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# Investigating motionese: The effect of infant-directed action on infants' attention and object exploration

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### ABSTRACT

Adults modify their communication when interacting with infants, and these modifications have been tied to infant attention. However, the effect infant-directed action on infant behavior is understudied. This study examined whether infant-directed action affects infants, specifically their attention to and exploratory behaviors with objects. Forty-eight 8- to 10-month-old infants and their caregivers participated in a laboratory session during which caregivers demonstrated objects to infants using infant-directed action. Results indicated that variation in amplitude and repetition were tied to differences in infant attention, and varying levels of repetition were tied to differences in object exploration.

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## 1. Introduction

In many cultures around the world (though not all; [Ochs & Schieffelin, 1995](#); [Pye, 1992](#)), adults and older children speak to infants differently than they do to peers ([Newport, 1977](#)). Specifically, speech to infants is characterized by high pitch, short utterance length, exaggerated intonation contours, content simplification, and limitation to shared experiences (e.g., [Snow, 1991](#); [Stern, Spieker, & MacKain, 1982](#)).

Infant-directed communication has also been described in the manual modality. Signs used with infants by signing caregivers are typically slow and involve high levels of repetition and exaggerated movements ([Masataka, 1992](#)). These characteristics are strikingly similar to those observed in infant-directed speech and it suggests that infant-directed communication is not modality specific ([Masataka, 1996](#)).

In addition to speech and sign, caregivers also modify the gestures they produce with infants. [Iverson, Capirci, Longobardi, and Caselli \(1999\)](#) found that when mothers were interacting with infants, relative to other adults, they used gestures less frequently, and when gestures were used, they were more likely to co-occur with speech and to reinforce rather than supplement the content expressed in speech.

Numerous studies also indicate that caregiver modifications of this sort influence infants' attention to the communicative input. For example, as early as 1 month of age, infants prefer infant-directed to adult-directed speech (e.g., [Cooper, Abraham, Berman, & Staska, 1997](#); [Fernald, 1985](#)); and infants' attention to a visual display is enhanced in the presence of infant-directed vs. adult-directed speech ([Werker, Pegg, & McLeod, 1994](#)). Similar results have been obtained for sign language, with longer times accruing for infant-directed relative to adult-directed signs, both for deaf infants and for hearing infants with no previous exposure to sign language ([Masataka, 1996, 1998](#)). While the specific features of infant-directed communication that capture infants' attention have yet to be identified, there is general agreement that the exaggerated properties of infant-

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directed speech (e.g., wide pitch variations) and sign (e.g., slow, large, repeated movements) are maximally likely to capture infants' attention (e.g., Masataka, 1996, 1998).

### 1.1. A new form of infant-directed communication: motionese

Recently, evidence for caregiver modification has been provided for a new domain: infant-directed action. Brand, Baldwin, and Ashburn (2002) investigated the properties of actions produced by 51 caregivers engaged in communication with either their own infant or a familiar adult. Caregivers were given five novel objects with instructions describing how each worked. They were then asked to interact with their partner (infant or adult) with each of these objects.

Results indicated that caregivers modified object-related actions when interacting with infants. The authors termed these modified actions "motionese" and identified six action parameters that differed significantly when the communicative partner was an infant. Relative to adult-directed action, infant-directed action occurred in closer proximity to the partner, involved higher interactiveness, more enthusiasm and more repetition, was simpler, and had increased amplitude of movement.

In interpreting their results, Brand and colleagues (2002, 2007) have speculated that motionese may enhance infants' attention to action and help infants understand structure in action. Brand and Shallcross (2008) addressed this possibility in a study of infants' visual preferences for infant-directed vs. adult-directed action. Their results indicated that both 6–8 and 11–13-month-old infants prefer infant-directed to adult-directed action, even when faces were obscured. While these results highlight infants' visual preference for infant-directed action, it is unclear whether the individual parameters of motionese play varying roles in infant attention.

Motionese may also influence infants in other ways. Adults' object-related actions with infants are just that, object-related. It stands to reason, therefore, that motionese may also influence infant attention to the objects upon which the caregiver is acting. Infants might attend longer to objects presented via motionese and/or they might be more likely to attend to certain object properties rather than to others. Since object properties are known to impact infants' manipulation of objects (e.g., Lockman & McHale, 1989; Ruff, 1984), variations in infant attention to objects as a function of caregivers' manipulation of the objects in the context of motionese may also influence infants' subsequent object manipulation.

While infant preference for motionese to adult-directed action has been documented (Brand & Shallcross, 2008), the role of individual parameters of motionese on infant attention is unclear. Further, no published work has addressed the role of infant-directed action in infants' object exploration. Therefore, the goals of the present study are twofold: (a) to examine infant attention to motionese and explore whether attention varies in relation to the number of action parameters modified; and (b) to assess the impact of motionese on infants' subsequent exploration of objects manipulated by caregivers in the context of motionese displays. In the present study, infants viewed a set of objects manipulated by caregivers with simple actions containing enhanced or low amplitude and/or repetition. Looking to these displays was compared to looking in trials in which objects were held still in front of the infants. Infants' subsequent exploration and manipulation of objects following motionese displays was coded to determine whether variations in aspects of motionese influenced ways in which infants engaged with the objects.

## 2. Methods

### 2.1. Participants

Forty-eight typically developing, healthy 8- to 10-month-old infants ( $M = 9$  months, 13 days, range = 8 months, 3 days–10 months, 28 days) and their primary caregivers participated in the study. This age range was chosen because motionese has been documented in mothers of infants in surrounding age ranges (e.g., Brand et al., 2002; Brand, Shallcross, Sabatos, and Massie, 2007), and it also coincides with the ages during which exploratory object behaviors peak in infants (e.g., Doolittle & Ruff, 1998; Thelen, 1979). Participants were recruited from a large, mid-Atlantic city and surrounding communities. Twenty-four boys and 24 girls participated in the study; all were from English-speaking households. Thirty-nine infants and 40 caregivers were Caucasian, three infants and three caregivers were Asian, two infants and two caregivers were African-American, one caregiver was Hispanic, and four infants and two caregivers reported multiple ethnicities. Of the 48 caregivers who participated in this study, 44 were mothers ( $M$  age = 31.11, range = 21–42) and four were fathers ( $M$  age = 31.25, range = 28–35). The caregivers in this sample were well educated, with 42 completing a degree at a 4-year college or beyond. Four additional caregivers had completed some college, and two had completed high school. Data from an additional three dyads were excluded due to infant fussiness (2) and experimenter error (1).

### 2.2. Procedure

Infants and primary caregivers visited the laboratory for one session lasting approximately 30 min. Infants, who were seated in a high chair, and primary caregivers, who sat opposite to and facing the infants, interacted with separate video cameras focused on each participant. The two cameras fed into a screen splitter for later coding. A combination television/DVD player was positioned directly behind and slightly above the high chair for viewing by the caregiver.

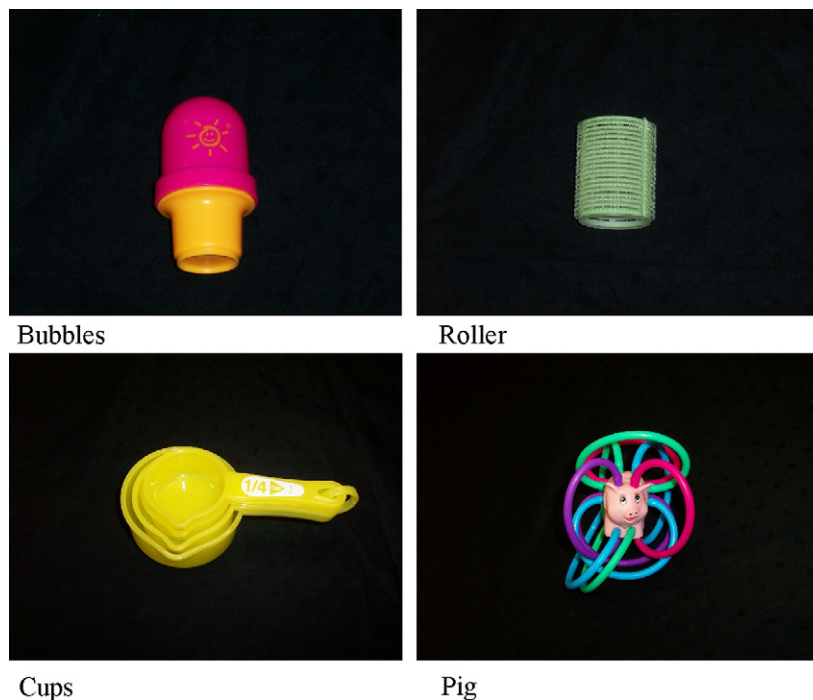


Fig. 1. Warm-up objects.

### 2.2.1. Warm-up

At the beginning of the session, primary caregivers were informed that the goal of the study was to investigate infants' learning about objects. All dyads experienced the same warm-up period regardless of Movement Training condition assignment (see below). In this phase, primary caregivers were asked to interact with their babies with unfamiliar objects (Brand et al., 2002). They were given four such objects (see Fig. 1), one at a time, and were asked to interact with their infants with the object for 45 s as they would with any toy at home. They were given no further guidance or restrictions in terms of what types of actions to use with the objects.

### 2.2.2. Movement Training

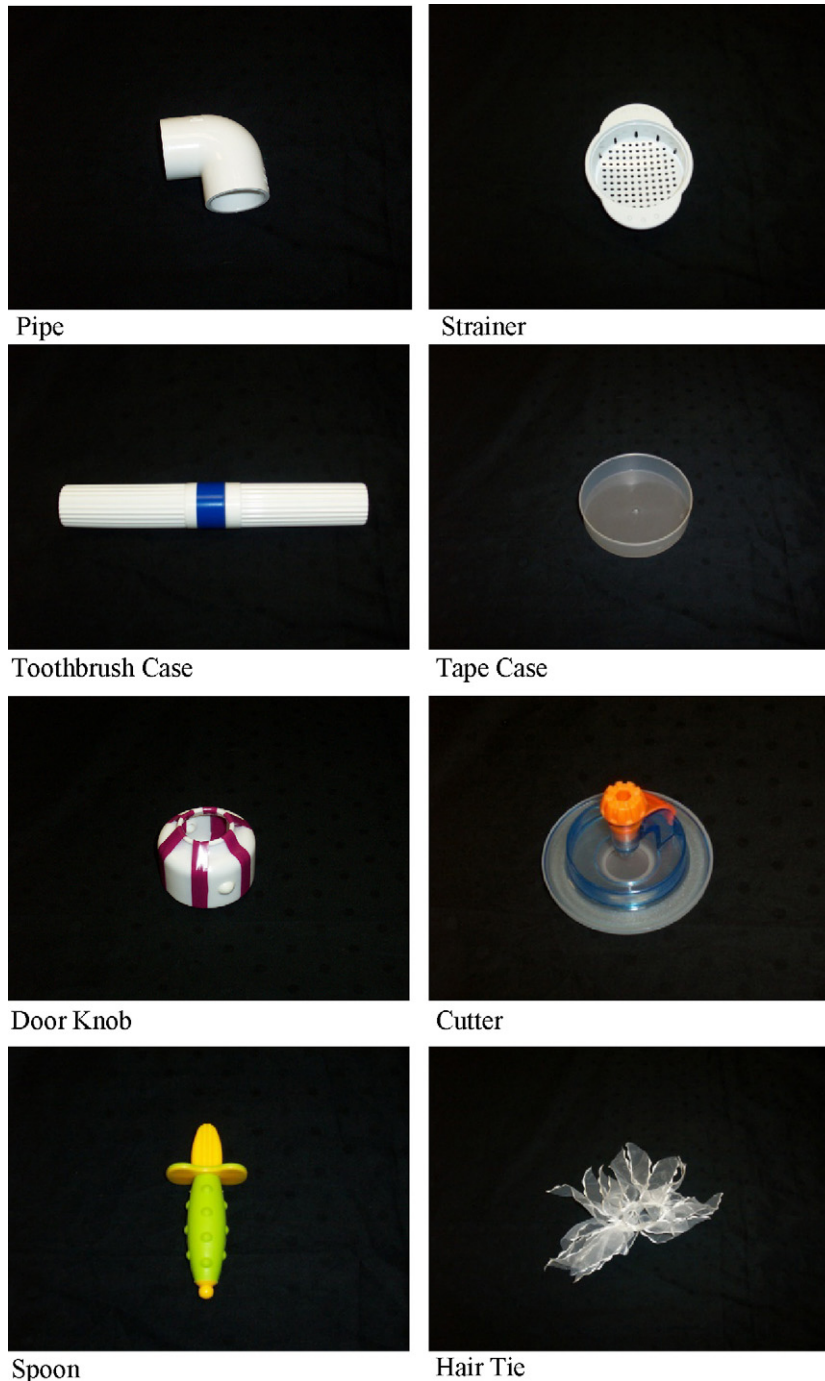
In the Movement Training phase, four different movement conditions were created by varying the two primary action parameters under investigation, amplitude and repetition, along two dimensions as follows: high amplitude/high repetition (HiAmp/HiRep), low amplitude/high repetition (LoAmp/HiRep), high amplitude/low repetition (HiAmp/LoRep), or low amplitude/Low Repetition (LoAmp/LoRep). Amplitude and repetition were chosen as action parameters for this study because they were among the parameters for which Brand et al. (2002) reported significant differences between infant-directed and adult-directed action.

Each condition had a corresponding DVD with a short video of an adult female demonstrating the target movement. Dyads were assigned to one of the four conditions prior to arrival at the laboratory. Condition assignment was randomly determined with the constraint that there were equal numbers of boys and girls in each group.

The target movement demonstrated in the HiAmp/HiRep Group consisted of a large up and down movement, stretching from the caregiver's waist to eye level, repeated three additional times for a total of four movements. The LoAmp/HiRep Group exhibited a small up and down movement, stretching from chest to chin. This movement also was repeated three times. Caregivers in the HiAmp/LoRep Group demonstrated a large up and down movement, also from waist to eye, but it was not repeated. Finally, the LoAmp/LoRep Group displayed a small movement from chest to chin that was also not repeated.

To ensure that infants in each group were exposed to target movements for equal amounts of time, movement speed was varied as it was impossible given the study design to investigate either amplitude or repetition without varying speed. Rates for the HiAmp/HiRep, LoAmp/HiRep, HiAmp/LoRep, and LoAmp/LoRep Groups were fast, medium-fast, medium-slow, and slow, respectively. Since Brand et al. (2002) did not find significant differences in rate of movement in infant- vs. adult-directed action, speed was not a primary parameter of interest in this study.

The Movement Training phase consisted of eight trials, each with a different novel object (see Fig. 2). Order of object presentation was determined prior to testing. Six different random assignments of objects to movement (presented with a target movement) or still (held in a static position) trials were created with the constraint that each object appeared in an equal number of movement or still trials. Each of these six object presentation orders was used twice in each group, with the object's trial assignment reversing from movement to still or vice versa in the second use of the order. This resulted in



**Fig. 2.** Movement Training objects.

a total of 12 object presentation orders. Infants in each group were randomly assigned to one of these presentation orders, and the 12 orders were repeated across conditions.

Caregivers were given a set of instructions prior to the beginning of the Movement Training phase, and these were repeated before beginning each trial. First, they were asked to get the infant's attention by calling his/her name. Second, they were asked to mimic exactly the experimenter's movements displayed on the television screen, resulting in a 5 s demonstration. An experimenter monitored caregivers' actions to ensure they mimicked those depicted in the video. Third, they were asked to refrain from speaking while copying the movement on the screen to diminish any potentially confounding influence of speech on the trial, but they were encouraged to smile at the infant. After the 5 s movement display was completed, caregivers



were instructed to pass the toy to the infant and the infant was allowed to interact with the toy for 30 s. Caregivers were additionally asked to refrain from labeling the object during this time.

The four movement trials alternated with four still trials. Still trials followed the same time sequence as the movement trials, with a 5 s demonstration period during which the caregiver held the object in a static position in front of the infant with no movement. Upon completion of the 5 s display, caregivers then gave the object to the infant for 30 s. Still trials were identical to movement trials except that the object demonstration involved no movement.

### 2.3. Coding

Seven primary observers who were blind to the study's purpose and hypotheses completed the coding for this study. Coders identified behaviors during the movement demonstration and the 30 s play period in the Movement Training phase. During the caregiver object presentation, coders identified infant looks to the demonstration. During the 30 s play period, coders identified instances of infant looks to objects, mouthing of objects, banging and shaking objects (rapid, rhythmic arm movement with an object in hand, contacting a surface in a bang and no surface contact for a shake; Thelen, 1979), and turning or rotating objects (turning the object over in the hands while simultaneously looking directly at it; e.g., Ruff, 1984). Inspection of the data revealed similar patterns for banging and shaking movements. As there were relatively few shakes, and banging and shaking movements are similar in movement and execution (Thelen, 1979), they were grouped together for purposes of analysis (Bang/Shake). Coders noted the onset and offset of all behaviors using a time-linked, computer-based video interface system (The Observer Video-Pro, Noldus Information Technologies).

Intercoder reliability was computed for a subset (13%) of the data. Mean percent agreement for looks to object demonstrations was 96% (range = 88–100%). Intercoder agreement was 92% (range = 81–98%) for identifying looks to objects; 84% (range = 70–97%) for identifying instances of object manipulation; and 99% (range = 95–100%) for classifying object manipulation behaviors by type during the 30 s play period following the demonstration. Disagreements were resolved through discussion, and if a resolution was not reached, the first author decided on the appropriate code.

## 3. Results

This study was exploratory in nature and was primarily designed to assess the effects of motionese on the infant. The goals of the study were to examine infant attention to motionese and potential variation in relation to the number of action parameters modified and to assess the impact of motionese on infants' object exploration behaviors following motionese displays. Data relevant to each of these goals are presented in turn.

### 3.1. Does motionese affect infant attention?

The first aim of the study was to ask whether infants differentially attend to motionese. Specifically, do infants exposed to displays containing at least one enhanced action parameter (i.e., HiAmp/Hi Rep, HiAmp/LoRep and LoAmp/HiRep) exhibit greater differential looking to movement vs. still displays than infants who saw only low levels of both parameters (LoAmp/LoRep)?

This aim was addressed by examining data on infant looking time during caregiver demonstrations. To control for small variations in demonstration length, data were converted to looking time as a proportion of demonstration length. These proportions were calculated separately for movement and still trials by dividing the total amount of time infants spent looking at a demonstration by the total length of the demonstration. Difference scores were then calculated by subtracting the percent of demonstration spent looking to still displays from the percent of demonstration spent looking at movement displays. These data are presented in Fig. 3.

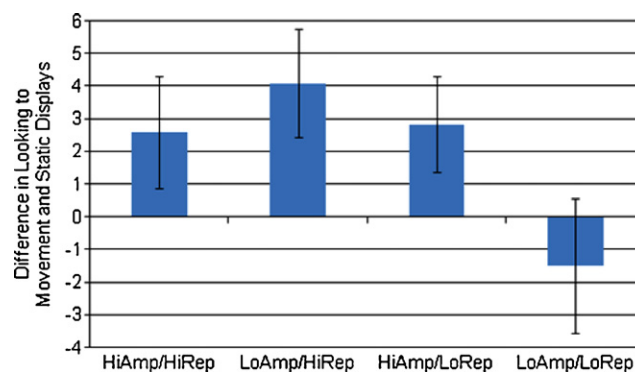


Fig. 3. Difference in looking to target and distracter objects.

As is evident in the figure, for infants in conditions with an enhanced action parameter (HiAmp/HiRep, LoAmp/HiRep, and HiAmp/LoRep), the difference scores for looking time to the demonstration were positive and relatively similar, indicating that these infants spent relatively larger percentages of time looking at movement rather than still displays (HiAmp/HiRep  $M = 2.58$ ,  $SD = 6.01$ ; LoAmp/HiRep  $M = 4.08$ ,  $SD = 5.73$ ; HiAmp/LoRep  $M = 2.83$ ,  $SD = 5.10$ ). In contrast, infants who saw a movement with no enhanced level of either motionese parameter (LoAmp/LoRep) demonstrated the opposite pattern. The mean difference scores for these infants were negative, indicating shorter percentages of time spent looking at movement than still displays ( $M = -1.5$ ,  $SD = 7.12$ ).

Simple effects analyses confirmed that the difference scores for infants in the LoAmp/LoRep Group were significantly lower than those of infants in all other groups,  $p = .028$  (all other comparisons were not significant, all  $ps > .05$ ). Thus, consistent with our prediction, the three groups of infants exposed to motionese displays containing at least one modified action parameter preferred motionese to a static display, and there was no indication that motionese containing two modified action parameters (i.e., HighAmp/HighRep) was more effective in capturing infants' attention than that containing only one parameter modification (i.e., HighAmp/LoRep and LoAmp/HighRep). In addition, although the LoAmp/LoRep display involved limited movement, infants in this condition did not exhibit this preference and instead looked longer at the still display.

### 3.2. Does motionese influence infant object exploration?

A second goal of this study was to determine whether exposure to motionese impacts infants' subsequent exploration of caregiver-manipulated objects. To address this issue, we coded infants' exploratory behaviors (looking at the object, mouthing, turning/rotating, and banging/shaking objects) during the 30 s play period following the caregiver's movement demonstration. We then computed the total duration (in seconds) of each of these behaviors separately by calculating the total time engaged in a given behavior (e.g., looking at object) on each movement trial and summing these across the four movement trials. Thus, only behaviors produced following motionese displays were included in this analysis. Visual inspection of the data for each of these variables revealed similar patterns of behavior in the two high amplitude and the two low amplitude conditions. A series of one-way ANOVAs confirmed that there were no differences between high and low amplitude groups for any manipulation type (looking  $F(1,46) = .0001$ ,  $p = .988$ ; mouthing  $F(1,46) = .564$ ,  $p = .456$ ; turn/rotate  $F(1,46) = .915$ ,  $p = .344$ ; bang/shake  $F(1,46) = 1.977$ ,  $p = .166$ ). Therefore, data were collapsed across the two amplitude conditions for all subsequent analyses, yielding two groups of infants: High Repetition and Low Repetition.

We first examined infants' overall engagement with target objects by analyzing total durations of looking and mouthing. Variation in repetition did not influence overall object engagement: the total durations of looking and mouthing were highly similar and did not differ statistically across the two groups (for looking, High Repetition  $M = 97.08$ ,  $SD = 15.43$ ; Low Repetition  $M = 97.06$ ,  $SD = 17.25$ ; for mouthing, High Repetition  $M = 17.79$ ,  $SD = 17.50$ ; Low Repetition  $M = 19.34$ ,  $SD = 13.72$ ).

We next explored whether more fine-grained object manipulation differed across infants in the two groups by examining total durations of turn/rotate and bang/shake behaviors. These data are presented in Fig. 4. As is evident, infants in the Low Repetition group spent more time engaged in turn/rotate ( $M = 3.894$ ,  $SD = 3.69$ ) than did infants in the High Repetition group ( $M = 1.335$ ,  $SD = 2.39$ ). Conversely, infants in the High Repetition group spent more time executing bang/shakes ( $M = 3.991$ ,  $SD = 5.09$ ) than did infants in the Low Repetition group ( $M = 1.134$ ,  $SD = 1.96$ ).

A 2 (repetition group)  $\times$  2 (manipulation type: turn/rotate, bang/shake) repeated measures ANOVA was carried out on these data. The main effects of repetition group and manipulation type were not significant, but the repetition group  $\times$  manipulation type interaction was highly significant,  $F(46) = 15.344$ ,  $p < .001$ . Follow-up  $t$ -tests confirmed that infants in the Low Repetition group spent significantly more time turning/rotating objects than did infants in the High Repetition group,  $t(46) = -2.850$ ,  $p = .007$ , while infants in the High Repetition group spent significantly more time banging/shaking objects than did infants in the Low Repetition group,  $t(46) = 2.568$ ,  $p = .014$ .

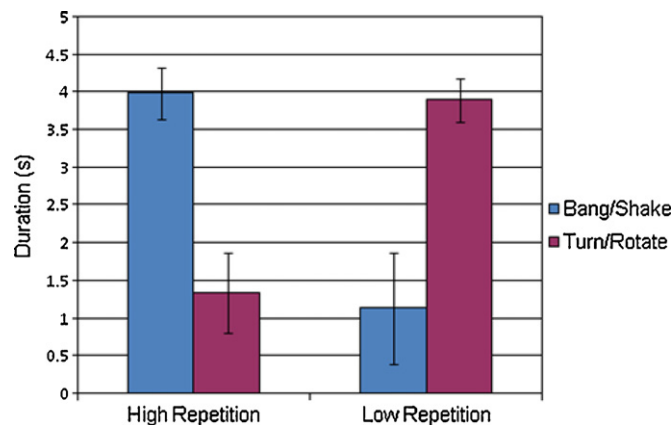


Fig. 4. Duration of bang/shake and turn/rotate.

These group-level patterns were also apparent in the performance of individual infants. Eleven of the 14 infants in the High Repetition group who engaged in at least one type of fine-grained object manipulation executed longer bang/shakes than turn/rotates, and 16 of the 20 infants in the Low Repetition group who engaged in fine-grained manipulations executed longer turn/rotates than bang/shakes, a difference that was statistically significant,  $\chi^2(1) = 11.459, p < .001$ .

#### 4. Discussion

This research was designed to examine a relatively unexplored component of infant-directed communication: infant-directed action, or “motionese.” Previous work has indicated that infants exhibit enhanced attention to infant-directed communication (e.g., Brand & Shallcross, 2008; Cooper et al., 1997; Masataka, 1998). Because it is unclear whether (1) infants attend differentially to individual parameters of motionese; and (2) whether motionese influences infant object manipulation, we examined 8- to 10-month-old infants' attention to motionese displays and subsequent manipulation of objects incorporated in these displays.

Results indicated that infants preferred movements with at least one enhanced action parameter (motionese) to no movement. In addition, patterns of infant object exploration were influenced by variation in repetition in previously viewed motionese displays. We consider each of these findings in turn.

##### 4.1. Infants attend to motionese

In light of the well-documented finding of infants' preference for infant-directed communication (e.g., Brand & Shallcross, 2008; Fernald, 1985; Masataka, 1998), our first question was whether infants would exhibit enhanced attention to action containing motionese than to no movement. Results from a comparison of infants exposed to displays with varying parameters of motionese confirmed our prediction, indicating that, in general, infants looked longer at movement displays with at least one modified action parameter than at static displays. However, infants exposed to movements with low levels of motionese parameters (LoAmp/LoRep group) did not show a preference for these movements over static displays. Thus, our findings confirm those of Brand and Shallcross (2008), suggesting that infants do appear to attend preferentially to motionese.

Interestingly, however, enhanced amplitude and enhanced repetition appeared to have relatively comparable effects on infant attention. When infants were exposed to at least one high level of either amplitude or repetition, they attended longer to that movement than to the static display. Moreover, movement with two enhanced parameters (HiAmp/HiRep) did not appear to be more effective in capturing infant attention than were movements with a single enhanced action parameter. While this result suggests that the effects of motionese may not be additive, further work is needed to examine the parameters of motionese identified by Brand et al. (2002) and determine their relative contributions to infant attention.

##### 4.2. Motionese influences fine-tuned object exploration

The second question addressed in this study was whether variation in motionese influences infant behavior with objects. Our findings suggest that variation in the repetition component of caregivers' movements played a role in infants' subsequent exploratory behaviors. While infants in both Repetition conditions did not differ in global examining behaviors (looking at and mouthing objects), there were substantial differences in time spent engaged in specific fine-grained manipulatory behaviors. Thus, infants exposed to movements with higher levels of repetition engaged in longer bangs and shakes than did infants exposed to lower levels of repetition. Conversely, exposure to low levels of repetition led to infants spending more time turning and rotating objects relative to infants who saw high levels of repetition.

Why might varying levels of repetition influence infant object exploration? With regard to the link between high repetition and banging and shaking behaviors, more extended banging/shaking of target objects may reflect infants' attempts to imitate the movement displayed by caregivers. The banging and shaking movements produced by the infants are similar in form to the high repetition movements displayed by caregivers, and the infants in our study were of an age (8–10 months) for which imitation has been documented in other studies (e.g., Legerstee & Markova, 2008). Thus, it may be that during motionese trials, infants in the high repetition condition focused their attention on the caregiver's movement, and when subsequently given the opportunity to play with the object, tried to recreate the *movement* themselves.

In contrast, infants who saw Low Repetition movements may have been attracted to and eager to examine the *objects* being moved. Indeed, once able to explore the object independently, these infants engaged in behaviors characteristic of examining (Doolittle & Ruff, 1998). These infants were able to glean information from the object both via tactile (touching objects with the hands) and visual (looking directly at an object) feedback.

#### 5. Conclusion

In sum, our findings support the notion that motionese is similar to other forms of infant-directed communication. Motionese appears to influence infant attention, and it is also linked to variation in infant object exploration. This link to object exploration may also have implications for learning about objects. Indeed, Brand and colleagues (2002, 2007, 2008) have hypothesized links between motionese and learning, and Ruff (1984) has argued that object exploration influences

learning. The results of this study represent an initial step in uncovering links between motionese and learning, and additional studies are needed to explore these links in greater depth.

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