

Will You Be Angry Too? Infants Generalize Emotional Dispositions Across People

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Abstract

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Adults appreciate that different people can have different emotional reactions (anger v. neutral) to the same situations (driving in traffic). However, little is known about whether infants also view emotions as person-specific. The current study examined whether 15-month-olds infants expect emotional dispositions (anger-proneness) to be person-specific or to generalize across people. In Trials 1-3, infants watched an Experimenter perform actions on a series of objects while an Emoter reacted with either anger or neutral affect. Infants were then allowed to play with each object while the Emoter silently watched. In Trial 4, the Experimenter performed a novel action on a novel object. Infants then watched as either 1) the Emoter entered the room and expressed anger/neutral affect, or 2) a new Actor entered the room and expressed no affect. Across all trials, infants in the anger conditions were significantly more hesitant to play with the objects than infants in the neutral conditions. Critically, infants in the anger conditions were hesitant regardless of whether the previously angry Emoter or the new Actor

was watching them in Trial 4. The findings suggest that infants not only inhibit their imitative behavior in the presence of an anger-prone adult, but they also generalize this emotional disposition to a new person. These results provide further insights to how infants learn about their social world through other people. Future research may manipulate either the paradigm or the identities of the Emoter/Actor in order to test the limits of infants' generalization tendencies.

Introduction

Infants learn much about their social world from other people. Through simple observation, infants can learn language, cultural norms, and new instrumental behaviors (e.g., Gampe, Liebal, & Tomasello, 2012; Hanna & Meltzoff, 1993). In order to acquire this information quickly and easily, infants must appreciate that knowledge is generalizable across individuals. For instance, if one person labels a round object as a “ball,” infants should assume that other people would also label the object as a “ball.” However, there are other instances in which information is not always generalizable across individuals. For example, while one person may be prone to expressing anger in frustrating situations (e.g., sitting in traffic, receiving telemarketing calls), another person may remain calm and neutral. As adults, we tend to understand that these emotional reactions are person-specific, in that emotions reside within an individual, and consequently, do not always generalize to other people. However, little is known about whether infants view emotions as generalizable across individuals. For this reason, the current study examined whether 15-month-olds infants expect emotional dispositions (anger-proneness) to be person-specific or to generalize across people.

Generalization Within a Person

Previous studies have explored the circumstances in which infants will generalize social information. Research on deferred imitation has found that 9- to 12-month-olds can learn a novel action in one location and imitate that action after a time delay and change of physical context (Klein & Meltzoff, 1999; Learmonth, Lamberth, & Rovee-Collier, 2004). This suggests that infants can generalize information about actions on objects to new contexts. Research has also found that infants can generalize information about a person to new contexts. For instance, 10-month-olds can generalize an agent’s social preferences to a new context (Hamlin, Wynn, &

Bloom, 2007). Furthermore, recent research suggests that infants can generalize *emotional* information across contexts and within a person. Specifically, 15-month-olds expect that an adult who repeatedly expresses anger in one social context will also express anger in a new social context (Repacholi, Meltzoff, Hennings, & Ruba, 2016b). Similarly, 15-month-olds expect that an adult who repeatedly expresses anger in response to different actions performed on objects will also express anger in response to a new action performed on a new object (Repacholi, Meltzoff, Toub, & Ruba, 2016a). Taken together, these studies suggest that infants are able to generalize both emotional and non-emotional information across contexts and within an individual.

Non-Emotional Generalization Across People

Additional studies have explored whether infants will also generalize non-emotional information *across* individuals. In Henderson and Woodward (2012), an experimenter either provided a label for a novel object (i.e., “this is called a modi”) or expressed a preference (i.e., “this is my favorite”). As evidenced in a looking time paradigm, 9-month-old infants expected a new experimenter to use the same label for the object as the first experimenter. However, infants did not expect a new experimenter to prefer the same object as the first experimenter. In another study, Chow, Poulin-Dubois, and Lewis (2008) gave infants information about the “reliability” of an experimenter. An experimenter expressed happiness after opening a container that contained a toy (i.e., “reliable” experimenter) or was empty (i.e., “unreliable” experimenter). In a subsequent gaze following task, 14-month-olds were less likely to follow the “unreliable” experimenter’s gaze to an object hidden behind a barrier. However, infants would follow a new experimenter’s gaze behind the barrier. Taken together, these studies suggest that while infants generalize object labels across people, reliability and object preference information does not

generalize in this way and may be viewed as person-specific.

Emotion Generalization Across People

To our knowledge, only two studies have examined whether infants generalize emotional information across individuals. Specifically, these studies examined *emotion-based preferences*, whereby a person uses emotional expressions to communicate their like or dislike of an object. In the first study, Egyed, Kiraly, and Gergely (2013) explored whether infants would be more likely to generalize emotion-based preferences across individuals when ostensive cues (e.g., eye contact, infant-directed speech) were provided. In this study, an Emoter expressed positive (happy) affect toward one object and negative (disgust) affect toward another object. In the “communicative” condition, the Emoter initially smiled at and greeted the infant. She then alternated her gaze between the objects and the infant while emoting about each object. In the “non-communicative” condition, the Emoter never looked at, talked to, or smiled at the infant before or while emoting. In the test phase, a new Experimenter smiled at and greeted the infant before requesting an object. Eighteen-month-olds were more likely to give the positive-valence object to the new Experimenter in the “communicative” condition than the “non-communicative” condition. The results suggested that when given ostensive cues, infants interpreted the emotional information as indicating generalizable, “shared knowledge” about the objects. On the other hand, without ostensive cues, infants interpreted the same emotional information as indicating a non-generalizable, person-specific preference about the objects. Thus, infants seemed to interpret the emotional information differently depending on whether or not ostensive cues were present.

Although this study provides important insights into how infants understand their social world, there is at least one alternative and leaner interpretation of the generalization findings.

The new Experimenter always used ostensive cues throughout the test trial: she smiled at and greeted the infant and made eye contact when requesting an object. Thus, in the communicative condition, because the Emoter and the Experimenter's social behaviors were similar, infants may have also expected their emotional behaviors to be similar. On the other hand, in the non-communicative condition, because the Emoter and the Experimenter were behaviorally different, infants may have expected their emotional behaviors to differ. In other words, it is possible that infants assumed that people who engage in similar social behaviors are more likely to share other behaviors, such as emotional responses to objects.

These findings are also difficult to interpret given that positive and negative emotions were presented simultaneously. Thus, it is unclear whether infants generalized the positive and/or negative preference information to the new experimenter in the communicative condition. To answer this question, Vaish, Grossmann, and Woodward (2015) had an Emoter express neutral affect towards one novel object and either positive (happy) or negative (fear/disgust) affect towards another novel object. A new Experimenter then asked 2-year-olds to point to the object that she should put in her handbag (i.e., "which should I take?"). Prior to this request, the new Experimenter had introduced the children to her handbag, in which she collected things that she "liked" (positive condition) or "disliked" (negative condition). During the test phase, children in the negative condition were more likely to point to the negative-valenced object, while those in the positive condition responded randomly: pointing equally often to the positive and neutral objects. Thus, the authors concluded that children generalized the Emoter's negative, but not positive, emotional responses to the new Experimenter.

However, the researchers overlooked the fact that the findings from the control conditions (in which the Emoter requested an object) were inconsistent with their generalization

interpretation. In the “negative” control condition, the Emoter indicated that she collected “disliked” toys in her handbag. After emoting negatively toward one object and expressing neutral affect about the other object, the Emoter asked children to point to the object that should go into her bag. In this condition, the majority of the children pointed to the “neutral” rather than the “disliked” toy. Children did not appear to understand that the Emoter wanted the “disliked” object (i.e., the object toward which she had expressed disgust). Consequently, it is difficult to then argue that children generalized the Emoter’s object preference to a new Experimenter if children did not understand which of the two objects was originally wanted by the Emoter. Interestingly, the majority of children in the positive control condition gave the Emoter the object she “liked” rather than the neutral object. Thus, it is still an open question as to whether infants generalize negative emotional information across individuals.

Current Study

The current study sought to answer this question using (1) a different type of emotional information (emotional dispositions), (2) a different negative emotion (anger), and (3) a different paradigm (“emotional eavesdropping”). Previous studies have tested whether infants expect an experimenter’s emotion-based object preference to generalize to a new person when the object and situation are held constant (Egyed et al., 2013; Vaish et al., 2015). Instead of examining emotion-based preferences (i.e., whether a person likes/dislikes an object), the current study aimed to investigate *emotional dispositions*. Dispositions differ from preferences in that dispositions are internal, psychological qualities that are stable over time and across situations (Liu, Gelman, & Wellman, 2007). Desires, on the other hand, do not necessarily have this stability. In addition, while young infants use emotional information to infer preferences/desires (e.g., Repacholi & Gopnik, 1997), little is known about how infants make attributions about

other people's emotional dispositions. Specifically, the current study explored whether infants generalized an experimenter's angry emotional disposition to a new person. Anger is a particularly salient emotion for older infants and toddlers (Campos, Anderson, Barbu-Roth, Hubbard, Hertenstein, & Witherington, 2000; Grossman, Striano, & Friederici, 2007). In fact, from an evolutionary standpoint, it may be adaptive for a young infant to generalize anger affect across people. This generalization may assist infants in quickly learning if certain groups of people are safe or dangerous. In contrast, over-generalization of negative emotional dispositions would likely be detrimental for social learning (e.g., if an infant generalized their mother's anger-proneness to all other adult females).

To assess whether infants generalize anger dispositions to new individuals, the current study utilized the "emotional eavesdropping" paradigm developed by Repacholi and Meltzoff (2007). In this paradigm, infants watched one adult (Experimenter) demonstrating an action on an object. Then, another adult (the Emoter) entered the room, watched the Experimenter perform the action, and responded by expressing either anger or neutral affect toward the Experimenter. Infants were then given an opportunity to play with the object, while the Emoter silently watched the infant with a neutral facial expression. Previous research with this paradigm has found that 15- and 18-month-olds are hesitant to play with the objects when the Emoter has previously expressed anger towards the Experimenter (Repacholi & Meltzoff, 2007; Repacholi, Meltzoff, & Olsen, 2008; Repacholi, Meltzoff, Rowe, & Toub, 2014). However, infants are not hesitant to play with the objects if an Emoter who was previously neutral is watching them in the response period.

In a recent study, Repacholi et al. (2016a) tested whether 15-month-olds expected the Emoter's anger affect to generalize *within* a person. Specifically, the Emoter expressed anger in

three “eavesdropping” trials. In the fourth trial, the Emoter expressed no affect, because her back was turned during the action demonstration. During the response period, the Emoter turned around to silently watch the infant. Interestingly, infants were still hesitant to play with the objects, as if they expected the Emoter to become angry again. The current study builds off of this finding to explore whether infants generalize emotional dispositions *across* people. Specifically, if infants observe one individual to be anger-prone, do they generalize this disposition to another individual? Thus, after the three eavesdropping trials with the angry Emoter, a *new* experimenter (the Actor) enters the room and expresses no affect.

In order to generalize the Emoter’s disposition to a new person, infants must be able to make a series of other generalizations as well. First, infants must generalize the recipient of Emoter’s anger affect (i.e., the Experimenter) to themselves: they need to assume that the Emoter will get angry at them as well. Second, in order to recognize that the Emoter is “anger-prone,” infants must track the Emoter’s anger across the different objects used in each trial. Finally, infants must generalize the Emoter’s “anger-proneness” to a new action on a new object and to a new person. Forming these multiple generalizations is a much more challenging task than has been previously presented to infants. If infants form these generalizations, they should be hesitant to play with the objects when the new Actor is watching. However, if infants fail to generalize the Emoter’s emotional disposition to the new Actor, then they should be more likely to play with the objects when the new Actor is watching.

Methods

Participants

The final sample included 128 (64 female) 15-month-old infants ($M = 15.06$ months, $SD = .18$ months, range = 14.66 months – 15.42 months). Participants were recruited from a

university database of parents who were interested in infant research studies. All infants were healthy, full-term (37 – 43 weeks), and of normal birth weight (5lb 9oz – 9lb 15oz). Parents reported that their infants were either Caucasian (77%), mixed race (20%), Asian (1%), or they declined to respond (2%). Most parents also reported that their infants were not Hispanic or Latino (86%). Additional infants were tested but excluded from the final sample due to parental interference ($n = 7$), procedural error ($n = 11$), equipment failure ($n = 2$) and fussiness or inattentiveness ($n = 21$).

Design

Equal numbers of male and female infants were randomly assigned to one of four experimental conditions ($n = 32$ per condition): *Anger-Standard*, *Neutral-Standard*, *Anger-Switch*, or *Neutral-Switch*. Each infant participated in four trials, each involving a different test object and target action. The order in which these objects were presented as well as the identity of the Emoter/Actor were counterbalanced across trials and participants.

Materials

Objects and actions. The four objects were the same as those used in previous studies of infant imitation (e.g., Meltzoff, 1988) and emotional eavesdropping (e.g., Repacholi et al., 2008). The first object was a buzzer box presented with a wooden stick. The target (i.e., demonstrated) action was to use the stick to press a button on the box, producing a buzzing sound. The second object was a “dumbbell” made of two wooden cubes attached to plastic tubing (one tube fit inside the other). The target action was to pull the two pieces apart, producing a popping sound. The third object was a plastic cup presented with a strand of beads. The target action was to drop the beads into the cup, producing a rattling sound. The fourth

object was a collapsible cup. The target action was to flatten the cup by pressing on the top with a flat hand, producing a clanking sound.

Emoter and Actor. To determine whether infants could generalize emotional dispositions across people, a new person (“Actor”) was used in trial 4 of the *Anger-Switch* and *Neutral-Switch* conditions. Both the Emoter and Actor were white, college-aged females, but otherwise looked very different (blonde vs. brown hair). To further maximize the visual differences between the Emoter and Actor, each styled her hair differently (ponytail vs. down) and wore different clothing (long-sleeved, blue lace shirt with jeans vs. sleeveless, purple chiffon dress). Given these visual differences and infants’ heightened attention to the new Actor when she entered the room in Trial 4 (see Results), infants likely could tell that the Emoter and Actor were, in fact, different people (see Figure 1).

Emotional expressions. After the Experimenter’s third demonstration of each target action, the Emoter responded with a facial and vocal emotional expression (dependent on the experimental condition). Regardless of the Emoter’s response, the Experimenter’s facial and vocal expressions were neutral. In the *Neutral-Standard* and *Neutral-Switch* conditions, the Emoter’s facial and vocal expressions were also neutral. Specifically, the Emoter’s mouth was relaxed, her forehead was smooth, and she spoke in a “matter-of-fact” fashion. The Emoter used a different verbal script in each trial (e.g., “that’s interesting; that’s so amusing”). All scripts were similar in their structure and syllable length (see Appendix).

In the *Anger-Standard* and *Anger-Switch* conditions, the Emoter’s facial and vocal expressions were angry. Specifically, the Emoter’s eyebrows were furrowed, her mouth was tight, and she spoke in a sharp tone of voice (Ekman & Friesen, 1975). Similar to the Neutral conditions, the Emoter also used a different verbal script in each trial (e.g., “that’s aggravating;

that's so annoying"). These scripts used words that were determined to be too difficult for infants to understand (Fenson et al., 1993). Thus, the assumption was that infants would use prosodic vocal and facial cues to identify the Emoter's affect.

In the response periods of all conditions, the Emoter maintained a neutral facial expression. The Actor also maintained a neutral facial expression in the trial 4 response period of the *Anger-Switch* and *Neutral-Switch* conditions. Manipulation checks ensured that 1) the Emoter displayed the facial and vocal expressions correctly in the expression period, and 2) the Emoter/Actor was neutral in the response period.

Equipment

Three video cameras captured different angles of the testing session for later coding. The first camera recorded the infant, parent, and the table. These recordings were used to code infants' instrumental behavior and check for parental interference. The second video camera recorded a close-up of the infants' face. These recordings were used to code infants' facial expressions and visual attention. The third video camera recorded a wide-view angle of the Experimenter and the Emoter/Actor. These recordings were used to check the Emoter/Actor's facial expressions.

Procedure

Infants were seated on their parent's lap at a small table across from the Experimenter. Parents were asked to remain neutral and avoid interacting with their infant during the study (e.g., avert their gaze if the infant looked at them). Infants whose parents engaged with them during the study (e.g., smiling or comforting behaviors) were excluded from the analyses.

The four trials included three *emotional eavesdropping* trials and one *test* trial. In the *emotional eavesdropping* trials, infants were given an opportunity to learn about another

person's emotional tendencies. The emotional eavesdropping trials consisted of a *demonstration, expression, and response* period. During the *demonstration period*, the Experimenter performed one of the target actions twice (e.g., putting beads in a cup). Then, during the *expression period*, the Emoter entered the room and sat beside the Experimenter. The Experimenter demonstrated the target action a third time, and the Emoter responded by expressing either anger (*Anger-Standard; Anger-Switch*) or neutral affect (*Neutral-Standard; Neutral-Switch*) toward the Experimenter. Finally, during the *response period*, the Experimenter placed the object in front of the infant. Infants were given 20 seconds to interact with the object. During this time, the Experimenter and Emoter were silent and neutral. The Experimenter looked down at her lap, while the Emoter looked in the direction of the infant. The Experimenter retrieved the object at the end of the response period, and the Emoter left the room. Each of the three emotional eavesdropping trials proceeded in the same fashion with a different object/action pair.

The fourth *test* trial varied depending on the infants' experimental condition. In the *Anger-Standard* and *Neutral-Standard* conditions, the same Emoter entered the room after the demonstration period and initially sat with her back turned to the Experimenter (to be equivalent with the *switch* conditions, see below). The Emoter then turned around and expressed either anger or neutral affect toward the Experimenter after the third demonstration of the target action with a new object. Infants were given 20 seconds to play with the object in the response period. These two conditions were used as a comparison to test for generalization in the *switch* conditions. In the *Anger-Switch* and *Neutral-Switch* conditions, the Actor entered the room and sat with her back to the infant and the Experimenter during the third demonstration of the target action. The Actor did not produce an emotional response, because her back was turned and she

did not see what the Experimenter was doing with the object. At the end of the demonstration, the Actor turned around and looked in the direction of the infant for the response period. During the demonstration and response periods, the Actor remained silent and neutral. Thus, the Actor provided no information to the infant as to her own emotional disposition.

Coding

The video recordings of the testing session were coded by trained undergraduate and graduate students. Three aspects of infants' behavior were coded according to criteria described below. Primary coding/analyses were done for infants' instrumental behavior, while secondary coding/analyses were done for infants' visual attention and expressed emotion. Primary coding examined whether infants' generalized the Emoter's angry affect to the new Actor, and secondary coding ruled out alternative reasons for infants' instrumental behavior. A manipulation check also ensured that the Emoter/Actor displayed the intended anger/neutral expressions.

Primary coding. To code infants' instrumental behavior, the four 20-second response periods for each infant were clipped and edited from the video recordings. In this way, coders were blinded to the infants' experimental condition (*anger v. neutral*). Infants' instrumental behavior was coded for *latency to touch* and *imitation*, since previous eavesdropping studies have found group effects in these dependent measures (e.g., Repacholi et al., 2008, 2014; Repacholi & Meltzoff, 2007). *Latency to touch* was defined as the time (in seconds) from when the object was first placed on the table to the time the infant first touched it. If infants did not touch the object in the response period, their latency was coded as 20 seconds (i.e., the duration of the response period). *Imitation* was defined as whether infants completed the target action

during the response period and was scored using a dichotomous (yes/no) measure (see Hanna & Melzoff, 1993).

Secondary coding.

Infant attention. Infants' visual attention to (1) the Experimenter in the *demonstration* period, (2) the Emoter in the *response* period, and (3) when the Emoter/Actor entered the room in trial 4, were scored from the camera focused on infants' faces. Therefore, there was no visual record of the Experimenter, Emoter, or Actor. Furthermore, the sound was disabled so that coders were blind to the infants' experimental condition. In each trial, the coder recorded the onset and offset of each look in the direction of the Experimenter, Emoter, or Actor, and the durations of the infants' looks were summed across each trial.

For trials 1-4, infant attention to the Experimenter was coded during the *demonstration periods*, which was marked by when the Experimenter started and stopped the target action. For trials 1-4, infant attention to the Emoter (or Actor in trial 4 of the *switch* conditions) was coded during the *response period*, which began when the Experimenter handed infants the object and ended 20 seconds later. For trial 4, infant attention to the Emoter/Actor was coded when the Emoter/Actor opened the door to enter the room and ended when the Experimenter began her third demonstration of the target action. Since the duration of this coding (i.e., entering the room) and the *demonstration* period varied slightly across trials/participants, infants' attention during these periods was calculated as a proportion. However, since the duration of the response period was fixed (i.e., 20 seconds) infants' attention during this period was summed.

Infant emotion. Infants' expressed emotion was recorded during the *demonstration/expression period* and the *response period*. Infant emotion was scored from the camera focused on infants' faces, and therefore contained no visual record of the Emoter.

Furthermore, the sound was disabled during scoring to keep coders blinded to the infants' experimental condition. Two separate, three-point scales (modified from Hertenstein & Campos, 2004) were used to rate the maximum positive and negative affect displayed by infants in each trial. For positive affect, 0 = no positive affect; 1 = slight smile (slightly upturned mouth, no cheek elevation); and 2 = broad smile (usually with mouth open and/or cheek elevation) or laughing face. For negative affect, 0 = no negative affect; 1 = one of the following: frown/brow furrowing, corners of the mouth pulled back in a grimace, disgust-like nose wrinkle, pout, or sneer; and 2 = (a) a frown/furrowed brow, plus one of the facial movements in score 1, (b) active avoidance of the Emoter by leaning away, plus one of the facial movements in score 1, or (c) a cry face.

Manipulation check. The Emoter's facial and vocal expressions were presented separately to naïve coders, who rated the hedonic tone of each of facial and vocal expressions with a five-point scale (-2 = very negative, +2 = very positive). In addition, the coders indicated which discrete emotion the facial expression most resembled (happiness, interest, neutral, surprise, sadness, anger, disgust, or fear). The facial expressions were presented to coders without sound, and the vocal expressions were low-pass filtered at 475 Hz so the coders could not tell what script the Emoter was reading. For the *standard* conditions, the Emoter's facial expressions were coded during the *expression* and *response* period of all trials. For the *switch* conditions, the Emoter's facial expressions were coded during the *expression* and *response* period for trials 1-3, and the Actor's facial expressions were coded during the *response* period of trial 4.

Reliabilities. Scoring agreement for all dependent variables was assessed by having independent coders re-code 33% of the sample. Agreement was excellent for all measures:

imitation, $\kappa = .95$; latency to touch, $r = .99$; attention to Emoter during demonstration, $r = .88$; attention to Emoter during interaction period, $r = .97$; attention to Emoter during response period, $r = .99$; positive affect during expression period, $r = .95$; negative affect during expression period, $r = .87$; positive affect during response period, $r = .94$; negative affect during response period, $r = .90$; Emoter/Actors' vocal expressions, $r = .91$; Emoter's facial expressions, $r = .94$.

Results

Manipulation Check

The manipulation check confirmed that the Emoter displayed the appropriate facial and vocal expressions during the experiment. The valence ratings for the Emoter's facial and vocal expressions during the *expression period* were averaged over trials 1-4 for the *standard* conditions and over trials 1-3 for the *switch* conditions, since there was no expression period in trial 4. The valence ratings for the Emoter's facial expressions during the *response period* were collapsed over trials 1-4 for all conditions. Analyses were conducted with Emoter identity (i.e., which Emoter performed trials 1-3).

Expression period. Valence ratings for the vocal expressions were analyzed in a 2 (Emotion: anger v. neutral) x 2 (Actor: standard v. switch) x 2 (Emoter) ANOVA, which revealed a main effect of Emotion, $F(1, 120) = 1074.38, p < .001, \eta_p^2 = .90$. An examination of cell means confirmed that the anger vocal expressions were rated as significantly more negative ($M = -1.78, SD = .38$) than the neutral vocal expressions ($M = .60, SD = .48$). This result was qualified by a significant Emotion x Emoter interaction, $F(1, 120) = 16.35, p < .001, \eta_p^2 = .12$. Follow-up comparisons revealed that the anger vocal expressions for Emoter 1 ($M = -1.97, SD = .10$) were rated as significantly more negative than the anger vocal expressions for Emoter 2 (M

= -1.59, $SD = .46$), $t(34.19) = 4.58$, $p < .001$, 95% CI [.21, .55]. The ratings for the neutral vocal expressions did not differ between the two Emoters, $t(60.40) = 1.75$, $p = .09$, 95% CI [-.03, .44]. There were no other significant main effects or interactions (see Table 1).

Valence ratings for the facial expressions were analyzed in a 2 (Emotion) x 2 (Actor) x 2 (Emoter) ANOVA, which also revealed a main effect of Emotion, $F(1, 120) = 1852.26$, $p < .001$, $\eta_p^2 = .94$. An examination of cell means confirmed that the anger vocal expressions were rated as significantly more negative ($M = -1.47$, $SD = .27$) than the neutral vocal expressions ($M = .00$, $SD = .03$). There were no other significant main effects or interactions (see Table 1). The majority of facial expressions in the *anger* conditions (91%) were classified as “anger.” Expressions not identified as anger were typically labeled as “disgust.” In contrast, the majority of facial expressions in the *neutral* conditions (99%) were classified as “neutral.” Expressions not identified as neutral were always labeled as “interest.”

Response period. All (100%) of the valence ratings for the facial expressions during the response period were given a score of 0. In addition, the majority of facial expressions in the response periods of the anger conditions (96%) and the neutral conditions (100%) were classified as “neutral.” Expressions not identified as neutral were always labeled as “interest.”

Taken together, these data suggest that (1) the Emoter displayed the intended emotions in the expression periods of the *anger* and *neutral* conditions, and (2) the Emoter/Actor maintained neutral expressions in the *response* period. Although one Emoter was rated as having more negative anger vocalizations than the other Emoter, this difference did not appear to influence infants’ instrumental behavior in the response period (see Main Analyses).

Preliminary Analyses

Preliminary analyses were conducted with infant gender and Emoter identity. Previous research has found gender differences in emotion understanding (see McClure, 2000). Unless otherwise noted, there were no significant main effects or interactions with these variables. For this reason, infant gender and Emoter identity were excluded from the subsequent analyses.

Main Analyses

Latency to touch. Latency to first touch the object (in seconds) was analyzed in a 2 (Emotion: anger v. neutral) x 2 (Actor: switch v. standard) x 4 (Trials) repeated-measures analysis of variance (ANOVA). There was a significant main effect of Emotion, $F(1, 124) = 9.62, p = .002, \eta_p^2 = .07$. As expected, infants in the *anger* conditions took longer to touch the objects ($M = 5.09, SD = 6.79$) than infants in the *neutral* conditions ($M = 2.27, SD = 4.02$).

This effect was qualified by a significant Emotion x Trials interaction, $F(3, 372) = 3.94, p = .01, \eta_p^2 = .03$. To explore this interaction, separate repeated-measures ANOVAs were conducted for each Emotion over the four trials. This analysis revealed a main effect of Trials for the *neutral* conditions, $F(3, 189) = 5.43, p = .001, \eta_p^2 = .08$, but not for the *anger* conditions, $F(3, 189) = 1.08, p = .36, \eta_p^2 = .02$. Follow-up comparisons revealed that infants in the *neutral* conditions were slower to touch the object in Trial 1 ($M = 3.35, SD = 6.46$) compared to all other trials: Trial 2 ($M = 2.06, SD = 4.42$), $t(63) = 1.99, p = .05, 95\% \text{ CI } [.00, 2.58]$, Trial 3, ($M = 1.37, SD = 3.48$), $t(63) = 2.88, p = .01, 95\% \text{ CI } [.60, 3.35]$, and Trial 4 ($M = 1.33, SD = 3.30$), $t(63) = 3.06, p = .003, 95\% \text{ CI } [.70, 3.35]$. This suggests that infants in the *neutral* conditions may have experienced a heightened level of hesitation or anxiety at the beginning of the procedure.

These analyses did not reveal any other significant main effects or interactions. Critically, there was not a significant main effect of Trials, $F(3, 372) = 1.68, p = .17, \eta_p^2 = .01$, a significant Trials x Actor interaction, $F(3, 372) = 2.01, p = .11, \eta_p^2 = .02$, or a significant Trials x

Emotion x Actor interaction, $F(3, 372) = .60, p = .62, \eta_p^2 = .01$. This suggests that infants' latency to touch behavior did not vary across the trials (see Table 2).

Imitation. To determine whether infants' imitative behavior differed across trials, Cochran's Q tests were conducted separately for each condition on the individual imitation scores (yes/no) for each trial. For each condition, the test was not significant: *Anger-Standard*, $Q(3) = 3.00, p = .39$, *Anger-Switch*, $Q(3) = 1.93, p = .59$, *Neutral-Standard*, $Q(3) = .43, p = .93$, *Neutral-Switch*, $Q(3) = 4.00, p = .26$. This suggests that infants' imitation behavior remained constant within each condition. For this reason, imitation scores were summed across the four trials (i.e., a total score ranging from 0-4).

Preliminary analyses revealed a significant main effect of Gender, $F(1, 120) = 4.02, p = .05, \eta_p^2 = .04$, where male infants imitated more actions ($M = 2.64, SD = 1.34$) than female infants ($M = 2.19, SD = 1.42$). However, since there were no interactions between Gender and Emotion and/or Actor, Gender was excluded from the following analysis.

A 2 (Emotion) x 2 (Actor) univariate ANOVA revealed a significant main effect of Emotion, $F(1, 124) = 20.72, p < .001, \eta_p^2 = .14$. An examination of cell means revealed that infants in the *anger* conditions imitated significantly fewer actions ($M = 1.89, SD = 1.49$) than infants in the *neutral* conditions ($M = 2.93, SD = 1.07$). There were no other significant main effects or interactions (see Table 2). A non-parametric Mann-Whitney U test confirmed the significant main effect of emotion, $U = 2861.5, p < .001$.

Secondary Analyses

Secondary analyses were conducted to examine alternative explanations for infants' instrumental behavior in the *anger* conditions.

Infant attention.

Attention to demonstrations. Infants' imitation scores may have been lower in the *anger* conditions, because they were less attentive to the demonstrations of the target actions relative to infants in the neutral conditions. Specifically, these infants may have been visually monitoring the Emoter when the Experimenter was demonstrating the target actions. Thus, when infants were given an opportunity to interact with the objects, they may not have known how to perform the actions.

To explore this possibility, infants' attention to the three demonstrations in each trial were averaged and subjected to a 2 (Emotion) x 2 (Actor) x 4 (Trials) repeated-measures ANOVA. There was a significant main effect of Trials, $F(3, 372) = 20.86, p < .001, \eta_p^2 = .14$, which was qualified by a significant Trials x Actor interaction, $F(3, 372) = 16.02, p < .001, \eta_p^2 = .11$. Follow-up comparisons revealed that in trial 4, infants in the *switch* conditions were more attentive to the demonstrations ($M = .98, SD = .04$) than were infants in the *standard* conditions ($M = .89, SD = .01$), $t(101.59) = 8.21, p < .001, 95\% \text{ CI } [.06, .11]$. On the other hand, in the first three trials, there were no significant differences across conditions in infants' attention to the demonstrations all $ps > .05$. This pattern of results suggests that in trial 4, infants in the *standard* conditions may have been somewhat distracted by the Emoter, and consequently, paid less attention to the action demonstration. However, the Actor in the *switch* conditions did not have this same effect, likely because her back was turned to the infant during the demonstration of the action. Critically, since there was no a significant main effect of Emotion, $F(1, 124) = 2.38, p = .13, \eta_p^2 = .02$, it cannot be concluded that infants did not see how to perform the actions in the *anger* conditions (see Table 3).

Attention to Emoter in response period. Infants may have also demonstrated low imitative behavior in the *anger* conditions, because they spent more time monitoring the Emoter

during the response period. If infants' attention was divided away from the toy to the Emoter, they may not have had ample time to imitate the actions.

To explore this possibility, infants' attention to the Emoter during the response period was analyzed in a 2 (Emotion) x 2 (Actor) x 4 (Trials) repeated-measures ANOVA. There was a significant main effect of Trials, $F(3, 372) = 10.15, p < .001, \eta_p^2 = .08$. Follow-up comparisons indicated that, regardless of condition, infants spent more time looking at the Emoter in the response period for Trial 1 ($M = 3.75, SD = 3.42$) compared to all other trials: Trial 2 ($M = 3.02, SD = 2.96$), $t(127) = 2.64, p < .01, 95\% CI [.18, 1.29]$, Trial 3 ($M = 2.59, SD = 2.51$), $t(127) = 4.39, p < .001, 95\% CI [.64, 1.69]$, and Trial 4 ($M = 2.59, SD = 2.64$), $t(127) = 4.21, p < .001, 95\% CI [.62, 1.71]$. However, there was not a significant main effect of Emotion, $F(1, 124) = 3.58, p = .06, \eta_p^2 = .03$. This suggests that infants were not more attentive to or distracted by the Emoter in the *anger* conditions compared to the *neutral* conditions during the response periods (see Table 3).

Attention to Actor in trial 4. An alternative explanation for the generalization effect is that infants in the *switch* conditions did not notice that the new Actor had entered the room, and thus behaved as if the Emoter was still present in trial 4.

To explore this possibility, independent samples *t*-tests compared infants' attention to the Emoter in trial 4 of the *standard* conditions to infants' attention to the Actor in trial 4 of the *switch* conditions. Infants' attention was recorded from the time the Emoter/Actor entered the room and ended when the Experimenter began her first demonstration of the target action. These analyses revealed that infants attended more to the Actor in the *Anger-Switch* condition than to the Emoter in the *Anger-Standard* condition, $t(62) = 2.07, p = .04, 95\% CI [.38, 21.39]$. Similarly, infants attended more to the Actor in the *Neutral-Switch* condition than to the Emoter

in the *Neutral-Standard* condition, $t(62) = 2.40, p = .02, 95\% \text{ CI } [1.97, 21.41]$. This increased visual attention to the Actor suggests that infants indeed noticed that a new person had entered the room in Trial 4 of both *Switch* conditions (see Table 3).

Infant affect. Another explanation for infants' behavior in the *anger* conditions is that infants "caught" the Emoter's negative affect (i.e., "emotion contagion"). In this way, infants' own negative affect may have inhibited their behavior in the response period.

For the *demonstration/expression period*, infants' positive and negative affect scores were averaged across trials 1-4 and subjected to separate 2 (Emotion) x 2 (Actor) univariate ANOVAs. For both the positive and negative affect scores, there were no significant main effects or interactions, all $ps > .05$. For the *response period*, infants' positive and negative affect scores were also averaged across trials 1-4 subjected to separate 2 (Emotion) x 2 (Actor) univariate ANOVAs. For both the positive and negative affect scores, there were no significant main effects or interactions, all $ps > .05$. Thus, infants' affect did not differ across or between the *anger* and *neutral* conditions (see Table 3).

Discussion

Taken together, these results suggest that 15-month-olds generalize emotional disposition information to a new action on a new object and, critically, to a new person. When infants learned that one adult was prone to expressing anger, they behaved as if they expected another adult to share the same emotional tendency. Specifically, in a fourth trial with a new action and object, infants were hesitant to touch the object and imitate the target action regardless of whether it was the previously angry Emoter or the new Actor who was watching them.

Lean Interpretations

One possible lean explanation for infants' behavior in response to the Emoter's anger is emotion contagion. However, the contagion account is unlikely given the infant affect coding scored during the demonstration/expression and response periods. Consistent with previous research (e.g., Repacholi et al., 2008), there were no significant differences between the *neutral* and *anger* groups in regards to infants' facial expressions. Indeed, there were very few negative infant expressions overall, although such expressions would be expected if emotional contagion were at play.

Additional lean interpretations focus on infants' attention to the Emoter. It is possible that infants in the *anger* conditions were distracted by the Emoter, and thus, 1) did not attend to the demonstrations of the actions, and/or 2) did not have adequate time to play with the object in the response period. However, there were no condition differences in infants' attention to the demonstrations of the actions or in their attention to the Emoter during the response periods. These findings suggest that infants' low imitation scores in the Anger conditions were not the result of their being distracted by the Emoter.

A third alternative explanation for the generalization effect is that infants did not visually discriminate between the old Emoter and the new Actor. Since the Actor walked into the room and immediately turned her back to the infant and the Experimenter, it was also possible that infants did not realize that a new person had entered the room. However, this explanation is also unlikely given infants looking behavior. In trial 4, infants' looked longer at the new Actor when she entered the room, compared to when the old Emoter entered the room. This increased attention suggests that infants indeed noticed that a new individual was present.

Rich Interpretations

Instead, we favor a richer interpretation of the results, suggesting that infants generalized emotional dispositions across individuals. As in other eavesdropping studies (e.g., Repacholi et al., 2008, 2014, 2016a, 2016b), we argue that infants detected the consistency in the Emoter's emotional responses to the different object-action pairings in trials 1-3. Then, in trial 4, infants used this given emotional information to make a prediction about the new Actor's behavior. In particular, infants expected that the Actor would become angry if they touched the new object or imitated the new actions. Thus, infants generalized the Emoter's angry emotional disposition to a new person. This adds to the existing literature that infants at this age generalize emotional dispositions within a person (Repacholi et al., 2016a) and across social contexts (Repacholi et al., 2016b). In these studies, infants appeared to the Emoter's emotional disposition as "trait-like," or consistent and enduring within a person. In the current study, infants also behaved as if they expected the new Actor to share this same disposition in a similar context.

One potential explanation for these generalization findings lies in the eavesdropping paradigm itself. Typically in studies of emotion generalization, infants watch an Emoter express affect towards various objects (Egyed et al., 2013; Vaish et al., 2015). Infants then choose which object to give to a new experimenter. However, in the current study, infants faced personal consequences. If infants chose to play with the "forbidden" object, they risked a potential negative, angry reaction from the Actor. Even if infants thought it was relatively unlikely that the Actor would share the same emotional disposition as the Emoter, they may not have been willing to take that risk. Since no emotional information was given about the Actor, infants may have erred on the side of caution in this situation.

Furthermore, since anger is a particularly salient emotion for young infants (Campos et al., 2000; Grossman et al., 2007), it may present additional inherent risk. For this reason, it is

possible that infants may generalize angry emotional tendencies but would not make the same generalizations for other emotions (e.g., sadness, disgust). Indeed, research has suggested that infants do not generalize positive (happy) emotion-based preferences across individuals (Vaish et al., 2015). In fact, social psychology research supports the existence of a negativity bias in adult impression formation (Rozin & Royzman, 2001)—a bias that is also present in infants (Vaish, Grossmann, & Woodward, 2008). Furthermore, this negativity bias may be more pronounced when the negative emotional information contains a “threat” (Kinzler & Vaish, 2014). For instance, 8- and 14-month-olds have quicker latencies to look at pictures of angry faces compared to happy faces. However, latencies to look at pictures of fearful faces compared to happy faces do not differ (LoBue & DeLoache, 2010). This negativity bias may also explain why infants generalize negative *emotion-based preferences* across individuals, but not positive emotion-based preferences (Vaish et al., 2015).

The current study adds to these findings by showing that young infants generalize *emotional dispositions* across people. Whereas preferences typically indicate whether a person currently likes/dislikes an object, dispositions are more stable psychological qualities (e.g., “anger-proneness”; Liu, Gelman, & Wellman, 2007). Thus, infants’ understanding of emotional tendencies may be an early indicator of their reasoning about trait-like attributes. In addition, these results are notable since they were obtained in a live, ecologically-valid paradigm. These findings generalize well to daily life, where infants regularly observe interactions between individuals (e.g., a parent reprimanding a sibling) and use this information to inform their own behavior. In this way, infants do not have to experience an event themselves to learn that such an action will provoke a negative response from (potentially) multiple individuals.

Future Directions, Limitations, and Implications

Future research could explore potential alternative explanations for the current findings. First, future studies could utilize paradigms that require less social risk, in order to determine if there are situations in which infants will *not* generalize emotional dispositions across individuals. One possibility is a violation-of-expectations (VOE) paradigm. Infants could be familiarized with three *anger* eavesdropping trials, followed by two test events: 1) the Actor enters the room and also expresses anger, or 2) the Actor enters the room and displays neutral affect. Infants should attend longer to the first test event if they do not expect that the Actor to become angry. This paradigm eliminates the social risk component of the eavesdropping paradigm (since infants could not be the target of the Emoter's anger), and instead, simply measures infants' expectations about the Actor's behavior.

Future research could also manipulate the current eavesdropping paradigm in several ways. First, the identity of the Emoter and Actor could be manipulated. In the current study, the Emoter and Actor belonged to the same social category (young, white females). Previous research has found that young infants can form perceptual categories of faces from different genders and races (see Quinn et al., 2011). Thus, infants appear to recognize (at least perceptually) differences between some social categories. It may also be the case that infants will not generalize emotional dispositions across these social categories. For this reason, future research could manipulate the social category membership of the Emoter and Actor by using experimenters of different genders (male v. female) or different races (black v. white). Pilot testing from our lab suggests that age (middle-age v. college-age) may also be a social category that is resistant to emotion generalizations.

Placing the Actor in a different physical context than the Emoter may also make generalizations less likely. For instance, trial 4 (when the Actor enters the room) could take

place in a different room. This change in location may provide more information to infants that the Actor is a different type of person from the Emoter. Another possibility is to change the social context in trial 4. Previous work has found that after watching an Emoter express anger in three eavesdropping trials, infants will relinquish desirable toys to the (now neutral) Emoter in novel social engagement tasks (Repacholi et al., 2016b). Thus, it is possible that while infants generalized the Emoter's angry disposition to a new Actor in the same eavesdropping context, infants would not generalize if the Actor engaged in a different task with the infant.

One potential limitation of this study is that infants, particularly in the *neutral* conditions, appeared to show some degree of hesitation or anxiety at the beginning of the study. This hesitation can be seen in infants' latency to touch scores, which were relatively high for trial 1 but decreased over the remaining trials. An analysis of infants' visual attention confirmed this hypothesis. Across all conditions, infants spent more time monitoring the Emoter in the *response period* of trial 1 compared to the other trials. Future research with this paradigm could provide more time for infants to acclimate to the study space and the Experimenter before testing begins, thereby eliminating any anxiety infants may feel.

The current study provides important new insights into how infants generalize their knowledge. Previous research has found that infants expected emotion-based object preferences to generalize to a new person when the object and situation are held constant (Egyed et al., 2013; Vaish et al., 2015). The current study extends this conclusion to suggest that infants also generalize emotional responses towards other people. Infants not only detected consistencies in the Emoter's angry emotional behavior, but they also used this information to make predictions about a new Actor's behavior in response to a new action on a new object. Although forming these multiple generalizations is a challenging task, infants were able to integrate this

information in order to regulate their own behavior. Future research can continue this line of research to explore the situations in which infants will not generalize emotional information. Such information is critical to determining how infants understand their social world from other people.

Tables and Figures

Figure 1. Pictures of Emoter/Actor.



Table 1. Valence ratings for manipulation check.

Variable	Experimental Condition							
	Anger-Standard		Anger-Switch		Neutral-Standard		Neutral-Switch	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Vocal expressions	-1.80	.35	-1.76	.41	.54	.49	.67	.46
Facial expressions	-1.46	.24	-1.48	.30	.00	.00	.00	.00

Table 2. Data for primary analyses. * indicates a proportion

Variable	Experimental Condition							
	Anger-Standard		Anger-Switch		Neutral-Standard		Neutral-Switch	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Latency to Touch								
Trial 1	3.55	6.08	5.35	7.59	2.96	5.74	3.74	7.16
Trial 2	4.79	7.55	6.00	8.31	2.49	5.19	1.64	3.54
Trial 3	4.41	6.87	6.44	8.60	.94	1.16	1.82	4.79
Trial 4	4.90	7.47	4.27	6.96	1.47	3.72	1.19	2.88
Average Trials 1-4	4.41	6.16	5.51	7.06	1.97	3.44	2.09	3.86
Imitation								
Trial 1*	.41	.49	.47	.51	.72	.46	.66	.48
Trial 2*	.41	.49	.47	.51	.75	.44	.66	.48
Trial 3*	.53	.51	.56	.50	.75	.44	.72	.45
Trial 4*	.38	.49	.56	.50	.78	.42	.84	.37
Total Trials 1-4	1.72	1.46	2.07	1.52	3.00	1.14	2.88	1.00

Table 3. Data for secondary analyses. * indicates a proportion

Variable	Experimental Condition							
	Anger-Standard		Anger-Switch		Neutral-Standard		Neutral-Switch	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Infant Attention								
Demonstration*	.90	.05	.91	.05	.91	.49	.93	.05
Response Period	3.06	2.29	3.70	3.22	2.34	1.54	2.85	2.01
Actor (Trial 4)*	.53	.18	.64	.23	.59	.22	.71	.17
Infant Affect								
Demo - Positive	.21	.45	.19	.39	.38	.53	.30	.45
Demo - Negative	.15	.29	.12	.20	.13	.29	.13	.19
Response - Positive	.69	.76	.64	.75	.87	.77	.80	.75
Response - Negative	.16	.16	.13	.25	.17	.30	.13	.19

Appendix. Scripts for the Emoter during the expression period.

4 Anger Scripts (one per trial)

Script 1

Emoter: "That's aggravating! That's so annoying!"

Experimenter: "Oh, I thought it was really interesting."

Emoter: "Well, that's just your opinion! Its aggravating!"

Script 2

Emoter: "That's infuriating! That's so irritating!"

Experimenter: "Oh, I'm sorry you feel that way about it."

Emoter: "Well, you should be sorry! It's infuriating!"

Script 3

Emoter: "That's so frustrating! That's really distracting!"

Experimenter: "Oh, I didn't realize you'd care so much."

Emoter: "Well, you're wrong about that! It's very frustrating!"

Script 4

Emoter: "That's distressing! That's really disconcerting!"

Experimenter: "Oh, I apologize for upsetting you."

Emoter: "Well, I don't care! That was really distressing!"

4 Neutral Scripts (one per trial)

Script 1

Emoter: "That's entertaining. That's so enticing."

Experimenter: "Oh, I thought it might have been too distracting."

Emoter: "Well, you could be right. But it is entertaining."

Script 2

Emoter: "That's encouraging. That's so engaging."

Experimenter: "Oh, I had no idea you'd feel that way."

Emoter: "I do feel that way. But it is encouraging."

Script 3

Emoter: "That's stimulating. That's very striking."

Experimenter: "Oh, I didn't think you'd really notice it."

Emoter: "Well, not to worry. But it is stimulating."

Script 4

Emoter: "That's amusing. That's so interesting."

Experimenter: "Oh, I didn't think you'd notice what happened."

Emoter: "I did notice. And it was amusing."

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