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# "Aren't you supposed to be sad?" Infants do not treat a stoic person as an unreliable emoter

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ABSTRACT

The current study examined how 18-month-old infants react to a "stoic" person, that is, someone who displays a neutral facial expression following negative experiences. Infants first watched a series of events during which an actor had an object stolen from her. In one condition, infants then saw the actor display sadness, while she remained neutral in the other condition. Then, all infants interacted with the actor in emotional referencing, instrumental helping, empathic helping, and imitation tasks. Results revealed that during the exposure phase, infants in both groups looked an equal amount of time at the scene and engaged in similar levels of hypothesis testing. However, infants in the sad group expressed more concern toward the actor than those in the neutral group. No differences were found between the two groups on the interactive tasks. This conservative test of selective learning and altruism shows that, at 18 months, infants are sensitive to the valence of emotional expressions following negative events but also consider an actor's neutral expression just as appropriate as a sad expression following a negative experience. These findings represent an important contribution to research on the emergence of selective trust during infancy.


As not all individuals have accurate or relevant knowledge about a given topic, children must be selective in whom they choose to learn from (Harris, 2007). There is ample evidence showing that toddlers and preschoolers are not gullible and show selectivity in learning (Harris & Corriveau, 2011; Mascaro & Sperber, 2009; Mills, 2013; Rendell et al., 2011; Sperber et al., 2010). Recently, selective trust has also begun to be documented during the infancy period, although the bulk of this research has focused on infants' detection of verbal communication or functional cues, such as mislabeling or misusing a familiar object (Brooker & Poulin-Dubois, 2013; Koenig & Echols, 2003; Koenig & Woodward, 2010; Zmyj, Buttelmann, Carpenter, & Daum, 2010).

Interestingly, the appropriateness of an actor's emotional expressions has also been manipulated in order to examine infants' sensitivity to "accuracy" in the emotional domain. As others' behaviors can often be predicted and explained through their emotional expressions, the detection and understanding of emotional expressions is critical in early socio-cognitive development. Infants are able to both categorize and discriminate a variety of emotional expressions early in development and begin to use emotional information from others to regulate their own behaviors. For example, infants are more likely to approach a novel object when a person displays a positive expression toward it, and avoid it when a negative expression is

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posed (Hornik, Risenhoover, & Gunnar, 1987; Mumme, Fernald, & Herrera, 1996; Quinn et al., 2011). In fact, such social referencing is observed even when the referent is out of sight, as 14- and 18-month-olds are more likely to initially search into a container previously associated with a "happy" expression by an actor, than into a container associated with a "disgust" emotional expression (Repacholi, 1998). This suggests that infants as young as 14 months are able to use both the experimenter's attentional cues and emotional expressions to predict the nature of the referent that is the focus of her attention.

Importantly, as others' emotional expressions may not always be accurate, children also begin to modify their behaviors based on the accuracy of the emoter. In a study with preschoolers, Hepach, Vaish, and Tomasello (2012) had 3-year-olds watch an adult constantly express sadness in either an appropriate or inappropriate context (being harmed or not), and found that children were more likely to show concern, less "checking" behaviors, and more prosocial behavior when the negative emotions matched the context. In an investigation of *infants'* exposure to emotional accuracy and how this affects their behaviors, infants as young as 14 months have been shown to be less likely to imitate or follow the gaze of an actor who had previously displayed inaccurate affect while looking into a container (e.g., positive affect while looking into an empty container) (Chow, Poulin-Dubois, & Lewis, 2008; Poulin-Dubois, Brooker, & Polonia, 2011). More recently, Chiarella and Poulin-Dubois (2013) reported that 18-month-olds, but not 15-month-olds, showed more concern when exposed to justified sadness and more checking behaviors when they saw actors express an unjustified emotion (happiness or sadness) after experiencing an emotional event. That is, infants were able to detect both positive (polyannas) and negative (crybabies) emotion-context mismatches. In a follow-up study, they had infants watch as an actor always expresses sadness after consistently receiving a desired object ("crybaby", unjustified group) or after receiving an undesired object (justified group) (Chiarella & Poulin-Dubois, 2014). Results showed that infants not only detected the actor's unjustified negative emotions, but also reacted differently to the actor during subsequent tasks measuring emotional referencing and prosocial behaviors. More specifically, infants in the justified group were more likely to be guided by her positive emotions when deciding which of two containers to look into first, and were quicker to help her when she needed emotional, but not instrumental, help. These findings show that infants as young as 18 months show selective behaviors toward emotionally unjustified individuals. Interestingly, it was recently reported that infants as young as 14 months show increased pupil dilation when they witness an actor express emotions incongruent with her actions (e.g., patting a toy tiger with an angry expression), suggesting some lower level processing of sympathetic arousal (Hepach & Westermann, 2013). Similarly, 10-month-olds have been shown to be sensitive to a cartoon's incongruent facial reactions after either successfully or unsuccessfully arriving at a desired goal (e.g., sadness after successfully jumping over a barrier; Skerry & Spelke, 2014).

In summary, there is evidence that infants are able to detect inappropriate emotional reactions (Chiarella & Poulin-Dubois, 2013; Hepach & Westermann, 2013; Skerry & Spelke, 2014) and also exhibit selective behaviors in emotional referencing and empathic helping tasks when interacting with someone who previously showed misleading negative expressions (Chiarella & Poulin-Dubois, 2014). However, it remains unknown if infants will be willing to help and whether they will follow someone's emotional cues after witnessing a "stoic" actor, that is, someone expressing *no* emotions after a negative experience.

The literature on infants' reactions to neutral facial expressions has typically used it as a control measure for the effects of other emotions, such as happiness, sadness, anger, and fear. For example, research on social referencing has shown that 12-month-olds are equally likely to approach a toy toward which a model expressed a happy or neutral facial expression, but not if the expression was negative (Hornik et al., 1987; Mumme et al., 1996). Similarly, Repacholi (2009) showed that 18-month-olds were equally likely to imitate an action by a model who showed a neutral or positive facial expression but less so if she showed a negative expression toward an ambiguous object. These findings, as well as others (Cacioppo & Berntson, 1999; Cacioppo, Gardner, & Berntson, 1997, 1999), suggest that in the absence of any emotional cues or information about an ambiguous novel object or stimulus, infants express a "positivity offset" (Vaish, Grossmann, & Woodward, 2008); that is, they evaluate these objects and stimuli as if they had experienced a positive reaction. However, many of these studies examined infants' willingness to approach or interact with an object which had been previously ambiguous. In an investigation of infants' reactions to a non-ambiguous context using neutral facial expression, Vaish, Carpenter, and Tomasello (2009) had 18- and 25-month-olds watch an actor experiencing a harmful situation (where her possessions were taken away or destroyed) and a neutral situation (where there was no harm done to the victim's possessions). After each event, the victim remained neutral. Both 18- and 25-month-olds were more likely to show concern and checking behaviors in the "harm" condition than in the "neutral" condition, despite the actor's neutral facial expression in both cases. Children in both age groups were also more likely to help the victim who had experienced the "harm" condition than the "neutral" condition. These findings suggest that infants as young as 18 months will show empathy and prosocial behaviors toward an individual experiencing a negative event even in the absence of overt negative cues. Although the study by Vaish et al. (2009) revealed that infants showed empathic reactions and helped an individual in the absence of overt emotional cues, the design had two important limitations. First, the authors did not include a manipulation of the *facial* expression with respect to a negative situation. Thus, it remains unknown whether infants would respond similarly to a "victim" expressing a justified reaction to a negative situation (e.g., sadness) and to a victim who remained neutral. In addition, only prosocial sharing and instrumental helping were manipulated in the study, so generalization of emotional "inaccuracy" to other tasks is unknown. In a recent study manipulating sad and neutral expressions during instrumental helping tasks, Newton, Goodman, and Thompson (2014) reported that 19-month-olds were equally willing to instrumentally help (i.e., fulfill a goal) individuals who displayed sad or neutral facial expressions. These findings suggest that during an instrumental prosocial act, neutral facial expressions alone are not sufficient for 19-month-olds to be selective in their willingness to engage in goal-oriented prosocial actions. An important limitation to this study was that the authors manipulated the neutral and sad facial expressions *during* the

instrumental helping tasks, and found that infants were equally willing to aid the experimenter in a goal-oriented helping act in either condition. However, the infants had no prior experience with the experimenter, raising the question as to whether infants are equally willing to help, emotionally reference, and imitate an individual who is either consistently neutral or sad following negative situations (i.e., having objects stolen).

Taken together, it remains unknown whether infants will (1) display different empathic responses toward a neutral versus a sad individual and (2) show selectivity in both their instrumental and empathic helping behavior, imitation, and emotional referencing toward an individual who either constantly expresses the appropriate sad reaction after a negative event or a neutral emotional expression. There were two main objectives to the current study. First, we wanted to examine whether infants would show increased looking times, increased hypothesis testing (i.e., checking behaviors), and decreased empathic concern toward an emotionally neutral, "stoic" person, and thus whether infants consider neutral expressions as unjustified after a negative experience, as they do for positive expressions (Chiarella & Poulin-Dubois, 2013). The second objective was to determine whether an adult's constant "unjustified" neutral emotional responses would impact infants' subsequent emotional referencing and prosocial empathic helping behavior, as they do for unjustified negative expressions (Chiarella & Poulin-Dubois, 2014). Given that the only study to date to have examined empathic responses toward neutral facial expressions reported that infants consider the context when presented with neutral expressions and only used instrumental helping tasks (Vaish et al., 2009), it was unknown whether infants' selective responses toward an actor would differ across neutral or negative facial expressions or would be mainly guided by the negative emotional experiences of the protagonist, and whether these would impact a wide range of infants' behaviors toward the actor, in both emotional and non-emotional contexts. It was hypothesized that if infants judge the neutral facial expression as "unjustified", they would show more hypothesis testing (i.e., checking) behaviors than if the actor expressed sadness after a negative event. In addition, if infants are sensitive to the valence of emotional expressions, it was hypothesized that they would show less concerned reactions toward a neutral individual following a negative event than toward a sad individual. In line with previous findings (Chiarella & Poulin-Dubois, 2014; Newton et al., 2014), no differences were expected between the sad and neutral group on the imitation task or in the instrumental helping task. However, if infants detected the neutral individual as "unreliable", then infants in the neutral groups would likely show less empathic helping and emotional referencing than those in the sad group.

## 1. Method

### 1.1. Participants

75 18-month-old infants ($M$ = 18.35 months, $SD$ = .41, range = 17.63–19.67 months) participated in this study. In order to be included in the final sample, infants were required to watch 3 out of the 4 exposure trials (preliminary analyses revealed no differences on any of the tasks between infants who watched all 4 trials ($n$ = 62) and those who watched a minimum of 3 trials). Three infants did not meet the inclusion criteria due to fussiness (0/4 trials $n$ = 1, 2/4 $n$ = 2) and one infant was excluded due to parental interference, leaving a final sample of 71 infants (Sad = 34; Neutral = 37, 36 males, 35 females).

### 1.2. Materials

During the reliability exposure phase, an apparatus resembling a puppet theater was used to display the experimenter (E1) acting out four live events (Spoon, Pegs, Drum, and Ball). Infants observed E1 from a child seat placed 90 cm from the display. A video camera placed underneath E1 focused on the infants' faces in order to record looking times and behaviors. During the interactive tasks, the infants sat in a high chair at a table directly across from E1. A split-screen camera angle focused on the infant's face, while a second camera recorded the whole scene. The emotional referencing task consisted of two colored boxes with lids, a plastic cockroach and a toy figurine. The *Book Stacking* (instrumental helping) task consisted of three thin sheets of wood all painted blue to resemble books (but that did not open as to not provide a source of distraction to the infants). These wooden "books" were exact replicas as those used in Warneken and Tomasello's (2007) study. The *Blocks* (instrumental helping) task consisted of six differently colored plastic shapes, with a red container and a pair of plastic tongs. For the empathic helping tasks, a pair of red cotton gloves and one brown teddy bear were used. The *Rattle* task (imitation) consisted of two plastic blue containers (which fit into one another) and a small rubber ball that could fit inside the containers. During the *Teddy-to-Bed* task (imitation), a purple teddy bear, a pink toy crib, a small felt pillow and cover were used.

### 1.3. Design

Infants were randomly assigned to one of two exposure conditions which included a between-subjects factor: A sad and neutral group. Infants in both groups saw four different trials of goal-directed behavior during which the experimenter (E1) played with a toy: Play-Drums, Play-Pegs, Eat-Spoon and Play-Ball. Each trial lasted 20 s and included two phases, a familiarization (10 s) and a test phase (10 s). All infants saw E1 have her toy taken away from her during the familiarization phase. During the test trials, depending on which condition the infant was in, E1 then always expressed sadness or she always remained neutral (both emotional expressions were based on Ekman, Friesen, and Ellsworth (1972). Following the

exposure phase, infants in both groups engaged in the same four interactive tasks with E1. They remained seated in the high chair that was placed in front of a table across from E1.

### 1.4. Procedure

Infants and their parents first spent a brief period of time in a reception room in order for infants to familiarize themselves with the two experimenters. They were then invited into the testing room. Infants were seated in a high chair and parents were asked to sit behind and to the left of the infants. They were instructed to remain neutral and keep their eyes on the stage so as to maintain the infants' attention on the events. Between trials, a screen (controlled by E2) was lowered and a small bell was rung to attract the infants' attention toward the stage at the onset of each trial.

#### 1.4.1. Reliability exposure

On each trial, E1 was positioned on the left side of a stage with one object on the right hand side of the stage, and with E1 holding another object in her left hand. Each trial lasted 20 s and included two phases. First, in the familiarization phase, E1 played with the object in her hand (5 s) then experienced a negative event, wherein the object was taken by E2's white, gloved hand (5 s). Second, during the test phase, E1 displayed either a sad or a neutral facial expression (depending on the condition), while looking downwards without any vocalizations or movements (10 s) and holding her left, empty hand in the air over the object on the left. E1 looked downwards as to not attract the infants' attention to her face and eyes, as well as to reduce infants' arousal during the negative facial expressions. Each infant saw four negative events. All events were counterbalanced across participants.

The four events included Play-Drums, Play-Pegs, Eat-Spoon and Play-Ball. In the Play-Drum familiarization phase, E1 beat a toy drum with a drumstick, repeating this sequence of actions three times. E2's gloved hand then entered the scene through the right hand side of the stage and took E1's drumstick. E1 then exclaimed "Oh". In the Play-Pegs familiarization phase, E1 hammered a set of pegs three times. Then, E2's gloved hand entered the scene and took E1's hammer, after which E1 exclaimed "Oh". In the Eat-Spoon familiarization phase, E1 mimicked eating from a bowl of rice. E2's gloved hand reached in and took E1's spoon, after which E1 then exclaimed "Oh". In the Play-Ball familiarization phase, E1 bounced a ball up and down in her hand. E2's gloved hand then took the ball from E1, followed by E1 exclaiming "Oh". The vocalizations were included in the familiarization so as to mark the transition to the test phase. The vocalizations were also added in order to increase the realistic nature of the scene, as infants themselves would often produce a vocalization after an emotional experience. During the test phase of all trials, E1 remained immobile while holding her left hand in the air, her head facing the infant (while gazing downwards) with a neutral or sad expression.

***Coding of the exposure phase***. The percentage of looking times at the stage, which included the actor's face and hand, during the familiarization phase (i.e., when the event occurred) and the test phase trials (i.e., when the actor was expressing the target emotion) was coded for each trial using INTERACT 8.0 (Mangold, 2010). Two other variables, hypothesis testing and concern, were coded based on an adaptation of the coding scheme developed by Zahn-Waxler, Radke-Yarrow, Wagner, and Chapman (1992) with modifications to account for the context and age of the infants. Concern, which included infants' observable preoccupied responses, was coded on a 3-point scale: 0 = none; 1 = facial concern only (e.g., furrowed or raised eyebrows in concern, open mouth, widened eyes); 2 = facial concern with vocalizations (e.g., same as 1, but with vocalizations such as "Oh!" or calling to the parent in the room with concern or pointing to the actor). Hypothesis testing, which included infants' level of checking responses to the event, was coded on a 4-point scale: 0 = none; 1 = looks back and forth between face and object or hands at least twice, in an attempt to decipher the distress; 2 = looks back and forth between face and object or hands more than twice in a more sophisticated attempt to decipher the distress than 1; 3 = looks back and forth between face and object at least twice, with a back and forth look toward the parent in the room OR looks back and forth between parent and the actor at least twice, in a more frequent attempt to decipher the distress than 1 or 2. Given that looking behaviors have consistently been considered a primary variable for hypothesis testing as a sign of very young children's attempts to attribute cause (e.g., see Hepach et al., 2012; Knafo, Zahn-Waxler, Van Hulle, Robinson, & Rhee, 2008; Zahn-Waxler et al., 1992), this variable was extended as a primary code for hypothesis testing due to infants' limited verbal abilities. Hypothesis testing and concern were not mutually exclusive categories, and thus children could engage in both behaviors simultaneously.

#### 1.4.2. Interactive tasks

***Emotional referencing***. The emotional referencing task was modeled after Repacholi (1998). After a brief warm-up trial, E1 placed two round opaque containers covered with lids on the table, out of the infant's reach. E1 shook the containers as to indicate that they were full, and placed one container to her left and one to her right. E1 always began by turning to the container on her left. During the "Happy" container trial, E1 opened the lid, tilted the container toward her and exclaimed "Wow! I found something! Wow I can see it! Wow!" accompanied by happy and excited vocalizations and facial expressions and then replaced the lid. E1 then turned to the right container, opened the lid, and said "Ew! I found something... Ew! I can see it... Ew!" to the "Disgust" container while displaying vocal and facial expressions of disgust and then replaced the lid. E1 then adopted a neutral facial expression, gazed at a marked area on the table located in front of the child, and slid the containers in synchrony toward the infant, at an equal distance from the marked area on the table. E1 continued to look at this marked area until the trial ended. The order of presentation of the Happy and Disgust container was counterbalanced

**Table 1**
Communicative cues and helping score.

| Order of presentation | Description | Helping scores |
|---|---|---|
| 1 | Facial/Vocal Cues of Sadness | 8 |
| 2 | "I'm Sad" | 7 |
| 3 | "I need something to make me happy/warm" | 6 |
| 4 | "A teddy bear/Glove!" | 5 |
| 5 | Alternating gaze from child to bear/glove | 4 |
| 6 | Reaching toward the bear/glove | 3 |
| 7 | "Can you help me?" | 2 |
| 8 | "Can you give me my bear/glove please?" | 1 |
| 9 | No response | 0 |

Adapted from Svetlova et al. (2010).

across participants. Infants were given 30 s to open one of the two boxes. The *first* container that infants attempted to open (by touching the lid) was coded.

***Instrumental helping***. Two instrumental helping tasks adapted from Warneken and Tomasello (2007) were administered. In the *Book Stacking* task, E1 demonstrated the stacking of three blue, wooden "books" on top of one another. During the test phase, E1 pretended to drop the fourth book next to the pile while exclaiming "Oh" and remained neutral for 30 s through a series of prompts (looking at the book, gazing back and forth between the infant and the book and ending with "Oh no! It fell!"). This was repeated for two more books trials. In the *Blocks* task, E2 quietly entered the room and sat behind the infant. E1 then demonstrated placing three blocks into a bucket using plastic tongs. After E1's demonstration, E2 placed one block in front of the infant. While remaining neutral, E1 engaged in a series of prompts to enable the infant to hand her the block (reaching toward the block using the tongs, gazing back and forth from the block to the child and ending with "Oh no! I can't reach it!"). The *Blocks* task included three trials.

*Coding of the instrumental helping tasks*. During the *Book Stacking* task, infants were given a score of 1 if they helped at any point during the 30 s trial, for a total score of 3, either by placing the book on the stack or by handing the fallen book to E1. During the *Blocks* task, infants were given a score of 1 if they handed or pushed the block toward E1 at any point during the 30 s trial, for a total score of 3. The *Blocks* and *Book Stacking* tasks were counterbalanced across participants.

***Empathic helping***. Two empathic helping tasks were adapted from Svetlova, Nichols, and Brownell (2010). For the *Glove* task, E1 showed the infant a pair of red gloves and displayed positive affect by saying "Look! These are my favorite gloves! They keep me warm!". E1 then rubbed her hands together while saying "Brrrr!" before putting on the gloves. E1 then handed the infant one of her gloves and kept the second glove on the table in front of her. E2 then entered the room, put on E1's glove, rubbed her hands together and walked out the room. In the *Bear* task, E1 showed the infant a teddy bear while displaying affective and vocal expressions of happiness by saying "Look! This is my favorite bear!" while hugging the bear, then handed the bear to the infant. E2 then entered the room and pretended to whisper something sad to E1 by cupping E1's ear in her hand and hissing in different tones for 3–5 s, and then left the room. As E2 left the room for both tasks, E1 gasped loudly and went through a series of 5 s prompts (see Table 1).

*Coding of the empathic helping tasks*. Infants were given a score from 0 (no help) to 8 (gave the bear/glove during E1's first prompt), with higher scores indicating that infants needed less overt and verbal requests from E1 (i.e., needing only the emotional cues) before handing the bear/glove to E1 (see Table 1).

***Imitation task***. All infants engaged in two deferred imitation tasks adapted from Bauer and Mandler (1989). In the *Rattle* task, infants were shown two plastic containers (which fit into one another) and a small rubber ball that could fit inside the containers, aligned on a tray. After a brief warm-up period, E1 said "Watch me!", while taking the ball and putting it in the largest container, then picked up the small container, inverted it then placed it on top of the large container (as to contain the ball), and then shook the items together to make a rattle while remaining neutral. This demonstration was repeated twice. During the test trial, E1 lined the items up on the tray while saying "Can you make the ball move, just like I did?" while sliding the tray toward the infants, as she gazed at a marker on the table located in front of the child while remaining neutral until the trial was over (60 s). In the *Teddy-to-Bed* task, infants were shown a teddy bear, a toy crib, a small felt pillow and cover. After a brief warm-up period, E1 took the items back, said "Watch me!" and placed the pillow, teddy, and cover in the crib, respectively. This demonstration was repeated twice. Then E1 replaced all of the items on the tray and said "Can you make the teddy go 'night-night', just like I did?". Both tasks were counterbalanced across participants.

*Coding of the imitation tasks*. During the *Rattle* Task, infants were given a score of 1 for each step they completed in the correct order (1 = ball into large container, 2 = small container inverted over large container, 3 = shaking the containers) for a maximum score of 3. During the *Teddy-to-Bed* Task, Infants were given a score of 1 for each step they completed in order (1 = pillow into the crib, 2 = teddy on pillow, 3 = cover on teddy) for a maximum score of 3.

### *1.4.3. Intercoder reliability*

In order to keep the coder blind to the hypotheses during the reliability exposure phase, all looking times for the entire sample were coded first, which allowed each event to be divided into the familiarization and test trials. The behavioral

variables were then coded (concern and hypothesis testing) during the 10 s test trial which did not include the vocalization in the familiarization phase (and thus the scene and condition remained blind to the coder). To establish inter-coder reliability, 35% of the sample ($n = 27$) was coded by a second independent observer who was blind to the hypotheses and the condition. The kappa for the concern variable was $\kappa = .91$, while the hypothesis testing variable yielded $\kappa = .87$. Intra-class correlations (ICC, McGraw & Wong, 1996) were calculated to determine the inter-coder agreement for the looking time measures. The ICC for the looking times at the scene was .936, $p < .001$. The ICCs for the interactive tasks with continuous variables were as follows: instrumental helping = .994, $p < .001$; empathic helping = .949, $p < .001$; imitation = .969, $p < .001$, while the kappa coefficient for the emotional referencing task was $\kappa = .90$.

#### *1.4.4. Emotion ratings*

As a validity check of the reliability of the actor's facial emotional expression during the live events, as well as during the interactive tasks, adult participants ($N = 31$) were shown still pictures of E1 displaying the same emotional expressions that she displayed during the test trials and the interactive tasks as well as distractors (Anger, Disgust, Happiness, Neutral, Fear, Pain, Sadness, Scared; based on Ekman, Hager, and Friesen (1981) and asked to identify each from a choice of seven emotions and to rate its intensity on a 5-point Likert-scale (with 1 *very low* and 5 *very high*). All 31 students rated the sad actor as expressing sadness (mean intensity = 3.71, $SD = 1.01$, range = 2–5), and as neutral when the neutral expression was displayed (mean intensity = 3.21, $SD = 1.04$, range = 1–5) during the live exposure events; while disgust (mean intensity = 4.00, $SD = 1.10$, range = 1–5) and happiness (mean intensity = 2.87, $SD = .56$, range = 2–4) were rated as the primary emotions manipulated during the interactive tasks.

## 2. Results

A Gender × Condition × Task Order repeated measures MANOVA was used to control for multiple testing on the interactive variables (i.e., instrumental helping, empathic helping, imitation, emotional referencing). The analyses were run only on the subsample of infants who completed *all* tasks ($n = 50$). No significant effect of Condition ($F(1, 49) = .374$, $p = .825$, $\eta^2 = .046$, $\lambda = .954$), Gender ($F(1, 49) = .399$, $p = .808$, $\eta^2 = .049$, $\lambda = .951$), Task Order ($F(3, 49) = .841$, $p = .609$, $\eta^2 = .097$, $\lambda = .736$) emerged. Similarly, no Condition × Task Order ($F(3, 49) = .330$, $p = .982$, $\eta^2 = .041$, $\lambda = .883$), Condition × Gender ($F(1, 49) = 1.16$, $p = .349$, $\eta^2 = .130$, $\lambda = .870$), Gender × Task Order ($F(3, 49) = 1.17$, $p = .321$, $\eta^2 = .129$, $\lambda = .660$), nor Condition × Gender × Task Order interactions ($F(3, 49) = .734$, $p = .715$, $\eta^2 = .086$, $\lambda = .764$) emerged on any of the dependent variables. Given that not all of the 71 infants completed all of the tasks, repeated measures multivariate ANOVAs were conducted separately to increase the sample size and statistical power per task. In addition, as task order effects were not observed, it was therefore removed from the remaining analyses to preserve the integrity of the data.

### *2.1. Exposure phase*

Preliminary analyses examining infants' looking times at the scene during the familiarization phases using a Condition (Sad/Neutral) × Gender mixed repeated measures MANOVA on the trials (Pegs/Drums/Spoon/Ball) revealed a significant main effect of trial, $F(3, 56) = 5.32$, $p = .003$, $\eta^2 = .22$, Wilks' $\lambda = .778$). All infants looked longer at the Spoon trial than at any other trial (Spoon: $M = 98.40$, $SD = 4.67$; Pegs: $M = 92.58$, $SD = 14.32$; Drums: $M = 94.68$, $SD = 8.68$; Ball: $M = 92.66$, $SD = 11.13$). However, no main effect of Condition ($F(1, 58) = 2.95$, $p = .09$, $\eta^2 = .05$), Gender ($F(1, 58) = 1.72$, $p = .19$, $\eta^2 = .03$), nor Condition × Gender emerged ($F(1, 58) = .659$, $p = .220$, $\eta^2 = .03$), suggesting that infants in both conditions looked at the scenes the same high percentage of time during the familiarization phase (Sad: $M = 96.17$, $SD = 4.10$, Neutral: $M = 93.19$, $SD = 7.83$).

Infants' looking times at the scene during the test phase using a Condition (Sad/Neutral) × Gender mixed repeated measures MANOVA on the trials (Pegs/Drums/Spoon/Ball) revealed a significant main effect of trial, $F(3, 58) = 5.60$, $p = .002$, $\eta^2 = .23$, Wilks' $\lambda = .775$). Infants overall looked less at the scene during the Ball trial ($M = 71.29$, $SD = 16.33$) than any other trial (Pegs: $M = 80.57$, $SD = 14.70$; Drums: $M = 80.00$, $SD = 17.50$; Spoon: $M = 79.34$, $SD = 21.35$). However, no main effect of Condition ($F(1, 60) = .565$, $p = .445$, $\eta^2 = .01$), Gender ($F(1, 60) = 3.15$, $p = .08$, $\eta^2 = .05$, Wilks' $\lambda = .778$), nor Condition × Gender ($F(1, 60) = 1.13$, $p = .959$, $\eta^2 = .00$) interaction emerged. Thus, across conditions, infants in both conditions looked at the actor an equally high amount of time during each of the four test trials. Analyses were run for looking times including and excluding the Ball trial. However, no differences were noted in the results for either the looking times or the concern and hypothesis testing variables.

Preliminary analyses revealed that the concern variable was positively skewed. Therefore, a log10 transformation was conducted on the concern variable for the analyses. A Condition × Gender MANOVA was used to analyze the effects of the empathy variables during the test phase. Results revealed that the sad group ($M = .51$, $SD = .37$) showed more concern than the neutral group ($M = .33$, $SD = .38$; $F(1, 70) = 4.03$, $p = .04$, $\eta^2 = .06$). However, no differences emerged between both groups on hypothesis testing (Sad: $M = 1.33$, $SD = .74$; Neutral: $M = 1.45$, $SD = .49$; $F(1, 60) = 1.13$, $p = .959$, $\eta^2 = .00$) (see Fig. 1). No Gender ($F(2, 66) = 1.54$, $p = .86$, $\eta^2 = .01$, Wilks' $\lambda = .996$) nor Condition × Gender interaction effects emerged ($F(2, 66) = .781$, $p = .46$, $\eta^2 = .02$, Wilks' $\lambda = .977$).

### *2.2. Interactive tasks*

#### *2.2.1. Emotional referencing*

Out of the 71 infants, 11 were excluded from the emotional referencing tasks (did not try to open the containers $n = 6$, opened both containers simultaneously $n = 3$, fussiness $n = 2$), leaving a total of 60 infants (Sad: $n = 31$; Neutral: $n = 29$). A Pearson Chi-Square revealed that infants in both conditions were equally likely to choose the "happy" (Sad: $n = 15$; Neutral: $n = 16$) and the "disgust" container (Sad: $n = 12$; Neutral: $n = 17$) ($\chi^2 = .30$, $p = .614$, $\varphi = .07$). In addition, a Fisher's Exact Test revealed no differences between the two groups for the infants who did not open the containers (Sad: $n = 4$; Neutral: $n = 2$) nor for the infants who opened both containers (Sad: $n = 2$; Neutral: $n = 1$) ($p = .541$, $\varphi = .00$).

#### *2.2.2. Instrumental helping*

The scores on the *Blocks* and *Book Stacking* tasks were averaged into a score on 3. Of the 71 infants, 3 infants were excluded due to fussiness (Sad: $n = 0$; Neutral: $n = 3$), leaving a final sample of 68. A Gender × Condition univariate ANOVA revealed no main effect of Condition ($F(1, 68) = 2.45$, $p = .12$, $\eta^2 = .04$) nor Gender ($F(1, 68) = .402$, $p = .528$, $\eta^2 = .01$) and no interaction effects ($F(1, 68) = 1.55$, $p = .217$, $\eta^2 = .02$). Therefore, infants in the sad and neutral conditions were equally likely to engage in instrumental helping (Sad: $M = 2.31$, $SD = .88$, Neutral: $M = 1.98$, $SD = .90$).

#### *2.2.3. Empathic helping*

The scores on the *Bear* and *Glove* tasks were averaged into a score on 8. Of the 71 infants, 7 infants were excluded due to fussiness (Sad: $n = 3$; Neutral: $n = 4$), leaving a final sample of 64. A Gender × Condition univariate ANOVA revealed no main effect of Condition ($F(1, 64) = .339$, $p = .56$, $\eta^2 = .01$) nor Gender

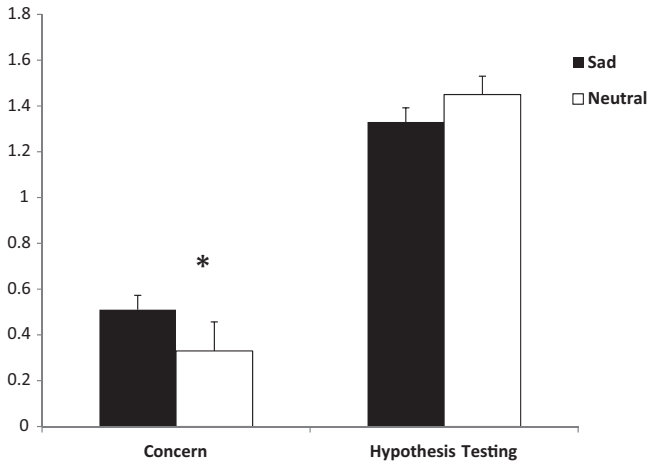


**Fig. 1.** Concern and hypothesis testing scores for the sad and neutral groups (*$p < .05$).

($F(1, 64) = .776$, $p = .382$, $\eta^2 = .01$) and no interaction ($F(1, 64) = .005$, $p = .943$, $\eta^2 = .00$). Therefore, infants in the sad and neutral conditions were equally likely to empathically help (Sad: $M = 4.77$, $SD = 2.19$; Neutral: $M = 4.43$, $SD = 2.36$).

*2.2.4. Imitation*

The *Rattle* and *Teddy-to-Bed* tasks were averaged into a score on 3. Of the 71 infants, 7 infants were excluded due to fussiness (Sad: $n = 5$; Neutral: $n = 2$), 3 for not touching the toy (Sad = 1; Neutral = 2) and 1 for parental interference (Sad = 1), leaving a total sample of 59 (Sad: $n = 28$; Neutral: $n = 31$). A Gender × Condition univariate ANOVA revealed no main effects of Condition ($F(1, 59) = .663$, $p = .42$, $\eta^2 = .01$) nor Gender ($F(1, 59) = .088$, $p = .768$, $\eta^2 = .01$) and no interaction ($F(1, 59) = .068$, $p = .795$, $\eta^2 = .00$). Thus, infants in the sad and neutral conditions were equally likely to recall an equal number of steps in order (Sad: $M = 1.30$, $SD = .95$; Neutral: $M = 1.12$, $SD = .68$). A second univariate ANOVA revealed that infants in both groups were also equally likely to recall the steps in any order (Sad: $M = 2.03$, $SD = .93$; Neutral: $M = 1.97$, $SD = .71$; $F(1, 59) = .851$, $p = .360$, $\eta^2 = .02$).

## 3. Discussion

The current study examined whether infants would show selectivity in their behaviors toward individuals who showed neutral or sad facial expressions after a series of negative experiences (having objects taken away from them). As expected, infants who saw the actor express sadness after experiencing a sad event showed more concern toward her than those who witnessed the actor express no emotion, while no differences in hypothesis testing were found between the two groups. These findings make two important contributions. The first contribution concerns the emergence of selective trust in infancy. As demonstrated in previous studies (Chiarella & Poulin-Dubois, 2013, 2014; Skerry & Spelke, 2014), infants' engagement in hypothesis testing or checking behavior is indicative that they have noticed an inconsistency between someone's experience and the emotional reactions that follow. Infants in the current study showed similar levels of hypothesis testing in the sad and neutral condition. These null results suggest that infants did *not* consider the actor's neutral facial expression as an inappropriate reaction to an unpleasant experience. This was shown by the absence of differences between the neutral and the negative expression groups for both hypothesis testing and total looking times. Therefore, infants do not consider this lack of emotional reaction as "unjustified" as they do when an actor expresses a positive emotion after a negative experience (Chiarella & Poulin-Dubois, 2013). Given that neutral facial expressions provided *no* information about the emotion of the person, and that the stimuli in the current study (and those from Vaish et al., 2009) included an emotionally loaded negative event that infants of that age have most likely experienced (e.g., having objects taken away from them), infants appear to be able to consider both their prior experiences with the negative event and the reaction of the emoter. Thus, while infants can detect when the emotions following familiar emotional events are unjustified (Chiarella & Poulin-Dubois, 2013, 2014), they do not appear to consider the absence of overt emotional cues as incongruent with a negative experience, just as they assume a "positivity attribution" to ambiguous objects (Cacioppo & Berntson, 1999; Cacioppo et al., 1997, 1999; Hornik et al., 1987; Mumme et al., 1996; Newton et al., 2014).

The findings also revealed that infants did not behave differently toward the "sad" versus "neutral" actor on subsequent interactive tasks. As infants did not seem to judge the neutral expression as inconsistent with the negative event, their apparent interpretation of the neutral facial reaction as a "justified" reaction rather than "unjustified" renders this lack of findings predictable since they did not have any reason to assume that the neutral actor is "untrustworthy". Previous studies on selective trust have revealed that infants are less likely to follow the gaze of a person whose emotional expressions are misleading (excitement about an empty container: Chow et al., 2008) and that they are less likely to learn from an inaccurate labeler (Brooker & Poulin-Dubois, 2013). In the current study, we extend this research by showing that 18-month-olds consider a neutral expression as "accurate" as a sad response to a negative event. Confirming their reactions to the display of emotions, their behaviors toward the "neutral" person were identical to those toward the "sad" person. This is

an important finding in that it shows that infants of that age require a strong violation of their expectations about emotional reactions to events.

The current findings are in line with those from Vaish et al. (2009) and Newton et al. (2014), who demonstrated that infants are willing to subsequently help individuals who displayed neutral facial expressions following a negative scene. Interestingly, our study extends these findings by showing that infants display less concern for "neutral" than sad individuals *after* a negative event, but are equally willing to help and imitate them and be guided by their emotional expressions, perhaps giving them "the benefit of the doubt". This contrasts with previous research revealing that when shown *unjustified* emotional reactions (happiness) following a negative event, infants are less likely to trust the person's emotional expressions in other contexts (Chiarella & Poulin-Dubois, 2014). We believe that the null results that are part of the current findings, as well as others (Brooker & Poulin-Dubois, 2013; Chiarella & Poulin-Dubois, 2013; Newton et al., 2014; Walle & Campos, 2014) provide important contributions to the selective trust literature during the infancy period. As infants' understanding of others' emotions develop with age, it is possible that neutral expressions are considered inaccurate at later ages and the development of this ability should be examined in future studies. Until then, the current findings provide important insights on the development of these selective abilities within the second year of life.

The second contribution of these findings is to the literature on empathy development in infancy, replicating previous observations that young infants will react with concern when watching someone express a negative emotion (Roth-Hanania, Davidov, & Zahn-Waxler, 2011; Zahn-Waxler et al., 1992). However, the current findings also show that while infants react appropriately to a sad facial expression following a negative event (i.e., displaying concern), a neutral facial expression following the same negative event does not appear to justify concern for the emoter. These findings also extend this literature by showing that, contrary to the suggestions made by Vaish et al. (2009), context alone does not trigger empathic responses. In their study, infants watched as an actor experienced either a negative (e.g., an actor breaking, tearing, or taking another actor's possessions) or neutral (e.g., an actor breaking, tearing, or taking another object that did not belong to the second actor) event, while the actor always remained "stoic", with a neutral facial expression. Their results revealed that infants showed more concern toward a "stoic" actor experiencing a negative event than a neutral event, concluding that in the absence of emotions, infants rely on context to guide their empathic responses toward individuals. However, without a negative facial expression condition, it remained unknown whether infants would show empathic responses *with the same intensity* toward expressive and non-expressive individuals experiencing the same negative event. The current study shows that infants *do* show concern toward individuals who express no emotion following a negative event, however, they do so *less* than toward an actor who displays a negative facial expression following the same event. These findings provide a more conservative test of infants' processing of neutral expressions and suggest that while infants do consider context in the absence of emotional facial expressions (as suggested by Vaish et al., 2009), they are also sensitive to the *salience* of the appropriate facial expressions. These findings are in line with the literature that highlights the importance of emotional salience in infancy (Beebe & Lachmann, 1994; Brown, Robinson, Herbert, & Pascalis, 2006; Gross, Hayne, Herbert, & Sowerby, 2002; Messinger, Mattson, Mahoor, & Cohn, 2012; Montague & Walker-Andrews, 2001).

Taken together, the current findings show that infants aged 18 months appear sensitive to subtle forms of emotional valence in response to negative emotional experiences. Given their increased concerned responses toward a sad versus a neutral individual, this conservative test of selective trust suggests that 18-month-olds do not solely rely on the context when processing others' emotional reactions but also take into account the valence of their emotions. However, the lack of difference in hypothesis testing behaviors suggests that infants treat negative and neutral emotions as equally appropriate reactions after a negative experience. Consequently, this lack of detection of "accuracy" induces similar subsequent selective behaviors.

No doubt, there are other interpretations to the current pattern of results. First, it is possible that infants in both conditions did not perceive the protagonist as having a negative experience at all. However, we believe that this interpretation can be ruled out. Importantly, the main dependent variable during the exposure phase is hypothesis testing, as analyzed through looking time at the face and object during the test phase. Given that infants of the same age showed more hypothesis testing behaviors when exposed to a happy person than a sad person *in exactly the same context* (Chiarella & Poulin-Dubois, 2013), it is clear that infants perceived the event as negative. Second, one could argue that it is possible that the adult's *vocal* expression in both conditions (Oh!) was interpreted by infants as a negative reaction, accounting for the lack of differences between the sad and neutral conditions. Again, the fact that infants perceived the protagonist as inaccurate if she responded to the same event (including the vocal expression) with a happy face also rules out this interpretation (Chiarella & Poulin-Dubois, 2013).

While the current study has many strengths, one limitation is that only negative emotional expressions were contrasted with neutral expressions. A previous study by Chiarella and Poulin-Dubois (2013) demonstrated that infants are sensitive to the mismatch between positive emotions and negative events. Given that one of the goals of this study was to replicate and extend previous research on empathic responses, expressions of sadness were essential during the exposure test phase and thus a positive condition was not included in the current study. Furthermore, a future line of research may investigate whether older infants or toddlers would identify a neutral facial expression as an "unjustified" reaction to a negative experience. Until then, the present study presents the first test of infants' sensitivity to subtle forms of emotional inaccuracy and its impact on prosocial and emotional referencing behaviors. These findings provide an important contribution to the emergence of selective learning and prosocial behaviors during the infancy period.

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