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The effects of parental interaction on infant learning.

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By

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Abstract

It was previously thought that infants could not perceive causal events as causal (e.g., one ball rolls into another making the 2nd ball move) until the age of 6 months (Cohen & Amsel, 1998). However, more recent research has shown that infants are able to understand the concept of causality earlier than 6 months of age if given the opportunity to have “real-life” exposure to physical causality with "sticky mittens" (Rakison &Krogh, 2012). "Sticky mittens” play sessions allow infants to manipulate Velcro balls while wearing mittens with Velcro sewn on the palms. This allows young infants, who are otherwise unable to grasp and manipulate objects, to do so. Data obtained from a recent study of infant causal perception in our lab indicated that “sticky mittens” play experience facilitated young infants' causal perception but only when parental interaction was limited; when parental interaction was encouraged, infants’ learning about causal perception was not facilitated (Holt, 2016). The current thesis seeks to test the hypothesis that parental interaction caused infants to be distracted during the learning task. Videos from previously recorded “sticky mittens” play sessions were coded frame by frame to determine the percentage of time infants spent “on-task” (i.e., looking at the balls or the mittens), the percentage of time infants spent “off-task” (i.e., looking anywhere other than the balls or the mittens), and the percentage of time parents spent moving in the infants’ field of vision, which was taken as a measure of parental interference. These data were compared across Talking and No Talking conditions. No statistically significant differences were found in the time infants spent “on-task” or “off-task.” However, it was found that parents in the Talking condition interfered significantly more often with their infants compared to parents in the No Talking condition. Together, the results show that parental interaction can negatively affect infant learning.

The Effects of Parental Interaction on Infant Learning

The question of how a parent can influence the learning of their infant is a topic of great importance in the realm of infant cognition research. Not only is it important to understand when infants begin to learn certain skills, such as walking, talking, or more specific skills like learning about physical causality (e.g., one object can make another object move if they collide), it is of equal importance to understand how the environment around the infant can influence their ability to learn. While many may assume that parental interaction with an infant during a learning task would be beneficial, there may be times when this interaction can interfere with infants' learning (Holt, 2016).

Infant Perception of Causal Events

Little is known about the impact that interference by the parent has on causal perception for 4-month-old infants, specifically whether it is beneficial or harmful. Causal perception is the ability to understand causal events such as a ball hitting another ball and causing the second ball to move. Causality has been a topic of interest dating back many years. According to the philosopher Hume, an understanding of causality is vital to understanding the world (Craig, 2001). This idea of causal perception being integral to understanding the events of the world has been studied in adults as well as infants.

It was previously thought that while younger infants are able to process the spatial (space between balls or not) and temporal (continuous movement or delay between to actions) aspects of events involving moving objects, such as billiard balls, they were unable to understand causal events as causal until six months of age (Cohen & Amsel, 1998). However, more recent research has shown that infants are able to perceive causality in launching events prior to six months of age--if they are given certain learning opportunities prior to being tested for understanding. Such

experience is offered by the "sticky mittens" play session. In the "sticky mittens" play session, the mittens had Velcro attached to the palm side and the balls were covered in Velcro. However, in the "non-sticky mittens" play session, there was no Velcro attached to the mittens or balls. "Sticky mittens" training has been used to study how infants perceive objects (Baillargeon, Kotovsky & Needham, 1996). This exposure to "sticky mittens" training has also been shown to increase object exploration in infants and therefore positively impact learning outcomes of young infants (Needham, Wiesen, Hejazi, Libertus & Christopher, 2017).

Rakison and Krogh (2012) tested the perception of physical causality of 4 ½-month-old infants after exposure to a "sticky mittens" or "non-sticky mittens" play session. In both play sessions, the infants wore mittens on their hands and were permitted to freely play with 4 balls. After the play session, infants were tested using a standard infant visual habituation task to determine their understanding of physical causality. They found that infants in the "sticky mittens" play session group showed evidence of causal perception whereas those in the "non-sticky mittens" group did not. Despite previous thinking that infants were unable to perceive causality until the age of six months, this study showed that infants as young as 4 ½-months-old could perceive causality with the aid of hands-on learning experience (Rakison & Krogh, 2012).

Rakison and Krogh's (2012) "sticky mittens" experiment was used as the basis for a more recent study conducted in our lab that focused on the effects of active versus passive participation and parental interaction during the sticky mittens task on infants' learning about causal perception (Holt, 2016). In Holt's (2016) experiment, infants were assigned to one of five sticky mittens conditions. There were two active conditions, in which the infant was controlling their movements in the play session, and two passive conditions in which the parent of the infant was controlling their movements throughout the duration of the session. The passive conditions

were not hypothesized to aid in causal perception as research has shown passive learning does not facilitate causal learning (Bakker, Summerville & Gredebäck, 2016). Within each subset of active and passive conditions, there was one condition in which the parent was allowed and encouraged to talk to their infant during the play session and to provide positive feedback (Active, Talking), while the other condition prohibited parents from speaking during the session (Active, No Talking). In the fifth condition, the control condition, infants underwent cognitive testing prior to the "sticky mittens" task.

This study is still ongoing in our lab, but preliminary results indicate that infants randomly assigned to the Active, No Talking condition show evidence of causal learning whereas those assigned to Active, Talking condition, as well as infants in both passive conditions and the control condition, do not (Holt, 2016). These results demonstrate that active experience facilitates infant learning, but only if parental interaction is limited.

Hypotheses for the Current Thesis

Using data from the dissertation on infants' understanding of causality previously mentioned, this thesis sought to answer why infants in the Active, Talking condition had poorer learning outcomes than infants in the Active, No Talking condition. The hypothesis for this thesis is two-fold. First, we hypothesized that the discrepancy between the two active conditions was due to infants' spending less time focused on the "sticky mittens" task in the Talking condition. Thus it was predicted that infants' in the Talking condition would spend a greater percentage of time not on task (i.e., looking around the room, at the experimenter, at the parent, etc.) and a lower percentage of time on task (i.e., looking at the Velcro balls or the red mittens) during the "sticky mittens" play session. Second, we hypothesized that the difference in learning outcomes between the two conditions was, in part, due to parental interference, defined as the

parent coming into the infant's field of vision during the play session. Thus, it was predicted that the parents in the Talking condition would spend a greater percentage of time interfering with the infant than in the No Talking condition. In sum, if the results are consistent with both of these hypotheses, they would provide strong evidence in support of the proposed mechanism, which is that increased parental interference in the Talking condition pulled infants off task more often during the "sticky mittens" task and, therefore, did not facilitate causal learning.

Methods

Participants

Participants included 39 healthy, full-term infants 3.5-5.2 months of age (M = 4.16 months) and their parents. Videos of parent-infant dyads from either of two randomly assigned conditions were used from a larger ongoing study in the Infant Cognition Lab. Of the 39 infant participants, 20 were male and 19 were female. The dyads consisted of 34 mother-infant dyads and 5 father-infant dyads. Families were invited to participate in a larger ongoing causality study being conducted in the Infant Cognition Lab. Participants are recruited via Facebook, mail, as well as word of mouth. All participation was voluntary and a small gift was given to the families (e.g., a bib or baby t-shirt) for participating. The data for the present study include 39 sticky mittens videos, solely from the two active conditions previously discussed in which the infant habituated. The coded videos include 20 infants in the Talking condition and 19 infants in the No Talking condition. Parents were asked to report the infant's race on a demographic sheet before participating in the study. 82% of the infants were Caucasian (n= 32), 3% were African American (n= 1), 3% Asian (n= 1), and 12% other (n= 5).

Procedure

When families came to the lab to participate, they were first given informed consent and asked to fill out demographic information such as race of the infant, highest level of education of both parents as well as occupations and total number of children. Additional information such as birth weight of the infant, gestational age at birth and status of vision and hearing at birth was also collected.

Sticky mittens play session.

The infant and the parent were taken into the experiment room. The parent sat at a table with their infant in their lap, opposite the experimenter. As shown in Figure 1, the infant wore a set of red mittens with Velcro sewn to the both palms. Four yellow Velcro balls that sat on top of a white tray on the table in front of the infant. The play session was recorded using iMovie on a MacBook Pro laptop set up in the corner of the experiment room behind and to the right of the experimenter and via a fixed Canon VC-C50i camera in the experiment room to the left of the infant. The fixed experiment room camera video was used for coding in this thesis. The experimenter read a script with instructions for the parent, which varied depending on the condition. For example, if the infant was in the Talking condition, then the parent would be instructed to allow their infant to freely move their arms throughout the duration of the session and to provide verbal positive feedback to their infant to encourage active participation. Parents were encouraged by the experimenter to ask the infant "Can you get it [the ball]?" to draw the infant's attention to the Velcro balls. In the No Talking condition the parent was told that there would be no talking during the duration of the play session and was asked to remain silent throughout the play session. In both conditions, however, the parent was encouraged to draw attention to the balls by pointing to them or by tapping them on the table. They were also

instructed to remove the balls from the mittens after approximately 10 seconds and to help prevent the infant from touching the Velcro balls to their face, as it could be uncomfortable for them. Play sessions lasted from 5-10 minutes, depending on the infant's mood.

Coding

Data for the current thesis project were obtained by coding the previously recorded videos of the sticky mittens play sessions frame by frame using DataVyu, a behavioral coding program (See Figure 2). Four variables were coded in the videos. First, there was "on-task" (O_T), which included anytime the infant was looking at the yellow, Velcro balls or the red mittens (see Figure 3). Next, as shown in Figure 4, there was "off-task" (N_T), which included anytime the infant looked anywhere other than on-task (experimenter, room, parent, etc.). A third variable, "ambiguous" (A) was coded anytime it could not be determined where the infant was looking (see Figure 5). Ambiguous looks most often occurred when the infants' head was turned away from the camera or when something obstructed the view of the camera (e.g., a parent arm). Lastly, parents' behaviors were coded (P). A parental look was only coded when it became intrusive to the infant, meaning when the parents face came into the field of vision of the infant (see Figure 6). Reliabilities were conducted on 25% of the data (10 videos). To be considered reliable, the number of continuous instances of a behavior (i.e., "on-task, "off-task", "ambiguous", etc.) had to be within one instance and the duration of each individual instance of behavior had to be within 1 second. Any discrepancies were discussed and resolved. All 10 videos were found to be reliable.

Results

Mean percentage of time infants spent "on-task, infants spent "off-task," and parents interfered in the Active, Talking and Active, No Talking conditions are displayed in Figure 7.

To test the hypothesis that infants in the Talking condition were more distracted than infants in the No Talking condition, an independent-samples t-test was conducted on the percentage of time infants spent “on-task” and "off-task" across conditions. No statistically significant difference between the conditions was found in percentage of time infants spent “on-task,” $t(37) = 1.26$, $p = 0.21$. Similarly, no statistically significant difference was found in the percentage of time spent “off-task,” $t(37) = -1.94$, $p = 0.06$.

To test the hypothesis that parents in the Talking condition interfered more than parents in the No Talking condition, a third independent-samples t-test was conducted. In contrast to the null findings with the infants, a significant difference was found. Parents in the Talking condition spent a greater percentage of time interfering with their infants than did the parents in the No Talking condition, $t(37)= 2.83$, $p= 0.007$.

Discussion

The results of this study partially supported the hypotheses. The initial hypothesis that infants in the Talking condition would spend a greater percentage of time “off-task” and a lower percentage of time “on-task” than infants in the No Talking condition was not supported by the results of this study. Although somewhat surprising, these results are still interesting because they indicate that infants did not behave differently during the sticky mittens task, yet only infants in the No Talking condition showed an understanding of causal perception.

Data obtained in this study did, however, support the second hypothesis that parents in the Talking condition would spend a greater percentage of time interfering with their infant (i.e., coming into the infants’ field of vision) than parents in the No Talking condition. These results are interesting because parents were never told to look at their infant in the Talking condition. Rather they were allowed and encouraged to speak to their infant during the “sticky mittens”

task. However, it seems that by allowing the verbal interaction, parents also assumed that the physical interaction of coming into the infants' field of vision was acceptable. While this behavior may be a natural tendency that parents have when interacting with their infants, it may be important for parents to realize that it could interfere with the infants' learning.

Overall the pattern of results found here support the hypothesis that parental interference prevented infants from learning optimally during the sticky mittens task. These results may seem surprising given the recent push in infant learning for parents to interact with their infants in order to improve learning outcomes. This push comes from literature demonstrating that at times parental interaction can facilitate infant learning. For example, a study by Striano, Chen and Cleveland (2007) showed that 9-month-old infants' visual attention to objects is more influenced by adults' focus of attention than that of 12-month-old infants. Results of this study suggest that younger infants were more influenced by the attentional behaviors of the adult when learning (Striano, Chen & Cleveland, 2007). Certain types of verbal feedback from parents have also been shown to facilitate infant learning. A study done with 9-month-old infants demonstrated that object-directed speech from adults improved infant attention during a learning task (Balaban & Waxman, 1997). While these results show that at times the infant can benefit from parental interaction during learning, other research demonstrates that this is not always the case.

A study conducted with 21-month-old toddlers showed that both word and non-word learning was negatively affected with increasing visual distractions caused by an experimenter entering the room during the learning task, as well as auditory distractions caused by the experimenter reading aloud a text during the learning task (Dixon, Salley & Clements 2006). These results support the findings of the current thesis that the increased parental interaction, both visual and auditory, in the Talking condition did not facilitate causal perception. With the

conflicting findings in the literature, it is clear that there is not one answer for whether parents should or should not interact with their infants during a learning task. Rather, it seems that this question should be considered on a case-by-case basis. Therefore, more consideration and research needs to be completed to determine when parental interaction should be encouraged and what type of parental interaction is best for the learning environment of the infant.

The findings do not support the proposed mechanism that increased parental interference caused the infant to spend a greater percentage of time “off-task” and a lower percentage of time "on task." No such differences were found between groups. One possible explanation for the results is that infants in the Talking condition were unable to perceive causality due to cognitive overload as a result of the verbal interference of the parent. It is also possible that infants in the Talking condition were unable to achieve the same level of concentration during the “sticky mittens” task. Previous research has shown that with increasing visual and auditory distractors in the learning environment, the level of focused attention of the infant is negatively impacted (Oaks, Ross-Sheehy & Kannass, 2004). Therefore, the auditory distraction of the parent in the Talking condition, combined with the increased visual distraction of the parent entering the infants’ field of vision could have prevented the infant from reaching the same level of focus as infants in the No Talking condition.

One limitation of the current study is that we cannot determine whether the effect is due to parents' talking, parents' moving into their infants' peripheral vision, or a combination of the two. It is also important to explore this issue further to determine if one type of interaction prevents learning more than the other, or what specifically about the parental interaction did not facilitate learning. For example, did infants in the Talking condition perform better when parents used object-directed speech (e.g. “Can you get the ball?) versus encouraging speech (e.g. “Good

job!")? It is also possible that although infants across both conditions spent the same amount of time "on-task" and "off-task", the times at which an infant went "off-task" could play a significant role in whether or not they were able to understand causal perception. Future research should explore this issue further.

Figure 1. Example of sticky mittens play session.

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	O_T	N_T	A	P
1	00:01:34:010 00:01:56:178 (OT1)	00:01:20:138 00:01:33:976 (NT1)	00:02:25:350 00:02:27:050 (A1)	00:01:45:366 00:01:48:698 (P1)
2	00:01:57:878 00:02:03:828 (OT2)	00:01:56:212 00:01:57:844 (NT2)	00:02:39:188 00:02:41:262 (A2)	00:01:50:840 00:01:58:456 (P2)
3	00:02:05:698 00:02:08:554 (OT3)	00:02:03:862 00:02:05:664 (NT3)	00:02:44:220 00:02:45:308 (A3)	00:02:00:870 00:02:05:698 (P3)
4	00:02:09:608 00:02:10:832 (OT4)	00:02:08:588 00:02:09:608 (NT4)	00:02:48:776 00:02:51:360 (A4)	00:02:08:690 00:02:25:928 (P4)
5	00:02:12:328 00:02:25:316 (OT5)	00:02:10:866 00:02:12:294 (NT5)	00:02:57:616 00:02:59:248 (A5)	00:02:40:650 00:02:45:648 (P5)
6	00:02:28:614 00:02:39:154 (OT6)	00:02:27:084 00:02:28:580 (NT6)	00:03:25:020 00:03:26:924 (A6)	00:02:48:708 00:02:54:046 (P6)
7	00:02:41:296 00:02:41:908 (OT7)	00:02:41:942 00:02:42:724 (NT7)	00:03:57:660 00:03:59:054 (A7)	00:03:03:974 00:03:05:980 (P7)
8	00:02:42:758 00:02:44:186 (OT8)	00:02:45:342 00:02:46:294 (NT8)	00:04:27:308 00:04:34:754 (A8)	00:03:07:850 00:03:08:292 (P8)
9	00:02:46:328 00:02:48:742 (OT9)	00:03:03:872 00:03:08:122 (NT9)	00:05:47:582 00:05:49:248 (A9)	00:03:22:062 00:03:29:678 (P9)
10	00:02:51:394 00:02:57:582 (OT10)	00:03:36:580 00:03:37:532 (NT10)	00:06:21:208 00:06:23:418 (A10)	00:03:36:818 00:03:37:940 (P11)
11	00:02:59:282 00:03:03:838 (OT11)	00:03:40:796 00:03:43:652 (NT11)	00:06:25:356 00:06:50:992 (A11)	00:03:59:700 00:04:09:832 (P12)
12	00:03:08:156 00:03:24:986 (OT12)	00:03:55:314 00:03:57:626 (NT12)	00:07:03:470 00:07:06:564 (A12)	00:04:21:800 00:04:33:972 (P13)
13	00:03:26:958 00:03:36:580 (OT13)	00:04:46:552 00:04:47:606 (NT13)	00:08:51:250 00:08:53:086 (A13)	00:05:02:464 00:05:04:844 (P14)
14	00:03:37:566 00:03:40:762 (OT14)	00:04:59:404 00:05:01:070 (NT14)	00:10:47:870 00:10:53:106 (A14)	00:05:06:374 00:05:08:958 (P15)
15	00:03:43:686 00:03:55:280 (OT15)	00:05:21:538 00:05:22:626 (NT15)	Click to create new cell	00:05:10:624 00:05:13:786 (P16)
16	00:03:59:088 00:04:27:274 (OT16)	00:06:14:714 00:06:21:174 (NT16)		00:05:19:804 00:05:34:798 (P17)
17	00:04:34:788 00:04:46:518 (OT17)	00:07:16:526 00:07:24:142 (NT17)		00:05:40:952 00:05:47:990 (P18)
18	00:04:47:640 00:04:59:370 (OT18)	00:07:34:002 00:07:39:646 (NT18)		00:06:02:576 00:06:12:096 (P19)
19	00:05:01:104 00:05:21:470 (OT19)	00:08:02:494 00:08:10:994 (NT19)		00:06:16:550 00:06:20:358 (P20)
20	00:05:22:660 00:05:47:548 (OT20)	00:08:15:040 00:08:17:420 (NT20)		00:06:50:108 00:06:53:304 (P21)
21	00:05:49:418 00:06:14:680 (OT21)	00:08:26:736 00:08:28:096 (NT21)		00:06:54:698 00:06:56:976 (P22)
22	00:06:23:452 00:06:25:322 (OT22)	00:08:31:258 00:08:38:602 (NT22)		00:06:58:132 00:07:00:818 (P23)

Figure 2. Example of coding set in DataVyu showing the four variables coded.

Figure 3. Example of an "on-task" look.

Figure 4. Example of an "off-task" look.

Figure 5. Example of an "ambiguous" look.

Figure 6. Example of a parental interaction.

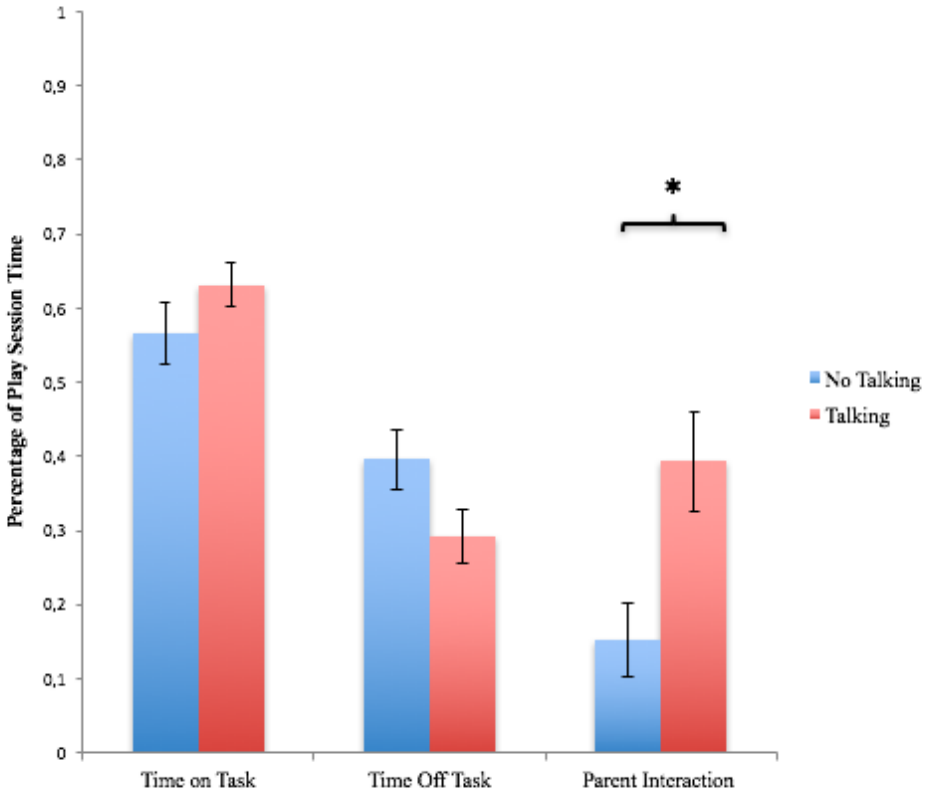

Figure 7. Mean percentage of time infants spent "on-task, infants spent "off-task," and parents interfered in both active conditions. Error bars represent standard error.
* $p < 0.05$.

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