Infant Behavior & Development 37 (2014) 119–129

Contents lists available at ScienceDirect

Infant Behavior and Development

Infants' ability to associate motion paths with object kinds

Rachel K. Baker*, Tamara L. Pettigrew[1], Diane Poulin-Dubois

Concordia University, Montréal, Québec, Canada H4B 1R6

ARTICLE INFO

Article history:
Received 2 October 2012
Received in revised form
13 December 2013
Accepted 23 December 2013
Available online 31 January 2014

Keywords:
Infants
Motion
Animacy
Cognitive development
Categorization
Habituation

ABSTRACT

The goal of the present research was to examine whether infants associate different paths of motion with animate beings and inanimate objects. An infant-controlled habituation procedure was used to examine 10–20-month-old infants' ability to associate a non-linear motion path (jumping) with animals and a linear (rebounding) motion path with vehicles (Experiment 1) and furniture (Experiment 2). During the habituation phase, infants saw a dog jumping over a barrier and either a vehicle or a piece of furniture rebounding off the barrier. In the test phase, infants looked longer when another inanimate object jumped rather than rebounded, but showed no such differential looking in the case of another animate object. The ability to restrict the animate motion path of jumping to animate beings was present by 10 months of age. The present findings support the hypothesis that motion path is associated with the animate–inanimate distinction early in infancy.

1. Introduction

The capacity to recognize and categorize things in one's surroundings as animate beings (humans and other animals) or inanimate objects (artefacts such as vehicles and furniture) is a fundamental cognitive ability (R. Gelman & Spelke, 1981; Opfer & S. Gelman, 2011; Rakison & Poulin-Dubois, 2001; Shutts, Markson, & Spelke, 2009). Developmental research has established that the animate–inanimate distinction is conceptually important by the preschool years (for a review, see Opfer & S. Gelman, 2011). For example, preschoolers determine quite accurately whether animals and objects are alive, attribute biological processes to humans and not to objects (Opfer & S. Gelman, 2011), and use animacy cues to interpret words (Backscheider, Gelman, Martinez, & Kowieski, 1999). Due to the centrality of the animate–inanimate distinction to human cognition and the extent of preschoolers' understanding of this distinction, it is of empirical and theoretical interest to study its developmental origin in infancy.

A wealth of research conducted over the past 20 years provides evidence that even infants have some grasp of the animate-inanimate distinction (Rakison & Poulin-Dubois, 2001). In one of the first studies of animate and inanimate categories in infancy, Mandler and Bauer (1988) found evidence that 16- and 20-month-old infants could categorize dogs vs. cars (different superordinate-level categories: vehicle and animal), but not cars vs. trucks (same superordinate-level category). The authors took this to suggest that sensitivity to superordinate-level (animals vs. artefacts) categories develops before sensitivity to basic-level categories (types of artefacts or animals). Similar results were found by Mandler, Bauer, and McDonough (1991) with 18–30-month-old infants. In a recent sequential touching study that systematically examined categorization at four different levels of inclusiveness in 12–30-month-old infants, categorization at the most inclusive level (e.g., ducks, lions, pigs, and porpoises categorized as 'animals') was above chance by 18 months of age, but even the youngest infants categorized

* Corresponding author at: P.O. Box 20011, Sydney Shopping Centre Post Office, Sydney, Nova Scotia, Canada B1P 5K0. Tel.: +1 902 270 5439.
E-mail address: rk_baker@hotmail.com (R.K. Baker).
[1] Now at Pettigrew Psychological Services Inc.

0163-6383/$ – see front matter © 2014 Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.infbeh.2013.12.005

at the less inclusive levels if the categories showed a high perceptual contrast (e.g., helicopters and trucks categorized as 'vehicles'; Bornstein & Arterberry, 2010). Another set of studies provided further evidence for the primacy of superordinate-level categories with even younger infants using an object examination task (Mandler & McDonough, 1993, 1998a). Both 9- and 11-month-old infants were found to categorize superordinate-level categories of animals and vehicles, with 7-month-old infants demonstrating a slightly lower level of performance than the older infants.

Other authors have obtained converging evidence for the developmental primacy of the broad animate-inanimate distinction using longitudinal designs (Pauen, 2002b; Poulin-Dubois, Graham, & Sippola, 1995). More recently, Poulin-Dubois, Frenkiel-Fishman, Nayer, and Johnson (2006) used a generalized imitation procedure to examine whether infants would extend motion and sensory properties modelled on people to animal exemplars (i.e., within the animate category). Both 16- and 20-month-old infants were more likely to extend animate actions to the animal exemplars than to the vehicle exemplars, providing some evidence for the presence of a broad category of animate objects. Similarly, infants as young as 14 months group animals and people together when a sequential task is used (Rostad, Yott, & Poulin-Dubois, 2012). Researchers have also begun to investigate what type of representation is associated with each object kind in preverbal infants. Most developmental psychologists agree that the preverbal animate–inanimate distinction is grounded in perceptual experience with both static features (e.g., appearance of objects) and dynamic features (e.g., properties involving movement). One prominent view of the developmental origin of the animate–inanimate distinction is that infants categorize animate beings and inanimate objects by attending to motion cues. Mandler (1992a, 1992b, 2000, 2011) has proposed that infants develop concepts of animate beings and inanimate objects by using *perceptual analysis* (Mandler, 1988), a representational process via which perceived motion cues are recoded into simpler, abstract representations called *image schemas*. These image schemas are then combined to form concepts. For example, according to Mandler, an infant's concept of an animate being might combine image schemas of self-propelled motion, moving along an irregular path, and interacting contingently with other entities at a distance. Infants might use several motion cues to identify and classify animate beings: (a) self-propelled motion onset, (b) irregular motion path, (c) action produced at a distance, (d) highly contingent motion, and (e) role of agent in causal interactions. Conversely, infants might use different motion cues to identify and classify inanimate objects: (a) caused motion onset, (b) smooth motion path, (c) action produced only by contact, (d) non-contingent motion, and (e) role of recipient in causal interactions (Mandler, 1992b). Some research has investigated whether infants expect animals to move according to animate motion properties. For example, self-propelled motion has been found to be associated with human hands and animals by 7 months of age (Markson & Spelke, 2006; Pauen & Träuble, 2009; Poulin-Dubois, Lepage, & Ferland, 1996; Saxe, Tenenbaum, & Carey, 2005). Path, the trajectory a figure takes with respect to a reference or ground object, has been proposed as one of the first motion property that infants represent (R. Gelman, 1990; Mandler, 1992b) and has also been the focus of some research. Infants as young as 7 months discriminate between silent, simple animated events in which the path of the event changes and can abstract the invariant path even when other features of the display are changing (such as manner of motion) by 10 months (Pruden, Roseberry, Göksum, Hirsh-Pasek, & Golinkoff, 2013; Pulverman, Song, Hirsh-Pasek, Pruden, & Golinkoff, 2013). By 14 months, infants tend to choose an item from the same category as the model to imitate a dog jumping over an obstacle and a car sliding down a ramp (Poulin-Dubois, Rakison, & Vyncke, 1999; Poulin-Dubois et al., 2006; Rakison, 2003). However, this technique may be inappropriate to test conceptual knowledge about animate motion because the experimenter causes all of the objects to move, violating one critical property of animate motion (Mandler, 2003). Furthermore, some authors have argued that generalized imitation of motion events could be explained by matching based on perceptual similarity (Rakison, 2003 but see Mandler & McDonough, 1996, 1998b; Poulin-Dubois et al., 2006 for conflicting results). The generalized imitation technique also poses a challenge for testing infants younger than 12 months (Mandler & McDonough, 1998b). Therefore, whether motion path and animacy are linked in infancy should be tested using paradigms with minimal task demands, such as violation of expectancy. In addition, whether infants younger than 14 months associate motion path and object kind should be tested. These issues were addressed in the present experiments.

The goal of the present experiments was to examine whether infants are able to associate one motion cue, motion paths, with the categories of animals, vehicles, and furniture. We tested infants' ability to associate a non-linear or irregular motion path with animals and a linear or smooth motion path with vehicles and furniture. The irregular path was jumping over an obstacle; the smooth path was hitting an obstacle and rebounding. We used motion paths because even young infants are able to discriminate between motion paths. For example, using a familiarization procedure, Sharon and Wynn (1998) found that 6-month-olds are able to discriminate between jumping and falling.

We used animals (mammals) as exemplars of animate beings and both furniture and vehicles as exemplars of inanimate objects for several reasons. First, researchers have frequently used animal–vehicle and animal–furniture contrasts when testing infants' ability to categorize at a global level. Researchers have found that infants categorize animals and vehicles during the first year of life, by 9 or 10 months when tested using an object examination procedure (Mandler & McDonough, 1993; Oakes, Coppage, & Dingel, 1997) and by 3 months when tested using a visual habituation procedure (Arterberry & Bornstein, 2001, 2002). Similarly, infants categorize animals and furniture during the first year of life, by 7 or 8 months when tested using an object examination procedure (Mandler & McDonough, 1998a; Pauen, 2002a, 2002b) and by 2–3 months when tested using a visual familiarization/habituation procedure (Behl-Chadha, 1996; Quinn & Johnson, 2000). Another consideration was that, in contrast to the research on infant categorization, typically only humans have been used as exemplars of animate beings in studies examining infants' knowledge of the motion of animates and inanimates. Thus,