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Predicting Social Behavior by Sound & Surface Appearance in Infancy

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PREDICTING SOCIAL BEHAVIOR BY SOUND & SURFACE APPEARANCE IN INFANCY

A Thesis Presented

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ABSTRACT

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Our naïve theory of social behavior assumes that the positive and negative actions of others are caused by some underlying social disposition. Furthermore, adults automatically infer such traits in advance based upon whatever observable, even superficial, properties are available (e.g., how someone looks or sounds). The goal of the current study is to explore the developmental origins of this bias. We tested whether 12-month-old infants automatically infer a character's social disposition (i.e., whether they 'help' or 'hinder' another character's goal) based upon the superficial properties they display. Infants were habituated to two characters that possessed surface properties that were rated either more positively (a soft, fluffy appearance and a happy-sounding laugh) or more negatively (a sharp, pointy appearance and a deep, ominous laugh) by adults. We then observed whether babies showed more visual interest in the characters that engaged in social actions that were inconsistent rather than consistent with their appearance. A control condition helped determine whether any observed looking differences were based upon infants inferring a causal relationship between surface property and disposition or a non-causal association between positive and negative characteristics. Results from these two studies showed that infants are able to use an agent's superficial properties in determining that agent's future behavior.

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CHAPTER I

INTRODUCTION

Predicting Social Behavior by Sound & Surface Appearance in Infancy

As social beings our daily lives consist of innumerable interactions with other people. Successfully navigating this complex social world depends, in large part, upon our ability to interpret the many behaviors that people engage in. For instance, understanding a person's behavior requires us to make educated guesses about the mental states that gave rise to those physical actions, such as the person's goals, desires, and perhaps even their moral character. Of course, these mental properties cannot be perceived directly, a fact that poses a distinct challenge for young learners. One way of understanding how infants accomplish this remarkable feat is to identify the physical and behavioral characteristics that support such automatic social inferences across development.

Many studies have investigated infants' ability to interpret the goals and intentions of others, and the ability to infer such mental states seems to develop at a relatively young age (Gergely, Nadasdy, Csibra & Biro, 1995; Johnson, Slaughter & Carey, 1998; Luo & Baillargeon, 2005; Premack, 1990; Woodward, 1998, 1999). For instance, by 6 months, infants will interpret the action of a hand reaching towards an object in terms of the hand having a specific goal (Woodward, 1998, 1999). Furthermore, infants also use these goal attributions to correctly interpret the social dispositions characters hold toward others based upon their history of interaction. For example, infants expect a character to respond differently to one who has helped the character achieve its goal than one who has thwarted that character's goal in the past (Kuhlmeier, Wynn & Bloom, 2003). More recent studies have found that infants even exhibit personal preferences for characters based upon their observed behavior relative to another's goal.

For example, infants show a significant reaching preference towards a character who was previously seen helping another character reach the top of a hill vs. one who kept the character from achieving this goal (Hamlin, Wynn & Bloom 2007, 2010). This finding has also been replicated using two different social situations (Hamlin & Wynn, 2011). For example, infants were shown a character struggling in their attempt to retrieve a toy from a box. On alternating trials, another character comes over and either helps the struggling character open the lid, or hinders the struggling character by stomping on the lid. Once again, infants systematically chose to reach for the helping character over the hindering character.

These prior studies demonstrate infants' ability to judge a character's disposition according to the history of behavior that the infant has observed. Although this is an impressive and important ability, judging others only after observing their behavior is not a fully adaptive form of social evaluation. In the everyday world, it can be much more beneficial for an observer to predict in advance if someone is likely to behave in a positive or negative way. For example, rather than waiting for an approaching stranger to engage in some socially relevant action, we might instead decide to avoid the individual based upon how they look or sound. Indeed, it is well documented that adults spontaneously infer many dispositional traits in advance of any direct behavioral evidence (Ambady & Rosenthal, 1997; Ambady, Hallahan & Conner, 1999; Rule & Ambady, 2008; Willis & Todorov, 2006). One such study showed that we can accurately judge sexual orientation after viewing a silent 1-second video clip (Ambady, et al., 1999). These fast and automatic inferences help us navigate through the social world by supporting predictions about how an agent will behave, especially how likely it is that an agent will behave positively or negatively toward us.

When in development do we expect an individual's social or moral character to reflect how they appear on the surface? For instance, might infants expect a positive looking or sounding character to behave in more positive or pro-social ways? Possessing this type of expectation early in development would seem to require that infants are 1) predisposed to encode certain stimuli as more positive or negative and 2) able to match corresponding stimuli with similar valences (e.g., positive looking to positive acting). We know, for example, that infants have some very early emerging preferences for certain auditory and visual stimuli that might be represented in positive/negative terms. For instance, within the first 6 months of life infants prefer vocalizations that are slower in tempo and higher in pitch (Cooper & Aslin, 1990; Cooper, Abraham, Berman,, & Staska, 1997; Trainor & Zacharias, 1998) sounds that are consonant rather than dissonant (Trainor & Heinmiller, 1998), and visual stimuli that are more symmetrical (Spears, 1964) including attractive looking faces (Langlois, Roggman, & Rieser-Danner, 1990; Langlois, Roggman, Casey, Ritter, Rieser-Danner, & Jenkins, 1987; Slater, Von der Schulenburg, Brown, Badenoch, Butterworth, Parsons, & Samuels, 1998) Moreover, infants seems to have a rudimentary ability to match stimuli of similar valences across modalities (Lyons-Ruth, 1977; Spelke, 1979a; Spelke 1979b). For instance, when it comes to infants' appreciation of how sounds relate to appearances in the social domain, studies have shown that by 5.5 months, infants pair positive and negative sounds with positive and negative facial expressions in a social referencing task (Vaillant-Molina & Bahrick, 2012). So although we know that infants both encode certain features as more positive or negative and that they can also recognize the relationship of features in one modality to another, we currently do not know whether infants interpret such valenced features as being diagnostic of a character's social/moral disposition.

The goal of the current study was to investigate whether infants, like adults, are able to use certain observable characteristics of an individual—such as how an agent looks or sounds—to actively predict that individual's social disposition and how it will behave in the future. This was tested by familiarizing infants to different individuals possessing contrasting appearance and sound characteristics that produce more socially positive or negative connotations in adults. Then in a separate scenario we showed these characters interacting in a helpful or unhelpful manner with a third individual who was trying to complete some goal. If infants spontaneously relate perceptual properties like sound and appearance to an individual's social disposition, we expect that infants will show increased attention and interest when a character engages in a social action that is inconsistent with the valence of its external cues.

CHAPTER II

EXPERIMENT 1

Methods

Participants

Sixteen infants participated in this study (8 girls and 8 boys). The infants' average age was 11 months, 26 days and ranged between 10 months, 10 days to 13 months, 22 days. Previous studies have shown that by this age, infants are able to make basic social judgments of agents (Hamlin & Wynn, 2011; Hamlin, Wynn & Bloom 2007; Kuhlmeier, Wynn & Bloom, 2003). Participants were recruited from the Child Studies Center database and were from the greater Amherst, Massachusetts area. Two additional infants were tested, but were excluded from the sample due to experiment error (2).

Materials

Infants were seated in their parents lap in front of a stage placed on a table. The chair was placed 42 inches from the stage. Curtains were placed around the sides and the top of the stage to block off any actions happening behind the stage. The dimensions of the stage were 48in. x 24 ¼ in. x 15 ¾ in., with a door 12in. x 8 ¼in. in the back in which the puppets entered from. During habituation, the two creatures were placed 13 in. away from each other, and during test trials the two creatures were placed 31 in. away from each other.

Both of the creatures used were made out of a 3 7/8 in. x 8 7/8 in. Styrofoam cone. The "nice-looking" character was created by attaching fluffy white fur to the Styrofoam cone body. The "mean-looking" character was created by spray painting the cone with yellow spray paint, and placing 2 ½ inch flat edged sticks into its body to create a spiky surface appearance. Both creatures were outfitted with medium sized googly eyes.

During the test events, infants were also presented with a cloth hand puppet who used 2x2x2 inch rubber blocks to build a block tower.

Procedure

Once the infant was brought into the lab and the parent consented to participate in the study, the parent and infant were brought into the testing room. Parents were asked to keep quiet during the study and to close their eyes during the test events to eliminate influence and bias. Infants were randomly assigned to either the Helping Condition (n=8) or Hindering Condition (n=8). They saw both the following events in a predetermined, counterbalanced order based on assigned condition. In the *helping familiarization event*, participants witnessed a puppet build a block tower but struggle to place the top block. Another puppet entered and helped place the last block on top of the tower. In the *hindering familiarization event*, the actions were the same except a different puppet came in and knocked the tower down. Looking time from both of these trials was recorded as a baseline measurement.

Following familiarization, infants in both conditions were habituated to two characters placed on opposite sides of the stage; a soft looking character that made a pleasant sound (a young child's laugh) and a spiky jagged character that made a more negative sound (an adult's deep ominous laugh). Each character was picked up while its corresponding sound was played. The sounds emanated from behind the stage, in a central location. A trial ended if the infant looked away from the stage for 2 consecutive seconds or if 60 seconds elapsed. At the conclusion of each trial a black curtain was lowered to occlude the entire stage, the position of each character was switched, and the curtain was lifted to commence the next trial. Infants were presented with a minimum of 6 and maximum of 12 habituation trials. An infant reached habituation when three consecutive trials totaled less than half of the first three trials. After

reaching the habituation criteria, infants experienced six test trials consisting of three pairs of either helping or hindering events. Infants who were assigned to the Helping Condition saw all six trials beginning with a new puppet character attempting to build a block tower. As this character was struggling to place the last block upon the top of the tower one of the characters from the habituation phase moved from the side of the stage towards the middle and attached onto the puppet and block, helping to raise them both to the top of the tower. Once it completed this helping action, the character moved back to its starting position. The order of which character helped first was counterbalanced across subjects. Infants' looking time to the event was recorded once all movement on the stage stopped. A trial ended if the infant looked away for 2 consecutive seconds or if 60 seconds elapsed. At the end of each trial the curtain lowered, the stage was reset, and then the trial was repeated with the opposite character from habituation completing the helping event. This sequence continued, with the two different puppets helping in alternation for six total test trials. Infants who were assigned to the Hindering Condition also saw events beginning with a new character attempting to build a block tower, however, now the characters from habituation hindered this character's goal by knocking the tower down. For instance, one of the characters moved from the side of the stage towards the middle and paused before knocking down the tower with its base. Once it completed this hindering action, the character moved back to its starting position and infants' looking time to the stage was recorded. This event was repeated with each of the characters hindering the tower builder in alternation for six test trials.

Looking time was measured by an on-line observer placed in a separate room from the infant via a closed circuit camera. Coders viewed the infant and recorded the duration of their looks on a computer screen using the jHAB coding program (Casstevens, 2007). Following the

live coding, a different observer who was blind to the condition completed a second set of off-line measurements and obtained an interobserver reliability score of .90.

Results

Baseline Trials. We analyzed looking times from the two familiarization trials in a paired t-test. This analysis revealed no significant difference in looking time between the helping familiarization (M=24.41, SD=17.08) and the hindering familiarization events (M=19.31, SD=13.68), $t(15)$=.884, p=.391.

Test Trials. The results for Experiment 1 are depicted in Figure 1 and Figure 2. Overall, infants successfully discriminated inconsistent from consistent feature/action pairings. This was confirmed by analyzing looking times from the six test trials in a 3 (Pair) by 2 (Type: Inconsistent vs. Consistent) ANOVA. This analysis revealed a significant main effect of pair, $F(2,30)$=6.91, p=.003, with a significant linear trend from Pair 1 to Pair 3, $F(1,15)$=11.22, p=.004. Critically, a significant main effect of type was found, $F(1,15)$=6.33, p=.024, showing a difference in looking time between the inconsistent and consistent pairing, with infants looking longer at the inconsistent (M=16.70, SD=9.13) over the consistent (M=12.80, SD=9.20). No significant interaction between pair and type was found.. A 3 (Pair) by 2 (Type: Positive vs. Negative Feature) ANOVA with condition (Helpful or Hindering) as the between subjects factor showed a significant interaction between condition and type, $F(1,14)$=6.72, p=.021.

Differences across the two conditions were explored with separate Pair (3) by Type (Helping vs. Hindering) ANOVAs. Infants who viewed the Hindering Condition looked significantly longer on inconsistent (M=17.79, SD=6.26) versus consistent (M=11.81, SD=5.05) trials, $F(1,7)$=7.34, p=.03. Infants who viewed the Helping Condition showed no significant looking difference between inconsistent (M=15.61, SD=11.70) and the consistent (M=13.80,

SD=12.40) trials, $F(1,7)=.788$, $p=.404$. There was no significant interaction between the helping and hindering conditions, $F(1,14)=1.93$, $p=.187$.

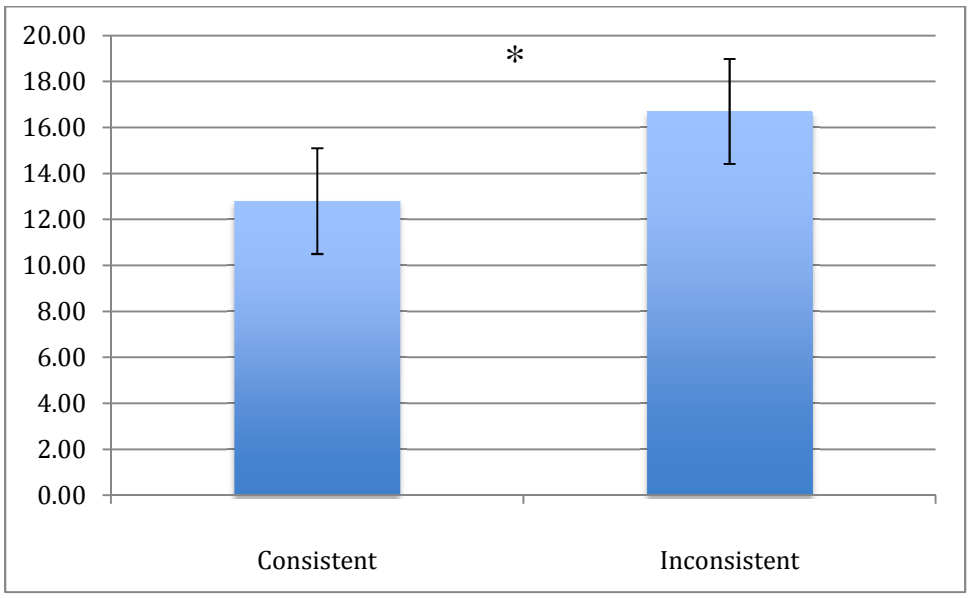

Figure 1: Looking Time (s) for the Consistent feature (sound & appearance)/action pairing and the Inconsistent feature (sound & appearance)/action pairing.

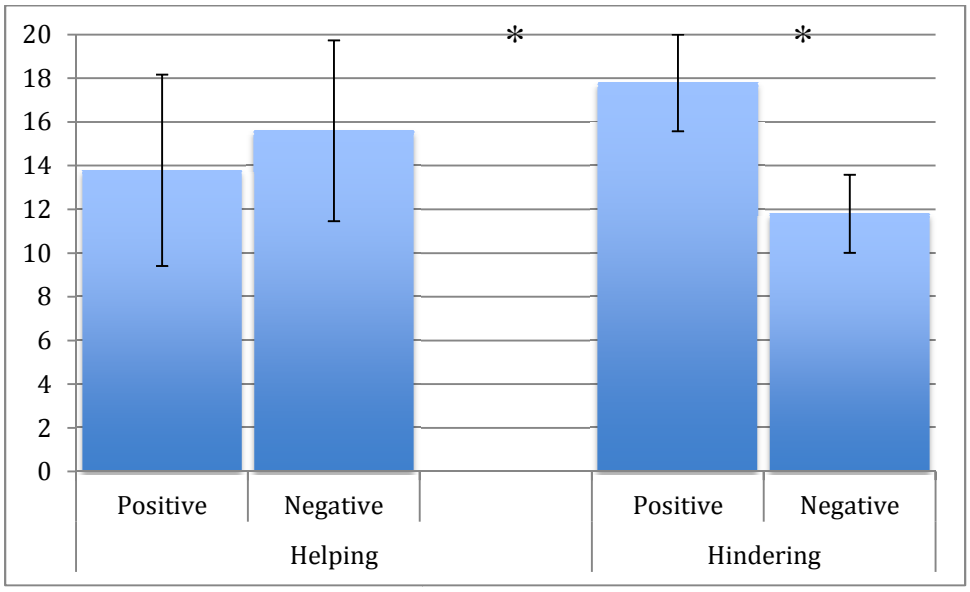

Figure 2: Looking Time (s) for the 'positive' and 'negative' feature pairings from both the Helping and Hindering Conditions.

Discussion

The results of Experiment 1 suggest that infants might automatically infer future social behavior on the basis of how an agent looks and sounds. This was evidenced by infants looking longer overall at the inconsistent versus consistent pairings of the character's observable features and its future behavior. In the current study, this connection was only observed for infants who viewed a character exhibiting a positive sound/appearance taking part in a hindering action. One possible explanation for why this effect was not obtained in the Helping Condition is that infants do not find the act of helping to complete the tower as nice as they find the act of destroying the tower in the Hindering Condition mean. In other words, infants might feel that the hindering action of knocking down the tower is much more negative, and while the helping action of placing one last block upon a partially built tower may be perceived as positive, it is not as salient a difference relative to a neutral action as compared the negative outcome (i.e., knocking down the mostly completed tower).

The finding that infants respond more strongly to an event where the positive looking/sounding character hinders the builder's goal falls in line with certain findings in the literature on adult's moral judgments. Adults may be biased to believe that positive/moral behaviors are less diagnostic of an individual's character than negative/immoral behaviors. For instance, while both moral and immoral people engage in moral actions some of the time only immoral people engage in immoral actions (Baumeister, Bratslavsky, Finkenauer & Vohs, 2001). This pattern is consistent with the current findings where infants looked longer when the nice or moral character did an immoral action (i.e., knocking down the tower), but did not see anything surprising with an immoral character performing a moral action (helping to complete the tower).

All together, the results of Experiment 1 suggest that infants are able to use visual and audio cues to form expectations about an agent's future social behavior. There are at least two separate explanations for infants' performance in this task. One possibility is that infants are making a causal connection between the features of the agent and its behaviors. For instance, infants may at some level believe that an agent's sound and/or appearance is causally related to the social behavior/disposition it later exhibit and that whatever underlying trait causes its behavior is somehow related to how it looks and sounds. A second interpretation is that infants are simply matching relatively low-level associations between the features of the agents (positive/negative looks and sounds) during habituation and the overall valence of the action observed during test. In this view, infants experience some feature observed during habituation as positive or negative (e.g., hearing a happy or mean sound) and associate it with the character's presence and wiggling movement on the stage in a way that is entirely non-mentalistic. Then, during test trials, infants might only detect whether these associations match the overall positive/negative valence of the event's outcome (i.e., a completed vs. destroyed tower). In other words, infants might have looked longer at the stage following the hindering event because the overall valence of that event is dissonant with the generally positive valence associated with the character that always moved when the 'happy' sound played.

CHAPTER III

EXPERIMENT 2

In order to tease the association view and the causal view apart, in Experiment 2 we maintained the association cues available to infants while interfering with their ability to establish a causal connection between the agent's features and their future behavior. To simplify this design we focused solely on the auditory cue[1]. In particular, we manipulated whether infants would attribute the positive/negative sound to the characters themselves (internal sound), or to some source external to the character (external sound). We did this by adding a waiting room familiarization phase where infants were exposed to the nature of how each character's sound was produced. The experimenter presented to the infant each of the characters used during habituation alongside a separate speaker device. Infants in the Causal Group saw the separated speaker but were played the sound emanating from the character itself, while infants in the Association Group were played the sound coming from the small spatially separated speaker rather than from the character. All other aspects of the habituation and test presentation were the same. Because the sounds are still perfectly associated with each of the objects over the habituation, we hypothesized that infants should show the same pattern of results as Experiment 1 in both the Association and Causal Group if infants are simply responding to simple patterns of association. However, if infants' pattern of looking in Experiment 1 is based upon them inferring a behavioral disposition based upon a causal connection with the sound the character makers,

[1] We chose to isolate sound rather than appearance based upon a literature showing that infants exhibit reliable preferences for sound cues very early on (Lyons-Ruth, 1977; Trainor & Heinmiller, 1998) and have been shown to relate certain sound cues to socially relevant stimuli, such as faces (Vaillant-Molina & Bahrick, 2012). Because of these findings, we hypothesize that sound cues alone might be strong enough to aid 12-month-old infants in predicting the characters' behaviors.

then only infants in the Causal Group should look longer at the inconsistent sound-behavior pairing (and no looking difference will be obtained in the Association Group).

Methods

Participants

Thirty-two 12 month-old infants participated in this study (16 girls and 16 boys). The infants' average age was 11 months, 27 days and ranged between 11 months, 15 days and 12 months, 14 days. Participants were recruited from the Child Studies Center database and were from the greater Amherst, Massachusetts area. An additional 13 infants were tested but were excluded from the sample due to experimenter error (7), fussiness (3), age (2), and equipment failure (1).

Materials

The materials used in Experiment 2 were identical to those in the previous experiment with the following exceptions. Two identically shaped characters that only differed in terms of their color were used. Alongside the white, fluffy, cone-shaped character from Experiment 1 was an otherwise identical red character created with a red feather-like material. The speaker was a small 9v-battery operated recording module from RadioShack that measured approximately 3 inches by 2 inches. It could be held separately in the experimenter's hand during the waiting room familiarization and was affixed to the center of the stage for habituation trials 11-¼ in. from the floor of the stage.

Procedure

The procedures and measurements in Experiment 2 were identical to those in Experiment 1, except for the added waiting-room familiarization phase that took place just prior to the beginning of the procedure from Experiment 1.

Association Group Familiarization. The purpose of this familiarization type was to demonstrate to the infants that the sounds they hear are externally caused and emanate from a separate speaker device rather than the character. The infant was first seated in their parent's lap in the waiting room. Once seated across from the infant, the experimenter showed the infant one of the habituation characters held in one hand and the small speaker separated by a couple of feet in the other hand. The experimenter said, "look!" while looking at the character, and then saw the creature move in the experimenter's hand. The experimenter then looked over to the speaker and said, "look!" and pressed a button on the speaker, which produced a sound. This sound was identical to the one that infants in Experiment 1 heard paired with the character during the habituation phase. Once this familiarization was completed, the Experimenter presented the second character alongside the speaker device that played the opposite sound.

Causal Group Familiarization. The purpose of this familiarization type was to demonstrate to the infants that the sounds they hear are internally caused and emanate from inside of the character rather than the separate speaker device. The presentation of the character and the speaker were identical to that of the Association Group except that the infant never heard the sound come from the speaker device. Instead the sound emanated from the back of the character as the experimenter wiggled it back and forth, whereas the speaker device in the experimenter's opposite hand moved back and forth without playing a sound. The sounds played out of each character were counterbalanced to control for any inherent color biases.

During habituation, an identical speaker was placed in the center of the stage on the back wall. This was placed there to remind infants in the Association Condition that the sounds came out of the speaker and not the character, while it served no purpose for infants in the Causal Condition. Importantly, as in Experiment 1, the sounds in both the Association and Causal

Conditions emanated from a central location behind the stage and not from the additional speaker located on the stage.

The coding measures used in Experiment 2 were identical to the measures used in Experiment 1. Following the live coding, a different observer who was blind to the condition completed a second set of off-line measurements and obtained an inter-observer reliability score of .90.

Results

Baseline Trials. We analyzed looking times from the two familiarization trials in a paired t-test. This analysis revealed no significant difference in looking time in the causal condition between the helping familiarization (M=15.89, SD=14.04) and the hindering familiarization events (M=22.73, SD=15.15), $t(15)$=-2.11, p=.052. This analysis also revealed no significant difference in looking time in the association condition between the helping familiarization (M=18.11, SD=13.45) and the hindering familiarization events (M=26.02, SD=16.78), $t(15)$=-1.82, p=.088.

Test Trials. The results for the Causal condition are depicted in Figure 3. Overall, infants in the Causal condition successfully discriminated inconsistent from consistent feature/action pairings. This was confirmed by analyzing looking times from the six test trials in a 3 (Pair) by 2 (Type: Inconsistent vs. Consistent) ANOVA that revealed a significant main effect of pair, $F(2,30)$=8.28, p=.001, due to a significant linear trend from Pair 1 to Pair 3, $F(1,15)$=9.89, p=.007. Critically, a significant main effect of type was found, $F(1,15)$=4.88, p=.043, showing a difference in looking time between the inconsistent and consistent pairing, with infants looking longer at the inconsistent (M=14.94, SD=9.09) over the consistent (M=11.17, SD=7.28). No significant interaction between the pair and type was found. A 3 (Pair) by 2 (Type: Positive vs.

Negative Feature) ANOVA with condition (Helpful or Hindering) as the between subjects factor showed a significant interaction between condition and type, $F(1,14)=4.92$, $p=.044$.Separate Pair (3) by Type (Inconsistent vs. Consistent) ANOVAs explored any differences within the Helping and Hindering conditions. Infants who viewed the Helping Condition showed no difference in looking time between the inconsistent ($M=18.89$, $SD=2.75$) and consistent ($M=13.33$, $SD=2.73$), $F(1,7)=3.40$, $p=.108$. Infants who viewed the hindering condition showed no difference in looking time between the inconsistent ($M=10.99$, $SD=3.18$) and consistent ($M=9.00$, $SD=2.32$), $F(1,7)=1.60$, $p=.248$. No significant interaction between the helping and hindering conditions was found, $F(1,14)=1.10$, $p=.312$.

The results of the Association condition are depicted in Figure 3. Overall, infants in the Association Condition did not discriminate inconsistent from consistent feature/action pairings. This was confirmed by analyzing looking times from the six test trials in a 3 (Pair) by 2 (Type: Inconsistent vs. Consistent) ANOVA that revealed a significant main effect of pair, $F(2,30)=11.34$, $p<001$, due to a significant linear trend from Pair 1 to Pair 3, $F(1,15)=21.72$, $p<.001$. No significant main effect of type was found, $F(1,15)=.008$, $p=.931$, showing no difference in looking time between the inconsistent ($M=12.44$, $SD=6.98$) and consistent ($M=12.66$, $SD=8.23$) pairing. No significant interaction between the pair and type was found. A 3 (Pair) by 2 (Type: Positive vs. Negative Feature) ANOVA with condition (Helpful or Hindering) as the between subjects factor also returned no significant interaction. Separate Pair (3) by Type (Inconsistent vs. Consistent) ANOVAs explored any differences within the Helping and Hindering Conditions. Infants who viewed the helping condition showed no difference in looking time between the inconsistent ($M=11.86$, $SD=9.05$) and consistent ($M=16.20$, $SD=9.41$) test trials, $F(1,7)=1.17$, $p=.316$. Infants who viewed the Hindering Condition showed no

difference in looking time between the inconsistent (M=13.03, SD=4.67) and consistent (M=9.13, SD=5.29), $F(1,7)=2.72$, p=.143. No significant interaction between the Helping and the Hindering Conditions was found, $F(1,14)=3.13$, p=.099.

An overall Pair (3) by Type (Inconsistent vs. Consistent) ANOVA with Condition (Association or Causal) as a between subjects factor showed no significant interaction, $F(1,30)=1.75$, p=.196.

We also performed analyses looking at the effect of combining the data from Experiment 1 with the data from the Causal condition in this current experiment. A Pair (3) by Type (Inconsistent vs. Consistent) ANOVA found a significant main effect of pair, $F(2,62)=15.38$, $p<$ .001, a significant main effect of type, $F(1,31)=11.44$, p=.002, and no significant interaction, $F(2,62)=.081$, p=.922. Infants looked longer at the inconsistent (M=15.82, SD=9.01) over the consistent (M=11.98, SD=8.20). A separate Pair (3) by Type (Inconsistent vs. Consistent) ANOVA explored any differences within each condition. Infants who viewed the Hindering Condition looked significantly longer on inconsistent (M=14.39, SD=8.27) versus consistent (M=10.40, SD=5.84) trials, $F(1,15)=8.01$, p=.013. Infants who viewed the Helping Condition showed no significant looking difference between the inconsistent (M=17.25, SD=9.75) and the consistent (M=13.57, SD=9.98) trials, $F(1,15)=4.08$, p=.062. With the results of Experiment 1 combined with the Causal group, we found no significant interaction between the Causal and Association groups, $F(1,46)=2.92$, p=.094.

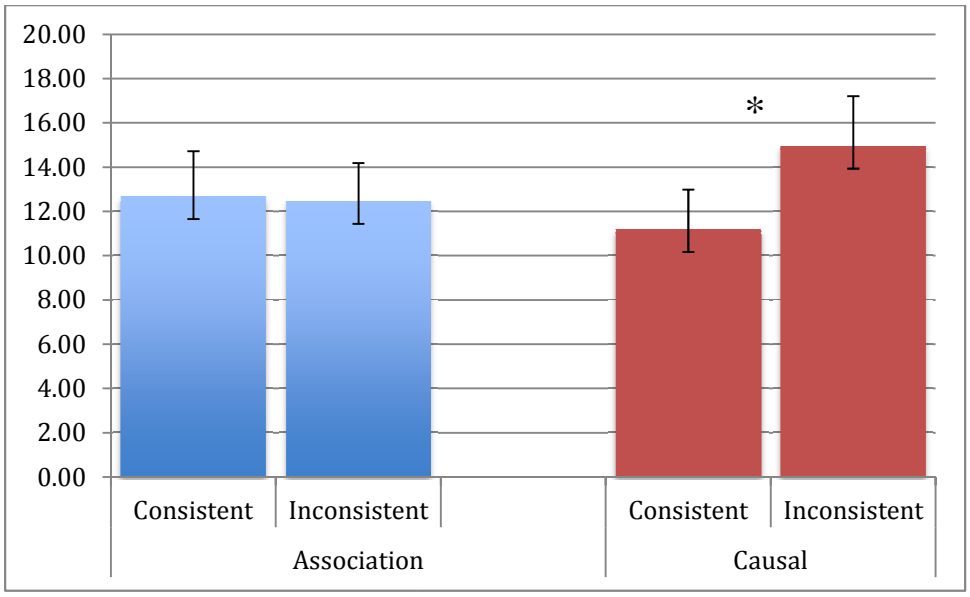

Figure 3: Looking Time (s) for the Consistent action and the Inconsistent action in the Causal and Association conditions.

Discussion

The results of Experiment 2 alone replicated the results of Experiment 1 for infants in the Causal Group but not the Association Group. That is, infant's looked significantly longer at test events where the helping/hindering social behavior was inconsistent with the sound played during habituation for that character, but only when they perceived the sound as emanating from the character. Infants did not discriminate the test events in the Association Group despite being exposed to the identical sound-character parings, presumably because they attributed the sounds to the speaker device affixed to the stage rather than to the character itself. Since we eliminated the appearance cue that was used in Experiment 1, these results also show that sound alone may be a sufficient cue in predicting an agent's future social behavior.

Unlike Experiment 1, infants did not show a stronger effect for the inconsistent action in the Hindering Condition. When the helping and hindering actions in the Causal Group were looked at separately, no significant looking differences between the inconsistent and consistent

action were found. However, like Experiment 1, the current results do show a trend of longer looking towards an inconsistent action for infants in both the helping and the hindering conditions.

CHAPTER IV

GENERAL DISCUSSION

The combined results of Experiment 1 and 2 help support the conclusion that infants use simple perceptual properties to infer a character's social dispositions and to predict and interpret their future social behavior. This result is consistent with a growing literature documenting infants' propensity to evaluate the social behavior of others. Whereas previous studies have shown that how this evaluation operates in response to viewing a character's social behavior directly, the current study suggests that infants have expectations about how characters might behave based upon the non-behavioral properties they possess. Like adults, infants may find properties such as a character's surface appearance or sound as salient predictors of how that character is likely to act towards others.

The results of Experiment 2 also suggest that sound cues alone are strong enough to help infants form expectations about an agent's social disposition. That is, infants might have an implicit understanding that the sound an individual makes is somehow causally related to its behavior. It would be beneficial to see if the same pattern holds true for appearance cues alone by stripping the sound cues away from the characters and observing differences in looking time between the helping and hindering events. While infants may or may not generate social predictions based upon the relatively abstract surface properties employed in Experiment 1 (e.g., spikey- vs. fluffy-textured characters), other surface properties are likely to be very salient to infants. For instance, in the domain of face perception we know that infants possess strong preferences for attractive over unattractive faces (Langlois, Roggman, & Rieser-Danner, 1990; Langlois et al., 1987; Slater et al., 1998) Since attractiveness seems to be a particularly salient

dimension for infants, future work could explore whether infants of the same age are capable of making predictions about the future actions of attractive versus unattractive agents.

The current studies may also help illuminate the underlying mechanisms that support infants' social evaluations more generally. For instance, despite the many demonstrations of infants' evaluating the social behavior of agents engaging in helpful or hurtful behaviors with others, we have very little understanding of the way in which certain events trigger such judgment. One possibility is that infants' evaluative responses result from an emotion-based attribution where salient properties from different modalities can be represented along a more abstract emotional dimension that becomes part of the infant's representation of that agent. Indeed, there is evidence in adults showing how properties of both sound and movement can access the same emotion-based representations in predictable ways (Sievers, Polansky, Casey, & Wheatley, 2012). In this study, adults were asked to use a computer program to generate behavioral patterns and sounds that corresponded to universal emotions such as anger, happiness, and sadness. Remarkably, the parameter settings that connote a particular emotion using sound are nearly identical to those used to express that emotion in movement, suggesting that the perceptual modalities (i.e., sound and movement) might share an underlying emotional structure. In light of this finding, it is possible that infants' representations of sound and behavior share a similar underlying emotional structure, such that the way a character sounds is intrinsically connected to how that character might behave. Future work could explore whether the linkage between sound and behavior exists to a similar extent in infants and whether the emotion-based representations they have in common are sufficient to drive social evaluations.

Data from the current experiments also revealed some preliminary support for the existence of certain biases in infants that exist in adult moral cognition. In Experiment 1 infants

responded more strongly to an event where the putatively nice or moral character did an immoral action (i.e., knocking down the tower), than when a putatively immoral character performed a moral action (helping to complete the tower). Adults exhibit this same asymmetry in certain moral reasoning tasks (Baumeister, Bratslavsky, Finkenauer & Vohs, 2001). Although this pattern was not replicated in Experiment 2 in isolation, the asymmetry still exists to a significant degree when the results of Experiment 1 and Experiment 2 are combined. It is possible that infants, like adults, have a hard time overriding the belief that while both immoral and moral people can do good things, only immoral people can do bad things, hence the longer looking at the good character performing a hindering action. Expanding the stimuli we use and manipulating the scenario could help to develop this idea further.

These results extend our understanding of the conditions that support infants' social attributions. While previous studies have demonstrated that infants can infer an agent's social disposition after observing it act in helpful/hurtful ways toward another, the current results suggest that, much like adults, infants are predisposed to make these attributions automatically on the basis of certain salient perceptual cues.

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