Cognitive Development 39 (2016) 21–35

Contents lists available at ScienceDirect

Cognitive Development

Parent–child conversations regarding the ontological status of a robotic dog

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ARTICLE INFO

Article history:
Received 17 August 2015
Received in revised form 17 February 2016
Accepted 2 March 2016

Keywords:
Robot
Parent–child
Ontology
Ontological
Animate
Inanimate
Concepts
Conceptual development

ABSTRACT

Prior research shows that children's reasoning about robots tests the boundaries of their ontological commitments. In this study, we investigated the potential role of parent–child conversation in guiding children's developing understandings about robots. Parents and children (3- and 5-year-olds) engaged in a play session in which they talked about a robotic dog, a live animal (a rodent), and a human-made artifact (a toy car). Afterwards, participants reasoned about whether each item had a set of animate (e.g., biological, psychological, sensory) and artifact (e.g., human-made, breakable) properties. Findings revealed that parents and children spontaneously talked about the robotic dog using both animate and artifact properties during the play session. Furthermore, parent talk in the play session had the most influence on children's reasoning when the properties under consideration were less well-established in children's thinking and/or not easily identified by visual cues (i.e., psychological and sensory).

1. Introduction

A classic issue regarding conceptual development is the nature and extent of young children's ontological distinctions, particularly when reasoning about animate versus inanimate items (for a review see Opfer & Gelman, 2011). Much of the available research investigates children's reasoning about the biological properties of clear exemplars of animate (i.e., animals) and inanimate kinds (i.e., immobile, human-made artifacts). Such work converges on the finding that preschool children largely respect category distinctions and demonstrate firm understandings of the differences between prototypical animate and inanimate kinds (e.g., Hatano & Inagaki, 1994; Jipson & Callanan, 2003).

The range of items available in the world, however, is varied and complex, with items that straddle the boundaries between animacy and inanimacy (i.e., items that may appear to share properties with both living and nonliving kinds). For example, plants are living kinds but do not have animate features, and dolls and stuffed animals share surface similarities with humans and animals, yet are not alive. When asked about a variety of biological properties (e.g., growth, death), 3–4 year old children reliably classify plants and animals under a common category of living things (Backscheider, Shatz, & Gelman, 1993; Carey, 1985; Hickling & Gelman, 1995; Inagaki & Hatano, 1996; Leddon, Waxman, & Medin, 2008, Springer & Keil, 1991), and exclude dolls, stuffed animals, and statues from this category (Dolgin & Behrend, 1984; Gelman, Spelke, & Meck, 1983; Massey & Gelman, 1988). Research examining children's reasoning about other types of properties (e.g., psychological,

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http://dx.doi.org/10.1016/j.cogdev.2016.03.001
0885-2014/

sensory) reveals more mixed results, with children sometimes attributing these properties only to animate kinds (e.g., Gelman et al., 1983), and sometimes attributing these capacities across domains (Jipson & Gelman, 2007). Intriguingly, both Coley (1995) and Jipson and Gelman (2007) demonstrated that young children's biological attributions do not always pair with their psychological attributions, suggesting that children possess multiple frameworks for reasoning about the items they encounter in the world.

In recent years, there has been a renewed research interest in children's thinking about animate and inanimate distinctions due to advances in technology that have introduced a wealth of new kinds of entities for children (and adults) to consider—entities that appear to straddle ontological boundaries. Encounters with robotic pets and humanoid robots, in particular, might present challenges and opportunities to contemporary children as they construct ontological understandings. These items are non-living yet look, move, and act in ways that suggest animacy. The ways that children reason about the relevant category membership of these items has consequences for the inferences that they make about them (Saylor, Somander, Levin, & Kawamura, 2010). Indeed, recent work demonstrates that children's reasoning about robots does *not* parallel their reasoning about inanimate artifacts, *nor* does it parallel their reasoning about living things (e.g., Bernstein & Crowley, 2008; Jipson & Gelman, 2007; Kahn et al., 2012; Saylor et al., 2010; Scaife & van Duuren, 1995). Rather, it appears as if children view robots as having both animate and artifact features—for example, by 3 years of age, children report that robots are not alive and do not have biological properties such as eating and sleeping, yet they attribute psychological characteristics to robots, such as feeling emotions or the capacity to think (Jipson & Gelman, 2007; but see Melson, Kahn, Beck, & Friedman, 2009).

Although research on children's thinking about robots is accumulating rapidly, less is known about the factors that support children's thinking about these entities. A number of featural (e.g., having a face) and dynamic cues (e.g., autonomous behavior) offer children information that guides their reasoning about the ontology and pursuant properties of robots (Jipson & Gelman, 2007; Saylor et al., 2010). However, in everyday experiences, young children are likely to encounter robots in a social setting, and social cues about category membership may serve as an important source of information for children's developing understanding of the category membership and properties of robots. For example, Meltzoff, Brooks, Shon, and Rao (2010) demonstrated that infants are sensitive to the referential nature of robot "gaze" only after witnessing a robot interacting with an adult in communicative manner. We reasoned that for young children, conversations with parents, specifically, may provide children with both explicit and implicit cues that guide them as they construct initial understandings of such novel and complex entities as robots. Our focus on parent–child conversation as a context for children's developing understanding of robots reflects a growing interest among developmental psychologists in the social context of children's conceptual development. As parents and children interact across multiple settings, they may enter into conversations that provide opportunities for children to construct and revise their understandings of the world. Work in this area reveals that parent talk contains information that can inform children's developing understanding of core areas of knowledge identified by adults, such as biology (e.g., Jipson & Callanan, 2003; Rigney & Callanan, 2011), psychology (e.g., Adrian, Clemente, Villanueva, & Rieffe, 2005; Cervantes & Callanan, 1998; Lagattuta & Wellman, 2002), physics (e.g., Crowley et al., 2001; Snow & Kurland, 1996; Szechter & Carey, 2009), and social kinds (e.g., Chalik & Rhodes, 2015; Gelman, Taylor, Nguyen, Leaper, & Bigler, 2004).

A critical kind of knowledge that may be conveyed in parent talk with children is how to organize entities into ontological domains. Several studies show that this may be accomplished through the domain-specific use of subtle cues, such as the verbs used to describe events occurring in different domains, the use of generics, and the use of pronouns (he/she, it). For instance, Jipson and Callanan (2003) found that parents largely explained the change in size of living and nonliving kinds in distinct ways, such as by concentrating their use of the term "grow" on biological events in which an object increased in size and using other descriptors for increases in size in other domains ("gets bigger"). As another example, Gelman et al. (2008) found that parent used generics more often to refer to animal kinds than artifact kinds, perhaps corresponding to the greater coherence and inductive potential of animal kinds (Brandone & Gelman, 2009, 2013). At the same time, however, parents are also flexible in their talk to children, for instance by describing nonbiological increases as growth (Jipson & Callanan, 2003), and by using gendered pronouns (he/she) for marine animals with faces and a neuter pronouns (it) for marine animals without faces (Rigney & Callanan, 2011). These studies demonstrate that the content of parent talk conveys information that may influence children's reasoning about animate and inanimate kinds, however there is little empirical evidence that demonstrates how children's reasoning relates to parent talk.

In the current study, we investigated two competing hypotheses concerning whether and how parents communicate information about ontological distinctions to children, particularly with regard to the category membership of robots. One possibility is that parents might clearly differentiate by domain by talking about robots in ways similar to their talk about other human-made artifacts, and dissimilar to their talk about living creatures. It is also possible, however, that parents might exhibit some degree of domain-blurring in their talk about robots, such as by sometimes talking about robots as if they are akin to living creatures, and sometimes treating them as artifacts. Because parent approach may have important consequences for children's developing understandings of robots, we also investigated how children's reasoning about robots relates to the information that parents provide. Specifically, we consider whether children's ideas about robots align with the information that parents provide, or whether parent talk is but one source of information used by children as they craft their own understandings of robots. Throughout, we investigate how child age contributes to parent talk and children's reasoning.