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The role of objects and effects in action imitation: Comparing the imitation of object-related actions vs. gestures in 18-month-old infants

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ABSTRACT

This study aimed to systematically investigate 18-month-old infants' imitation of object-related actions compared to motorically similar gestures. An additional goal of the study was to examine the role of action effects on infants' imitation of target actions. One group of infants ($n = 17$) observed object-related actions and gestures leading to salient effects (sounds or visual resp. social effects), and the other group ($n = 16$) watched the same actions without effects. Furthermore, this study examined whether infants show a consistent imitation ability for object-related actions and gestures. First, the present study showed that 18-month-old infants imitated object-related actions more frequently than gestures. Second, the presence of an effect significantly increased the imitation rate of object-related actions; however, this difference was not found for gestures. Third, indications for a general imitation ability were found as results on an individual level showed that object-related action imitation significantly correlated with gesture imitation. Implications of the results for theory and future studies are discussed with a focus on the role of objects and effects in 18-month-old infants' action imitation.

1. Introduction

Imitation, which can be defined as performing an action after perceiving it (Bekkering, Wohlschläger, & Gattis, 2000), is an important learning mechanism during infancy and childhood. Through the observation and repetition of others' actions, infants are able to learn one to two new behaviors each day (Barr & Hayne, 2003). This observational learning enables infants to acquire many new skills in a reduced amount of time due to the skip of trial-and-error learning (Bekkering et al., 2000).

In a typical imitation task, a model performs novel actions on one or a series of objects in front of the infant. Therefore, this can be defined as a form of teaching situation, where the model shows an infant what an object is for or what can be done with it. However, acquiring new object-related skills is not the only reason that infants copy others. Since an imitation situation is also an interactive setting, social learning takes place within the interactive exchange between the model and the infant (Matheson, Moore, & Akhtar, 2013).

Hence, imitation has two widely acknowledged functions: a cognitive function to learn something about the object or action and a social function to interact and affiliate with the model (Uzgiris, 1981).

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The function of imitation for the child at the moment of the demonstration is important in determining which aspect of a demonstration the child is likely to copy (Carpenter, 2006; Over & Carpenter, 2012). Although the cognitive function and the social function co-occur, the cognitive function might become more apparent when infants are presented with novel object-related actions. In this form of imitation, infants focus much of their attention on the functions of the objects in order to learn a new skill and are accordingly mainly interested to attain a particular result (see also Zmyj, Aschersleben, Prinz, & Daum, 2012). This is especially true in the case of younger infants as they focus more on the cognitive components in a demonstration situation. Infants around 12 months imitate primarily in order to satisfy cognitive motivations (e.g., Nielsen, 2006). However, with increasing age the social function of imitation becomes more important in general: older infants, from 18 months onward, imitate the specific actions of a model even if the actions are unsuccessful or irrational in order to promote interaction with the model and to satisfy social motivations. For example, in Nielsen's study (2006) infants saw a model's demonstration to use an object to open a box. The findings showed that 12-month-olds reproduced the model's results but did not copy the specific actions used by the model, unless they were given a rational reason to do so. Contrary to this, most of 18- and 24-month-olds imitated the model's object use, irrespective of the apparent logic of the actions. Further results showed that 18-month-olds copied the specific modeled action sequence with high fidelity when the model was being social while they focused on performing the end results when the model was acting aloof.

The conclusion that social motivations start to have a greater impact on infants' imitation at around 18 months of age (e.g., Carpenter, 2006; Nielsen, 2006) was mainly based on studies that were conducted with object-related actions. Given the general view that imitation is also a tool for learning within other non-object-related action types as well, the question arises whether the impact of social motivation to imitate varies in relation to the action type of use. When non-object-related actions such as gestures are given as a learning material in a demonstration situation, the target behavior ask for both cognitive and social motivation, yet as the cognitive task of understanding the observed action is related to a social partner (what is the model communicating/showing to me?), necessarily infants focus more on the social aspects of the imitation situation. Therefore, the above questions can be answered with the help of comparing the imitation of object-related actions to similar actions introduced as gestures.

So far only a few studies have compared infants' imitation of gestures to object-related actions (e.g., Abravanel, Levan-Goldschmidt, & Stevenson, 1976; Christie & Slaughter, 2009; Rodgon & Kurdek, 1977). These studies showed that infants are less likely to imitate gestures and that the imitation level is relatively low. For example, Abravanel et al. (1976) reported that 12- and 15-month-old infants imitated actions with objects more frequently than actions without objects, such as tongue protrusions, smacking lips and shaking of the head. Likewise, in the study of Christie and Slaughter (2009), six object-related actions (e.g., shaking a rattle) and nine bodily gestures (e.g., pulling the earlobe and patting the head) were shown to 6- and 15-month-old infants. Only one of the 62 infants imitated a gestural action, whereas most of the infants imitated at least some of the object-related actions. Importantly, these studies compared object-related actions with gestures that differed in their motor components, thus only limited conclusions can be drawn. As infants have to draw on different motor or cognitive abilities in order to perform different actions, such study designs cannot exclude the impact of motor complexity in the imitation of different kinds of target actions. In addition, there has been no systematic investigation of older infants' imitation of object-related actions and comparable gestures.

Furthermore, compared to the amount of studies about object-related action imitation, the question whether gesture imitation is influenced by similar factors as object-related action imitation or not has received little attention. A substantial number of studies have reported that the presence of salient action effects (e.g., light or sound effect) has a strong influence on infants' imitation of object-related actions. Studies showed that action effects, for example pushing a button which produces a beeping sound or shaking a box which makes a noise, facilitate infants' imitation (e.g., Devouche, 1998; Hauf, Elsner, & Aschersleben, 2004). However, to our knowledge, no prior study has investigated the question whether these principles apply to infants' imitation of gestures as well. Other than in the imitation of object-related actions, gestures cannot have physical effects as they are not directed at the physical world. Rather, as social motivation is emphasized in gesture imitation, social effects could be especially important. A study by Masur and Ritz (1984) may be taken as evidence for the influence of social factors on the imitation of gestures. They showed that 10- through 16-month-old infants imitated more familiar and communicative gestures (waving, headshaking, pointing, and open-hand reaching) than comparable hand and arm gestures without communicative significance (e.g., opening and closing the fist, raising an arm). This finding illustrates that infants' imitation is influenced by the social goals of an action or in other words, the social function of the gesture. Therefore, social effects (e.g., interaction with somebody) should have an influence on the imitation rate of communicative gestures, similar to the influence of physical effects on the imitation of object-related actions.

Comparing the imitation of two different kinds of target actions also poses the question whether infants show a consistent imitation ability or if imitation is rather a specific skill, which depends on the domain of the type of action given (object-related action vs. gesture). In other words, are there infants who imitate consistently better than others, regardless of the kind of target action encountered? It is widely known that especially children with autism have difficulties in learning by imitation (e.g., DeMyer et al., 1972; Meltzoff & Gopnik, 1993). This low level of imitation ability is closely linked to the atypical social, cognitive and communicative development of children with autism (Dawson & Adams, 1984; Smith & Bryson, 1994). So far, however, no consensus has been reached about the individual imitation abilities of typically developing infants. Studies on infants' verbal imitation have suggested the existence of a general ability to learn from an imitative situation and that therefore, there are infants who are consistently better imitators than others (Bloom, Hood, & Lightbown, 1974). Other studies have investigated the correlation among imitation performances assessed for different action types (e.g., gestures,