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The effect of parent interactions on young infants' visual attention in an object manipulation task.

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THE EFFECT OF PARENT INTERACTIONS ON YOUNG INFANTS' VISUAL ATTENTION IN AN OBJECT MANIPULATION TASK

By

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M.S., Missouri State University, 2015
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ABSTRACT

THE EFFECT OF PARENT INTERACTIONS ON YOUNG INFANTS' VISUAL ATTENTION IN AN OBJECT MANIPULATION TASK

Nonah M. Olesen

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The Sticky Mittens (SM) task, an object-manipulation task that facilitates typically developing pre-reaching infants' learning through active experience with objects, is often utilized to understand how experience affects young infants' learning about objects. SM experience has been shown to increase infants' attention to objects, object engagement, and object exploration (Libertus & Needham, 2010; Needham, Barrett, & Peterman, 2002) and facilitates development of causal perception (Rakison & Krogh, 2012; Holt, 2016). Although the majority of SM studies have involved parents' interacting naturally with their infants, few have focused on how those interactions affect infants' learning and performance during or after SM. Holt (2016) found that infants in an active, no parent encouragement condition (AN) exhibited causal perception following a brief in-lab SM training session, while infants in an active, parent encouragement condition (AE) did not. I hypothesized that parent interaction behaviors in the AE condition disrupted infants' attention to objects and may have negatively impacted infants' learning. In the present study, videos from Holt's (2016) AE and AN conditions were coded to compare the effect of parent interactions on infant attention to objects across conditions. While no significant effects were found on overall measures of infant

attention or parent interactions, infants in the AE condition were more likely to look away from the toys following a parent interaction than were infants in the AN condition, supporting the hypothesis that parents in the encouragement condition distracted their infants during SM training. These findings are an important first step in understanding the role of parent interactions in the SM literature, infant attention, and infant attention to objects and learning.

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INTRODUCTION

As infants develop physically, they are able to interact with their environment and expand their world exponentially. Infants' physical experiences in their environment play an important role in their learning and cognitive development (Piaget, 1964). Some of the earliest emerging physical skills that allow infants to engage with their environment on their own and offer new opportunities for learning are reaching and grasping. The development of reaching and grasping leads to multimodal object exploration (Rochat, 1989) and new opportunities to learn and develop cognitively. Typically, infants begin grasping objects arbitrarily at 2-to 3-months-old; however, they do not begin intentionally reaching for and grasping objects until 5 months of age (Bushnell & Boudreau, 1993; Rochat, 1989; Thelen et al., 1993). This study investigates the underlying mechanisms of learning about objects in pre-reaching infants.

Sticky Mittens and Active Experience

Over the past two decades, researchers have developed a greater interest in the cognitive effects of early reaching, grasping, and object manipulation experience – particularly on pre-reaching infants. Many of these studies have used an experimental paradigm called "sticky mittens" (Needham, Barrett, & Peterman, 2002). Sticky mittens (SM) is a training paradigm in which infants wear Velcro covered mittens while interacting with objects also covered in Velcro. The training provides pre-reaching infants an opportunity to experience reaching, grasping, and object manipulation prior to the typical development of these skills and allows researchers to examine the process of object learning in young infants.

The first SM study was conducted by Needham, Barrett, and Peterman (2002). The researchers were interested in how active experience with reaching and grasping in pre-reaching infants affected infants' object exploration. Pre-reaching 3-month-old infants were divided into two conditions: an experimental SM experience condition and a control condition. Infants in the control condition did not receive any SM experience. Infants in the experimental SM condition participated in daily 10-minute-long parent-led play sessions for 2 weeks. For the first session an experimenter visited the infants' homes to bring them the Velcro-covered toys and mittens and to train the parents in facilitating the SM sessions. At the beginning of the play session parents placed the sticky mittens on their infants' hands. During the play sessions infants were seated on their parents' laps in front of a table with the Velcro-covered toys placed in front of them. Parents were instructed to draw attention to the toys if the infant did not spontaneously swat or reach for the toys and to remove the toys from the mittens and place them back on the table after contact was made. Both the infants in the SM experience condition and infants in the control condition were then brought to the lab for a two-part test trial assessing their looking and reaching behavior and object exploration skills. The first test trial assessed prehension in infants by measuring looking behavior and swatting behavior to Velcro-covered plastic blocks with and without sticky mittens. The second test phase measured object exploration using novel objects. Needham et al. (2002) found that infants in the SM condition looked at objects more and exhibited significantly more intentional swats than did infants in the control condition, who had not received any training.

In an effort to understand the role of *active* versus *passive* SM experience on infants' attention, reaching, and grasping, Libertus and Needham (2010) replicated the two-week, in-home procedure used in Needham et al. (2002) but included both an active and a passive condition. Three-month-old pre-reaching infants were randomly assigned to either the active or passive condition. Infants in the active condition received SM experience as infants did in Needham et al. (2002), while infants in the passive condition wore mittens, but their parent moved the toys around on the table in their field of view. Libertus and Needham (2010) found that infants in the active experience condition exhibited increased reaching, grasping, and visual attention to objects after the training; however, infants in the passive experience condition did not.

These findings were bolstered by a follow-up study conducted one year after infants participated in SM training. In Libertus, Joh, and Needham's (2016) follow-up study, the researchers re-visited the 15-month-old infants who had participated in both active and passive SM training in their previous study (Libertus & Needham, 2010). Researchers compared object exploration and attention measures between infants who had previous active vs. passive experience vs. a control group who had not participated in the previous study and had no SM training. To measure object exploration and attention, infants' visual attention and manual engagement was assessed during an in-lab 5-minute free play task with a set of toys and a separate grasping assessment. Parents also completed the Early Childhood Behavior Questionnaire (ECBQ, Putnam, Gartstein, & Rothbart, 2006)). Libertus et al. (2016) found that infants who had active SM experience at 3-months-old showed more attention to objects, spent less time distracted (e.g., off task), exhibited more grasping activity, spent more time exploring objects, and had higher

Attention Focusing ratings on the ECBQ at 15 months old, compared to infants who had previous passive SM experience. Further, researchers found no difference in these measures between infants who had passive SM experience at 3 months and infants in the control group with no training. Libertus et al. (2016) concluded that early motor experiences directly impact subsequent motor skills, and that early motor experiences influence infants' attention skills into the second year.

Active SM experience, versus passive experience, has also been shown to facilitate causal perception in pre-reaching infants. Infants do not typically develop causal perception, that is, the ability to differentiate a causal event (e.g., one ball rolling into another ball, causing the second ball to move) from a non-causal event (e.g., similar to the causal event, but with a temporal delay or a spatial gap), until at least 6 months of age (e.g., Cohen & Amsel, 1998). Rakison and Krogh (2012) reasoned that SM experience mimics infants' participation with real world causal events. Believing that infants' actions in the world facilitate their perceptual and cognitive development, the researchers hypothesized that having active experience manipulating objects in the SM paradigm might facilitate infants' development of causal perception.

To test their hypothesis, Rakison and Krogh (2012) assessed 4.5-month-old pre-reaching infants' causal perception following a 3-minute in-lab SM session. In this study, infants were divided into an active or a passive condition. In both conditions, infants were seated on a caregiver's lap wearing mittens with balls on a table in front of them. In the active condition, infants wore mittens with Velcro on them and were able to interact with and move around four Velcro-covered balls. In the passive condition, infants still wore mittens; however, the mittens did not have Velcro attached and the balls were glued down and immovable. As a result, infants in the passive condition could move in the same way as infants in the active condition, but they were prevented from causing the balls to move. In both conditions, parents were instructed not to talk or interact with their infant or the experimenter. After the SM session, infants in both conditions participated in a causal perception habituation task. In this task infants were habituated to a causal Michottian launching event and then were shown three test events. The test events included a familiar causal event, a causal switch event, and a non-causal switch event. It was hypothesized that due to their experience with SM, infants in the active condition would look longer to the causal switch event and the non-causal event compared to the familiar event, indicating that these infants perceived the causal nature of the events. Rakison and Krogh (2012) found that infants who had active experience with SM exhibited causal perception in the habituation task. However, infants in the passive mittens condition did not. Their findings supported their hypothesis that infants' early active experience reaching, grasping, and interacting with objects facilitates causal perception.

Sticky Mittens and Parent Interaction

Although the effect of active vs. passive experience on infants' learning about objects is well established in the SM literature, the role of parent behaviors during SM training has received less attention. Understanding the role of parent interactions and whether they help or hinder infants' learning at this developmental stage is critical. Pre-reaching infants are often in the presence of a caregiver. The majority of studies using sticky mittens have involved parents interacting naturally with their infants (Needham et al., 2002; Libertus & Needham, 2010; Sommerville et al., 2005; Libertus et al., 2016), yet

Rakison and Krogh (2012) did not allow parents to talk or interact with their infants during the SM session, and causal perception was still found to be facilitated by the experience. This raises questions about the role of parental interactions in the SM paradigm, with respect to infant learning.

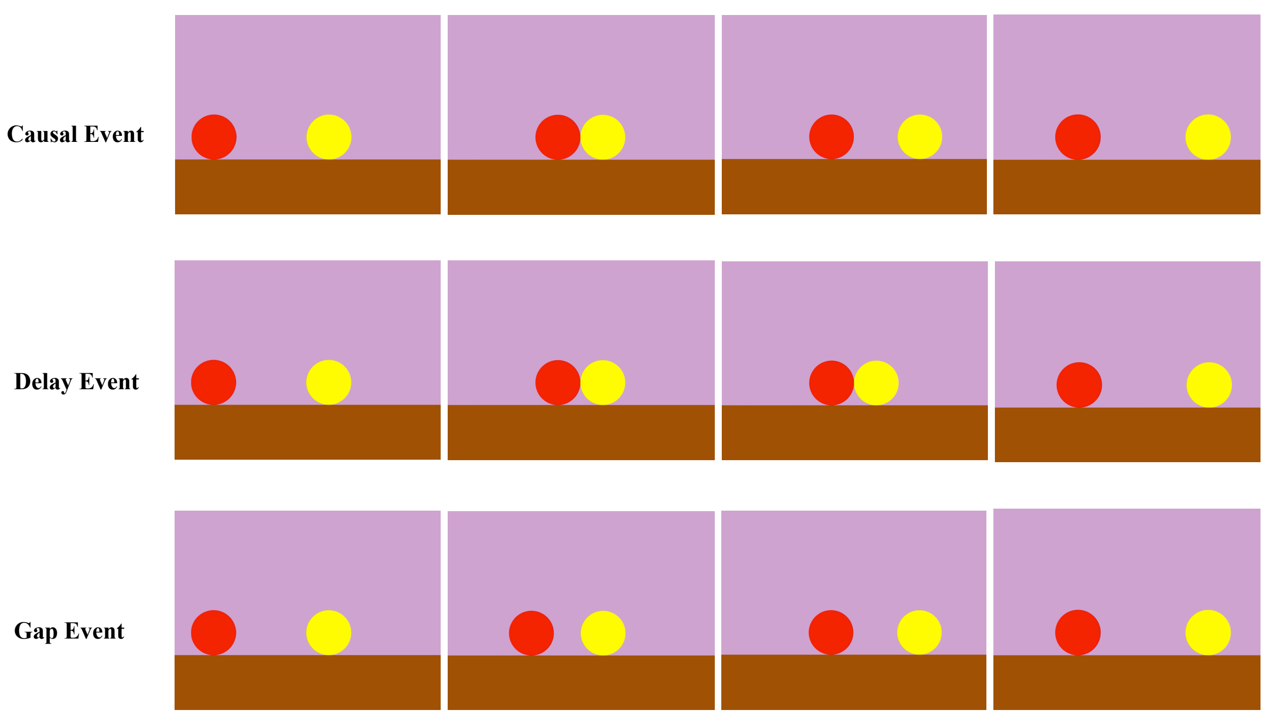
To date, there are two studies that examine the role of parent interaction in the SM literature. The first is a study by Libertus and Needham (2014). The researchers argued that the combination of parental interaction and active SM experience, not active SM experience or parent encouragement alone, led to increased reaching in the 3-month-olds tested in Libertus and Needham's (2010) study. However, this conclusion was based on comparing their 2010 SM results with those of two additional conditions that utilized a different object engagement task (Libertus & Needham, 2014). Thus, it is difficult to make strong conclusions based on these findings.

A second test of parent interaction in the SM paradigm was conducted by Holt (2016). In a follow-up to Rakison and Krogh's (2012) study, Holt tested the effects of parent interaction and active or passive experience on infants' causal perception by comparing conditions in which parents were either instructed to talk or not to talk to their infants during active or passive SM play sessions. In their study, 4.5-month-old infants were randomly assigned to one of four experimental SM conditions or the control condition without training. The four experimental SM play sessions were active/encouragement (AE), active/no encouragement (AN), passive/encouragement (PE), and passive/no encouragement (PN). In the encouragement conditions, caregivers were explicitly instructed to provide encouragement to their infants throughout the play session, especially after infants made contact with the sticky balls. In the no encouragement conditions, parents were instructed not to talk to their infants during the play session. In the active conditions, the infants were in control of their own movements, while in the passive conditions, caregivers controlled their infants' arm movements for the session. Infants in the four experimental conditions completed the SM training prior to the habituation task, while infants in a control condition completed the habituation task first, and then were given SM training.

After the SM session, infants' perception of causality was measured using an infant-controlled habituation task modeled after Rakison and Krogh (2012) (see Figure 1). This task consisted of infants' being habituated to one of two non-causal events: a gap or a delay event.

Figure 1

Examples of Causal and Non-Causal Event Stimuli in Causal Perception Task



Note. Examples of causal and non-causal (delay and gap) event stimuli used in causal perception task in Holt (2016) and the proposed study. In this task, infants are habituated to one of the non-causal events (delay or gap) and then are tested on all three events (causal, delay, and gap).

In the test phase, infants were presented with three randomized test trials: a familiar event (identical to the non-causal event to which they were habituated), a novel non-causal event (the non-causal event to which they were not habituated), and the novel causal event. In this task, infants who have causal perception are expected to respond visually (i.e., dishabituate) to the test trials on the basis of causality. In other words, after habituating to a non-causal event, infants who have causal perception should dishabituate to the causal but not the novel non-causal test event, as this is conceptually familiar. However, infants who do not have causal perception, and who respond on the basis of perceptual instead of causal differences, should look longer at both the causal and novel non-causal test events compared to the familiar test event, as these are both novel events perceptually.

As expected, Holt (2016) found that 4.5-month-old infants in the control condition, who were tested in the causal perception task prior to receiving SM experience, responded to perceptual changes in the stimuli, not on the basis of causality. This finding replicates previous research indicating that infants do not show evidence of causal perception until 6.25 months of age (e.g., Cohen & Amsel, 1998; Cohen, Chaput, & Cashon, 2002). Regarding the four experimental SM training conditions, only infants in the AN condition showed evidence of causal perception. Together, the results of Rakison and Krogh (2012) and Holt (2016) indicate that causal perception may only be facilitated by active training *without* parent encouragement.

Sticky Mittens, Parent Interaction, and Infant Attention

Given previous null results with passive experience, it is not surprising that passive SM training did not facilitate causal perception in Holt (2016). An important question that remains, however, is why causal perception was not facilitated by active SM experience when combined with parent encouragement? One possible explanation is that parents' behaviors in the AE condition interfered with infants' attention to objects during the SM play sessions and negatively affected causal perceptual learning. First, this possibility is supported by previous research demonstrating that by 4 to 5 months of age, infants' exploration of objects is grounded in visual exploration (Rochat, 1989), and that visual attention, in particular sustained attention, plays a key role in infants' information processing and learning (Cohen, 1972, 1973; Kannass & Oakes, 2008; Lawson & Ruff, 2004; Richards, 1989; Ruff, 1986; Ruff, Lawson, Parrinello, & Weissberg, 1990).

Second, previous studies have shown that infants' attention to objects is influenced by their caregivers' actions and attention to objects in a shared environment (Bornstein, Rahn, Tamis-Lemonda, & Pecheux, 1991). In some cases, parents' behaviors have been shown to benefit young infants' attention to objects. Maternal scaffolding of infant attention to objects, through verbal and physical encouragement, at age 4 months has been shown to positively predict language development at age 12 months and positively influence intelligence test scores at age 4 years (Ruddy & Bornstein, 1982; Bornstein, 1985). Mothers who encouraged their infants' attention to objects through physical or coinciding verbal and physical means more at 5 months had 8-month-old infants who exhibited higher amounts of sustained attention to objects (Pecheux, Findji, & Ruel, 1992).

However, not all parent behaviors enhance very young infants' learning about objects, even if they are intended to. Findji (1998) found that while parents' "scaffolding" behaviors involving introducing new objects to their infant while their infant was not attending to the objects benefitted 8-month-old infants, in that they explored objects longer after these parent behaviors, these parent behaviors may be too advanced for 5-month-old infants, who did not explore objects longer following these behaviors. Findji (1998) also noted that while parents' redirective behaviors (introducing an object when their infant is engaged with a different object) did not occur often in the infants' homes, where this study took place, parents' redirective activity might be heightened in a lab set-up, as parents may feel they need to elicit more activity in their child in a lab setting.

As Findji (1998) predicted, a more recent study provides evidence that parent redirectiveness can negatively affect infant attention to objects at 5 months of age in a lab setting. Mason, Kirkpatrick, Schwade, and Goldstein (2019) studied how parent interactions affected 5-month-old infants' attention to objects in an in-lab 15-minute naturalistic play session. The researchers found that infants who were provided with a high proportion of parent-infant interactions that were jointly focused exhibited visual preferences for objects with which their parents engaged physically. In contrast, infants of parents who provided a high proportion of parent responses attempting to redirect their infants' current focus of attention showed no visual preference for objects with which their caregivers engaged. Infants in the joint attention group were more likely to visually follow their caregivers' actions and respond to social cues than were infants in the redirective group. Additionally, infants who experienced more redirection showed increased gaze shifting in their play, which the researchers categorized as distraction.

Thus, while the researchers found that very young infants are sensitive to jointly focused social cues regarding objects at this age, they concluded that redirective parent behaviors can disrupt infants' visual attention to objects, leading infants to be more distractible (Mason et al., 2019).

Taken together, these studies provide support for my hypothesis that in Holt's (2016) study, parents' behaviors in the AE condition disrupted infants' attention to objects, affecting how and when infants looked at objects, the effects of which may have hindered causal perceptual learning. However, Holt did not analyze the parent-infant interactions for parent or infant behaviors. The purpose of the present study was to test this hypothesis.

Current Study

In the present study, a secondary analysis of the AE and AN conditions' SM training sessions from Holt (2016) was conducted to test the hypothesis that parent interaction behaviors in the AE condition negatively affected infants' visual attention to objects. To test this overarching hypothesis, infants' visual attention to objects and parent behaviors were coded from Holt's previously recorded videos and several key variables derived from these measures were compared across conditions. In coding the videos, trained coders marked the onset and offset times of parent and infant behaviors observed throughout each video. These behaviors occurring within an onset and offset were considered "bouts". Onset and offset times were then used to calculate the duration and number of bouts of infant and parent behaviors (see Table 1). The video recordings of the

SM sessions did not include sound; therefore, it was not possible to assess verbal communicative variables in the present study.

There were three main hypotheses. First, I hypothesized that parent interactions in the AE condition negatively affected infant's sustained visual attention to objects. Infants' sustained attention was measured by two key variables: duration and number of sustained attention bouts on task (i.e., prolonged, unbroken infant looks to mittens and balls). I predicted that in the AE condition, infants' sustained attention bouts on task would be shorter in duration and occur more frequently in the AE condition compared to the AN condition. As an indirect measure of parent interaction and a direct measure of infant attention, this finding would imply that parent interaction behaviors in the AE condition negatively affected the duration of infants' sustained looks on task, decreasing the average amount of time infants exhibited sustained attention per bout and increasing their number of shorter looks to objects.

Second, I hypothesized that parent interaction behaviors in the AE condition would interfere with infants' visual attention during the object manipulation task. Parent interference with infant attention was measured by the key variable proportion of infants' clean attention to objects. (Clean attention to objects was defined as the total time the infant was visually attending to mittens and/or balls without parent interaction behaviors co-occurring.) I predicted that infants in the AE condition would have smaller proportions of clean attention to objects than infants in the AN condition. As a direct measure of parent interaction behaviors co-occurring with infant visual attention, this finding would imply that parents in the AE condition interacted more while their infants were on task compared to parents in the AN condition.

Third, I hypothesized that parent interaction behaviors in the AE condition would distract infants, causing them to go off task. This was measured by the key variable of proportion of infants' going off task following parent interaction behaviors. I predicted that infants in the AE condition would have higher rates of going off task following a parent interaction behavior relative to infants in the AN condition. As a direct measure of parent interaction behaviors' effect on infant visual attention to objects, this finding would imply that parents' interaction behaviors distracted their infants, causing their infants to go off task.

METHODS

Participants

The present study consists of a secondary analysis of previously recorded SM session videos from Holt (2016). For the purposes of the present study, only infants and their parents who participated in one of the two active experience experimental conditions AE (N = 18; 10 females; M_{age} = 4.34, SD = 0.51, $Range$ = 3.61 – 5.26) and AN (N = 17; 10 females; M_{age} = 4.34, SD = 0.51, $Range$ = 3.61 – 5.26) were included. Race and ethnicity were self-reported as informed consent was completed in the lab. Caregivers of thirty infants identified their infants as White non-Hispanic, 2 as multiracial non-Hispanic, 2 as multi-racial Hispanic, and 1 as Black/African American non-Hispanic. All participants were healthy, full-term (i.e., gestational age of > 36 weeks and weighing > 5 pounds) infants with normal vision and hearing.

SM Sessions and Videos

Details of Holt's procedure that are deemed most relevant to the present study are provided here for clarity (see Holt, 2016 for more details). In Holt's original study, SM training sessions were recorded using a Canon VC-C50i camera located approximately three feet away from the participants at an angle of 90° to the left of the infant-parent dyads (see Figure 2). During the SM play sessions, infants were seated in a parent's lap at a small table across from an experimenter. The SM training materials (e.g., four yellow “sticky balls,” covered in yellow Velcro set on a white wooden tray) were arranged on the table in front of parent-infant dyads. Infants wore a pair of custom-made red “sticky mittens” with red Velcro sewn on the palms over their hands.

Upon being seated, parents received verbal instructions read from a script by an experimenter that differed based on training condition (for details, see Holt, 2016). Parent-infant dyads were randomly assigned to conditions. Parents in the AE condition were instructed to encourage and praise their infant throughout the play session. Parents in the AN condition were instructed not to talk to their infant at all throughout the play session. Each SM training session lasted up to approximately 10 minutes with a 3-minute minimum session time required. Some sessions ended before 10 minutes if an infant became too fussy to continue.

Figure 2

Example View of Parent-Infant Dyad from the Camera

Note. Example of view of parent-infant dyad from the Canon VC-C50i camera located approximately three feet away from and to the left of the participants at an angle of 90°.

Behavioral Coding

In the present study, infant visual attention and parent behaviors (see Coding Manual in Appendix) were coded by three trained coders using Datavyu (Datavyu Team, 2014). Coders were individually trained on Datavyu software and the coding manual, then asked to code the entirety of a video in real time with the supervision of a reliable coder. After this initial training, trainees were asked to code two additional videos independently. Coders were deemed reliable if their coding on these two videos met or exceeded 90% agreement with that of an expert coder.

Coding of each video was conducted in two coding passes. Coders first coded infant visual attention behaviors and then coded parent behaviors on a second pass. For each pass, coding began at the point in the video immediately after it appeared the experimenter had finished giving the parent instructions and answering any questions. Coding concluded at the end of the play session when the experimenter indicated to the parent the session was over and the parent began to take the mittens off the infant.

Coders recorded the onset and offset times of each behavior bout, beginning when a behavior began and ending when the behavior ended/a new behavior began, and assigned a behavior code from the relevant set to each bout (see Figure 3). As recommended by Bakeman and Quera (2011), the coding schemes for each set were mutually exclusive and exhaustive (ME&E), meaning that within each set, all behaviors were coded, and for every behavior bout coded, only one behavior code in the set applied.

Infant visual attention behaviors were coded as one of the following three codes: “on task” (OT: when the infant is visually attending to the balls and mittens), “off task” (NT: when the infant is visually attending anywhere but the balls and mittens), or “ambiguous” (A: when focus of the infant’s visual attention could not be clearly determined). Bouts coded as “ambiguous” were rare and were removed from the dataset prior to any further data processing or data analysis.

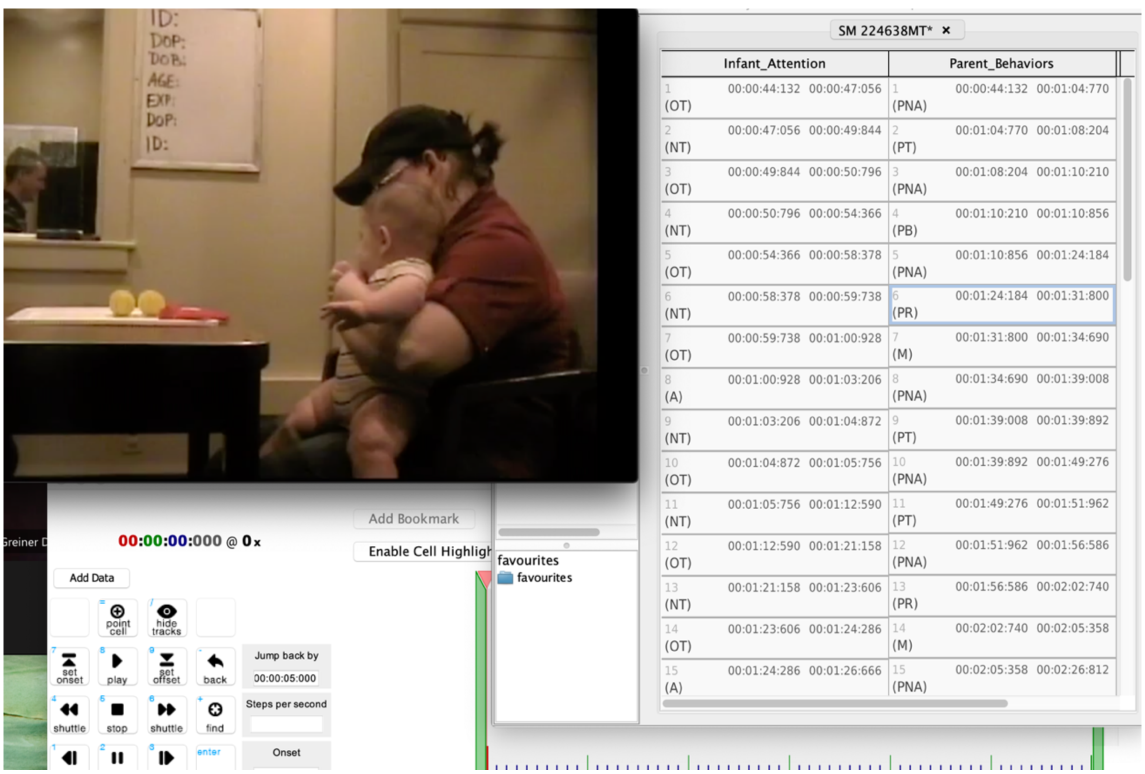
Parent behaviors were coded as one of the following eight codes: “parent toys” (PT: when the parent is manipulating the balls and not resetting them), “parent in view” (PI: when the parent’s face moves into the view of the infant and parent is not resetting the balls), “parent guiding” (PG: when the parent is controlling the infant’s hands), “parent toys and in view” (PTI: when the parent is manipulating the balls and their face moves into the field of vision of the infant but is not in the act of resetting), “parent moving baby” (PB: when the parent moves the infant out of reach and/or sight of the balls), “mittens off” (M: when the parent is placing the infant’s mittens back on after they have come off), “parent resetting” (PR: when the parent is resetting the balls), and “parent not acting” (PNA: when the parent is not acting; might include parent watching, looking away, or otherwise not engaging).

The first five of the parent behaviors (PT, PI, PG, PTI, and PB) involved parents’ interacting with their infants in ways that are not required by the SM training protocol during the play sessions and were considered parent interaction behaviors. These five parent interaction behaviors were the focus of several calculations (described later) and analyses.

M, PR, and PNA were parent non-intrusive behaviors and not included in any of the main analyses. They are behaviors that all parents were asked to do as needed during the SM play sessions and thus were not expected to differ between conditions. A Mann-Whitney U test confirmed that the proportion of total durations for M (Z = .508, p = .636), PR (Z = -.314, p = .757), and PNA (Z = 1.287, p = .207) were comparable across conditions.

Figure 3

Example View of Coding Infant and Parent Behaviors in Datavyu



Reliability

For reliability purposes, 25% of videos coded by each coder (9 total) were re-coded by an expert coder who was blind to the condition of the participants but was aware of the goals and hypotheses of the study. To assess the reliability of the *behavior* *codes*, reliabilities were conducted on the entirety of each video selected. Percent agreement between the original coder and expert coder for infant visual attention codes ranged from 90-99% with a mean of 96%. Percent agreement for parent behavior codes ranged from 91-100% with a mean of 95%. To assess the reliability of behavior *bout durations*, reliabilities were conducted on randomly selected one-minute segments of each video (different one-minute segments were chosen for infant and parent behaviors). Pearson correlations for infant visual attention bout durations ranged from $r = .97$-1 with a mean correlation of $r = .99$. Pearson correlations for parent behavior bout durations ranged from $r = .97$-1 with a mean correlation of $r = .99$.

Data Processing

To prepare the data for analysis, the onset and offset times provided by Datavyu were used to calculate bout durations for each behavior coded. A minimum bout duration of 1 second was established. This is similar to the minimum look time required in infant visual habituation paradigms, which is often 1 second, in which a minimum duration of visual attention is required for a look to count towards a measure of infant visual attention, (Oakes, 1994; Oakes, Sperka, DeBolt, Cantrell, 2019). Rather than throwing out behavior bouts lasting less than 1 second, the decision was made to interpolate, or merge, those data into the preceding behavior bout. For example, if an “on task” behavior bout that lasted for 2 seconds was immediately followed by a behavior bout (of any code) lasting 0.5 seconds, the short, latter behavior would be recoded as “on task” and the length of the original “on task” behavior would be extended to 2.5 seconds. Furthermore, in the event that the behavior immediately following an interpolated bout held the same behavior code as the previously interpolated bout, the data were merged again into one longer, single behavior bout. Continuing with the previous example, if the interpolated 2.5-second-long “on task” bout was immediately followed by another “on task” bout lasting 3 seconds, these bouts would be merged into one 5.5 -second “on task” bout.

Calculations

Number of bouts, mean duration per bout, and total duration of bouts for all infant and parent behaviors coded were calculated for each participant (see Table 1 for descriptive statistics). Several hypotheses required the calculation of additional variables. These calculations are described in the Results section.

RESULTS

Due to the limited sample size of the two groups, nonparametric tests were used in all analyses and outliers were included to maintain power. For all group comparisons, Mann-Whitney U tests were used. Prior to running the primary analyses, preliminary tests were conducted to determine if there were effects of infant sex on any of the dependent variables. As was the case in Holt's (2016) original study, no significant effects of sex were found ($p \geq .635$). Thus, the data were collapsed across sex on all analyses.

Overall Measures

Descriptive statistics for the coded infant visual attention behaviors and parent behaviors (see Appendix) are presented in Table 1.

Table 1

Descriptive Statistics for Overall Infant Visual Attention and Parent Behaviors by Condition

Behaviors Coded	**AE Condition**	**AN Condition**
	Mdn (IQR)	*Mdn (IQR)*
Infant Visual Attention		
On Task (OT)		
Number of Bouts	26 (21.25-27.75)	27 (16.50-34.00)
Mean Duration of Bouts (sec)	9.06 (5.41-13.76)	8.33 (5.63-12.33)
Total Duration (sec)	251.25 (130.80-309.93)	208.76 (132.76-325.01)
Off Task (NT)		
Number of Bouts	24 (17.00-31.75)	26 (17.00-34.00)
Mean Duration of Bouts (sec)	6.39 (4.54-11.01)	9.00 (4.56-11.54)

Total Duration (sec)	182.02 (105.02-257.01)	231.61 (134.74-303.43)
Parent Behaviors		
Parent Interaction Behaviors		
Parent Toys (PT)[1]		
Number of Bouts	7.50 (3.00-10.25)	.00 (.00-6.50)
Mean Duration of Bouts (sec)	3.20 (1.84-4.86)	.00 (.00-4.41)
Total Duration (sec)	25.06 (5.88-38.55)	.00 (.00-22.06)
Parent In View (PI) [1]		
Number of Bouts	4.50 (1.00-14.25)	.00 (.00-1.00)
Mean Duration of Bouts (sec)	3.56 (2.14-6.41)	.00 (.00-3.05)
Total Duration (sec)	12.95 (4.18-57.55)	.00 (.00-3.57)
Parent Guiding (PG) [1]		
Number of Bouts	.00 (.00-2.00)	.00 (.00-.00)
Mean Duration of Bouts (sec)	.00 (.00-3.16)	.00 (.00-.00)
Total Duration (sec)	.00 (.00-8.28)	.00 (.00-.00)
Parent Toys and in View (PTI) [1]		
Number of Bouts	.00 (.00-.00)	.00 (.00-.00)
Mean Duration of Bouts (sec)	.00 (.00-.00)	.00 (.00-.00)
Total Duration (sec)	.00 (.00-.00)	.00 (.00-.00)
Parent Moves Baby (PB) [1]		
Number of Bouts	1.50 (.00-4.25)	2.00 (1.00-6.00)
Mean Duration of Bouts (sec)	1.48 (.00-5.76)	2.53 (.90-21.19)
Total Duration (sec)	2.07 (.00-18.51)	21.56 (1.80-65.25)
Parent Non-Intrusive Behaviors		
Mittens Off (M) [2]		
Number of Bouts	1.00 (.00-2.25)	1.00 (.00-3.50)
Mean Duration of Bouts (sec)	7.02 (.00-14.96)	10.35 (.00-13.53)
Total Duration (sec)	9.35 (.00-21.89)	11.83 (.00-43.96)
Parent Resetting (PR) [2]		
Number of Bouts	8.50 (2.75-15.75)	5.00 (2.00-16.00)
Mean Duration of Bouts (sec)	4.99 (3.39-6.80)	6.27 (3.90-7.57)
Total Duration (sec)	38.61 (13.07-92.49)	29.41 (11.08-91.03)
Parent Not Acting (PNA)		
Number of Bouts	20.50 (13.50-35.00)	18.00 (6.00-26.00)
Mean Duration of Bouts (sec)	9.28 (8.33-16.26)	22.61 (11.51-42.80)
Total Duration (sec)	292.38 (210.74-326.32)	307.26 (241.24-391.00)

[1] PT, PI, PG, PTI, and PB are considered parent interaction behaviors, which may vary across participants and condition and may interfere with infants' learning.

[2] M and PR are behaviors that are expected of parents in the SM sessions, regardless of condition, and are not as likely to vary.

Infant Attention to Objects

To determine if infants' overall attention to objects differed across conditions, separate Mann-Whitney U tests were conducted on two measures of infant visual attention to objects: the total duration of attention on task and the proportion of infant attention on task. The proportion of infant attention to objects was calculated as the total duration of infant attention on task divided by the total duration of the play session as defined by infant attention (combined total duration per infant of infant attention on task and off task). No significant difference between conditions was found for total duration of infants' attention to objects, $Z = -.165$, $p = .883$, $\eta^2 = .001$, or for infants' proportion of overall attention to objects, $Z = -.561$, $p = .590$, $\eta^2 = .009$.

To test the first hypothesis that parent interaction behaviors in the AE condition would negatively affect infants' sustained attention to the toys, infants' mean bout duration on task and infants' number of sustained attention bouts on task (see Table 1) were compared across conditions. No significant group difference was found for mean bout duration on task, $Z = -.495$, $p = .636$, $\eta^2 = .007$. Additionally, no significant difference was found for number of sustained infant attention bouts on task, $Z = .314$, $p = .757$, $\eta^2 = .003$ (also see Table 1).

Parent Interaction Behaviors

Five of the 8 parent behaviors (i.e., PT, PI, PG, PTI, and PB) were considered parent interaction behaviors that may vary across condition and may interfere with infants' learning (see Table 1). To determine if the overall amount of time parents engaged in these five key behaviors (i.e., PT, PI, PG, PTI, and PB) differed across conditions, total duration and proportion were calculated for each dyad and compared across conditions. Total duration of parent interactions was calculated by summing the total durations of the five parent behaviors. Proportion of total duration of parent interactions was calculated as the combined total duration of PT+PI+PG+PTI+PB divided by the combined total duration of all parent behaviors (PT+PI+PG+PTI+PB+M+PR+PNA). No significant difference was found between conditions for total duration of parent interactions (AE: *Mdn* = 94.01, IQR: 26.23-162.62; AN: *Mdn* = 27.68, IQR: 15.59-134.25), $Z = -1.650$, $p = .103$, $\eta^2 = .078$, or for proportion of total duration of parent interactions (AE: *Mdn* = .211, IQR: .099-.329; AN: *Mdn* = .050, IQR: .041-.314), $Z = -1.782$, $p = .077$, $\eta^2 = .091$.

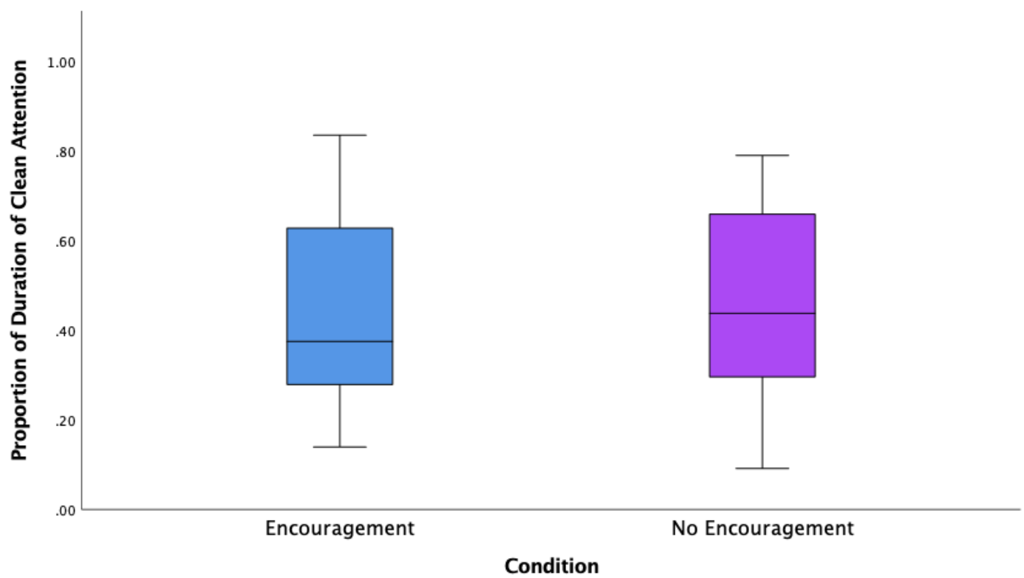
Associations between Parent Interactions and Infant Attention to Objects

Infants' Clean Attention to Objects

To test the second hypothesis that infants in the AE condition experienced less clean attention (i.e., attention toward the toys without simultaneous parent interaction) during the SM task relative to infants in the AN condition, the proportion of infants' clean attention to objects was compared across conditions. Proportion of infant clean attention was calculated as the total time an infant spent on task without co-occurring parent interaction behaviors (PT, PI, PG, PTI, and PB) divided by the total duration of the play session as defined by infant attention (OT+NT). Boxplots of these data are presented in Figure 4. No significant difference was found between conditions for our key measure of clean attention, infants' proportion of clean attention to objects, (AE: *Mdn* = .374, IQR: .267-.635; AN: *Mdn* = .437, IQR: .261-.661), $Z = .264$, $p = .807$, $\eta^2 = .002$.

Figure 4

Boxplot of the Proportion of Infants' Clean Attention by Condition

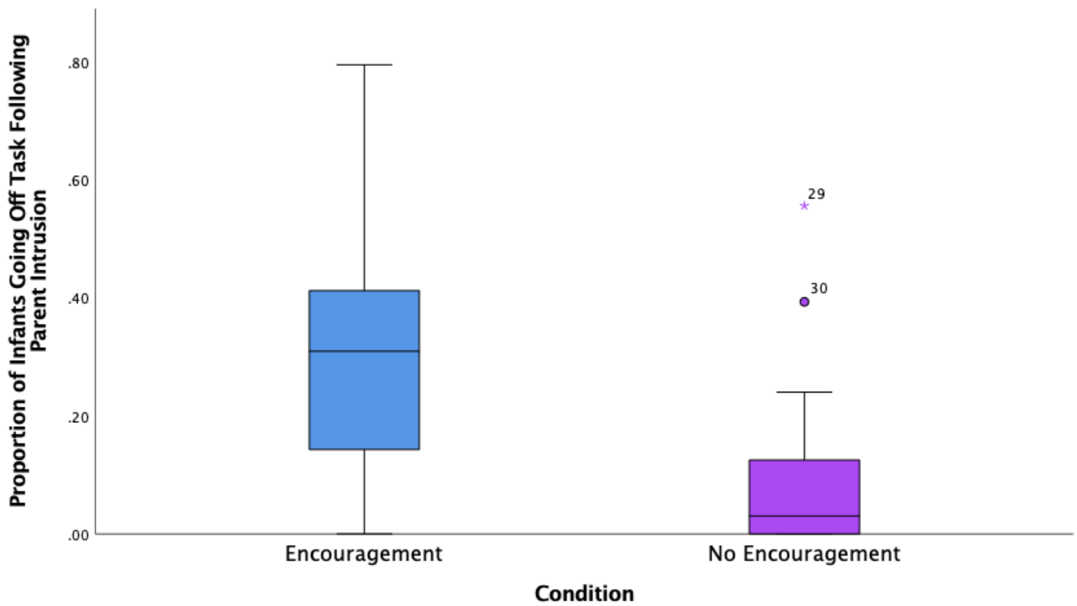


Parent Distraction

To test the third hypothesis that parent interaction behaviors in the AE condition distracted infants more than those in the AN condition, the proportion of time infants went off task following parent interactions was compared across conditions. To calculate individual proportions for each dyad, the number of times infants went off task following a parent interaction behavior was first calculated. Only off task behaviors that occurred within 2 seconds of one of the five parent interaction behaviors, i.e., PT, PI, PG, PTI, and PB, were included in this count (Findji, 1998). Next, the data were converted into proportions by dividing the number of times an infant went off task following a parent interaction behavior by the total number of the infant's off task episodes. Boxplots depicting these proportions for each condition are shown in Figure 5. Infants in the AE condition were found to have a statistically significantly higher proportion of going off task following a parent interaction (*Mdn* = .31, IQR: .117-.421) compared to that of infants in the AN condition (*Mdn* = .03, IQR: .000-.155), $Z = -2.716$, $p = .007$, $\eta^2 = .204$.

Figure 5

Boxplot of the Proportion of Infants' Going Off Task Following a Parent Interaction by Condition



Exploratory Analyses of Parent Behaviors

To better understand the significant effect of condition found for infants' going off task following any parent interaction, exploratory analyses were conducted to determine which of the five parent interaction behaviors were driving the effect. First, to explore differences across condition in the amount of time parents spent engaging in the different interaction behaviors, proportion of duration for each of the five parent interaction behaviors was calculated (e.g., total duration PT/total duration of PT+PI+PB+PG+PTI+M+PR+PNA) and compared across conditions using a Bonferonni correction method, rendering significance at a value of $p = .01$. A significantly higher proportion of total duration of PT (parent interacting with toys) was found in the AE condition (*Mdn* = .053, IQR: .013-.088) compared to that in the AN condition (*Mdn* = .000, IQR: .000-.042), $Z = -2.588$, $p = .009$, $\eta^2 = .187$. The proportion of total duration of PI (parent in view) was also significantly greater in the AE condition (*Mdn* = .028, IQR: .028-.129) compared to that in the AN condition (*Mdn* = .000, IQR: .000-.006), $Z = -3.436$, $p < .001$, $\eta^2 = .324$. However, the median proportions for the remaining behaviors were zero or very close to zero. Thus, not surprisingly, no significant group differences were found for proportions of PG (parents guiding, AE *Mdn* = .00, IQR: .000-.022, AN *Mdn* = .00, IQR: .000-.000, $Z = -2.563$, $p = .096$, $\eta^2 = .081$), PTI (parent toys and in view, AE *Mdn* = .00, IQR: .000-.000, AN *Mdn* = .00, IQR: .000-.000, $Z = -1.733$, $p = .405$, $\eta^2 = .020$), or PB (parent moves baby, AE *Mdn* = .005, IQR: .005 -.045, AN *Mdn* = .04, IQR: .003 -.171, $Z = 1.503$, $p = .143$, $\eta^2 = .063$).

Finally, because PT and PI were the only two parent interaction variables found to occur at different rates across conditions, analyses were conducted to compare the proportion of infants' going off task following PT and PI parent behaviors individually across conditions. A Bonferonni correction method was used rendering significance at a value of $p = .025$. No significant difference between groups was found for proportion of infants' going off task after a PT behavior ($Z = -2.042$, $p = .057$, $\eta^2 = .103$, Figure 6). However, the proportion of infants' going off task following a PI behavior was significantly higher in the AE condition (*Mdn* = .038, IQR: .00-.17) than in the AN condition (*Mdn* = .00, IQR: .00-.00), $Z = -2.758$, $p = .014$, $\eta^2 = .170$ (see Figure 7).

Figure 6

Boxplot of the Proportion of Infants' Going Off Task Following a Parent Toys (PT) Behavior by Condition

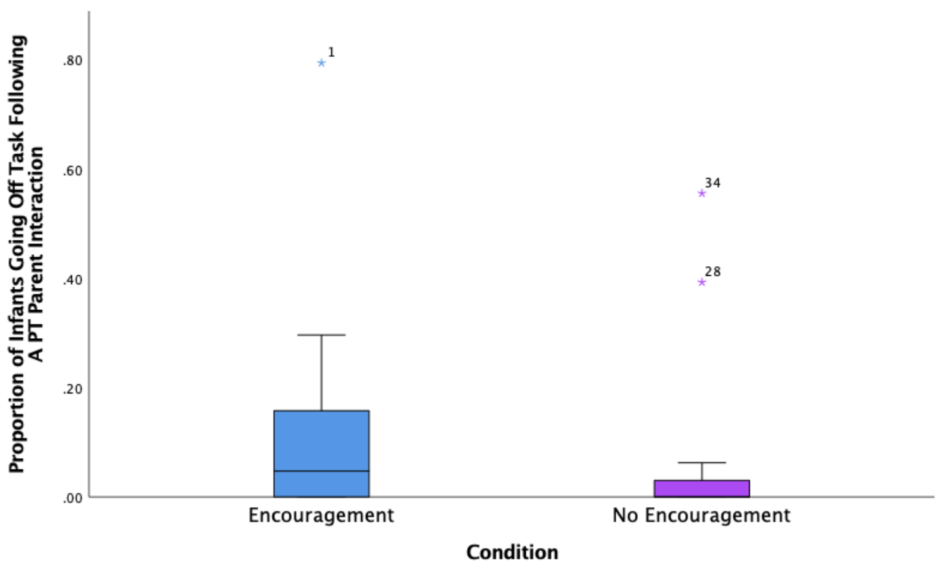
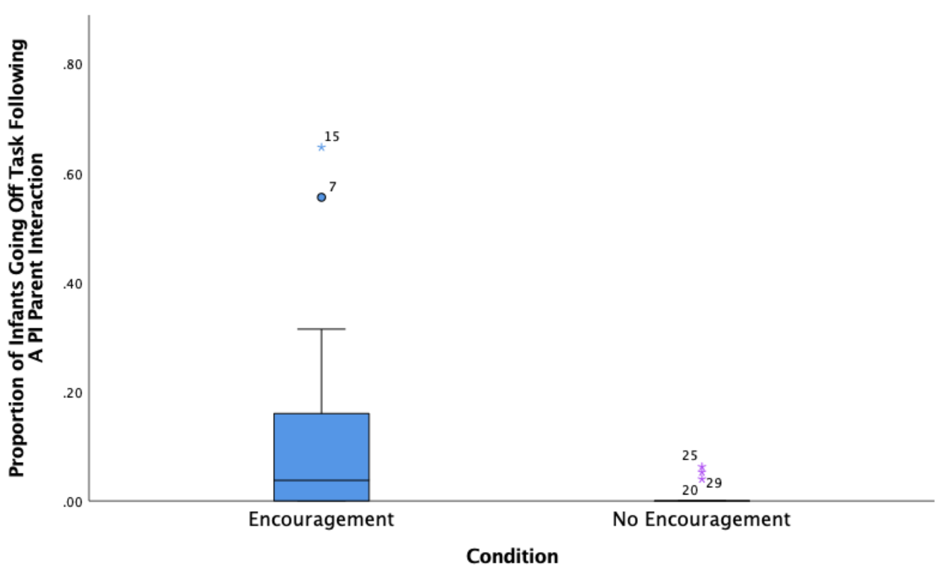


Figure 7

Boxplot of the Proportion of Infants' Going Off Task Following a Parent in View (PI) Behavior by Condition



DISCUSSION

The present findings are consistent with the hypothesis that parents in Holt's (2016) AE condition distracted their infants during SM training, preventing them from experiencing the full facilitative effects of SM training on causal perception that infants in the AN condition experienced. While no differences between conditions were found on the overall measures of infants' attention to objects (i.e., mean duration of sustained attention bouts on task, number of sustained attention bouts on task, and proportion of clean attention to objects) or overall amount of parent interaction behaviors (i.e., proportion of total duration of parent interactions), the proportion of infants' going off task following a parent interaction behavior, the key measure of parent distraction, was significantly greater in the AE compared to the AN condition. In fact, the proportion was 10 times greater for infants in the AE condition than for infants in the AN condition (AE *Mdn* = .31 vs. AN *Mdn* = .03).

Results of the present study indicate that how and when parents interact with their pre-reaching infants can negatively affect infants' attention to objects during active SM training. The fact that infants were more likely to go off task following a parent interaction behavior in the AE condition than in the AN condition raises further questions about which aspects of parent interactions in the encouragement condition may have distracted infants. Exploratory analyses revealed that parent in view (PI) behaviors, at least in part, drove that main effect. While parents displayed two parent interaction behaviors, PI and PT, significantly more in the AE condition than in the AN condition, infants went off task only following a PI behavior significantly more in the AE condition. These PI interaction behaviors, in which parents' faces entered their infants' field of view, may have had a particularly significant distracting effect on infants due to the social nature of faces and the attention-getting effects of faces for infants at this age (Kwon, Setoodehnia, Baek, Luck, & Oakes, 2016).

These findings support previous research regarding the importance of parent-infant interactions being infant-led, even at a very young age, and make an important contribution to the literature in understanding how parent behaviors affect infant attention to objects. Previous research has shown that parent interactions that are not redirective but instead are initiated by the infant, or are infant-led, are important for infants' learning about objects (Mason et al., 2019; Bigelow, MacLean, & Proctor, 2004). These infant-led interactions in play have been shown to be associated with infants being more engaged when playing with objects and playing in a more sophisticated way, while caregiver interactions that were redirective or intrusive resulted in infants' being less engaged in play (Bigelow et al., 2004). A similar effect has been shown in kindergarten-aged children, in that parents interacting in a controlling or guiding way while their child was on task predicted lower levels of executive function and observed self-regulation (Obradović, Sulik, & Shaffer, 2021). Thus, it is evident from the findings of the current study in combination with previous research that infant-led interactions are important and that redirecting or disrupting infant attention has negative effects on infants' learning.

It is also important to consider the difference in instructions given to parents in the two conditions and as result, the differences in parent speech that likely occurred in the two conditions. While caregiver speech during the play session was not able to be measured in this study due to limitations of the recordings, the potential effects of caregivers speaking to infants are important to note. In the AE condition, parents were instructed to encourage and praise their infant physically and verbally throughout the session, whereas parents in the AN condition were instructed not to talk to their infant at all throughout the play session. Caregiver speech might have especially affected infants in the AE condition due to these instructions. Caregiver verbal encouragement or praise may have come at inopportune times (i.e., when infants were focusing on the toys) and in combination with other parent interaction behaviors (i.e., when parents' faces were in their infants' field of view), which may have had compounding negative effects on infant attention to objects.

Speech directed to infants has important social implications, even before infants have learned language, including encouraging social interaction, promoting infant attention to language, and relaying information (Golinkoff, Can, Soderstrom, Hirsh-Pasek, 2015). However, redirective speech, or speech which directs infant attention away from a current focus of attention to a new object, often requires infants to shift their attention, which is taxing for very young infants (Tomasello & Todd, 1983). In fact, although redirective speech has been shown to promote infants' learning of social words, it has also been found to lead to infants' learning less about objects (Tomasello & Todd, 1983). Thus, parent speech, which likely occurred more often in the AE condition, and potentially at inopportune times, may have redirected the attention of infants in that condition away from the toys and impaired their learning about the objects.

Current messaging to parents tends to encourage parents to talk often to their infants. Much of this is rooted in findings that the rate of vocabulary growth in a toddler's second and third year (highly correlated with the number of words children heard per hour) predicts later performance in school (Hart & Risley, 2003). However, an important implication of this study's findings, in addition to previous research on parent speech, is that while speaking to infants is important for infant language learning, vocabulary growth, and social development, the timing of parent interactions and speech is also important, especially when engaging with very young infants. Thus, parents should allow their infants time to explore and experience new objects and environments without parent distractions (verbal or physical) and only engage in infant-led interactions with new objects in their environment when their infants are ready.

In addition to the implications of these findings regarding parenting, these findings also have important implications regarding infant attention to objects. Previous research has shown that visual attention, and specifically sustained attention, is important for infants' learning about objects (Cohen, 1972, 1973; Kannass & Oakes, 2008; Lawson & Ruff, 2004; Ruff, 1986; Richards, 1989; Ruff, Lawson, Parrinello, & Weissberg, 1990). However, infants' overall and proportional duration of attention to objects, mean duration of sustained attention bouts, number of sustained attention bouts, and clean attention were not found to differ across conditions. Yet, infants went off task more following parent interactions in the AE condition compared to the AN condition. Taken together, these findings indicate that it was not an overall or sustained measure of infants' attention to objects, but infants' control of their own attention, (i.e., controlling when they went on and off task without distraction) that was important for infant learning about objects.

These findings also contribute greatly to the SM literature regarding the effect of parent interactions on infant attention to objects in this paradigm. Previously, most SM studies involved limited instructions to parents, allowing them to engage naturally with their infants, and only two SM studies examined the role of parent interactions in the SM paradigm regarding infant learning about objects (Holt, 2016; Libertus & Needham, 2014). However, neither of these studies assessed how parent interaction behaviors affected infant attention within the SM play sessions. The findings of the current study indicate that parent interaction behaviors that occur while infants are already visually attending to the sticky mittens and sticky toys have a distracting effect on infant attention to the toys. The current findings should inform future SM studies regarding the role of parent interaction behaviors and instructions given to parents when they are facilitating the SM play sessions.

This study is an important first step in understanding the effects of parent interactions on young infants' learning about objects in the SM paradigm; however, it was not without limitations, allowing many opportunities for future research. Limitations include the inability to examine caregivers' speech in combination with parent behaviors, a small sample size, and, in part, video being from a single 90-degree camera angle. While caregivers' speech was not able to be analyzed in this study, aspects of caregiver speech (i.e., the timing of when caregivers spoke, whether this coincides with other parent interaction behaviors, and how this affects infant attention to objects) are likely an important factor to consider in future research. The current unknowns regarding caregiver speech in this paradigm are an important missing piece in understanding the effects of caregivers on infant attention to objects and learning about objects. Future research should further investigate the potential important effects of when and how caregivers interact with and speak to infants in this the SM training paradigm.

A second limitation to consider is the small sample size of the current study. Although the sample size was adequate for the nonparametric analyses used, a larger sample size might have allowed for other more subtle group or individual differences to be discerned. Various analyses were run to determine if any key variables in this study (e.g., mean duration of sustained attention on task, clean attention, and infants' going off task following a parent interaction behavior) were related to infants' behavior on the causal perception habituation test trials which followed their SM play sessions in Holt (2016). However, these exploratory analyses did not identify significant relations between key variables and the infants' performance on the test trials. Perhaps, with a larger sample size and available audio to address other important variables of interest (i.e., caregiver speech), finding such relations would be more likely. Future research should take this into consideration and use larger sample sizes.

Additionally, while it is not necessarily a limitation, aspects of infant attention (e.g., sustained attention) may be more precisely measured with the additional angle of a camera facing the infant analyzed in combination with the current 90-degree angle that was available. While the current camera angle was adequate for coding infant visual attention and parent behaviors in order to assess the key variables of this study, an additional camera angle would allow more precise coding of these behaviors and contribute to even fewer instances of ambiguous infant attention coding.

In sum, this study was an important step in better understanding the role of parent interactions in infant learning during SM training. The results indicate that parent interactions can be distracting to young infants in this novel learning task. Future research should further investigate the relationship between parent interactions and infant attention to objects and subsequent learning utilizing audio recording of parent speech, larger sample sizes, and multiple camera angles. It is worth noting, a study that fulfilled many of these future research suggestions was underway in our lab at the University of Louisville, when the lab was shut down due to COVID-19 precautions. While that study was halted in the spring of 2020, in the future, a similar study could investigate additional parent speech factors and their effect on infant attention to objects and learning, as well as further exploring the key variable of parent distraction of infant attention as measured in this study.

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Appendix

Coding Manual

Initial video coding will be conducted in Datavyu and will consist of timed-event recording for two mutually exclusive and exhaustive sets of coding schemes by noting onset and offset times to record durations of behavior. These coding schemes are considered mutually exclusive and exhaustive (ME&E), meaning that within each set, for every occurrence coded one and only one code in the set applies (Bakeman & Quera, 2011). Bakeman and Quera (2011) state that this is an appropriate, consistent, and beneficial way to code.

Coding in Datavyu will consist of individual onset and offset times for each behavior listed below. These will be used to create durations for secondary coding measures in R and Tableau.

Coding Rules

- Coding in Datavyu will begin immediately following experimenter instructions and initial parent example. Parent example will involve parents' putting the mittens on their infants and then guiding their infants' hands to the balls and attempting to then draw their infants' attention to the balls/mittens (see Sticky Mittens Instructions for more details).

- Coding will end when it is clear the experimenter has ended the play session (i.e., the experimenter and parent begin talking and the parent moves the infant away from the table, removes the mittens, etc.) or until the video ends (these might coincide).
- Coders will code first Infant Visual Attention set all the way through the video, then will code Parent Behavior set.

Codes in Datavyu:

Infant Visual Attention	
Code	Definition
STOP	When the parent and baby leave the table – this ends when the parent and baby are back and prepared to play (mittens on, facing table, etc.). Note – this begins when parent takes mittens off in preparation to leave table, or picks baby up and leaves the table.
OT	"On Task" - Infant visual attention is on the mittens while engaging with the balls and/or visual attention is on the balls.
NT	"Off Task" - Infant visual attention is on anything in the room other than mittens and/or balls. This includes the infant looking away from the table, at the experimenter, around the room, at the parent, etc.
A	"Ambiguous" - It cannot be determined if infant visual attention is on task or off task, but there is a possibility they are on task. These looks most often occur when something is obstructing the view of the camera (e.g., a parent's arm, hair, etc.). This does not occur often.

Parent Behavior	
Code	Definition
STOP	When the parent and baby leave the table – this ends when the parent and baby are back and prepared to play (mittens on, facing table, etc.). Note – this begins when parent takes mittens off in preparation to leave table, or picks baby up and leaves the table.
M	"Mittens Off" Mittens are off - mittens have fallen or been pulled off and continues as the parent is replacing mittens. Ends when mittens have been placed back on infant's hands. This does not occur often and might occur as the parent attempts to remove the balls from the mittens and reset the balls. *Note – when coding "M" do not need to code any co-occurring behaviors the parent engages in while trying to replace the mittens, M takes precedence over other codes.
PR	"Parent Resetting" Parent is setting or resetting the balls. This includes when the parent is removing the balls from the mittens and resetting them on the table in front of the infant, and includes parent adjusting mittens as they are resetting (as long as mittens do not come completely off). Afterwards, any subsequent manipulation of the balls will be coded as PT. *Note parents are told in the instructions they received to do this if their infant brought the balls to their mouth, and/or after the balls had been on the infant's mittens for 10 seconds; however, this timing was not enforced by the experimenter.

PG	"Parent Guiding" Parent guides the infants hands/mittens to the balls and/or during play.
PT	"Parent Toys" Parent is fingering or otherwise manipulating the balls and is not in the act of resetting them. This manipulation also includes parents pointing to the balls or tapping on the table or board near the balls.
PI	"Parent In View" Parent's face moves into infants' field of view (when infant is facing the table with the balls in view) and parent is not resetting toys or mittens or replacing mittens. This behavior is coded when the parent comes past an imagined 180-degree plane created by the baby's eyes, dependent on the baby's head tilt, into the baby's peripheral field of vision.
PTI	"Parent Toys and In View" Parent is manipulating the balls (and is not in the act of resetting the mittens/balls), AND parent's face moves into infants' field of view (when infant is facing the table with the balls in view). This behavior is coded when the parent comes past an imagined 180-degree plane created by the baby's eyes, dependent on the baby's head tilt, into the baby's peripheral field of vision, AND is ALSO manipulating the balls.
PB	"Parent Moving Baby" Parent moving infant out of reach and/or sight of the balls on the table, but not resetting the balls/mittens (which would be coded as PR). This begins when parent begins the act of moving their infant out of reach and/or sight of the balls on the table and ends when they have moved the infant back into reach and/or sight.

PNA	"Parent Not Acting" Parent is not acting on the balls or mittens or in the infant's field of view. This might include parent watching the play session, looking away, sitting quietly, etc. This should account for any remaining time in the play session that is not M, R, PT, or PI.

CURRICULUM VITAE

Nonah M. Olesen

Graduate Teaching Assistant and Doctoral Candidate at the University of Louisville

Education

2021 (expected) Ph.D., Experimental Psychology, University of Louisville
Tentative title: “The Effect of Parent Interactions on Young Infants’ Visual Attention in an Object-Manipulation Task”
Advisor: Cara H. Cashon, Ph.D.

2018 M.S., Experimental Psychology, University of Louisville

2015 M.S., Experimental Psychology, Missouri State University

2013 B.A. (cum laude & Honors), Psychology, Missouri State University

Professional Experience

2015- Present Graduate Student, Doctoral Program in Experimental Psychology, Department of Psychological and Brain Sciences, Infant Cognition Lab, University of Louisville
Advisor: Dr. Cara Cashon

2018- Present Co-Founder, Developing Scientists Program
University of Louisville, Louisville, KY
Co-Founded by: Nonah Olesen and Catherine McDermott
Faculty Advisors: Dr. Cara Cashon and Dr. Nicholaus Noles

2019- Present Graduate Student Ambassador
Graduate School, University of Louisville

2020-2021 Teaching Assistant
Department of Psychological and Brain Sciences, University of Louisville
Courses: PSY 302 (Research Methods), PSY 306 (Lifespan Development)
Supervisors: Dr. Paul Rosen, Dr. Edna Ross

2017- 2019 Graduate Student Representative – 2 terms – Elected Position
Department of Psychological and Brain Sciences, University of Louisville

2018- 2019 Graduate Research Assistant
Department of Psychological and Brain Sciences, University of Louisville
Supervisor: Dr. Cara Cashon

2017-2018 Teaching Assistant
Department of Psychological and Brain Sciences, University of Louisville
Courses: PSY 322 (Cognitive Processes), PSY 321 (Psychology of Learning)
Supervisors: Dr. Nicholaus Noles, Dr. Melinda Leonard

2016- 2017 Graduate Research Assistant
Department of Psychological and Brain Sciences, University of Louisville
Supervisor: Dr. Cara Cashon

2013-2015 Graduate Student, Masters Program in Experimental Psychology,
Psychology Department, Missouri State University
Supervisor: Dr. Wayne Mitchell

2013-2015 Director of Recruitment and Outreach
Infant Perception and Learning Laboratory, Missouri State University
Supervisor: Dr. Wayne Mitchell

2014-2015 Teaching Assistant
Missouri State University
Lab Instructor for Experimental Psychology
Supervisor: Dr. Melissa Fallone

2013-2014 Research Assistant, College of Health and Human Services, Dean's Office
Missouri State University
Supervisor: Dean, Dr. Helen Reid

2013 Certificate in Conflict Dispute and Resolution, awarded by the Communication Department
Missouri State University

Research

Manuscripts

Holt, N.A., *Olesen, N.M., Dixon, K.C., & Cashon, C.H. (in prep). Four-month-old infants' learning about causality from self-produced causal actions is disrupted by parent encouragement.

*Olesen, N. M., Thurman, A., Cashon, C.H., & Mervis, C. B. (in prep). Self-recognition, pretend play, and personal pronoun use by toddlers with Williams syndrome.

Cashon, C. H., *Olesen, N. M., Holt, N.A., Dixon, K.C. (in prep). Do infants experience face pareidolia? An investigation of infants' preference for upright faces and face-like images.

Kartushina, N., Mani, N., AKTAN-ERCIYES, A., Alaslani, K., Aldrich, N. J., Almohammadi, A., … Mayor, J. (2021). COVID-19 first lockdown as a unique window into language acquisition: What you do (with your child) matters. https://doi.org/10.31234/osf.io/5ejwu

ManyBabies Consortium. (2020). Quantifying sources of variability in infancy research using the infant-directed-speech preference. *Advances in Methods and Practices in Psychological Science*, *3*(1), 24-52.

Peer-Reviewed Presentations

*Olesen, N. M., Slaton, J. N., Holt, N. A., & Cashon, C. H. (2021, April). *Effects of active experience and parent interaction on infants' learning about objects during sticky mittens* [Symposium presentation]. Society for Research in Child Development (SRCD) 2021 Virtual Biennial Meeting.

Golway, K. G., Vincent, K. A., *Olesen, N. M., & Cashon, C. H. (2021, April). *Parent-infant interactions, parent well-being, and changes in daycare at the onset of the COVID-19 pandemic* [Poster session]. Society for Research in Child Development (SRCD) 2021 Virtual Biennial Meeting.

*Olesen, N. M., Kaufling, K. G., Dixon, K, C., Mervis, C. B., & Cashon, C. H. (2020, July). *Visual attention to emotional facial expressions by toddlers with Williams syndrome* [Poster session]. Biennial Meeting of the International Congress on Infant Studies, Virtual Biennial Meeting.

Cashon, C. H., Dixon, K, C., & *Olesen, N. M., (2020, July). *7- to 9-month-old infants prefer fearful but not angry facial expressions* [Poster session]. Biennial Meeting of the International Congress on Infant Studies Virtual Biennial Meeting.

*Olesen, N. M., Dixon, K. C., Mervis, C. B., & Cashon, C. H. (2019, October). *Emotional facial expression preference in toddlers with Williams syndrome* [Poster session]. Cognitive Development Society, Louisville, KY.

*Olesen, N. M., Dixon, K. C., Crenshaw, R. D., Holt, N. A., & Cashon, C. H. (2018, June). *The effects of parental interaction on infant learning: When less is more* [Poster session]. Meeting of the International Congress on Infant Studies, Biennial meeting, Philadelphia, PA.

Dixon, K. C., Holt, N. A., *Olesen, N. M., Mervis, C. B., & Cashon, C. H. (2018, June). *Causal perception of Michottian launching events by toddlers with Williams syndrome?* [Poster session]. International Congress on Infant Studies, Biennial Meeting, Philadelphia, PA.

*Olesen, N. M., Dixon, K. C., Holt, N.A., Dale, L. E., & Cashon, C. H. (2017, October). *Do babies see faces in face, face-like, and ambiguous stimuli? Pareidolia in infancy* [Poster session]. Cognitive Development Society, Portland, OR.

Holt, N., Payal, P., *Olesen, N. M., Dixon, K.C., Cashon, C. H. (2017, April). *Parent Interaction Disrupts 4-month-old Infants' Learning about Causality during Sticky Mittens Training* [Conference presentation]. Society for Research in Child Development, Austin, TX.

Dixon, K.C., *Olesen, N. M., Kondaurova, M., Woodruff-Borden, J., Cashon, C.H. (2017, April). *Prosody of IDS and Maternal Negative Affect: An Investigation of Mothers from a Community Sample* [Poster session]. Society for Research in Child Development, Austin, TX.

*Olesen, N. M., Kulhanek, K. M., Mitchell, D. W., Graves, B. Fallone, M. D. (2015, April). *Feature Preferences: Visual Scanning Differences of Infant, Adult, and Inanimate Faces* [Poster session]. Southwestern Psychological Association, Wichita, KS.

Mitchell, D. W., *Olesen, Nonah, M., Kulhanek, Kirsty, M., Graves, Benjamin, Willis, Jessica, K. (2015, April). *The Effects of Prolonged Priming on Visual Scanning and Response Latency* [Poster session]. Southwestern Psychological Association, Wichita, KS.

Ham, J., Mitchell, D.W., *Olesen, N. M., Kulhanek, K., M., Graves, B., Steuber, T. B., Rockwell, Z. (2015, April). *Changes in Anticipatory Heart Rate on a Delayed Match to Sample Task* [Poster session].Southwestern Psychological Association, Wichita, KS.

Mitchell, W. D., Willis, J. K., Kulhanek, K. M., *Olesen, N. M., Ham, J. (2015, April). *The Relationship Between the BAS-BIS, Goal Setting, and Response Latency* [Poster session]. Southwestern Psychological Association, Wichita, KS.

Mitchell, D. W., *Olesen, N. M., & Kulhanek, K. M. (2015, March). *A Non-Linear Relationship Between Fixation Time And Subsequent Visual Discrimination Learning* [Poster session]. Society for Research in Child Development, Philadelphia, PA.

Mitchell, D. W., *Olesen, N. M., Kulhanek, K. M., Melia, C., Eschman, B. T., Gora, K. M. (2014, May). *Visual Scanning, Reaction Time, and Heart Rate: Indicators of Perceptual Deficits in Low Reading Ability Children* [Poster session]. Association for Behavior Analysis International Conference, Chicago, IL.

Eschman, B., Mitchell, D. W., Gora, K. M., *Olesen, N. M., Ham, J., Kulhanek, K. (2014, May). *Individual Differences in Anticipatory Heart Rate and Visual Scanning on a Delayed Match To-Sample Task* [Poster session]. Association for Behavior Analysis International Conference, Chicago, IL.

Eschman, B., Mitchell, D. W., Krause, G., *Olesen, N. M., McCracken, M. (2013, May). *Relationship between visual scanning behavior and heart rate on a visual match to sample task* [Poster session]. Association for Behavior Analysis International Conference, Minneapolis, MN.

Eschman, B., Krause, G., Mitchell, D. W., *Olesen, N. M., McCracken, M. (2013, April). *Visual match to sample: Relationship between heart rate and spatial ability* [Poster session]. Southwestern Psychological Association Conference in Ft. Worth, TX.

Colloquia and Other Presentations

Olesen, N. M., (April, 2018). Selected Presenter, GRADtalks Brown Bag Series, "Do Babies See Faces in Face, Face-Like, and Ambiguous Stimuli? Pareidolia in Infancy," hosted by Graduate Network in Arts & Sciences, University of Louisville

Olesen, N. M., (March, 2018). The effects of parental interaction on infant learning: When less is more. Talk presented at the experimental brown bag series, University of Louisville, Kentucky.

Olesen, N. M., (December, 2016). Self-recognition, pretend play, and personal pronoun use by toddlers with Williams syndrome. Talk presented at the experimental brown bag series, University of Louisville, Kentucky.

Thompson, Q.M., Dixon, K.C., *Olesen, N. M., Kondaurova, M., Woodruff-Borden, J., Cashon, C.H. (2016, April). Maternal negative affect and infant directed speech. Poster presented at the University of Louisville Undergraduate Research and Community Engagement Symposium.

Academic Service and Community Engagement

2020-2021	Chair, KAS Education & Advocacy Committee, Kentucky Academy of Science
2021	Manuscript Reviewer for Developmental Science

2021	Mentor, Undergraduate Psychology Honors Thesis, “The Effect of Parent Interaction on Pre-Reaching Infants’ Visual Attention During an Object Manipulation Task,” by Jalena Slaton Department of Psychological and Brain Sciences, University of Louisville Supervisor: Dr. Cara Cashon
2020, 2021	Head Judge, Behavioral Health Sciences, Louisville Regional Science and Engineering Fair, Louisville, KY
2020	Judge, Undergraduate Arts and Research Showcase, University of Louisville, Louisville, KY
2019	Mentor, Undergraduate Psychology Honors Thesis, “Preference for Infant Directed Speech (IDS) and Expressive Vocabulary Acquisition in Infants,” by Bethany Carrier Department of Psychological and Brain Sciences, University of Louisville Supervisor: Dr. Cara Cashon
2019	Speed Mentor, 2019 Youth Science Summit in partnership with the Governor’s Scholars Program, Kentucky Science Center
2018	Student Reviewer, SRCD Panel: Attention, Learning, Memory Supervisor: Dr. C. H. Cashon, reviewer for the panel: Attention, Learning, Memory
2018	Mentor, University Honors Senior Thesis, “The Effects of Parental Interaction on Infant Learning,” by Rachael Crenshaw Department of Psychological and Brain Sciences, University of Louisville Supervisor: Dr. Cara Cashon
2018	Speed Mentor, Future S.T.E.M. Professionals Summit, Kentucky Science Center
2018	Presenter, Developing Scientists Program, Brain Days, Kentucky Science Center
2018	Guest Lecturer, Lifespan Development – PSYC 306 – Infant Cognitive Development, University of Louisville
2018	Guest Lecturer, Psychology of Learning - PSYC 321, University of Louisville
2017	Mentor, University Honors Senior Thesis, “Infants’ Perception of Faces in Face-Like and Ambiguous Images,” by Lauren Dale Department of Psychological and Brain Sciences, University of Louisville Supervisor: Dr. Cara Cashon

2016-2017 Graduate Peer Mentor
Department of Psychological and Brain Sciences, University of Louisville

2016 Judge, duPont Manual Regional Science Fair, Louisville, KY

2014 Student Reviewer, SRCD Panel: Attention, Learning, Memory
Supervisor: Dr. D. W. Mitchell, reviewer for the panel: Attention, Learning, Memory

2014 College of Health and Human Services Symposium Committee Member – Graduate Student Representative, Missouri State University

2014 Guest Lecturer, Unraveling the GRE, Preparation for Graduate School, Missouri State University

2014 Panel Member, Graduate School and Faculty Panel: Question and Answer, Psi Chi, Missouri State University

2014 Panel Member, Graduate student question and answer panel: How did I get here? Preparation for Graduate School, Missouri State University

2014 GRE Undergraduate Study Sessions Leader, Psi Chi Graduate Student Mentoring Program, Missouri State University

2012-2015 Girls on the Run (Girls on Track), Head Coach, Girls on the Run of Southwest Missouri, Springfield, Missouri

Academic and Travel Awards, Certificates, Grants, & Fellowships

2021 Runner-Up, Three Minute Thesis, University of Louisville

2020 Award for Excellence in Service: All Levels, Psychological and Brain Sciences, University of Louisville
Evidence of excellence in service includes service to student life, the department, the university, professional organizations, and/or service to the community.

2015, 2020 University Fellowship, University of Louisville School of Interdisciplinary and Graduate Studies, University of Louisville

2019 Society for Improvement of Psychological Science Mission Award for improving psychological science in the face of challenge, as contributor to the ManyBabies1 Collaboration

2019 Certificate of Completion in Mentoring Academy

School of Interdisciplinary and Graduate Studies, University of Louisville
Supervisor: Dr. Michelle Rodems

2019 Graduate Network in Arts & Sciences Travel Award, University of Louisville

2019 Department Travel Award, Psychological and Brain Sciences, University of Louisville

2017-2018 Certificate of Completion in Community Engagement Academy
School of Interdisciplinary and Graduate Studies, University of Louisville
Supervisor: Dr. Michelle Rodems

2018 Graduate Student Council Travel Award, University of Louisville

2017 Graduate Student Council Travel Award, University of Louisville

2017 Graduate Network in Arts & Sciences Travel Award, University of Louisville

2016 Graduate Student Council Travel Award, University of Louisville

2016 Graduate Network in Arts & Sciences Travel Award, University of Louisville

2016 Department Travel Award, Psychological and Brain Sciences, University of Louisville

2015 Graduate Student Council Travel Award, University of Louisville

2015 Department Travel Award, Psychological and Brain Sciences, University of Louisville

2014 Thesis Research Grant, Graduate College, Missouri State University

2009-2013 Presidential Scholarship, Missouri State University

Research Grant Proposals:

Awarded*:*

University of Louisville College of Arts & Sciences Graduate Student Grant for Research and Creative Activities. *Funding the Effect of Parent Interactions on Young Infants' Visual Attention in an Object-Manipulation Task.* 2020-2021. Amount $500.00

University of Louisville Graduate Network in Arts & Sciences Research Grant. *Funding the Effect of Parent Interactions on Young Infants' Visual Attention in an Object-Manipulation Task.* 2020. Amount $250.00

Professional Society Memberships:

International Congress on Infant Studies
Cognitive Development Society
Society for Research in Child Development
Kentucky Psychological Association
Phi Eta Sigma Honors Society
Psi Chi (Psychology Honors Fraternity)
Kentucky Academy of Science
Kentuckians for Science Education
Society for the Teaching of Psychology