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Infant perception of sex differences in biological motion displays

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ABSTRACT

We examined mechanisms underlying infants' ability to categorize human biological motion stimuli from sex-typed walk motions, focusing on how visual attention to dynamic information in point-light displays (PLDs) contributes to infants' social category formation. We tested for categorization of PLDs produced by women and men by habituating infants to a series of female or male walk motions and then recording posthabituation preferences for new PLDs from the familiar or novel category (Experiment 1). We also tested for intrinsic preferences for female or male walk motions (Experiment 2). We found that infant boys were better able to categorize PLDs than were girls and that male PLDs were preferred overall. Neither of these effects was found to change with development across the observed age range (~4–18 months). We conclude that infants' categorization of walk motions in PLDs is constrained by intrinsic preferences for higher motion speeds and higher spans of motion and, relatedly, by differences in walk motions produced by men and women.

Introduction

One important attentional mechanism available to infants is the tendency to orient toward motion patterns that are specific to animate entities (Frankenhuis, Barrett, & Johnson, 2013; Frankenhuis,

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House, Barrett, & Johnson, 2013). Perception of *biological motion* was initially demonstrated in classic experiments by Johansson (1973, 1976), who showed that adults quickly and spontaneously recognize human figures in point-light displays (PLDs) consisting of a small number of illuminated moving dots that were affixed to the joints of a human actor. Adult observers readily recognize actions (Dittrich, 1993; Norman, Payton, Long, & Hawkes, 2004), emotions (Johnson, McKay, & Pollick, 2011), intentions (Blakemore & Decety, 2001), gender (Kozlowski & Cutting, 1977; Mather & Murdoch, 1994; Troje, 2002), and identity (Cutting & Kozlowski, 1977; Fani, Prasad, Harber, & Shiffrar, 2005; Troje, Westhoff, & Lavrov, 2005) solely from PLDs. Perception of biological motion offers vital insights into the nature of the social brain (Adolphs, 1999; Anderson et al., 2013; Lieberman, 2013), social behavior (Grossman, Blake, & Kim, 2004; Shi, Weng, He, & Jiang, 2010), and social cognition (Blake & Shiffrar, 2007; Klin, Lin, Gorrindo, Ramsay, & Jones, 2009). As such, insights into mechanisms of attention for PLDs and their development during infancy might aid in understanding social development more broadly, perhaps including the perceptual origins of social categorization—the question we address in the current article.

Visual mechanisms that support the perception of biological motion seem to be in place early in development (Bertenthal, 1993). For example, newborns look longer at upright human PLDs relative to foil stimuli consisting of the same number of dots moving randomly (Bidet-Ildei, Kitromilides, Orliaguet, Pavlova, & Gentaz, 2014). By 3 months infants differentiate walking motions from running motions in PLDs (Booth, Pinto, & Bertenthal, 2002), and by 5 or 6 months infants distinguish a point-light (PL) hand from a foil stimulus (Fox & McDaniel, 1982), recognize walk direction in sagittal PLDs (Kuhlmeier, Troje, & Lee, 2010), and discriminate canonical PLDs from those in which rigidity of the limbs (Bertenthal, Proffitt, & Kramer, 1987) or bilateral symmetry of gait (Booth et al., 2002) is disrupted. By 7–9 months, even more complex human actions may be perceived veridically, including PL versions of infants' own leg motions (Schmuckler & Fairhall, 2001), emotional expression in PL faces (Soken & Pick, 1992), and timing of self-occlusion of limbs in PL walkers (Bertenthal, Proffitt, Spetner, & Thomas, 1985). It is unknown, however, whether infants perceive PLDs as providing information relevant to social categories such as sex.

In the current article, we report two experiments that examined infants' categorization and discrimination of PLDs produced by men and women. Categorization is critical for the systematization and stability of cognition, serving to organize low-level structure and prepare cognitive resources for identification of more abstract relations (Bruner, 1957). Social categorization, in particular, is regarded as an obligatory aspect of social life (Allport, 1954). Informed by visible cues in the face and body of others, social categorization allows observers to readily and rapidly parse the social world in terms of sex, race, age, and even sexual orientation. Once categorized, social categorizations and the percepts that inform them elicit knowledge structures (i.e., stereotypes) that impinge on adults' judgments of fairness, discrimination, and distribution of reward (Billig & Tajfel, 1973; Freeman & Johnson, 2016).

It is not known whether infants can detect sex differences in PLDs, but adults use information in biological motion to discriminate between and categorize men's and women's walk motions (Lick, Johnson, & Gill, 2013; Pollick, Kay, Heim, & Stringer, 2005; Troje, 2002), and infants use information in bodies and faces to distinguish social categories. For example, there is an advantage in processing characteristics of female faces (vs. male faces) by 3 or 4 months (Quinn, Yahr, Kuhn, Slater, & Pascalis, 2002; Ramsey, Langlois, & Marti, 2005), a preference for own-race faces by 3 months (Kelly et al., 2005), a decline in the ability to discriminate faces from other races by 9 months (Kelly et al., 2007), a progressive narrowing of intersensory matching of face and voice by 10 months (Lewkowicz & Ghazanfar, 2006), and a preference for minority race faces by 11 months (Liu et al., 2015; Singarajah et al., 2017). Moreover, infants prefer sex-congruent (face and body of the same sex) images over sex-incongruent images by 5 months and, thus, discriminate and match sex differences in bodies and faces (Hock, Kangas, Zieber, & Bhatt, 2015); by 6.5 months, infants discriminate and match emotions in body movements and voices (Zieber, Kangas, Hock, & Bhatt, 2014a, 2014b). Such effects are presumed to stem in part from infants' typical day-to-day exposure to bodies and faces (Bhatt, Hock, White, Jubran, & Galati, 2016; Scott, Pascalis, & Nelson, 2007).

If similar developmental processes were operational for perception of biological motion, they would require a growing sensitivity to structural information in PLDs because a substantial proportion