and Hinzen (2014). Acts of reference in humans are structurally organized as bipartite units, in which both a referential and a predicative part can be discerned, which are inherently integrated. The latter specifies what kind of object is being referred to (how it is “thought of”), the former functions so as to identify it in context. This bipartite structure is already pertinent in index-finger pointing, for example, an infant pointing to a dog and saying “dog.” This pointing

²If, despite of this evidence, we supposed that reference in the shape of early declarative pointing around the first birthday was a special, language-independent cognitive adaptation in humans, reference in this non-linguistic sense would still, in that case, be sharply limited in its scope. For example, it would be restricted to the immediate context, without an option for temporal or spatial displacement. This would have the theoretical consequence that most human reference would, even on this re-interpretation, still be linguistic in nature.
is “declarative” because some new information is being “declared” about something, for example, that the referent in question is a dog. What is being declared is the predicative part, while the index-finger is the referential part. These two parts are early analogs of determiners and lexical nouns, respectively, as found in complex noun phrases produced later on in development (e.g., *this + dog*), which early pointing indeed longitudinally predicts (Cartmill, Hunsicker & Goldin-Meadow, 2014; Iverson & Goldin-Meadow, 2005). In any determiner–noun combination, the determiner regulates the form of reference (e.g., definiteness and deixis in the foregoing example), while the noun provides the description restricting the referent as belonging to the kind *dog*, which defines its identity (Martin & Hinzen, 2014).

Due to this bipartite structure, it is clear that referential acts in humans will exhibit an element of generality, necessarily. There is reference in such acts, canonically, because an individual, say a particular dog, is being pointed at or referred to. But there is generality, too, because a general concept is involved, encoded as a lexical noun (e.g., “*dog*”), which provides a description of the object and functions predicatively when it is applied to the referent in question. This general concept, by its nature, can be used to describe an unbounded number of referents an unbounded number of times, outlasting any specific episode in which it is retrieved and configured as part of a predication. This illustrates its intrinsic generality and context-independence. General concepts, reference, and predication thus form an inextricable triangle, with each of these elements depending on each of the others. Predication presupposes reference, as a referent is needed for a predicate to be predicated of. The reverse is also true: Declarative reference presupposes predication, since without predication, nothing is declared. Finally, both reference and predication presuppose concepts, given that concepts provide the lexical ingredients or contents of the predications, which for example are used to identify the referent via its kind (“*this dog*”) or to describe its features (e.g., “*this dog is loud*”). As the three elements of this triangle are co-dependent, reference disconnected from general concepts and predication would be a different phenomenon—it could be a form of imperative reference as present in apes (Tomasello & Call, 2019), or causally controlled by a stimulus triggering an adaptive action, as in predator alarm calls in monkeys. In contrast, human declarative reference is not stimulus-controlled or stimulus-determined: Perceiving a dog does not necessarily trigger reference to it; if reference occurs, it need not occur under the description “*dog*”; and reference to dogs can occur without dogs present.

Note now that, in no act of pointing to an individual as described in the basic template above, kind-reference is ever taking place: Reference is to the individual, not the kind, though the referent is referred to as falling under the kind, and the kind serves to describe it (and sometimes defines criteria of its identity). A predicate, in turn, is by definition not the referential part of the template, so it also could not be what accounts for kind-reference. How, then, does kind-reference arise? Our basic suggestion is that if the referential part (index-finger/pointing or the determiner) is either missing in a linguistic representation or not cognitively represented, there is nothing for the predicate to be applied to. Logically, this truncation can have two consequences: Either there is reference failure altogether (no reference takes place), or else the lexical noun that is normally functioning predicatively itself functions referentially. The latter option leads to kind-reference: Kind-reference is what “saves” reference, when the representation of the referential template is incomplete and the only element present to allow reference is the general concept normally forming part of the predicate.

In line with this idea, index-finger pointing (the referential part) is less natural for adults when generic knowledge is conveyed, and may be in the way of forming such knowledge (Meyer & Baldwin, 2013); and in languages like English, determiners tend to be obligatorily
absent in generics (we return to elements of cross-linguistic variation in Section 7). Thus, in English, forms of object reference that are referentially specific (e.g., This/the horse, in relevant contexts) exhibit an obligatory functional element (i.e., deictic this or definite the). Where it is absent, only two forms of reference are possible: reference of the bare noun phrase (NP) to a “mass,” which lacks object individuation entirely (e.g., I bought horse, which can only mean I bought some horse-meat), or generic reference (e.g., Horses are tall). With a determiner added in the latter case, genericity disappears. In short, if the determiner is absent, genericity is either enforced (if grammatical number is specified and set to plural), or else even individual reference disappears (as in mass-reference). This pattern again suggests that genericity in language is structurally simpler or a more primitive form of reference, defined by the lack of the extra elements needed to encode specificity.

In sum, we suggest that kind-reference arises as a byproduct of a change in the configuration of a referential template involved in all object reference, specifically a simplification, where the referential element accounting for specificity is missing or not represented. This has the result that the category or general concept comes to function as the referential element instead, and thus can become the subject of a predication itself. The key to kind-reference is the absence of one part of the referential template that would be needed for inducing specificity. Without it, there can only be reference based on a general predicative concept, where this concept must function as referring to a kind given its lexical meaning, which is general and makes it unsuited to refer to an object. The next question is when such a representation is triggered.

5 | WHEN GENERICS ARE FORMED

To address this question, we go back to the 3–4-year-olds of the Butler and Markman (2012) experiment. Those were introduced to an object as “a blicket,” that is, in their mind, “blicket” will come to be interpreted as functioning like a common noun used predicatively. It is applied to a referent, but as a predicate it expresses a concept, which as such has general meaning (applying to any blicket and identifying a kind). Then there is a second predicate provided, corresponding to the blicket’s property of “being magnetic.” Since this property is perceptually salient through the demonstration, the predicate does not have to be verbally explicit.3

The child is thus offered an initial premise for their reasoning, which we could phrase as: (1) This is a blicket, and then a second premise, (2) It is magnetic. Then it views a set of new objects, which are also identified as blickets, that is, the same label is consistently used. They are thus explicitly identified as belonging to the same kind, and interpreted as such, consistent with a host of studies demonstrating the role and power of linguistic labeling (predicative nouns) on infant’s and preschooler’s object categories (Waxman & Markow, 1995; Graham, Kilbreath & Welder, 2004; Schulz et al., 2008; Dewar & Xu, 2009; Westermann & Mareschal, 2014; Havy & Waxman, 2016). The question now is why, at this point and based on (1) and (2), the child appears to have arrived at the generalization: (3) Blickets are magnetic and not (4): These blickets are magnetic, or (5) All blickets are magnetic. Both of the latter would be immediately refuted by the evidence of the nonmagnetic blickets, contradicting the continued search behavior that we in fact observe. The obvious answer is that (4) and (5) are both more

3In a similar way, a noun can be grammatically omitted when the restriction of the demonstrative “this” is perceptually salient, as in [This np, is blue, as opposed to This box is blue; or an adjective such as “big” can be, when a speaker says “This is ...” and produces a descriptive gesture for “big.”
complex than (3), since they have the noun functioning as a restrictor to a determiner (these) or quantifier (all). The child has no evidence for positing this additional complexity. Positing it to be present in the child’s mind would require special reasons, and in fact would constitute an explanatory puzzle, while its absence does not. Nothing restricted the demonstration to this blicket, let alone only this blicket. In the absence of such a restriction, the default should be that, if something is a blicket, that is, falls under the kind, the demonstrated property holds of it.⁴

This model of why a generic representation is formed in the context in question does not appeal to either communication or natural pedagogy as explanatory factors per se, except for the fact that communication, in humans, insofar as it is linguistic, will involve both reference and predication (nonlinguistic forms of communication and reference need not involve either, Tomasello & Call, 2019). If there is reference and predication, but there is no specificity marked or restriction introduced, generics must ensue. In the noncommunicative conditions of this experiment, there is no referential triangle involving reference, predication, and a general concept on which the predication is based—there is nothing to base a generalization on.

There is also no such thing as “an object standing for or becoming a symbol for its own kind” in this model, unlike in Csibra and Shamsudheen (2015). There is only a word used as a common noun, blicket, on which reference is based, and which provides the identifier of a kind, which can then function as the referential subject of a further predication (is magnetic). There also is no inductive learning problem, as in Butler and Markman (2012)—or none that goes beyond learning lexical concepts in the first place, and how they function as parts of the referential triangle. Finally, no special “bias” toward generalization in communicative contexts needs to be postulated or would be warranted: All that is needed is the basic referential triangle, which is constitutive of human-specific communication. Indeed, a bias toward generalization would not turn the trick, since generalization as such is not the point: (4) and (5) both exhibit forms of general meaning, yet they are not generics and of the wrong form to explain the data.⁵

Summarizing, we posed the following challenges for a comprehensive model: first, kind-reference requires an explanatory mechanism; second, something needs to be identified in the nature of communication causing a shift from individual to kind-reference, so as to understand when this mechanism is operative; and third, the mechanism needs to account for the specific meanings of generic sentences, that is, for what makes them nonequivalent to other sentences expressing generality, that is, explicitly quantificational ones. We have addressed these problems as follows. The mechanism in question is language, as a cognitive mechanism structuring thought and social and communicative interaction from the beginning of a human life. Its inherent elements are: the lexicalization, in humans, of general concepts as words, and their

⁴This mechanism could also help to explain why children are more likely to retain information about kinds (Cimpian & Erickson, 2012), which memorizing information about individuals incurs a processing cost (through the additional representation of specificity).

⁵Both teaching and communication plainly often are about individual objects (The stick is red, Some blickets are magnetic) and nothing in the notions of either communication or pedagogy per se explains why kind reference is taking place—especially when pointing to an individual is involved. It is true that there is nothing in the notion of language either that forces kind-reference to take place: Language can be specific. But the extra complexity required for this—beyond the reference and predication that language mediates necessarily—is what gives us the argument that, where the extra functional structure is missing, kind-reference must result. One could point out, with Ho, Cushman, Littman and Austerweil (2019), that the communicators in the Butler and Markman experiment were engaged in “intentionally communicative demonstrations” and that the children engaged in pragmatic interpretations of these demonstrations, formed the intended beliefs. But the question remains why it should be generic rather than individually specific ones, when it is both types of belief that intentionally communicative demonstrators could have wanted to convey, and it was an individual that was referenced.
uses as part of a referential template inherently integrating reference and predication in a single structural unit. The reason that the shift from individual to kind reference occurs in the context of communication is that communication, in humans, involves reference and predication, the latter itself based on a general concept encoded as a word and used predicatively. Where there is no reason for children to form a structurally more complex representation, generics are derived as the structurally less complex option preserving referentiality as such. Finally, the reason that the meaning of generics is not equivalent to quantificational sentences is that the structures involved in the former and the latter are systematically different, with a structural element encoding specificity or quantification missing in the former, so that the predicate in question cannot appear in the scope of such an element. We will next apply this model to evaluate apparent kind-reference in younger, preproductively verbal children and infants.

6 | KIND-REFERENCE IN YOUNGER CHILDREN

A remarkable example of apparent kind-based individuation of referents is substitution pretense play, for example, holding a banana and pretending it to be a telephone, where one specific object (a banana) is used to refer to a telephone, yet not a specific one, but any telephone, that is, an abstract kind. One way of putting this is that the kind to which a given object belongs (banana) is switched for another (telephone), keeping the object itself (the banana) constant. Such behavior shows a keen realization of a crucial aspect of reference in humans, which is inherent to the model above: in acts of declarative reference, objects are individuated by descriptions, which reflect concepts we have of these objects (how we think about them). But as the objects do not determine their descriptions or how they are being thought of, the predicates corresponding to the descriptions can be switched for others, if we think about them in different ways, leaving the referent (in this case the banana) constant. This feature is what substitution pretense exploits.

Creative and imaginative substitution pretense play in this sense, however, is seen in 3–4-year-olds (Bijvoet-van den Berg & Hoicka, 2019) but possibly not much earlier, entailing that language even in production is well underway by this point. Unlike what is claimed in Csibra and Shamsudheen (2015), moreover, such play does not appear to be a good example of kind-reference strictly speaking, beyond the fact that a child realizes that predicates identifying given objects can be replaced by others, leaving the object unchanged. These predicates are based on concepts with general meaning (e.g., banana), but this does not entail that kind-reference takes place in the specific sense in which it does in generics: Nothing is claimed or conveyed about kinds or their general properties (e.g., that bananas are telephones). A specific banana is used as a specific telephone in a specific play scene.

Another example of referencing involving a predication as based on a kind, but again not reference to a kind, comes from toddlers at 15 months of age, who are learning a new word (e.g., “whisk”) from a picture. These toddlers later successfully apply this word to real-world instances of the general concept it encodes, as opposed to other pictures of the object, including when such instances differ in perceptual features such as color from the object originally depicted in the picture (Geraghty, Waxman & Gelman, 2014; Preissler & Carey, 2004). That is, toddlers interpret words as having referential and predicative as opposed to associative meaning: A general and abstract concept is encoded by the word, which determines what it can be used to refer to, including when referents perceptually differ (Yin & Csibra, 2015). From our model, we expect such behavior precisely as long as such a concept functions as a predicate and
is not explicitly restricted to holding of the object in the picture. If so, it will naturally be applied to any object fitting the kind as a default. What is being referred to, though, in these instances, are still particular objects, again not an abstract kind. The abstract meaning of the general concepts involved is represented, and objects are referred to as falling under these concepts, but kind-reference as seen in generics is again a different phenomenon.

The same conclusion also appears to hold nine-month-old infants, who, in an experiment of Baldwin, Markman and Melartin (1993), generalized a nonobvious (i.e., nonvisible) property from an object to which they were introduced (e.g., a can making a wailing sound when tipped), to a perceptually similar such object. In the condition of interest, where the property in question was removed from the second object, infants' exploratory play behavior suggested that they expected this property to be present. It is tempting to interpret this result as suggestive of the generic generalization *Cans (of this type) wail*. However, infants showed this behavior only under conditions of high perceptual similarity of the pairs of objects, and one might question whether a general concept of the object was actually involved (if the reasoning might be based on perceptual similarities or association). There is evidence from 13-month-olds (Graham et al., 2004), and from 9-month-olds (Dewar & Xu, 2009), that when verbal labels are provided, infants expect even perceptually dissimilar items named in the same way to share the same property (i.e., function). This label-based generalization again illustrates the impact and power of predicatively used words on early categorization (see also Ferry, Hespos & Waxman, 2010): A category is generated through the act of naming, inviting the inference that if one member has some nonobvious essential property, other members of the same category should have it too. Since the category is provided by a verbal label, it is a more plausible example of reference based on an abstract kind. Perceptual (dis-)similarities are over-ruled when identity conditions are provided through such a label.

Another classical experiment with nine-month-olds found a memory bias for identity information after viewing communicative scenes, and a memory bias for location information after viewing noncommunicative scenes (Yoon, Johnson & Csibra, 2008). Specifically, the infants watched scenes where an actor either reached for or else pointed to an object, in the latter case engaging communicatively with the child, addressing it verbally. In this communicative condition, the infants tended to detect the change of an object's identity, but not its location, after it was hidden behind an occluder and then revealed again, while in the former, non-communicative context, infants were more likely to be surprised when the object disappeared or changed location, than when it had apparently changed its identity as defined by its kind. It thus appears that, in the communicative context, an individual object was encoded by its *kind identity*, not by its nature as an individual with its unique spatiotemporal properties (for related data regarding numerosity vs. kind-based individuation, see Chen, Volein, Gergely & Csibra, 2011). This would explain why a change of the object's location is not registered as likely by the infant, despite the fact that infants at this age do not have problems in tracking objects by their unique spatio-temporal properties per se (Carey & Xu, 2001; Haun, Call, Janzen & Levinson, 2006; Mareschal & Johnson, 2003). However, in this case, a recent replication attempt casts doubts on the existence of the memory bias in question (Silverstein, Gliga, Westermann & Parise, 2019). If future work would confirm its existence, this type of experiment could be interpreted to suggest that these infants appreciated that communicators referred to the object in question as falling under a description capturing their kind. This assumption would explain the surprise when the identity suddenly appeared flipped. The experiment would also support the idea that infants appreciate that human speech has referential content (Marno et al., 2015), and that pointing is related to the
provision of new predicative information (Kovács, Tauzin, Téglás, Gergely & Csibra, 2014). But it could again not be evoked to show that, beyond this, reference to kinds as involved in generics takes place in these infants. It is simply that any predication must involve a general concept, a way the object is thought of by the communicator. This general concept as such cannot exhibit specificity. If the communication is thus recalled as holding of objects of this kind in general, a change in its kind is predicted to be more surprising than a change in its location. When there is no communication, on the other hand, the referential triangle made up of a referent, a predicate, and a concept, is not involved. The experimental data then fall into place.

To summarize this section, there is strong evidence that toddlers and even infants represent objects that are referenced in communicative situations as falling under kinds, especially in the presence of words for them, but it is unclear to what extent generic knowledge is formed at these ages, in the more specific sense that (i) a kind (not an object falling under one) is itself being referred to, and (ii) a predicate is then attached to it, with (iii) a representation of generic knowledge irreducible to quantification resulting. There is early comprehension of reference for sure, and it is based on the referential triangle. As such it involves the generality that comes with predicatively used concepts; but this does not mean that it involves generic reference in an appropriate and narrow sense.

7 | UNIVERSAL GENERICS

In this final section, we discuss a prediction of our model, namely that generic forms of knowledge should be an apparent cognitive universal, available irrespective of the socio-economic and cultural context. This is because generics, we have argued, are based on fundamental configurational properties of language, and from a linguistic point of view, these are expected to be universal and not to covary with such contextual factors. In a similar way, it would be highly surprising if a given language could not make a distinction between definite and indefinite noun phrases, say (though, importantly, due to different morpho-lexical and morpho-syntactic resources, the grammatical configurations distinguishing such forms of reference can take systematically different forms). Nonetheless, the question of universality was raised by Mannheim et al. (2010), who, based on a different model of generics, contemplate the possible dependence of such knowledge on language-specific and cultural factors. This specifically motivated their study of Southern Peruvian Quechua. In this final section, we comment that, in fact, linguistic encoding of generics in English and Quechua follows the same essential pattern (i.e., generics are structurally simpler than object-specific forms of reference), in line with the expectation arising from the present linguistic model. Since we do not know of any language in which the

In contrast to this interpretation, Csibra and Shamsudheen (2015) suggest that in this experiment, too, infants recognize that the communications in question are not about the individual referenced: The communicator's actual referential intention is the kind it exemplifies. An object, in their terms, becomes a "symbol of its own kind." But what is being referenced by the communicators clearly is an individual, just as in the Butler and Markman (2012) experiment, though it is referenced under a description encoding a general concept, as is the case in (declarative) reference in general. The experiment therefore only suggests that infants, like adults (Marno, Davelaar & Csibra, 2014), are sensitive to the fact that, in reference, objects are referred to under descriptions identifying them as belonging to a general concept identifying their kind, and such general concepts cannot, as such, encode specificity.

See further Longobardi (2005), Hinzen and Sheehan (2015), and Göksel and Kerslake (2005), Chapter 22, for a case study of definiteness, specificity and generic reference in Turkish, which lacks determiners.
essential pattern reverses, we will conclude that it should be a default expectation that generics are as universal as other core forms of reference.

As Mannheim et al. (2010) state, Southern Peruvian Quechua, “unlike English, ... is a highly inflected language in which generics are marked by the absence rather than the presence of any linguistic markers” (p. 3). For example, in the generic (1a), the subject waka (cow), the object q’achu (forage), and the verbal predicate mihu (eat) are minimally or not inflected morphologically, in the nongeneric (specific) (1b), rich inflection is seen (for information structure, evidentiality, Aspect):

(1)a.
Waka q’achuta mihun.
Waka q’achu-ta mihu-n.
Bovine forage-acc. eat-3.
“Bovines eat forage.”

(1)b.
Wakaqa q’achutan mihu-shan watananpi.
Waka-qa q’achu-ta-n mihu-sha-n wata-na-n-pi.
Bovine-topic forage-acc-evid eat-durative-3 tie-material nom.-3poss-loc.
“The cow is eating forage at its hitching post.”

In other words, rather than marking genericity through explicit morphemes or functional items, this language marks them through the absence of morphemes encoding specificity. Hence the exact same patterns as in English are seen. Thus, in English, it is because determiners are missing as in (2a), that a specific interpretation is ruled out, and it is because they are present as in (2b), that a generic interpretation is ruled out:

(2a) Cows eat grass.
(2b) The cows eat grass.

A morphosyntactic difference between English and Quechua is that generic nouns in the latter carry no number marking, while English generic nouns without a determiner necessarily do so. However, as the necessary absence of quantificational determiners in generic sentences in English suggests, cows in (2a) does not actually mean the same as some cows or all cows. The grammatical specification of number, therefore, does not entail quantification over instances of a kind in English either, which would be structurally more complex.

Another morphosyntactic quirk of English and many other languages (see, for example, Longobardi, 1994 on Italian) is that where plurality is not expressed on a noun with a generic interpretation, as in (3), a determiner can be present in some cases, yet does not entail definiteness in the way that the definite article normally does:

(3) The African tiger has died out.

The determiner is a “dummy” determiner for this reason, which entails no quantificational readings (Longobardi, 1994) and thus does not change the basic pattern: Generics require the absence of functional items in grammatical positions where the NP is a complement and the common noun functions semantically as a quantificational restriction. As Mannheim
et al. (2010) themselves note, Quechua is further similar to English in the way that tense and aspect are used to enforce specific readings.

The conclusion from this test case is that we find what the present model makes us expect. The model specifies that generic knowledge arises as one of a canonical range of forms of reference that exploit configurational properties of structured linguistic representations. These are expected to be as universal as language itself. All languages have arguments and adjuncts, subjects, and predicates, and can express definite and indefinite forms of nominal reference in grammatically different but comparable ways, with the existence of none of these factors co-varying with socio-economic or cultural factors. It would thus be puzzling indeed if some language lacked the grammar to configure generic forms of reference, particularly where generic knowledge has the functional significance it does, in mediating learning and memory. It would be even more surprising on the specific linguistic model of Hinzen and Sheehan (2015), where the range of forms of reference available to humans, from generic and quantificational-indefinite to definite and deictic forms of reference, directly reflect the cognitive function of grammar and are a core defining aspect of universal grammar. More specifically, we also do not know of languages where the relation specified above between generic and specific forms of reference is reversed, with the former more complex grammatically than the latter.

8 | CONCLUSIONS, QUALIFICATIONS, AND REPERCUSSIONS

We have suggested that both early individuation of referents by a general concept or kind, and generics more specifically, reflect linguistic minds evolving. The linguistic ingredients involved are present very early in infants, from the general understanding of the referential triangle to the understanding of words as capturing categories and used predicatively in declarative reference. There is no basis in this model for distinguishing a “verbal” and “nonverbal” phase in cognitive development. Drawing such a line based on whether infants produce or do not produce words would be both arbitrary and contradict the pervasive role of language in infant social-cognitive development. There is also no basis in the model for generics being formed in some distinct mental space of thought separated from language-processing, while representations structurally similar to those seen in language are, at the same time, involved. Drawing such a line would arbitrarily confine the term “language” to its role in the externalization of thought, as opposed to extending it to the internal cognitive system in which the structures are generated that are necessarily involved in such externalizations. At the level of the brain, the distinction between a mental process of forming a representation of generic knowledge, and forming the abstract mental representation of a sentence, may be meaningless. Such representations are communication-induced insofar as communication in humans is linked to language and the specific type of referential contents it carries.

We have thus “inverted” the learning challenge that generics and kinds as such have long been thought to pose: The child is not struggling its way upwards from particulars and labels at the start to general categories and kinds at the end. Rather, kinds are involved in the form of predicative concepts in the earliest beginnings of referential communication, as are categories based on perception. With that in place, specificity is what requires special explanations. We have also argued that what yields both reference as based on predicatively identified kinds, and reference to kinds as specifically involved in generics, is the basic referential format of language. On the other hand, we stress that none of this entails that all of conceptual development is
linguistic. In particular, we have not discussed the capacity for forming object categories as such as based on perception, which may well not be language-dependent (Hespos & Spelke, 2004; Mendes, Rakoczy & Call, 2008); although, at the same time, evidence for the role of language in perceptual categorization and generalization is pervasive (Waxman & Markow, 1998; Graham et al., 2004; Schulz et al., 2008; Dewar & Xu, 2009; Westermann & Mareschal, 2014; Havy & Waxman, 2016; Novack & Waxman, 2019). Our target, instead, has been reference to objects and predication, within the specific triangular format in which these appear in humans. The issue of individual-specific or generic reference arises at this level, not at the level of object individuation as such (after all, even as adults, we might hold up a “blicket” or a banana to communicate about the specific referent or about its category, without any changes in our representation of the physical object as such).

While our conclusion serves to further clarify the role of language in cognitive development and its relation to communication and natural pedagogy (Mattos & Hinzen, 2015), its benefits are not merely theoretical. Several neurodevelopmental disorders including autism spectrum disorder (ASD) include basic problems with generalization and abstraction leading to overly concrete object processing styles and a related obsession with sameness as first described by Kanner (1943). Such problems are interwoven with anomalous patterns of language development and use, including anomalous word learning (Arunachalam & Luyster, 2016; Preissler, 2008; Tek, Jaffery, Fein & Naigles, 2008), and they may be inseparable from these at a neurocognitive level (Hinzen, Slusna, Schroeder, Sevilla & Vila, 2019). This pattern makes the testable prediction that generics, as a particular way of encoding generality and general world knowledge, would create particular problems for people with ASD. Understanding forms of atypical development depend on models that specify the role of language in them and make predictions for behavioral patterns that can inform clinical and therapeutic decisions.

DATA AVAILABILITY STATEMENT
There is no data available.

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REFERENCES


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