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Is selective attention the basis for selective imitation in infants? An eye-tracking study of deferred imitation with 12-month-olds

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ABSTRACT

Infants and children do not blindly copy every action they observe during imitation tasks. Research demonstrated that infants are efficient selective imitators. The impact of selective perceptual processes (selective attention) for selective deferred imitation, however, is still poorly described. The current study, therefore, analyzed 12-month-old infants' looking behavior during demonstration of two types of target actions: arbitrary versus functional actions. A fully automated remote eye tracker was used to assess infants' looking behavior during action demonstration. After a 30-min delay, infants' deferred imitation performance was assessed. Next to replicating a memory effect, results demonstrate that infants do imitate significantly more functional actions than arbitrary actions (functionality effect). Eye-tracking data show that whereas infants do not fixate significantly longer on functional actions than on arbitrary actions, amount of fixations and amount of saccades differ between functional and arbitrary actions, indicating different encoding mechanisms. In addition, item-level findings differ from overall findings, indicating that perceptual and conceptual item features influence looking behavior. Looking behavior on both the overall and item levels, however, does not relate to deferred imitation performance. Taken together, the findings demonstrate that, on the one hand, selective imitation is not explainable merely by selective attention processes. On the other hand, notwithstanding this reasoning, attention processes on the

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item level are important for encoding processes during target action demonstration. Limitations and future studies are discussed.

Introduction

Understanding and reproducing other persons' actions (i.e., imitating) is crucially relevant for learning new behaviors throughout the whole lifespan. Imitative learning requires that an agent properly observes specific actions performed by a (human) model, encodes and represents these actions, and finally maps these actions onto his or her own motor repertoire. One of the major problems for an imitative learner is to extract relevant aspects out of a perceptual stream of a series of activities constituting an action of an agent. Imagine, for example, somebody learning to play the trumpet by not only taking music classes but also watching movies of his or her favorite trumpet player Miles Davis. Each time Miles Davis makes bending postural motions while playing his tunes, the learner needs to evaluate and select which actions were related to playing the instrument or just to stage performance.

Infants and children learning via imitation face comparable and even more complicated problems during action processing and action understanding. In a naturalistic, non-infant-directed observation and imitation setting, and even in a more restricted, infant-directed educational situation, a caregiver often produces a significant amount of arbitrary actions among functionally relevant actions. An imitative learning laboratory setting allows researchers to manipulate the specific character of the actions demonstrated to the infants by, for example, showing a number of arbitrary actions in line with functional actions.

Since the seminal experimental studies by Meltzoff (1985) and Meltzoff (1988) relying on earlier work by Piaget (1951/1999), infants' imitation behavior has been used to study learning and memory. In a typical imitation paradigm, infants or children observe a set of actions demonstrated by an experimenter in a demonstration phase and then are allowed to play freely with the objects in an imitation phase. Whereas in an immediate imitation paradigm infants are immediately allowed to play with the objects, in deferred imitation studies there is a delay of minutes, hours, or even days between the demonstration and imitation phases (e.g., Barr, Dowden, & Hayne, 1996). Depending on the design of the study, either a baseline phase prior to the demonstration phase (elicited imitation design; e.g., Bauer, 1996, 2005) or a control group (observation-only design; e.g., Barr et al., 1996; Meltzoff, 1985, 1988) allows controlling and evaluating for spontaneous production of target actions.

The immediate imitation paradigm is mostly used within a social cognition-oriented research approach to study how infants process others' actions. This approach focuses on describing how infants process, interpret, and imitate actions and how they also interpret the demonstration situation. For example, in a well-known study, Gergely, Bekkering, and Király (2002) demonstrated that 14-month-olds imitated a head-touch action (Meltzoff, 1988); that is, they switched on a lamp via touching it with the head only when the model's hands were free during target action demonstration. In case the model's hands were occupied, infants switched the lamp on with their hands, showing that infants are selective imitators. This finding was interpreted in the sense that early imitation of goal-directed actions is a selective inferential process by which imitators evaluate the rationality of the means in relation to the constraints of the situation (Csibra & Gergely, 2007; Gergely & Csibra, 2003). In line with this idea, a series of studies demonstrated that selective imitation is influenced by several experimental factors such as communicative cues (Nielsen, 2006) and the demonstration situation (Király, 2009). This higher cognitive interpretive explanation of selective imitation is, however, heavily debated in the imitation literature. A different research account conceptualizes (selective) imitation as a rather biologically driven, relatively automatic process of perception–action matching (e.g., Hauf & Prinz, 2005; Meltzoff, 2007; Paulus, Hunnius, Vissers, & Bekkering, 2011a). As an extension of their idea, Paulus, Hunnius, Vissers, and Bekkering (2011b) argued for a two-stage