

*Infancy*, 22(1), 5–22, 2017

Copyright © The Authors. *Infancy* published by

Wiley Periodicals, Inc. on behalf of International Congress of Infant Studies

This is an open access article under the terms of the Creative Commons Attribution-NoDerivs License, which permits use and distribution in any medium, provided the original work is properly cited and no modifications or adaptations are made.

ISSN: 1525-0008 print / 1532-7078 online

DOI: 10.1111/inf.12142

WILEY Blackwell

# Do You Do as I Do?: Young Toddlers Prefer and Copy Toy Choices of Similarly Acting Others

Sarah A. Gerson

*School of Psychology Cardiff University and  
Radboud University Nijmegen, Donders Institute for Brain, Cognition, & Behaviour*

Harold Bekkering and Sabine Hunnius

*Radboud University Nijmegen, Donders Institute for Brain, Cognition, & Behaviour*

Recognizing similarity between one's own and others' actions is important for identifying others with whom to affiliate and from whom to learn. In this study, 40 19-month-old toddlers recognized when a puppet chose the same toys as them. Toddlers preferred to affiliate with a puppet who chose the same toys as themselves relative to a puppet who chose other toys and they modified their subsequent behavior by choosing the same toys as that puppet when presented with novel toys. Toddlers' actions were not based on perceivable features of the puppet (e.g., similar accent or language as oneself) or an association between the puppet and the preferred toys (as assessed in a control condition). Results indicate that toddlers identified and recognized the similarity in action choices between themselves and the puppet via comparison between their own and the puppets' actions. Identifying this similarity is critical for children's developing understanding of and engagement in interactions with others.

The ability to distinguish one's preferences from others' is a critical step to understanding others' actions and mental states. In the second year of life, young toddlers recognize when others' preferences differ from their own and can use this information to guide their behavior accordingly. In a classic study by Repacholi and Gopnik (1997), toddlers used information they received about another person's food preference to inform their actions on that specific food item (i.e., give her the food she preferred instead of the food the toddler preferred). In our everyday interactions, we need to recognize others' preferences and patterns of behavior in a broader sense. It is important to learn peoples' preferences for particular items (e.g., that your class-

---

Correspondence should be sent to Sarah A. Gerson, School of Psychology, College of Biomedical & Life Sciences, Cardiff University, 70 Park Place, Cardiff CF10 3AT, UK. E-mail: GersonS@cardiff.ac.uk

The copyright line in this article was changed on 27 June 2016 after online publication.

mate hates puzzles), but further recognizing *patterns* of behavior is important for choosing with whom to interact and for making predictions about another person's actions in a new context and how those actions might relate to oneself (e.g., that your neighbor tends to like the same games you do and, so, you can probably trust that you will like the games she chooses in the future). As we learn about more general tendencies concerning others' preferences, we come to realize that, at least within domains (e.g., foods, hobbies), our own preferences align with some individuals and deviate from others.

Here, we argue that monitoring behavioral patterns and comparing them to our own is an important basis for identifying similar others with whom we prefer to interact and whose action choices might influence our own behavior in the future. This notion is consistent with theoretical perspectives emphasizing the importance of comparisons between self and other for social cognitive development (Barresi & Moore, 1996; Meltzoff, 2007; Gerson, 2014). According to Meltzoff's "like me" framework, "the bedrock on which commonsense psychology is constructed is the apprehension that others are similar to the self" (Meltzoff, 2007, p. 27). Meltzoff suggests that the recognition of others as similar to the self is a starting point for social cognition. Whereas this theory broadly defines those that the child identifies as "like me" as agents or social beings (relative to inanimate objects), the current research more closely examines the intricacies of similarly behaving others.

In this study, we examine whether 19-month-old toddlers recognize similar behavioral patterns (i.e., action choices for toys) between self and other and base future actions on these similarities. More specifically, we investigate whether young toddlers identified puppets who had chosen the same or different toys from them, preferred to interact with the similar puppet, and made future (novel) toy choices based on the similar puppet's actions. This research addresses how young toddlers begin to recognize similar others based on behavioral, rather than featural, information and investigates whether one's own action choices are, in part, determined by the actions of similar, relative to dissimilar, acting others.

## PREFERENCE FOR SIMILAR OTHERS

As humans, we like those who are similar to us. We prefer others who speak our language (Kinzler, Dupoux, & Spelke, 2007), have our accent (Kinzler, Shutts, DeJesus, & Spelke, 2009), and are the same gender as us (Wolff, Kemter, Schweinberger, & Wiese, 2014). Recent research suggests that children both affiliate with and prefer to learn from those similar to them in perceptual features. For example, 3-year-old children tend to imitate the activity or object choice of an individual who is similar to them in age, gender, or native language (Howard, Henderson, Carrazza, & Woodward, 2014; Shutts, Banaji, & Spelke, 2010). At 18 months, toddlers selectively imitated the actions of a native, relative to a foreign, speaker when actions were presented via video (Howard et al., 2014). At 12 months, infants chose the same food as others who spoke their native language (relative to foreign speakers; Shutts, Kinzler, McKee, & Spelke, 2009; see also Buttellmann, Zmyj, Daum, & Carpenter, 2013). Overall, infants and young children seem to imitate the actions and action choices of others who share objective, external features with them (similar language, race, or gender) in a variety of contexts.

## CONTRASTING PERCEPTUAL SIMILARITY WITH ACTION CHOICE SIMILARITY

Whether infants and children can use information about the action choices, in addition to perceptual features, of another individual to detect when others are similar to them (e.g., act on, or prefer, the same toys) is important for understanding how infants and children recognize similar others within or across larger groups. Identifying similar others based on perceptual features is likely important for a variety of reasons. For example, those who have similar accents and speak the same language as us are useful resources for learning new words. Outside the domain of language learning, however, recognizing that someone *acts* in similar ways to oneself is potentially more useful for informing future action choices than recognizing similarities based on accent or gender, for example, given that action choices, but not external features, reflect internal states such as preferences. For example, if someone likes the same food I do (as seen in their choice of one food over another), I should trust his or her opinion about a novel food more so than someone who is merely similarly female.

## COPYING CHOICES OF SIMILARLY ACTING OTHERS

Research conducted in the 1970s and 1980s (e.g., Kauffman, Kneedler, Gamache, Halahan, & Ball, 1977; Thelen, Dollinger, & Roberts, 1975; Thelen, Frautschi, Roberts, Kirkland, & Dollinger, 1981) suggests that kindergarten and first-grade children showed increased attraction toward and imitation of an individual who conveyed similar preferences via actions (i.e., chose the same color crayon), relative to an individual who did not demonstrate similar preferences (Thelen et al., 1975).

Surprisingly, little research has gone beyond that conducted by Thelen et al. (1975) to explore whether, earlier than kindergarten, children base their future behaviors on the observed behavior of those who shared preferences (via similar action tendencies). An experiment by Fawcett and Markson (2010), however, is indicative that 2-year-olds base their action choices on those of a similarly acting other when the preferences they share are relatively universal. In this study, 2-year-old children viewed an actor play with either exciting objects (similarly preferred by the child) or boring objects (not preferred by the child). When given the chance to choose between hidden objects based on the actor's choice, children chose the same object as the actor who had previously chosen the exciting objects rather than the boring objects.

## INFANTS PREFER SIMILARLY ACTING OTHERS

More recent work has found evidence that younger children prefer to interact with an individual who previously acted on the same object as oneself. In this work (Mahajan & Wynn, 2012), 11-month-old infants chose between two foods and viewed puppets who acted on the same or different foods as themselves. The infants were then asked with whom they would prefer to play. Infants tended to choose the puppet with the matching food preference as themselves. This finding is important in establishing that infants recognize and prefer individuals who share similar preferences with themselves. It is limited, however, in that food preferences were matched on only one trial (i.e., for one item), thus indicating a simple tracking of one preference and not across actions.

## LIMITATIONS OF PRIOR RESEARCH

Prior research has not sufficiently ruled out the possibility that lower-level explanations could have driven young children's behavior. In particular, whether a preference for similarly acting others is a function of attention to the similarly acting individual or preferred object (i.e., orientation or looking toward the individual), based on an association between the positively valenced object and that particular individual, or based on a more intricate understanding of the other's actions (i.e., recognition that this person shares action goals with oneself) in these developmentally early cases is relatively unexplored but important for identifying the development of this preference. The possible confound of attention is pertinent because previous research has found that infants tend to look more toward an individual who imitates their actions than to an individual who acts in an inconsistent manner with their own actions (Meltzoff, 2007).

Of the above-discussed research, only Thelen et al. (1975) found that imitation of action choices and preference for the similar other was not a function of differential looking (i.e., attention) to either individual. In the research by Fawcett and Markson (2010) and Mahajan and Wynn (2012), no coding of children's gaze was reported. Therefore, object or puppet choices due to differences in attention cannot be ruled out. Discovering whether attention toward similar and dissimilar others differs is important for uncovering the mechanism via which children begin to recognize and act on similarities between self and other. This is one of our aims in the current study.

## CURRENT STUDY

In the current study, we assessed whether 19-month-old toddlers recognized similar action choices (i.e., choices for toys without an objective valence) between self and other, preferred interacting with similar others, and used this information to guide future behavior (i.e., generalized shared toy choices to novel toys). Nineteen-month-old infants were tested based on previous research indicating that young toddlers can recognize when an individual's preference differs from their own (Repacholi & Gopnik, 1997). This age range also falls between that of Mahajan and Wynn (2012) and Fawcett and Markson (2010). That is, we investigated how young toddlers determine who is "like me" on an individual action choice level. Specifically, in the key *choice* condition, toddlers were introduced to two puppets, one of whom always chose the same toy as the child during familiarization trials and one who always chose the opposite toy. In this way, toddlers could recognize the matched or mismatched action choice based on the matched structural *goal relation* between self and the puppet (see Woodward, Sommerville, Gerson, Henderson, & Buresh, 2009 for a discussion of goal relations). When the puppet chose the same toy as the child, the relation between the child and the desired object (e.g., child [agent]: turtle toy) was identical to that of the puppet and the desired object (e.g., puppet [agent]: turtle toy). When, however, the puppet chose the opposite object, the goal relations were mismatched. During test trials, the child chose to interact with one of the two puppets and had the chance to copy the toy choice (i.e., copy toy picked by individual when presented with new toys) of one of the two puppets. If toddlers recognized that the matched action choices between self and other were indicative of similarity between goals (or shared preferences), they should prefer to play with the similar puppet. Further, if toddlers generalized matched

action tendencies (i.e., choosing the same toys) between self and other (puppet) across individual trials to novel toys, they should choose the same toy as the puppet who shared their preferences during familiarization when introduced to new toys in toy choice test trials. The use of puppets as social partners and mentalistic agents is well established (e.g., Bartsch, Wade, & Estes, 2011; Hamlin & Wynn, 2012; Mahajan & Wynn, 2012; Rakoczy, Warneken, & Tomasello, 2008) and allowed us to control and match actions with fewer experimenters.

In a second condition, we controlled for the possibility of a mere perceptual association between one of the puppets and the toys preferred by the child. In the *Assign* condition, one puppet was consistently assigned the same toy the child chose during each familiarization trial and the other puppet was consistently assigned the opposite toy. In this way, the physical relation between the puppets and the toys was identical to that in the *Choose* condition, but the goal relation differed in that the puppet did not retrieve his preferred toy, but instead received the toy indicated by a second experimenter. If toddlers' behavior in the choice condition was based on an *association* between the toy they preferred and the puppet who received it, then they should similarly choose to play with and choose the same toy as the puppet that received the same toys in the *Assign* condition. If, however, toddlers recognized the matched action choices (i.e., goal relations) between themselves and the puppet, they should not prefer to interact with or choose the same toy as the puppet who received the similar toys in this condition because the puppet's receiving of the toys during familiarization did not imply that the puppet had the same preference for or intention toward acting on that toy as that of the child (and, thus, his or her future preferences as expressed via action choices are not alignable with the child's).

Importantly, we also measured toddlers' gaze to the different toys and puppets in both of these conditions to assess whether any differences between conditions were due to attentional differences in the familiarization or test trials. If toddlers attend more to the similar puppet than the dissimilar puppet during either familiarization or toy choice test trials in the choice, but not the *Assign* condition, this would leave open the possibility that orientation toward a particular puppet due to low-level factors drives toddlers' subsequent behavior in test trials. If, however, toddlers spend an equivalent amount of time attending to both puppets in both conditions, this would suggest that any differences in toy choice or interaction preference are based on toddlers' interpretation of the actions on a goal level.

## METHODS

### Participants

Forty 18- to 20-month-old toddlers (18 males) were randomly assigned to one of two conditions, *Choose* ( $n = 20$ ;  $M$  age = 19 months, 10 days) or *Assign* ( $n = 20$ ;  $M$  age = 19, 13 days). An additional four toddlers were not included in the final sample due to failure to complete the study. All toddlers were recruited via a database of families who volunteered to participate in infant and child studies, were born full term, and had no reported developmental delays. The sample was largely Caucasian and middle class and from a mid-sized European metropolitan region.

## Stimuli

Two hand puppets were used in this study: a fox and a raccoon. Piloting was conducted with a set of eighteen small toys (approximately 5 cm) to create pairs of toys that were chosen approximately equally across children. The same eight toys were always presented in pseudorandomized order during familiarization trials, and the other ten were pseudorandomly presented in pairs in the test trials.

## Procedure

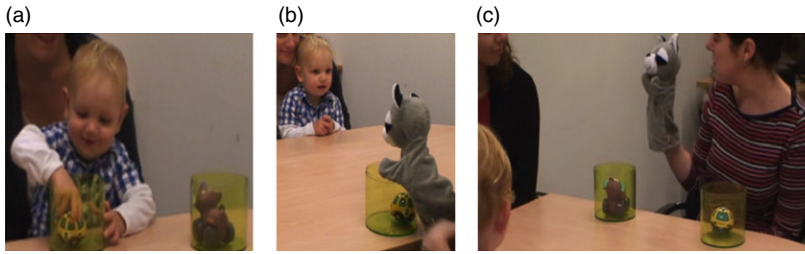
Following written informed consent, toddlers were seated on a parent's lap at a table across from an experimenter during the entirety of the session. Parents were asked not to interfere but to encourage the toddler to play if they were reticent. A camera facing the toddler recorded the full session for offline coding. In both conditions, toddlers participated in four familiarization trials, five toy choice test trials, and a final interaction preference trial. The familiarization trials differed between conditions; toy choice test trials and the interaction preference trial were identical across conditions.

## Familiarization

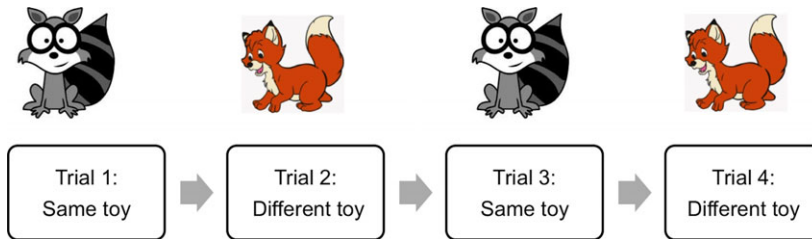
Familiarization differed as a function of condition, which was varied between subjects. Below, we describe the familiarization trials for both the Choose and the Assign conditions.

### *Choose condition*

In each familiarization trial, toddlers in the Choose condition received a pair of toys contained within green, translucent buckets. The toys were passed across the table by the experimenter such that each toy was equidistant from the child and within the child's reach. The order of pairs presented and which toy within a pair was presented on which side was counterbalanced across participants. The toddler was encouraged to choose one of the two toys (see Figure 1). If the toddler did not respond within approximately 30-s, the experimenter took both toys out of the buckets and placed them in front of the child, being careful to place both toys at the same time. If the toddler clearly chose one toy, the other toy was removed. If children chose both toys, they were allowed to hold on to both toys. The experimenter then asked the toddler which toy he or she wanted (original language: "Welke wil je? Wil je er een?"). The toddler was given approximately 15–30 s to play with the toy before the experimenter retrieved the toy(s). The experimenter then placed the toys back in the buckets (out of sight of the child) and returned them to the tabletop, in front of the experimenter and out of the child's reach. The experimenter told the child that someone else wanted to play with the toys and introduced one of the two puppets. The order in which puppets were presented in familiarization trials was counterbalanced across toddlers. The two puppets alternated appearances across familiarization trials, each appearing twice across the four trials (see Figure 2). One of the two puppets chose the same toy the child had chosen both times, whereas the other puppet chose the opposite toy (see Coding section below for details). The choices made by the puppets were identified on a trial-by-trial, child-by-child, basis



**Figure 1** In familiarization trials, infants in both conditions first chose between two toys (a). In the Choose condition, infants then saw a puppet choose the same (b) or different toy than the one they had chosen. In the Assign condition, a second experimenter told the puppet he could play with one of the two toys (c).



**Figure 2** Across four familiarization trials, each puppet appeared twice and consistently chose the same or a different toy relative to the child's choice.

(i.e., puppet choices were individualized to match the specific choices of the infant on each trial). Whether the fox or raccoon puppet chose the same or different toy was counterbalanced across toddlers. In *similar puppet* trials, the puppet looked at both toys and at the child, noting how nice both toys looked and saying he wanted to play. He then chose the same toy the child had previously chosen, saying he found that toy better (see Figure 1b). The experimenter then told the child, “See that? Mister Fox [or Raccoon] chose the same toy you did!” (original language: “Zie je dat? Meneer Vos [or Wasbeer] heeft hetzelfde speeltje als jij gekozen!”). In the *dissimilar puppet* trials, the puppet carried out the same actions as in the same puppet trials, except that he always chose the opposite toy. After he made his choice, the experimenter said, “See that? Mister Raccoon [or Fox] chose the other toy!” (original language: “Zie je dat? Meneer Wasbeer [or Vos] heeft het andere speeltje dan jij gekozen!”). The toys were then removed from the table to begin the next familiarization trial, in which the child chose between two new toys. Note that both the similar and dissimilar puppets chose the toy by stating their choice and holding the bucket that contained the toy of choice. The puppet never touched the toy itself so that both toys were always equally visible. In this way, the goal relation between the child and his or her toy choice was matched to that of the similar puppet (and mismatched with the dissimilar puppet), but the physical instantiation of the toy choice varied between puppet and child.

### *Assign condition*

During familiarization trials in the Assign condition, a second experimenter sat to the right of the original experimenter and was silent throughout the session except when asked a question by the puppet, as described below. As in the Choose condition, at the beginning of the familiarization trials, the child always had the chance to choose between two toys. The toys were then replaced in front of the experimenter, and the puppets each appeared in alternating trials. In the *Assigned Same Toy* trials, the puppet looked at each of the toys and at the child and exclaimed how nice the toys were. He then looked at the second experimenter and asked whether he could play with one of the two toys (See Figure 1c). The second experimenter enthusiastically answered, “Yes! You can play with the [!]” (original language: “Ja! Jij mag met [toy the child chose] spelen!”). The puppet responded, “Ooh! Look! I get this toy!” The experimenter said, “See that? Mister Fox [or Raccoon] got the same toy as you!” (original language: “Ooh! Kijk! Ik kan met dit speeltje spelen!”... “Zie je dat? Meneer Vos [or Wasbeer] kan met hetzelfde speeltje als jij spelen!”). In the *Assigned Different Toy* trials, the same exact actions were carried out except that experimenter two told the puppet he could play with the opposite toy and the experimenter exclaimed, “See that? Mister Raccoon [or Fox] got the other toy!” (original language: “Zie je dat? Meneer Wasbeer [or Vos] kan met het andere speeltje dan jij spelen!”). Thus, the only difference between the two conditions was whether the puppet chose a toy himself or was assigned a toy by the second experimenter. As in the Choose condition, the puppet held the bucket containing the toy of choice rather than touching the toy itself. In this way, the physical relation between the puppet and the toy was identical in both conditions. In the Assign condition, however, the goal relation was not matched between puppet and child because the puppet did not choose a toy to act on himself (i.e., the goal relation in the Assign condition incorporated the direction given by the second experimenter).

### Test trials

Test trials were carried out identically across conditions. In the Assign condition, the second experimenter remained seated so as not to disrupt the session but was silent and gazed downward. Test trials always consisted of five toy choice test trials and one interaction preference trial.

#### *Toy choice test trials*

In each toy choice test trial, a pair of toys was placed in front of the experimenter. Both puppets were then introduced. The puppets each looked at both toys and chose one of the two toys. The toy chosen within each pair, the side on which the puppet and toy were presented, and which puppet chosen first were each counterbalanced across subjects. After each puppet chose a toy, the experimenter reminded the child of the choices and drew the toddler’s attention to each of the choices, saying “See that? Mister Fox chose the [name of toy] and Mister Raccoon chose the [name of other toy]!” (original language: “Zie je dat? Meneer Vos heeft [name of toy] gekozen en Meneer Wasbeer heeft [name of toy] gekozen!”). The experimenter ensured that the toddler looked to both puppets and their choices before the puppets disappeared. The experimenter then drew the child’s attention back to the center and asked with which



toy the child would like to play. The toddler was encouraged to point to one of the two toys while the toys were still out of reach. If the child did not respond within approximately 30-s, the experimenter placed the toys (an equal distance apart) in front of the child and encouraged the toddler to choose without drawing attention to either toy in particular. After the toddler chose a toy, the child had approximately 30-s to play before all toys were removed and the next trial began.

#### *Interaction preference test trial*

After the five toy choice test trials, the experimenter presented the toddler with both puppets and asked with which puppet the child would like to play. The puppets were held out within reach of the toddler, and the toddler was encouraged to choose a puppet. If the child did not choose right away, the experimenter asked further probing questions (e.g., Do you want to hug one of the puppets?; original language: “Wil je een van deze knuffelen of een kusje geven?”). If the toddler did not choose within approximately 30-s, the session was ended. Because this individual test trial differed from prior trials and always occurred at the end of the session, nine children ( $n = 6$  in Choose) did not make a choice during the interaction preference test trial. This dropout rate is likely due to a combination of exhaustion, shyness, and disinterest.

#### Coding

Three types of coding were completed: an online measure of choice during familiarization trials, an offline assessment of choice during toy choice and interaction preference test trials, and an offline fine-grained analysis of toddlers' attention across familiarization and toy choice test trials.

#### *Online familiarization trial coding*

During familiarization trials, the experimenter noted the toy the toddler chose on each trial (in the assigned condition, the first experimenter did so within view of the second experimenter but out of view of the infant). For cases in which the child did not clearly choose one toy, the experimenter asked the child which toy was preferred. If the toddler still did not choose one, the experimenter made a judgment based on the child's amount of engagement with and attention to each toy. A reliability coder, blind to the experimenter's online coding, assessed the child's preference offline and agreed with the original experimenter in 90% of the cases across conditions (Cohen's kappa = 0.81). Only the original coder's scores were used in analyses.

#### *Offline toy choice test trial coding*

Digitized videos of the session were coded offline for the toddler's choice during toy choice test trials. The first toy the child touched during or after looking at the toy was coded as the toddler's preference. This coding was consistent with other research coding toy preference in a toy choice paradigm (e.g., Gerson & Woodward, 2012; Hamlin, Hallinan, & Woodward, 2008). The coder also coded infants' interaction preference by noting the first puppet touched by the infant during the interaction preference test

trial. A second coder, blind to condition and hypotheses, double-coded all videos,<sup>1</sup> and the coders agreed in 97% of trials across toddlers ( $\kappa = 0.93$ ).<sup>2</sup>

### *Attention coding*

Toddlers' attention to the toys, puppets, and experimenter was coded throughout the portion of the familiarization and toy choice test trials that the puppet(s) were acting (i.e., not while the child was acting) using ELAN software (<http://tla.mpi.nl/tools/tla-tools/elan/>; Wittenburg, Brugman, Russel, Klassmann, & Sloetjes, 2006). During familiarization trials, the coder assessed the duration and number of gazes toward the puppet, the experimenter(s), and the left and right toys. In toy choice test trials, the coder assessed toddlers' looking to the experimenter(s) and left or right side of the experimenter, combining looks to the left puppet and left toy, for example, into one code. Because the puppet was always presented on the same side as the toy he chose, this created a measure of attention toward each puppet and his toy choice, defined by spatial side. Four toddlers' data were not included in attentional analyses due to equipment error (i.e., unable to code at a more fine-grained level). Twenty-five percent of videos were double-coded, and the two coders had high intraclass correlations for coding of attention during both the familiarization and test phases (ICCs > 0.82,  $ps < 0.001$ ).

### *Bias coding*

Given that the same experimenter conducted the familiarization and test trials, additional coding was conducted to ensure that the experimenter did not subconsciously bias the infants' behavior in accord with hypotheses. A newly trained coder, blind to the hypotheses of the study, the condition of each participant, or the puppet who was similar or dissimilar coded the videos of the majority of participants ( $N = 35$ ) for possible bias. The coder watched the toy choice test trials and noted his best guess as to any bias by predicting which puppet the child might copy based on the following criteria in hierarchical order of priorities: (1) whether one toy was physically closer to the child than another (he noted, however, that this occurred extremely rarely), (2) how long and how engaging the puppet's speech was, and (3) the experimenter's focus of attention to one side or another. If he could not choose based on these criteria, he guessed based on his intuition. This coding revealed that his guesses as to the preferred puppet across trials for each participant were no different from chance ( $p = .27$ ) and were unrelated to infants' proportion of similar toy choice across conditions ( $r = -.06$ ) or within either condition (Choose:  $r = -.22$ ; Assign:  $r = -.002$ ). The rate at which the bias coder guessed the puppet who acted similarly to the child was marginally different between conditions ( $t(33) = 1.86$ ,  $p = .07$ ) such that it was slightly higher in the Choose condition ( $M = 0.57$ ,  $SEM = 0.04$ ) than in the Assign condition ( $M = 0.48$ ,  $SEM = 0.02$ ). The fact that this was not significant and that the coder's guesses were

---

<sup>1</sup>Three infants could not be coded due to loss of video data following initial coding.

<sup>2</sup>The reason we veered from this coding scheme for the familiarization trials was because some infants chose one toy and then clearly became more interested in the other toy and we wanted to assure that the puppets' toy assignments were based on the infant's preference for a particular toy and not their first impulse. We coded first touch as well, and this was consistent in 77% of the trials across conditions.

unrelated to the children's actions, however, suggests that any possible bias did not drive the effects seen.

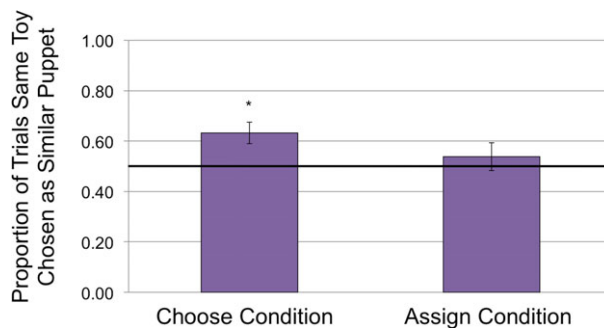
## RESULTS

### Toy choice test trials

In each condition, we conducted one-sample t-tests for with the proportion of toy choice test trials for which the child chose the same toy as the similar puppet as the dependent variable against chance rate (50%). Proportion scores were used, in accordance with the previous literature (e.g., Gerson & Woodward, 2012; Hamlin et al., 2008; Thoermer, Woodward, Sodian, Perst, & Kristen, 2013), account for the fact that some toddlers only had usable data on 4 of five test trials (due to not choosing or choosing both toys simultaneously on some trials,  $n = 3$ ) and assess infants' behaviors relative to chance levels. In the Choose condition, toddlers chose the same toy as the similar puppet significantly more often than would be expected by chance,  $t(19) = 2.60$ ,  $p = .017$ , Cohen's  $d = 1.19$ ,  $M = 0.61$  [ $SEM = 0.04$ ]. In the Assign condition, toddlers' toy choice did not significantly differ from chance level,  $t(19) = 0.67$ ,  $p = .51$ , Cohen's  $d = 0.31$ ,  $M = 0.53$  ( $SEM = 0.04$ ) (see Figure 3). Nonparametric analyses confirmed these patterns. One-sample Wilcoxon's signed-rank test indicated that toddlers' behavior differed from chance in the Choose condition ( $p = .022$ ) but not in the Assign condition ( $p = .52$ ). In contrast to our prediction, however, children in the two conditions did not significantly differ from one another in their rates of toy choice with regard to the similar puppet,  $t(38) = 1.43$ ,  $p = .16$ , Cohen's  $d = 0.46$  (nonparametric Mann-Whitney test:  $Z = -1.36$ ,  $p = .17$ ).

### Interaction preference test trial

We conducted binomial tests for each condition to assess whether the number of toddlers who preferred to affiliate with the similar or dissimilar puppet differed significantly. In the Choose condition, of the 14 children who acted on one of the two puppets, 12 preferred to affiliate with the similar puppet, whereas only two preferred



**Figure 3** Infants in the Choose condition chose the same toy significantly more often than would be expected by chance ( $*p < .05$ ). Infants in the Assign condition did not. Means are plotted with standard errors represented in the error bars.

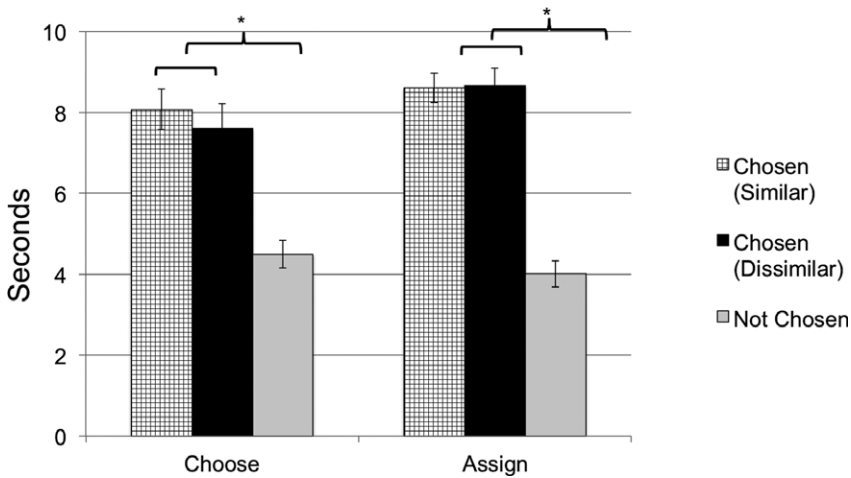
to affiliate with the dissimilar puppet,  $p = .035$ . In the Assign condition, the 17 children who chose a puppet did not significantly prefer either puppet,  $p = .14$  (similar:  $n = 5$ , dissimilar:  $n = 12$ ). A chi-square test indicated that toddlers in the two conditions differed from one another in their affiliative choices,  $\chi^2(1) = 8.19$ ,  $p = .004$ .

### Attention

During each familiarization trial, we measured whether toddlers attended (as defined by gaze toward an object or event) similarly to the chosen toy vs. the toy not chosen in the two conditions to ensure that children were similarly attentive to the preferred toy when it was chosen by or given to a puppet (regardless of whether the puppet made the same or different toy choices as the child). A repeated-measures ANOVA with attention to each toy (chosen or nonchosen) as a within-subjects factor and condition (choose or assign) as a between-subjects factor revealed a main effect of toys,  $F(1,33) = 143.19$ ,  $p < .001$ ,  $\eta_p^2 = 0.81$ , no effect of condition,  $F(1,33) = 0.034$ ,  $p = .86$ ,  $\eta_p^2 = 0.001$ , and a marginal interaction between condition and toys,  $F(1,33) = 3.94$ ,  $p = .055$ ,  $\eta_p^2 = 0.11$ . The marginal interaction hinted that toddlers in the Assign condition showed a larger difference between the chosen and other toy than toddlers in the Choose condition, but this interaction did not reach significance and, across both conditions, children attended more to the toy the puppet chose than to the toy the puppet did not choose (*mean difference* = 4.74 and 3.39, respectively,  $ps < 0.001$ ).

We then compared the amount of time toddlers attended to the chosen toy of the similar puppet (i.e., the toy the child had previously chosen) vs. the dissimilar puppet (i.e., the toy the child had not chosen) across familiarization trials. A repeated-measures ANOVA, with looking time to chosen toy as the dependent variable, trial type (similar or dissimilar puppet) as a within-subjects measure, and condition as a between-subjects measure, revealed no main effect of trial-type  $F(1,33) = 0.30$ ,  $p = .58$ ,  $\eta_p^2 = 0.009$ , condition  $F(1,33) = 1.30$ ,  $p = .26$ ,  $\eta_p^2 = 0.04$ , or interaction between trial-type and condition  $F(1,33) = 1.26$ ,  $p = .27$ ,  $\eta_p^2 = 0.04$ . Thus, across conditions, toddlers systematically attended to the toy chosen by the puppet, regardless of whether the puppet chose the same toy as the child or not (see Figure 4), suggesting that saliency of the similar puppet or inattention to the dissimilar puppet during familiarization trials did not drive subsequent toy choice or interaction preference behavior.

Although no differences in attention to the two puppets were evidenced during familiarization, it was important to assess attention during toy choice test trials, because this was the only portion of the session when both puppets were simultaneously visible. If, during these more complex scenes, toddlers looked more to the similar puppet because he was more salient or the children liked him more, their subsequent toy choices (during toy choice test trials) might solely be based on the fact that they had not noticed the toy acted on by the dissimilar puppet. We therefore assessed whether attention to the similar puppet and his chosen toy relative to attention to the other puppet and toy differed across conditions during toy choice test trials in a repeated-measures ANOVA. There was no main effect of puppet,  $F(1,33) = 0.008$ ,  $p = .93$ ,  $\eta_p^2 = <0.001$  and no interaction between puppet and condition,  $F(1,33) = 0.002$ ,  $p = .97$ ,  $\eta_p^2 = <0.001$ . Thus, toddlers did not attend more to either puppet/toy in either condition. A main effect of condition,  $F(1,33) = 6.86$ ,  $p = .013$ ,  $\eta_p^2 = 0.17$ , revealed that toddlers' looking times to the puppets were longer across the Assign



**Figure 4** In familiarization trials, infants in both conditions attended more to the toy acted on by the puppet than the toy not acted on and did so regardless of whether the puppet acted on the same or different toy than the one the child had chosen.  $*p < .05$ .

condition (estimated marginal mean = 11.83s,  $SEM = 0.34$ ) than the Choose condition (estimated marginal mean = 10.54s,  $SEM = 0.35$ ). Because this was unexpected, we followed up to see whether toddlers' looking times to the experimenter differed between conditions. Although the trend was in the opposite direction (Choose:  $M = 2.62$  ( $SEM = 0.53$ ); Assign:  $M = 2.17$  ( $SEM = 0.33$ )), this difference was nonsignificant,  $t(33) = 0.73$ ,  $p = .47$ . Therefore, we further explored whether the proportion of time toddlers looked toward each puppet (e.g., (time looking toward similar puppet)/(time looking toward either puppet + time looking toward experimenter)) differed between conditions. As before, this analysis revealed no main effect of puppet or interaction between puppet and condition ( $ps > 0.76$ ) and the main effect of condition washed out,  $F(1,33) = 1.28$ ,  $p = .27$ ,  $\eta_p^2 = 0.04$ . Further, duration of attention (i.e., amount of time looking) to the similar puppet during test trials was unrelated to toddlers' toy choice with regard to the similar puppet ( $r = -.16$ ,  $p = .36$ ).

## DISCUSSION

Knowing when others are similar to oneself has profound effects on infants' and young children's future interactions with those individuals, influencing their future interactive behaviors, imitation, and cultural learning (Meltzoff, 2005). In this experiment, we examined whether comparisons between matched or mismatched action choices (i.e., goal relations) between self and other influenced young toddlers' identification of and responses to similar and dissimilar others. We found that 19-month-olds recognize when others' relational goals mirror their own based on matched action choices. They act on this recognition by demonstrating a preference to interact with and match the toy choices of an individual who acts similarly in her action choices. Previous research on this topic largely focused on the identification of similar others via perceptual

features such as language and gender (e.g., Shutts et al., 2010). Identification of these kinds of similarities is important for shaping behavior in certain instances, but in other instances, informative behavior crosses these borders and breaks down within these larger categories. It is, therefore, important to identify when and how young children begin to recognize similar others based on information that is not only perceptual or featural but also based on the action choices (i.e., goal relations) of another individual. Actions are particularly important because they are the means by which we can, at some point, infer the mental states underlying behavior. We know that actions are especially salient for infants and young children, who attend to actions and their outcomes in their everyday environments (Amano, Kezuka, & Yamamoto, 2004). Hints of the saliency of actions can be seen in our attentional data, in that toddlers always attended more to the action occurring than to other features of the scenes presented to them during both familiarization and test trials.

Identifying similar others is important not only for knowing with whom to interact, but also because those who share common behaviors and preferences with us are important sources of information concerning what we might want to do in the future (Howard et al., 2014). The present findings provide novel evidence that 19-month-olds recognize and act on similarities in action patterns between self and other. In acting on this information, toddlers were able to generalize from prior behavior to inform their own actions on novel objects. That is, not only toddlers recognized that the similar puppet chose the same toys as them during familiarization, but also they chose the same toy as the similar puppet when viewing the puppet act on novel toys to which they had no prior exposure in toy choice test trials. This finding is in accord with Fawcett and Markson's (2010) finding that toddlers base their actions on universally common preferences of others within a domain. The current findings go further in that the similar puppet's actions were defined by the specific choice of the child in that trial, rather than consistently choosing an objectively more interesting toy across participants. Tracking the similarity of individual action choices requires more than a nearly universal categorization of items as fun vs. not. Instead, toddlers had to identify their own choices and how their actions related to those of each puppet. Thus, toddlers' actions during test trials were not based on a general trait of the other individual. Toddlers' preference to affiliate with and copy the toy choice of a particular individual was based on more than mere perceptual or featural information.

Critically, unlike prior research (e.g., Mahajan & Wynn, 2012), the current research is controlled for the possibility of lower-level accounts based on association or saliency by measuring toddlers' attention to different aspects of the familiarization and test trials. Given evidence that infants prefer to look more toward individuals who are similar to them (Kinzler et al., 2007; Meltzoff, 2007), without controlling for attention, any possible differences in preference for or imitation of one puppet could be based on attending more (i.e., looking longer) to that puppet. Although this finding would be interesting in that it would be consistent with the notion that toddlers viewed the similar puppet as like them in the Choose condition but not in the Assign condition, it would make it difficult to interpret toddlers' action choices during test trials. Additionally, an alternative explanation for this finding in the current study would be that toddlers simply looked longer to the toy he or she had previously chosen and the similar puppet simply happened to be in that vicinity. Although the Assign condition largely controlled for this possibility, we further accounted for it by measuring looking times during the familiarization trials. We found that toddlers attended similarly to both

puppets during both familiarization and test trials and across both conditions. Thus, toddlers' propensity to interact with and match toy choices of the similar puppet in the Choose condition was not a function of longer looking to that puppet or the puppet's toy choice. The fact that attention did not differ between conditions speaks to the underlying mechanism of toddlers' behavior and negates the possibility that attentional mechanisms drove toddlers' actions in this research. Instead, we suggest that children recognized that the puppets' actions shared the same relational goal (i.e., relation between agent and specific goal object) as their own actions during familiarization (see Gerson, 2014) and that they acted on this relational comparison between their own actions and those of the puppets.

The finding that children prefer to interact with others who previously made similar action choices as themselves is consistent with a large literature suggesting that both humans and nonhuman primates prefer others who act like themselves, whether when producing instrumental actions or making intransitive movements. Mimicry, the automatic mirroring of others' movements, leads to increased preference for and trust of the person doing the mimicking (in the person being mimicked; Lakin, Jefferis, Cheng, & Chartrand, 2003). Although these effects have not been greatly studied in developmental populations (but see Meltzoff, 2007; van Schaik, van Baaren, Bekkering, & Hunnius, 2013), similar effects of preference for individuals who mimicked one's actions were found in rhesus macaques (Paukner, Suomi, Visalberghi, & Ferrari, 2009), suggesting that preference for similarly acting others is a widespread mechanism in primates.

### LIMITATIONS OF THE CURRENT STUDY

The lack of significant difference in toy choice between the two conditions indicates that the different outcomes of toy choice behavior in the two conditions should be interpreted cautiously. One possible reason for this lack of interaction is that the sample sizes were appropriate for testing within condition effects but were too small to detect a difference between conditions in what may be a subtle effect. Despite the small sample sizes, significant differences between conditions were still evident in toddlers' preference to interact with a particular puppet.

One possibility for a lower-level alternative account that must be ruled out is the simple difference in number of experimenters present between the two conditions. In the Assign condition, a second experimenter sat silently throughout the experiment except when asked a question. Perhaps toddlers' attention to or interpretation of the events differed due to the presence of this second experimenter. The lack of difference in attention to the ongoing events across conditions suggests that the second experimenter's presence did not influence children's attention to the events. Still, it is possible that their actions differed based on the presence of this experimenter, but there is no strong theoretical or observable explanation for this possibility.

In the present study, there is no direct evidence that toddlers perceived the puppet's actions as reflective of their internal states. That is, the toddlers could have recognized that the puppets were acting on their preferences or they could have simply recognized the similarity between their own actions and those of the puppet without assigning mentalistic labels to the actions. Whether or not their interpretation of the puppets' behavior was mentalistic, the lack of effect observed in the Assign condition and the

similar attentional patterns across conditions indicates that toddlers' actions (i.e., toy choice and interaction preference) in the Choose condition were based on the identification of the similarity between goal relations (i.e., a behavioral analysis of the action choices) rather than an association between the puppets and particular toys or the saliency of the actions. Interestingly, toddlers' actions in the toy choice test trials occurred in the absence of the puppets, suggesting that children were not acting based on affiliative motivations and instead were perhaps acting based on the knowledge that they would be more likely to prefer a toy chosen by a similar puppet (i.e., motivation to play with what they might perceive as the "better" toy on an individual level).

### FUTURE DIRECTIONS

This research is the first to directly show that young toddlers can use information about another individual's actions in relation to the self to recognize them as similar to themselves and apply this knowledge in relevant novel contexts (i.e., to make future action choices). The present data focused on toddlers' identification of individuals they observed producing similar or dissimilar action tendencies as themselves. Whether these findings relate to toddlers' identification of in-group vs. out-group members of groups is currently unknown but could have implications for social development more generally. The fact that toddlers preferred to interact with a puppet that chose the same toys as them is consistent with research indicating preferences for in-group members in infants and young children (Cvencek, Greenwald, & Meltzoff, 2016; Dunham, Baron, & Banaji, 2008), but whether identification of a similar individual follows a similar developmental trajectory as identification of in-group membership is an important question for future research. It is possible, for example, that the comparison processes evidenced in the current research interact with or work in conjunction with, for example, recognition of perceptual similarities and motivational or attentional factors that influence group membership identification throughout the development.

Future research is needed to identify the breadth and constraints associated with this process. What role does the contrastive nature of the similar vs. dissimilar other play? Do toddlers adaptively constrain the behavioral influence of the similar other to relevant domains or does this extend to other domains, such as food (see Fawcett & Markson, 2010 for discussion)? Would toddlers rely more so on the similar other to teach them novel actions that might have cultural relevance, as would be expected if the other were truly considered an in-group member (see Howard et al., 2014 for discussion)? Uncovering the answers to these important questions will allow us to better understand the origins of children's recognizing others as "like them" and delve deeper into the question of how and when they learn from similar others.

### ACKNOWLEDGMENTS

We would like to extend our gratitude to Angela Khadar, Birgit Knudsen, Celeste Peereboom, Marlene Meyer, Denise Janssen, Renske van der Crujisen, Gleb Dobrovolskiy, and other members of the Nijmegen Baby Research Center for their help with data collection, coding, and thought-provoking discussions. We are especially grateful



to the parents and children who participated in this study. This work was funded by a Brain-and-Cognition-Excellence-Grant from NWO (433-09-253) and a TOP-research grant from NWO (407-11-040).

## REFERENCES

- Amano, S., Kezuka, E., & Yamamoto, A. (2004). Infant shifting attention from an adult's face to an adult's hand: A precursor of joint attention. *Infant Behavior and Development*, *27*, 64–80.
- Barresi, J., & Moore, C. (1996). Intentional relations and social understanding. *Behavioral and Brain Sciences*, *19*, 107–154.
- Bartsch, K., Wade, C. E., & Estes, D. (2011). Children's Attention to Others Beliefs during Persuasion: Improvised and selected arguments to puppets and people. *Social Development*, *20*, 316–333.
- Buttelmann, D., Zmyj, N., Daum, M., & Carpenter, M. (2013). Selective imitation of in-group over out-group members in 14-month-old infants. *Child Development*, *84*, 422–428.
- Cvencek, D., Greenwald, A. G., & Meltzoff, A. N. (2016). Implicit measures for preschool children confirm self-esteem's role in maintaining a balanced identity. *Journal of Experimental Social Psychology*, *62*, 50–57.
- Dunham, Y., Baron, A. S., & Banaji, M. R. (2008). The development of implicit intergroup cognition. *Trends in Cognitive Sciences*, *12*, 248–253.
- ELAN (2013). *Max Planck Institute for Psycholinguistics*. Nijmegen, The Netherlands: The Language Archive. <http://tla.mpi.nl/tools/tla-tools/elan/>
- Fawcett, C. A., & Markson, L. (2010). Children reason about shared preferences. *Developmental Psychology*, *46*, 299–309.
- Gerson, S. A. (2014). Sharing and comparing: How comparing shared goals broadens goal understanding in development. *Child Development Perspectives*, *8*, 24–29.
- Gerson, S. A., & Woodward, A. (2012). A claw is like my hand: Comparison supports goal analysis in infants. *Cognition*, *122*, 181–192.
- Hamlin, J. K., Hallinan, E. V., & Woodward, A. L. (2008). Do as I do: 7-month-old infants selectively reproduce others' goals. *Developmental Science*, *11*, 487–494.
- Hamlin, J. K., & Wynn, K. (2012). Who knows what's good to eat? Infants fail to match the food preferences of antisocial others. *Cognitive Development*, *27*, 227–239.
- Howard, L., Henderson, A. M. E., Carrazza, C., & Woodward, A. L. (2014). Infants' and young children's imitation of linguistic ingroup and outgroup informants. *Child Development*, *86*, 259–275. doi: 10.1111/cdep.12056.
- Kauffman, J. M., Kneeder, R. D., Gamache, R., Hallahan, D. P., & Ball, D. W. (1977). Effects of imitation and nonimitation on children's subsequent imitative behavior. *The Journal of Genetic Psychology*, *130*, 285–293.
- Kinzler, K. D., Dupoux, E., & Spelke, E. S. (2007). The native language of social cognition. *Proceedings of the National Academy of Sciences*, *104*, 12577–12580.
- Kinzler, K. D., Shutts, K., DeJesus, J., & Spelke, E. S. (2009). Accent trumps race in guiding children's social preferences. *Social Cognition*, *27*, 623–634.
- Lakin, J. L., Jefferis, V. E., Cheng, C. M., & Chartrand, T. L. (2003). The chameleon effect as social glue: Evidence for the evolutionary significance of nonconscious mimicry. *Journal of Nonverbal Behavior*, *27*, 145–162.
- Mahajan, N., & Wynn, K. (2012). Origins of “us” versus “them”: Prelinguistic infants prefer similar others. *Cognition*, *124*, 227–233.
- Meltzoff, A. N. (2005). Imitation and other minds: The “like me” hypothesis. *Perspectives on Imitation: From Neuroscience to Social Science*, *2*, 55–77.
- Meltzoff, A. N. (2007). The ‘like me’ framework for recognizing and becoming an intentional agent. *Acta Psychologica*, *124*, 26–43.
- Paukner, A., Suomi, S. J., Visalberghi, E., & Ferrari, P. F. (2009). Capuchin monkeys display affiliation toward humans who imitate them. *Science*, *325*, 880–883.
- Rakoczy, H., Warneken, F., & Tomasello, M. (2008). The sources of normativity: Young children's awareness of the normative structure of games. *Developmental Psychology*, *44*, 875–881.
- Repacholi, B. M., & Gopnik, A. (1997). Early reasoning about desires: Evidence from 14- and 18-month-olds. *Developmental Psychology*, *33*, 12–21.

- van Schaik, J. E., van Baaren, R., Bekkering, H., & Hunnius, S. (2013). Evidence for nonconscious behavior-copying in young children. In M. Knauff, M. Pauen, N. Sebanz, & I. Wachsmuth (Eds.), *Proceedings of the 35th annual conference of the cognitive science society* (pp. 1516–1521). Austin, TX: Cognitive Science Society.
- Shutts, K., Banaji, M. R., & Spelke, E. S. (2010). Social categories guide young children's preferences for novel objects. *Developmental Science, 13*, 599–610.
- Shutts, K., Kinzler, K. D., McKee, C. B., & Spelke, E. S. (2009). Social information guides infants' selection of foods. *Journal of Cognition and Development, 10*, 1–17.
- Thelen, M. H., Dollinger, S. J., & Roberts, M. C. (1975). On being imitated: Its effects on attraction and reciprocal imitation. *Journal of Personality and Social Psychology, 31*, 467–472.
- Thelen, M. H., Frautschi, N. M., Roberts, M. C., Kirkland, K. D., & Dollinger, S. J. (1981). Being imitated, conformity, and social influence: An integrative review. *Journal of Research in Personality, 15*, 403–426.
- Thoermer, C., Woodward, A. L., Sodian, B., Perst, H., & Kristen, S. (2013). To get the grasp: Seven-month-olds encode and selectively reproduce goal-directed grasping. *Journal of Experimental Child Psychology, 116*, 499–509.
- Wittenburg, P., Brugman, H., Russel, A., Klassmann, A., & Sloetjes, H. (2006). ELAN: A professional framework for multimodality research. Proceedings of LREC 2006, Fifth International Conference on Language Resources and Evaluation. Genoa, Italy.
- Wolff, N., Kemter, K., Schweinberger, S. R., & Wiese, H. (2014). What drives social in-group biases in face recognition memory? ERP evidence from the own-gender bias. *Social Cognitive and Affective Neuroscience, 9*, 580–590.
- Woodward, A. L., Sommerville, J. A., Gerson, S., Henderson, A. M. E., & Buresh, J. S. (2009). The emergence of intention attribution in infancy. In B. Ross (Ed.), *The psychology of learning and motivation*. Vol. 51 (pp. 187–222). Waltham, MA: Academic Press.