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The role of action effects in 12-month-olds' action control: A comparison of televised model and live model

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Abstract

The present study investigated differences in infant imitation after watching a televised model and a live model and addressed the issue of whether action effects influence infants' action control in both cases. In a 2 × 2 design, 12-month-old infants observed a live or a televised model performing a three-step action sequence, in which either the 2nd or the 3rd action step was combined with an acoustical action effect. We assumed that infants would use the observed action-effect relations for their own action control in the test phase afterwards. Even though results exhibited differences in the absolute amount of imitation between the two demonstration groups, both groups showed similar result patterns regarding the action effect manipulation: infants imitated the action step that was followed by a salient action effect more often and mostly as the first target action, emphasizing the important role of action effects in infants' action control.

Keywords: Infants; Action understanding; Action control; Imitation; Televised model; Live model

1. Introduction

An important step in infant development is the understanding of goal-directed action. Unless infants perceive and interpret actions as goal-directed, that is as directed towards an observable end-state, people around them seem to move meaninglessly in the world. But what might help infants to detect goal-directedness in other persons' actions? In this regard, the Common Coding approach (Prinz, 1990, 1997) complemented by the Theory of Event Coding (Hommel, Müsseler, Aschersleben, & Prinz, 2001), emphasizes the crucial role of action effects for both action perception and action control. The basic assumption underlying the Common Coding approach is that action and perception share a common representational resource. At a central level both afferent sensory and efferent motor codes feed into a commensurate representational domain. Thus, no translation is necessary. A second basic assumption is the action-effect principle (Prinz, 1997). According to this principle, actions are represented and controlled in the form of an action's anticipated distal effect on the environment. Thus, actions are controlled by anticipating the desired action effect provided that action-effect relations are known. The relevance of action effects has both been shown for action acquisition and action control in adults (for an overview see Hommel et al., 2001) and, recently, for action

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understanding in infants: Jovanovic and colleagues (Jovanovic et al., submitted for publication) modified a habituation study by Woodward (1999) by adding a salient action effect to an unfamiliar back-of-hand movement. This modification led 6-month-old infants to interpret the back-of-hand movement as goal-directed, which was not the case in the original study (Woodward, 1999). Similarly, 12-month-olds interpreted the grasping of a mechanical claw as goal-directed, when the action was followed by an action effect (Hofer, Hauf, & Aschersleben, 2005). Both studies demonstrate that infants use object-directed action effects to specify action goals (for similar findings see Hofer, Hauf, & Aschersleben, submitted for publication; Hofer, Hohenberger, Hauf, & Aschersleben, submitted for publication; Király, Jovanovic, Prinz, Aschersleben, & Gergely, 2003). Furthermore, a study by Baldwin and colleagues (Baldwin, Baird, Saylor, & Clark, 2001) indicated that 10- to 11-month-old infants parse continuous sequences of everyday intentional actions at junctures coinciding with boundaries between intentions. This suggests that infants are sensitive to the occurrence of action effects that mark the completion of intentions. Action effects may help infants to parse the otherwise complex flow of motion into separate actions. Overall, we have some evidence supporting the notion that action effects are important for action understanding.

However, these findings leave the question open whether action effects are also important for infants' action control. Hauf, Elsner, and Aschersleben (2004) aimed at showing that infants control their actions by anticipating desired action effects once they know about specific action-effect relations. In Hauf et al.'s study, the authors manipulated whether an action step was followed by an acoustical action effect during the demonstration of a three-step action sequence (either the 2nd or the 3rd action step was followed by the action effect). If the salient action effect helped infants to infer a goal in the models actions, infants in the different conditions should infer different goals from the demonstrated actions and adapt their own action control in the test phase accordingly. Indeed, the results revealed that both 12- and 18-month-old infants produced those action steps that were combined with an acoustical effect more often, with lower latency and in most cases as the first target action. Significant differences in these variables were each found in comparison to the other experimental condition as well as to a control condition, in which no action step produced an acoustical effect at any time. This heightened level of executed target actions shows that the acoustical effect highlights the action it is associated with, as opposed to simply inhibiting the likelihood that the other action will be produced. Overall, the results support the notion that infants in their second year of life control their actions by anticipating desired action effects when they are informed about specific action-effect relations. Moreover, the influence of perceived goals on infant action production was confirmed, which is in accordance to other studies (Carpenter, Call, & Tomasello, 2005; Meltzoff, 1995), who have shown that 12- to 18-month-old infants imitate preferentially those actions that they interpreted as the adults' goal.

As the Hauf et al. study is the first and to our knowledge the only study demonstrating an influence of action effects on infant action control, the present study aimed at replicating and extending this work. Therefore, we asked the question of whether infants are able to learn specific action-effect relations from TV as they seem to do from live presentations and if they transfer this knowledge into their own action control.

In order to learn from a video-based presentation, infants must be able to perceive and interpret what they see on the screen. Furthermore, they have to form memory representations of their experience and retrieve the information when imitating the modeled actions (Barr & Hayne, 1999; DeLoache & Korac, 2003; McCall, Parke, & Kavanaugh, 1977; Meltzoff, 1988). Past findings indicate that infants perceive and interpret video images. Using imitation tasks, it has been well established that older infants learn from video presentations meaning that they form memory representations and retrieve them later on. In these studies, infants observe a televised model (TV model) performing specific actions on objects and either immediately or some time later, they are presented with the same objects and have the opportunity to perform the actions themselves. If infants imitate the actions this is interpreted as an indicator for the infants having learned and remembered the observed actions. Meltzoff (1988) explored infants' ability to imitate a one-step action upon an object demonstrated by a TV model at 14 and 24 months of age either with no delay or a 24-h delay. He found significant imitation at both ages even after the delay indicating that simple actions shown on TV can be learned and retained by infants in the second year of life (see also Barr & Hayne, 1999; McCall et al., 1977). Mumme and Fernald (2003) showed that 12-month-old infants can even use social information presented on television (positive, neutral or negative affect directed toward one of two objects) to guide their own behavior.

Whereas these studies demonstrate that 12- to 36-month old infants use information picked up from television immediately or after a 24-h delay, some studies also show that imitation after watching a TV model lags behind and is inferior to imitation of a live model. Infants' imitation of actions from television emerges during the second year of life (Barr & Hayne, 1999), which is substantially later in development than imitation of similar actions modeled live