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Quantified statements are recalled as generics: Evidence from preschool children and adults

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ABSTRACT

Generics are sentences such as "ravens are black" and "tigers are striped", which express generalizations concerning kinds. Quantified statements such as "all tigers are striped" or "most ravens are black" also express generalizations, but unlike generics, they specify how many members of the kind have the property in question. Recently, some theorists have proposed that generics express cognitively fundamental/default generalizations, and that quantified statements in contrast express cognitively more sophisticated generalizations (Gelman, 2010; Leslie, 2008). If this hypothesis is correct, then quantified statements may be remembered as generics. This paper presents four studies with 136 preschool children and 118 adults, demonstrating that adults and preschoolers alike tend to recall quantified statements as generics, thus supporting the hypothesis that generics express cognitively default generalizations.

1. Introduction

Much of cognitive psychology has focused on how our core conceptual knowledge of the world is represented (e.g., Carey, 2009; Gelman, 2003; Holyoak & Morrison, 2005; Keil, 1989; Murphy, 2002; Rosch, 1973; Smith & Medin, 1981; and myriad others). A significant portion of this core conceptual knowledge consists of generalizations about *kinds* (e.g., Gelman, 2003; Margolis & Laurence, 1999; Prasada, 2000). For example, the beliefs that connect *tigers* with *stripes*, *dogs* with *tails*, and *doctors* with *healing people* all involve the generalization of properties to kinds. What is the nature of these kind-based generalizations? Are they at heart quantitative and statistical (e.g., Rosch, 1973), or some-

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thing more complex and richly structured (e.g., Carey, 2009; Gelman, 2003; Prasada & Dillingham, 2006, 2009)?

Researchers have studied these questions using an enormously wide variety of methods. One example includes the body of empirical work devoted to studying the nature of kind-based generalizations in memory (e.g., McCarthy, 1995; Meyer, 1970; Smith, Shoben, & Rips, 1974). In particular, researchers have for many years studied the nature of semantic memory (or 'gist memory') as a way of assessing which aspects of a target will be encoded, and which will be forgotten (e.g., Jacoby & Dallas, 1981; Kintsch, 1988; Tulving, 1972). Thus, classic and ongoing studies of semantic memory provide a window onto aspects of conceptual representation.

This paper presents a series of studies conducted on both children and adults, designed to assess their semantic memory for different types of kind-based generalizations. Kind-based generalizations may be either quantificational (e.g., "All tigers have stripes") or generic (e.g., "Tigers have stripes"). Which (if either) of these forms corresponds to our core conceptual beliefs about kinds? Answering this question has important consequences for the study of concepts and categorization. If our most basic way of generalizing information about kinds is quantificational, this means that it can be characterized in quantitative, statistical terms – that our semantic knowledge is organized in terms of logic sets and set-inclusion relations, as these are the hallmarks of quantificational generalizations (e.g., Barwise & Cooper, 1981). Generic generalizations, in contrast, cannot be characterized in these terms, but rather reflect richer and more complex relations between the kind and the property, which cannot be reduced to purely formal, quantitative terms (Carlson, 1977; Leslie, 2007). The precise nature of generic generalizations is not yet fully understood (but see Cimpian, Brandone, & Gelman, 2010; Cimpian, Gelman, & Brandone, 2010; Khemlani, Leslie, & Glucksberg, 2009, in press; Leslie, 2008; Prasada & Dillingham, 2006, 2009 for some important work).

The main focus of this work is the nature of the underlying conceptual knowledge that is *expressed by* the linguistic form, rather than the linguistic form itself. However, understanding how our conceptually fundamental generalizations are expressed in language is itself of interest for several reasons. For example, it provides insight into subtle linguistic differences with implications for implicit messages that are conveyed in ordinary conversation. Further, because language is a primary source of information to children regarding regularities in the world around them (Gelman, 2010), this investigation can shed light on how conceptually important information is communicated to young children by parental speech—and how they are interpreted by young children as they hear such speech.

Recent theoretical and empirical work has begun to address whether general conceptual knowledge is quantificational or generic. In particular, Leslie (2007, 2008) and Gelman (2010) argue that generics, not quantified statements, articulate conceptually central generalizations. They argue that generics express cognitively fundamental, default generalizations, and that quantified statements, in contrast, express more sophisticated, less accessible generalizations. We briefly review the data in favor of this claim, and then report a series of experiments designed to further test the predictions of this hypothesis.

Children begin to produce generics around age two-and-a-half, and by the time they reach 3–4 years, they produce generics as frequently as adults (Gelman, Goetz, Sarnecka, & Flukes, 2008). Recent evidence suggests that two-and-a-half-year-olds understand that generics express general claim about kinds, rather than specific claims about individuals (Gelman & Raman, 2003; Graham, Nayer, & Gelman, 2011). Thus, as soon as children master the requisite syntactic skills, they produce and understand generics (Gelman, 2010; Gelman et al., 2008).

When it comes to expressing generalizations about kinds, generics are used much more frequently than universal quantifiers (e.g., "all", "every", "any") in both children's speech and in child-directed speech (Gelman, 2003; Gelman, Hollander, Star, & Heyman, 2000). Universal quantifiers are used primarily in reference to specific sets of individuals (e.g., "pick up all those toys") rather than to kinds as a whole (e.g., "all tigers have stripes"). Hollander, Gelman, and Star (2002) found that both 3- and 4-year-olds could appropriately interpret the quantifiers "all" and "some" in reference to a specific set of items (e.g., "are all the crayons in the box?"); however, they also found that 3-year-olds had difficulty with "all" and "some" when the quantifiers were used to make kind-wide generalizations (e.g., "are all fires hot?"). Interestingly, while Hollander et al. found significant developmental differences in the case of category-wide uses of "all" and "some", they found no developmental differences in the