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Brief Report

Cues that trigger social transmission of disinhibition in young children

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ABSTRACT

Previous studies have shown that observing a human model's actions, but not a robot's actions, could induce young children's perseverative behaviors and suggested that children's sociocognitive abilities can lead to perseverative errors ("social transmission of disinhibition"). This study investigated how the social transmission of disinhibition would occur. Specifically, the authors examined whether a robot with human appearance (an android) triggered young children's perseveration and compared the effects of the android with those of a human model. The results revealed that the android induced the social transmission of disinhibition. Also, children were more likely to be affected by the human model than by the android. The results suggested that behavioral cues (biological movement) may be important for the social transmission of disinhibition.

Introduction

During the past decade, there has been growing interest in the development of executive function. A search of the PsycINFO database using the keywords "executive function" under 12 years of age yielded 48 records for the period from 1985 to 1995 and 458 records for the period between 1996 and 2005. This expansion includes advances in brain research (e.g., Durston et al., 2002), research

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on the developmental relationship between executive function and other cognitive abilities (e.g., Carlson & Moses, 2001), and research on developmental disorders (e.g., Barkley, 1997).

Executive function refers to the ability to plan, execute, and monitor appropriate and relevant actions and to inhibit irrelevant and inappropriate actions for the attainment of a specific goal. This ability develops rapidly during the preschool years, with adult-level performance being achieved during adolescence, which is subserved by the maturation of the prefrontal cortex (Davidson, Amsoa, Anderson, & Diamond, 2006; Moriguchi & Hiraki, 2009; Zelazo & Müller, 2002).

Recent studies have shown that developing cognitive control may involve more social processes than were considered previously. For example, Moriguchi, Lee, and Itakura (2007) showed that young children's cognitive control may be affected by observing another person's actions. They used a social modification of the Dimensional Change Card Sort (DCCS) task, which is used for assessing children's executive function (Zelazo, Frye, & Rapus, 1996). In the standard DCCS task, children are asked to sort cards that have two dimensions such as color and shape (e.g., yellow flowers, green houses) into trays with target cards (e.g., a yellow house, a green flower). First, children are asked to sort cards according to one dimension (e.g., color) for six trials. Next, children are asked to sort the cards according to the other dimension (e.g., shape) for six trials. Typically, most 3-year-olds fail to switch the dimension, whereas 4- and 5-year-olds make the dimension switch. In the modified social DCCS task, instead of sorting the cards by themselves, preschoolers watched an adult model sorting the cards according to one dimension (e.g., shape), after which they were asked to sort according to a different dimension (e.g., color). The results showed that most 3-year-olds failed to sort the cards according to the different dimension and perseverated sorting according to the observed dimension, as in the standard DCCS task (see also Moriguchi & Itakura, 2008).

Interestingly, children's cognitive control process could be affected by a human's actions but not by a robot's actions. Moriguchi, Kanda, Ishiguro, and Itakura (2010) showed that children who observed a robot sorting according to one dimension had no difficulty in sorting the cards according to a different dimension. The authors explained the results in terms of a sociocognitive perspective that children perseverate on the human model's rule because they mentally simulate the model's actions while watching. In fact, children used the first observed rule even when asked to choose the second rule. On the other hand, the children's actions were not affected by the robot's actions because the robot did not induce young children's simulative process. Moriguchi and colleagues concluded that children's sociocognitive abilities can lead to perseverative errors in the social DCCS task, and they labeled the perseverative tendencies as the "social transmission of disinhibition."

The social understanding literature suggests that observing human actions, but not mechanical actions, may elicit young children's and adults' imitative behaviors (Itakura et al., 2008; Kilner, Paulignan, & Blakemore, 2003; Meltzoff, 1995). This is consistent with Moriguchi and colleagues' (2010) explanation. However, it is still unclear why a human's actions, but not a robot's actions, may induce the social transmission of disinhibition. The cues that may trigger the social transmission of disinhibition are not known.

Recent research regarding infants' perception of others' goal-directed actions is relevant to understanding the influence of human or robot action. In this field, some researchers have suggested that behavioral cues may be important for infants' perception of goal-directedness, and others have suggested that featural cues may be relatively important (Biro & Leslie, 2007). The former emphasizes that infants are sensitive to behavioral cues such as self-propelledness and contingent responses (Gergely & Csibra, 2003; Johnson, Slaughter, & Carey, 1998; Luo & Baillargeon, 2005; Premack, 1990; Shimizu & Johnson, 2004). On the other hand, the latter emphasizes that the appearance of the agents may have a significant role in infants' perception of goal-directed actions (Meltzoff, 1995; Woodward, 1998). Research evidence is currently inconclusive, providing some support for each theory (Biro & Leslie, 2007; Gergely, Nádasdy, Csibra, & Biro, 1995; Woodward, 1998).

Both appearance and behavioral cues may be important for infants' social perception. The current study examined which cues may trigger young children's social transmission of disinhibition. We tested hypotheses that behavioral cues (biological movement) may affect young children's social transmission of disinhibition. We devised a new android condition and compared it with a human condition in the social DCCS task. The android had a human appearance (Fig. 1); however, its movement was mechanical, similar to the robot used in the previous study (Moriguchi et al., 2010). Thus,