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Fourteen-month-old infants copy an action style accompanied by social-emotional cues

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ABSTRACT

Human adults exaggerate their actions and facial expressions when interacting with infants. These infant-directed modifications highlight certain aspects of action sequences and attract infants' attention. This study investigated whether social-emotional aspects of infant-directed modifications, such as smiling, eye contact, and onomatopoeic vocalization, influence infants' copying of another's action, especially action style, during the process of achieving an outcome. In Study 1, 14-month-old infants ($n = 22$) saw an experimenter demonstrate goal-directed actions in an exaggerated manner. Either the style or the end state of the actions was accompanied by social-emotional cues from the experimenter. Infants copied the style of the action more often when social-emotional cues accompanied the style than when they accompanied the end state. In Study 2, a different group of 14-month-old infants ($n = 22$) watched the same exaggerated actions as in Study 1, except that either the style or the end state was accompanied by a physical sound instead of social-emotional cues. The infants copied the end state consistently more often than the style. Taken together, these two studies showed that accompanying social-emotional cues provided by a demonstrator, but not accompanying physical sound, increased infants' copying of action style. These findings suggest that social-emotional cues facilitate efficient social learning through the adult–infant interaction.

1. Introduction

Learning new skills from other people—social learning—is more efficient than trial-and-error methods. In particular, copying the actions of others is one of the representative examples of social learning observed from human infancy, and this form of learning also plays a role in building social relationships with others (Chartrand & Bargh, 1999; Uzgiris, 1981). In such cases, it is important to attend to certain aspects of the action and copy them selectively. Previous studies have shown that infants selectively copy others' actions based on various contexts. Fourteen-month-olds copied using one's head to turn on a light when a model's hands were free but not when the model's hands were occupied (Gergely, Bekkering, & Király, 2002). The authors argued that infants perceived the other's action as rational and copied it selectively on the basis of the other's external constraints (see also Buttelmann, Carpenter, Call, & Tomasello, 2008). Recently, alternative accounts have been proposed for the underlying mechanism of infants' selective imitation, e.g., the motor resonance and the effects of an action (Paulus, Hunnius, Vissers, & Bekkering, 2011) and the saliency of perceptual distraction (Beisert et al., 2012). Furthermore, 12- and 18-month-olds, after observing an adult putting a toy in a house using certain styles such as hopping

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or sliding, ignored the styles and copied only the end state (i.e., putting the toy in the house) when the house was present, but not when the house was absent (Carpenter, Call, & Tomasello, 2005). These findings indicate that the perceptual cue (e.g., house) modulates the likelihood of infants copying the action style. Although the rational stance or perceptual cues are critical to infants' selective imitation, communicative cues from an actor are considered important for copying the actor's action.

Selective imitation by infants is influenced by communicative cues. Eighteen-month-olds copied an adult's action styles when the adult provided infants with information about the end state before the action demonstration, but they did not do so when the adult had provided no precedent information (Southgate, Chevallier, & Csibra, 2009). The authors argued that 18-month-olds did so because they interpreted the adult's style demonstration as relevant new information and assumed that the infants' expectation that the demonstrator would communicate new information to be learned is advantageous in human cultural practices where the causal link between an action and a goal is often ambiguous (Csibra & Gergely, 2009). This process might often happen in human adult–infant interaction.

Human adults typically exhibit their actions in an exaggerated mode for infants. This infant-directed modification has been observed in various forms, such as vocalization (Fernald & Mazzie, 1991), action (e.g., larger range of motion: Brand, Baldwin, & Ashburn, 2002; Brand, Shallcross, Sabatos, & Massie, 2007; longer pause: Rohlfing, Fritsch, Wrede, & Jungmann, 2006), and facial expressions (Brand et al., 2002; Chong, Werker, Russell, & Carroll, 2003). The infant-directed action is assumed to facilitate infants' action learning by highlighting a relevant aspect of the action and attracting their attention to it. Previous studies have shown that human infants look longer at infant-directed action than at adult-directed action (Brand & Shallcross, 2008). However, little is known whether and how the infant-directed actions influence infants' action learning. Only one study has investigated the effect of infant-directed action on infants' behavior (Koterba & Iverson, 2009). The study showed that the frequency of repetition of parents' demonstrations was related to certain aspects of infants' object exploration, such as shaking (in high repetition) or rotating (in low repetition), but that amplifying motion did not influence infants' behavior, whereas both repetition and amplifying motion attracted infants' attention. The findings of Koterba and Iverson (2009) imply that the visual exaggeration of action alone is not enough to elicit infants' copying behavior even if it attracts their attention.

We assume that the issue to be addressed is the effect of the social-emotional aspect of infant-directed modification on infants' copying behavior. Previous studies have suggested that adults demonstrating actions for infants produced an enhanced level of social-emotional cues, such as exaggerated smiles and frequent eye contact (e.g., Brand et al., 2002). Some previous studies have shown that infants reproduce an adult's object manipulation when it is socially marked (Brugger, Lariviere, Mumme, & Bushnell, 2007; Nielsen, 2006). However, these studies investigated *whether or not* infants manipulated an object but did not focus on *how* they behaved to an object (i.e., the action style). Therefore, we investigated whether infants appreciate an actor's social-emotional cues synchronized with an action style and copy it based on the cues.

We focused on whether the presence or absence of social-emotional cues of infant-directed modifications would modulate infants' copying action. We tested whether infants matched an adult's action with regard to two aspects: the end state of an action, and the style followed by the end state, using a modified version of Carpenter et al.'s (2005) methodology. Accordingly, we defined the end state as the final location of a toy, and the style as the trajectory of hand movement holding a toy. In Study 1, an experimenter demonstrated an action exaggeratedly (amplifying motion and the long pause) in which social-emotional cues such as smiling, eye contact, and onomatopoeic vocalization accompanied either the style or the final location. We hypothesized that (a) in general, infants would match the location more often than the style, and (b) if social-emotional cues influence infants' copying behavior, they would match the style more frequently when social-emotional cues accompanied it than when such cues did not. We focused on infants aged 14 months because at this age they begin to understand the causal relation between an action and its outcome (Brugger et al., 2007; Want & Harris, 2002).

2. Study 1

2.1. Method

2.1.1. Participants

Twenty-two 14-month-old infants participated in this experiment (8 girls; *M* age = 14.3 months, range = 13.9–14.6 months, *SD* = 0.21). Four additional infants were tested but excluded from later analysis because of experimenter error ($n = 1$) or lack of sufficient number of trials in which infants performed task-related behaviors ($n = 3$, one of the three infants did not respond in all of the eight trials and the other two did not respond in three of the four trials of the style-highlighted condition). We describe the definition of the task-related behaviors and a criterion for the sufficient number of trials to be analyzed in the Coding section (2.1.4).

The infants were recruited by telephone calls to families using Kyoto University's computerized subject list. The protocol of this study was approved by the Ethics Committee of Kyoto University, and the study was conducted in accordance with standards specified in the 1964 Declaration of Helsinki. Before the experiment, each parent provided written informed consent.