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## Vocal Tones Influence Young Children's Responses to Prohibitions

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### Abstract

Vocal reactions to child transgressions convey information about the nature of those transgressions. The present research investigated children's ability to make use of such vocal reactions. Study 1 investigated infants' compliance with a vocal prohibition telling them to stay away from a toy. Compared to younger infants, older infants showed greater compliance with prohibitions elicited by moral (interpersonal harm) transgressions, but not with prohibitions elicited by pragmatic (inconvenience) transgressions. Study 2 investigated preschoolers' use of firm-stern vocalizations (associated with moral transgressions) and positive vocalizations (associated with pragmatic transgressions). Most children guessed that the firm-stern vocalizations were uttered in response to a moral transgression and the positive vocalization were uttered in response to a pragmatic transgression. These two studies suggest that children use vocal tones, along with other experiences, to guide their compliance with and interpretation of prohibitions.

### Keywords

prohibitions; emotional communication; social domain theory

## Vocal Tones Influence Young Children's Responses to Prohibitions

Emotional signals can convey information about rules to children (Dix, 1991; Weiner, Graham, Stern, & Lawson, 1982). Mothers of infants have reported and expressed different emotional reactions to *moral harm* violations (when infants are harming others) than to *pragmatic* violations (when infants create inconvenience, e.g. by spilling food) (Dahl & Campos, 2013; Dahl, Sherlock, Campos, & Theunissen, 2014; see also Cole & Tan, 2015; Honig & Chung, 1989). Emotional signals may be especially important during early childhood, when children's linguistic understanding is limited (K. C. Barrett & Campos, 1987; Kochanska, 1994). Yet, these emotional signals only influence the development of rule

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conceptions insofar as children perceive and make use of the emotional signals (Walle & Campos, 2012). If a child were oblivious to the differences in her mother's reactions to moral and pragmatic violations, the child could not use such differences to guide future behavior (for instance in guessing whether she might get away with a violation) or understand differences between rules (for instance that hitting causes pain, whereas spilling merely causes minor inconvenience) (Dahl & Kim, 2014; Dunn & Munn, 1985; Smetana, 1989). The present research investigated how caregivers' vocal prohibitions of moral and pragmatic transgressions influence behavioral reactions in infancy (Study 1) and interpretations of social events in preschool age (Study 2).

### **The Construction of Moral and Pragmatic Rules through Social Interactions**

By preschool age, children endorse and distinguish between a variety of rules. In the third year, they view moral prohibitions as more generalizable and less alterable than social conventions (e.g. dress codes or codes of politeness) (Smetana & Braeges, 1990; Smetana, Jambon, Conry-Murray, & Sturge-Apple, 2012). In the fourth year, children also provide different justifications for different judgments about violations, for instance justifying judgments about moral violations with references to rights and welfare of individuals and judgments about pragmatic violations with references to inconvenience or material disorder (Dahl & Kim, 2014; Nucci & Weber, 1995; Smetana, 1985; Tisak & Turiel, 1984). At this age, children can also protest when others commit violations and react differently to different types of violations (Killen & Smetana, 1999; Rakoczy, Warneken, & Tomasello, 2008; Schmidt, Rakoczy, & Tomasello, 2012; Smetana, 1989; Vaish, Missana, & Tomasello, 2011; for a review, see Smetana, Jambon, & Ball [2014]).

Theorists have proposed that children develop an understanding of and concern with moral and other rules through differentiated social experiences (Killen & Smetana, 2015; Smetana et al., 2014; Turiel, 1983). For instance, children experience that physical harm is painful (most directly experienced when they themselves are the victim) and often elicits signs of distress or protest from the victim, pragmatic violations elicit references to disorder or property damage, and often require someone to clean up, and conventional violations do not have immediate consequences and tend to elicit references to rules or authorities (Dahl & Campos, 2013; Killen & Smetana, 1999; Nucci & Turiel, 1978; Smetana, 1989; Tisak, Nucci, & Jankowski, 1996).

The experiential origins of rule distinctions in the transition from infancy to preschool age has received little attention. Most research on children's experiences with rule violations has involved older children and, accordingly, focused on the linguistic content of reactions to violations (e.g. explicit references to harm or rules) (see Smetana, 2013). As noted, young children's limited linguistic abilities may prevent them from understanding parents' commands and explanations regarding violations (Fenson et al., 1994; Kaler & Kopp, 1990; Kochanska, 1994; Kuczynski, Kochanska, Radke-Yarrow, & Girmius-Brown, 1987). Moreover, there has been little research on how children use their social experiences with different types of prohibitions to guide their behavior (e.g. comply with the prohibition, Study 1) and interpretation of prohibitions (e.g. infer the nature of the event being prohibited, Study 2).

Others' emotional reactions to rule violations may be particularly important for the early development of children's reactions to prohibitions. As noted, some studies have found that mothers have different emotional reactions to infants' moral and pragmatic violations (Dahl & Campos, 2013; Dahl et al., 2014). Dahl and his colleagues (2014) analyzed both mothers' responses to naturally occurring violations in the family homes and to videotaped infant violations. In the latter paradigm, mothers were shown short video clips of infants engaging in violations, for instance hitting a sibling, and asked to respond to these video clips using a standardized phrase ("No, don't do that."). Dahl and his colleagues found that mothers were especially likely to respond to moral violations with intense *firm-stern* (anger-like) vocalizations, whereas positive tones of voice, termed *warm-comforting* (loving) or *playful-playing* (joyful), were more common in response to pragmatic violations. Situational differences in caregiver responses to infants' moral and other violations are also seen in other verbal and non-verbal behaviors (Dahl & Campos, 2013; Smetana, 1989; Zahn-Waxler & Chapman, 1982).

The differences in mothers' vocal and other responses reflect mothers' different conceptions of moral and pragmatic violations. Mothers rate discouraging infants from harming others as more important than discouraging infants from spilling or breaking things, and mothers provide different justifications for moral and pragmatic rules (Dahl & Campos, 2013; Dahl et al., 2014; Smetana, Kochanska, & Chuang, 2000). Thus, if young children perceive and make use of differences in caregivers' emotional reactions to violations, this information could help them (1) decide which prohibitions are particularly important to caregivers (e.g. prohibitions of moral violations, such as harming others) and which prohibitions children may be able to ignore without major consequences (e.g. prohibitions against pragmatic violations, such as making a mess) and (2) grasp differences between moral and pragmatic violations.

### Young Children's Use of Emotional Signals from Others

Past research suggests that young children would be able to perceive and make use of differences in caregivers' vocal responses to moral and pragmatic violations. Infants show some ability to discriminate canonical (prototypical) facial and vocal expressions of different emotions, such as fear and anger, in the first year of life (Flom & Bahrick, 2007; Walker-Andrews, 1997). By the first birthday, infants are also able to regulate their behavior in response to emotional signals from others. Sorce, Emde, Campos, and Klinnert (1985) found that infants were less likely to cross a transparent surface covering a 30 cm drop-off when their mother displayed a fearful facial expression than when she displayed a joyful expression. Mumme, Fernald, and Herrera (1996) found evidence that infant responsiveness to negative vocal signals may be even more reliable than their responsiveness to facial expressions.

Several other studies have confirmed that, by late in the first year, infants perceive and make use of the distinction between canonical positive and negative emotional signals (e.g. Campos, Thein, & Owen, 2003; Hornik & Gunnar, 1988; Miyake, Campos, Kagan, & Bradshaw, 1986; Moses, Baldwin, Rosicky, & Tidball, 2001). By the middle of the second year, infants can integrate information about others' observed emotional reactions with cues

about what the person is attending to: After merely observing an adult getting angry at another person, 15- and 18-month-olds were more likely to avoid the anger-provoking action when the angry adult was present than when the adult was absent or distracted (Repacholi & Meltzoff, 2007; Repacholi, Meltzoff, Rowe, & Toub, 2014). However, evidence for differential responses to different canonical negative expressions (e.g. of fear and anger) is mixed (Gendler-Martin, Witherington, & Edwards, 2008; Walle & Campos, 2012).

During the preschool years, children become increasingly able to generate appropriate labels for canonical facial and, eventually, vocal expressions of positive and negative emotions (Nelson & Russell, 2011; Sauter, Panattoni, & Happé, 2013; Widen & Russell, 2010). However, children's ability to adequately label emotional expressions is dramatically hampered if the situational context conflicts with the emotional expression (Aguert, Laval, Lacroix, Gil, & Le Bigot, 2013; Aguert, Laval, Le Bigot, & Bernicot, 2010; Morton & Trehub, 2001). In one study, when 4-year-olds heard sentences describing positive or negative events stated in either a positive or a negative tone of voice, they overwhelmingly relied on the content (nature of the event) rather than tone of voice (Morton & Trehub, 2001). For instance, when 4-year-olds heard the sentence, "My dog ran away from home," they would typically guess that the speaker was sad, even if the speaker spoke in a positive tone of voice. By comparison, older children and adults give greater priority to the tone of voice when guessing the speaker's emotional state.

One limitation of past research on children's responses to emotional expression is the reliance on canonical vocal or facial expressions. These canonical emotional expressions are those used in studies demonstrating cross-cultural recognition of so-called basic emotions such as fear or anger (Ekman, 1992; Ekman et al., 1987; Laukka et al., 2013; Sauter, Eisner, Ekman, & Scott, 2010). However, in everyday life, emotional expressions often do not conform to these canonical patterns and instead show a great deal of contextual variability (Barrett, 2009; Russell, 2003). The existing evidence does not suggest that people typically show the canonical facial expressions of anger, fear, or joy when they are in the respective emotional state (see Fridlund, 1994). An angry person may yell at the perceived transgressor or refuse to talk to the person at all, while the expression of joy over success in sports is culturally variable and depends on whether the person is engaged in a social interaction (Matsumoto & Willingham, 2006; Ruiz-Belda, Fernández-Dols, Carrera, & Barchard, 2003). Campos, Dahl, and He (2010) refer to this as the principle of "equifinality" of emotional expressions: Any given emotion can be expressed in multiple ways.

The present research used as stimuli the types of vocal prohibitory signals that children encounter in everyday life rather than posed vocal signals. In doing so, these studies presented children with a task similar to tasks they face in everyday life: that of using naturally occurring caregiver vocalizations to guide their behavior (i.e. compliance, Study 1) and interpret caregiver messages (i.e. the nature of the transgression to which the caregiver is reacting, Study 2).

A second limitation of much past research on children's responses to emotional expressions is the emphasis on discrimination or labeling rather than adaptive use (see Walle & Campos, 2012). Emotional signals from others do not just indicate others' emotional states; they also

provide information about others' concerns, expectations, and intentions. Adaptive use of these signals may therefore involve actions that take the other person's concerns, expectations, or intentions into account. For instance, as children grow older they respond to others' distress not merely by themselves showing distress or concern, but also acting upon the cause of the other person's concern, for instance by providing a blanket to a person who is cold (Hoffman, 2000; Svetlova, Nichols, & Brownell, 2010; Zahn-Waxler, Radke-Yarrow, Wagner, & Chapman, 1992).

In the present study, the purpose was not merely to see whether young children could discriminate or label maternal vocal reactions to transgressions. The purpose was to see whether young children could make use of adult vocal prohibitive tones in deciding whether to continue a behavior (Study 1) and in determining the nature of the transgression to which an adult was responding (Study 2). The studies contrasted prohibitions against moral and pragmatic transgressions, since such prohibitions, in addition to being commonplace, are recognized by both preschoolers and parents as differing in both their justification and importance (Dahl & Kim, 2014; Dahl et al., 2014; Smetana et al., 2000).

### Study 1: Infants' Response to Prohibitive Vocal Tones

In Study 1, children (13-25-month-olds) were given the opportunity to approach a novel toy (a small, stationary humanoid robot). When children approached the toy, they heard a prerecorded vocal prohibition from their own mother responding to a videotaped, naturally occurring child transgression. The videotapes shown to mothers included either child harming someone else (*moral* condition) or creating mess or other inconvenience (*pragmatic* condition). Children's responses to the playback of the recorded prohibitions were assessed by coding (1) whether they moved away from the prohibited toy after the playback, (2) whether they expressed negative emotion after the playback, and (3) whether they approached the toy in a subsequent phase when no prohibitions were played back.

We hypothesized that, over the course of the second year, children would become increasingly responsive to mothers' vocal responses to moral violations, as reflected in an increased tendency to move away from the prohibited toy after prohibition, decreased tendency to display negative reactions after prohibitions, and increased tendency to avoid the prohibited object in the subsequent phase without prohibition. The hypothesized increase in responsiveness to vocal prohibitions of moral transgressions was based on (1) mothers' emphasis on the prohibition against harm (Dahl & Campos, 2013; Dahl et al., 2014), children's improved ability to make adaptive use of emotional signals from others during the second year (Gendler-Martin et al., 2008; Repacholi & Gopnik, 1997; Walle & Campos, 2014; Zahn-Waxler et al., 1992), and (2) general increases in behavioral inhibition during this period (Kaler & Kopp, 1990; Kopp, 1982). In contrast, we did not hypothesize increases in responsiveness to vocal prohibitions of pragmatic violations with age, as these prohibitions tend to be less stern and more positive (warm or playful) than prohibitions of moral violations (Dahl et al., 2014). Although infants grow more able to comply with parental prohibitions, we expected that infants would consider parental reactions to pragmatic violations as less serious, and hence be more likely to try to "push boundaries" after hearing such vocal reactions. Further supporting this prediction, mothers have reported

that their infants complied more with prohibitions against harming others than with prohibitions against pragmatic violations (Smetana et al., 2000).

Our hypotheses do not imply a perfect association between transgression type (moral vs. pragmatic) and vocalization category (e.g. firm-stern vs. positive tones, such as warm-comforting or playful-laughing). First, the relation between transgression types and adult reactions is probabilistic, not deterministic. Along with average differences between parental reactions to different transgressions, there are also some similarities, with most types of transgressions eliciting commands and at least somewhat firm vocalizations (Dahl & Campos, 2013; Dahl et al., 2014; Smetana, 1989). Second, the vocalization categories developed by past research (Dahl et al., 2014) are unlikely to capture all of the relevant features of mothers' prohibitive vocal tones. For instance, two vocalizations from the same mother may both be classified as firm-stern and yet, for a child who knows this mother, one vocalization may convey a highly negative reaction while the other vocalization may convey a mild reaction. For this reason, the vocalizations played back to the children in Study 1 were not chosen based on whether they fit into a given vocal category (e.g. firm-stern) but rather based on how each mother tended to respond to a given videotaped transgression type.

## Method

**Participants**—The final sample consisted of 119 mother-infant dyads. An additional 13 dyads were recruited, but their data could not be used for the following reasons: The child never approached the prohibited object and hence did not hear any vocal recordings ( $N = 4$ ); the mother interfered with the procedures ( $N = 5$ ); the child was distressed ( $N = 3$ ); the study equipment malfunctioned ( $N = 1$ ). Families were living in a large metropolitan area in the western United States and were recruited from a participant database maintained by the Institute of Human Development at the University of California, Berkeley. Fifty-eight percent of caregivers were European-American, 13% were Asian-American, 13% were Hispanic, were of other ethnicities.

Children were recruited in three different age groups: 13.0–15.0 months ( $N = 46$ ,  $M_{age} = 14.4$  months), 18.0–20.0 months ( $N = 37$ ,  $M_{age} = 19.3$  months), and 23.0–25.0 months ( $N = 36$ ,  $M_{age} = 24.1$  months).

## Materials

**Video recordings shown to mothers:** The experimental stimuli in Study 1 were video clips obtained from Dahl et al. (2014, see original article for additional details). Video clips showed infants engaging in moral (harming others), prudential (doing something that threatened child well-being), or pragmatic (creating inconvenience) transgressions. Each clip lasted 2–5 seconds. At the end of each clip, the final image frame was frozen for another three seconds, giving mothers additional time to respond. In the present study, only mothers' responses to moral and pragmatic clips were used (see Introduction).

Mothers were randomly assigned to receive one of three sets of video clips containing 12 clips (four moral, four prudential, and four pragmatic). For each video set there were also six extra clips (two moral, two prudential, and two pragmatic), to be used if a mother did not

respond to one or more of the four initial clips in the corresponding category (see Procedures below).

Although only vocal responses to either moral or pragmatic clips (depending on condition, see Procedures) were considered for playback to the child, all sets contained clips of moral, pragmatic, as well as prudential events. This variation in the nature of events was included to reduce the likelihood that mothers noticed the similarity of the clips (e.g. that they all contained a child harming someone), which could have drawn their attention to the study hypotheses.

**Recording and playback set-up:** The mothers' vocalizations were recorded using a microphone positioned approximately 6 inches from the mothers' mouths. For playback to the child, a speaker was placed behind the mothers' chair in the area with the prohibited object (Figure 1). The speaker volume was adjusted so that the mean volume of each vocalization was 74dB, as measured by a sound meter placed immediately in front the speaker.

**Target object (prohibited toy)**—The target object that the child would be prohibited from touching was a small humanoid robot (Chicco Baby Space). The toy was attached to a 10 lb weight to prevent the child from moving the toy.

**Procedures**—Children from each age group were randomly assigned to hear a vocalization elicited by a *moral* or *pragmatic* video clip, yielding a 3 (age group: 13–15, 18–20, 23–25 months) by 2 (condition: moral, pragmatic) between-subjects design.

The experiment had three phases: A *recording phase* (during which the mother's vocalizations were recorded), a *prohibition phase* (during which the mother's vocalizations were played back to the child when the child approached the prohibited object), and a *no-prohibition phase* (during which the child could approach the prohibited object, but no vocalizations would be played back).

**Recording phase:** Experimenter 1 (E1) told mothers that the study was about how children use commands from others to guide their behavior. Importantly, E1 made no mention of the three categories of child transgressions depicted in the video, nor about the hypothesized role of vocal tones. Mothers were told to respond vocally to these clips as if they were telling the child not to do whatever the child was doing, using the phrase, "No, don't do that." The phrase was shown visually to mothers so as not to lead mothers to say the phrase in a particular way. The researcher emphasized that the mother should not vocalize if the clip showed a behavior upon which they would not normally intervene.

The recording session took place in a separate room, while Experimenter 2 (E2) and the child stayed in the original warm-up room (to prevent the child from hearing the mothers' vocalizations). In order to avoid auditory clipping effects, E1 adjusted microphone gain while the mother repeated the phrase into the microphone before beginning the recording. Mothers were randomly assigned to view one of the three video sets. Mothers first watched the twelve initial clips in the assigned set. If a mother had failed to respond to one or more of

the twelve ordinary clips, she was then shown extra clips in the same category (up to two extra clips per each category). All mothers thus watched between 12 and 18 clips total.

After the recording session, the mother went back to the warm-up area and rejoined E2 and the child. Because there was some variability in whether mothers followed instructions and in whether recordings included extraneous sounds (e.g. extra words), it was necessary to standardize a procedure for selecting which of the recordings to play back to children. E1 listened to all the vocal recordings corresponding to the child's condition. (For instance, if the child was in the moral condition, E1 would listen to all the mothers' vocal responses to moral video clips.) For each clip, E1 determined whether the mother failed to use the standard phrase or the clip contained extraneous noises, rendering the clip unsuitable for playback. Since mothers typically had more than one suitable audio recording, a procedure was established for selecting the most intense audio recording from the most typical vocal category. Using the coding scheme developed by Dahl and his colleagues (2014), E1 classified the vocalizations as either firm-stern, playful-laughing, warm-comforting, or worried-scared and rated their intensity (see Dahl et al. [2014] for definitions and sample sound clips). E1 then determined which category of emotional tone was the most common (the "modal category"), and selected the clip in the modal category with the highest intensity rating (on a scale from 1 to 4) that was not deemed otherwise unsuitable. E1 was trained until agreement with the main author on clip classification was 70%. Agreement was subsequently spot checked to ensure continued agreement. If two or more recordings in the same vocal category were equally intense and suitable, the experimenter randomly selected which clip to use. It is difficult to achieve high inter-rater agreement for categorization of vocal emotional tones on a single coding pass (see e.g. Shrivastav, Sapienza, & Nandur, 2005). However, some randomness in choice of recording was deemed acceptable since E1 was already choosing between vocalizations elicited by the target video clip (moral or pragmatic), and hence any of these clips were at least minimally suitable for testing the study hypotheses (except for clips that contained extraneous words or other sounds).

**Prohibition phase:** During the prohibition phase, the mother was seated in the chair in front of the speaker. To make it seem as if the played-back vocalizations were coming from the mother, the mother pretended to read a magazine during the prohibition phase, holding a magazine high enough to cover her mouth but not so high as to cover her eyes. This way, the child could not see that the mother's mouth was not moving when a vocal recording was played back, yet the mother could in principle see whether the child approached the robot. The mother was instructed to remain in the chair throughout the phase, look at the magazine, and minimize her interactions with the child. Mothers were told that if the child insisted on interacting with them, they could redirect the child to two small toys (a green fabric cube and a yellow plastic star) located next to the chair. They were also told explicitly that they should not direct the child toward the robot.

On signal from E2, the mother put the child on the floor, which marked the beginning of the prohibition phase. E1 monitored the child's movements through a video feed. Each time the child moved within a 2 × 2 foot square around the robot, E1 triggered a playback of the mother's vocalization. If the child remained in the 2 × 2 foot square, E1 triggered another playback five seconds after the end of the last playback. Each child heard up to four



playbacks. The prohibition phase ended 15 seconds after the 4<sup>th</sup> playback or after 4 minutes, whichever happened first. At the end of the prohibition phase, E2 brought the mother and the child back to the warm-up area.

**No-prohibition phase:** Three minutes after the end of the prohibition phase, E2 brought the mother and child back to the area with the prohibited toy for the final phase of the study. As for the prohibition phase, the mother had been instructed sit down in the chair in front of the speaker, put the child down on the floor, and read a magazine for the duration of the phase, interacting as little as possible with the child. During the no-prohibition phase, no vocal recordings were played back to the child. The phase lasted two minutes.

**Coding**—Research assistants blind to the child’s experimental condition continuously coded the *location of the child* (inside prohibited area versus outside prohibited area) after the first playback until the end of the prohibition phase. The child’s location was also coded during the entire no-prohibition phase. In a second pass, a coder assessed whether the child showed vocal or facial signs of *negative emotion* between the end of the first playback until the end of the prohibition phase. Coders also assessed whether the child looked toward the mother at least once immediately before or after entering the prohibited area (*social referencing*). Twenty percent of the data were double-coded. Inter-rater agreement: Emotional tone of vocalization: Cohen’s  $\kappa = .63$  (84% agreement), prohibition phase location coding:  $\kappa = 1.00$  (100%), no-prohibition phase location coding: Pearson’s  $r = .95$ , prohibition phase negative emotion:  $\kappa = 1.00$  (100%), social referencing:  $\kappa = .83$  (93%).

**Data analysis**—Data were analyzed using Generalized Linear Models with age group, condition, and the age group by condition interaction as predictors (Fox, 2008). Hypotheses were tested using likelihood ratio tests. With regards to the child’s location in the prohibition phase, the dependent variable was whether children remained in the prohibited area from the first playback until the end of the prohibition phase. This dichotomous variable was analyzed using logistic GLMs (logistic link function, binomial error distribution). The presence of negative emotional signals after the first playback (a dichotomous variable) was also analyzed using logistic GLMs. The time children spent in the prohibited area during the no-prohibition was positively skewed, with some children spending no time in the prohibited area. To model these duration data, we modelled the number of seconds children spent in the prohibited area using Poisson GLMs (logarithmic link function, Poisson error distribution).

## Results

**Vocal recordings**—Consistent with past research, there was a significant association between condition and vocal tone played back to children, Pearson  $\chi^2(3, N = 119) = 9.45, p = .024$ . Firm-stern vocalizations were more common in the moral condition (84% vs. 72% for pragmatic), and warm-comforting vocalizations were more common in the pragmatic condition (33% vs. 11% for moral condition), whereas playful-laughing (3% in pragmatic, 2% in moral) and worried-scared (3% in moral, 0% in pragmatic) were rarely used in either conditions. Among mothers who used a firm-stern vocalization, those in the moral condition was coded as responding with higher emotional intensity than those in the pragmatic condition,  $M_{Moral} = 3.0, M_{Pragmatic} = 2.6$ , Wilcoxon rank-sum test:  $W = 1126.5, p = .01$ .

**Prohibition phase**—Most children (68%) heard the maximum number of playbacks (4, mean number of playbacks = 3.3,  $SD = 1.0$ ). Although younger children were somewhat more likely than older children to hear all four clips (13–15 months: 74%, 18–20 months: 70%, 23–25 months: 58%), the probability of receiving all four clips did not depend significantly on age group, logistic GLM:  $D(2) = 2.30$ ,  $p = .32$ , nor did it depend on condition,  $D(1) = 0.06$ ,  $p = .80$ , or the age group by condition interaction,  $D(2) = 0.54$ ,  $p = .76$ .

Most children appeared to expect some reaction from their mother: 86% of children socially referenced the mother at least once immediately before or after entering the prohibited area. There were no significant effects of age group,  $D(2) = 3.08$ ,  $p = .21$ , condition,  $D(1) = 1.58$ ,  $p = .21$ , or the age group by condition interaction,  $D(2) = 0.08$ ,  $p = .96$ .

**Child leaving prohibited area:** Children's tendency to leave the prohibited area at least once after the first playback depended on the age group by condition interaction, logistic GLM:  $D(2) = 7.47$ ,  $p = .024$ . In the moral condition, older children were significantly less prone than younger children to remain in the prohibited area continuously after the playback (13–15 months: 40% of children, 18–20 months: 32%, 23–25 months: 6%),  $D(2) = 7.36$ ,  $p = .025$  (Figure 2). In contrast, there was no such age group effect in the pragmatic condition, as children were similarly prone to remain in the prohibited areas across the second year (13–15 months: 38%, 18–20 months: 22%, 23–25 months: 44%),  $D(2) = 2.20$ ,  $p = .33$ .

Adding a term for the interaction between age group and coded vocal tone (firm-stern vs. non-firm-stern) did not significantly improve the fit of the regression model,  $D(2) = 4.35$ ,  $p = .11$ . However, we note that children's responses to the vocal tones were in the predicted direction. In the youngest age group, children were slightly more likely to remain in the prohibited area after hearing a firm-stern vocalization (44% vs. 39% for non-firm-stern), 18- to 20-month-olds showed no difference (firm-stern: 27% vs. non-firm-stern: 27%), whereas older children were less likely to remain in the prohibited area after hearing firm-stern vocalization (19%, vs. 60% for non-firm-stern), pooling across moral and pragmatic conditions. Still, the age group by condition interaction remained significant after adding the group by vocal tone interaction ( $p = .02$ ).

**Child negative emotion:** For presence of children's negative emotion, there was no significant interaction between age group and condition, logistic  $D(2) = 5.00$ ,  $p = .08$ . We note, though, that children's tendency to show negative emotion differed significantly between age groups, with no children in the oldest age group showing negative emotion in the moral condition (13–15 months: 15%, 18–20 months: 21%, 23–25 months: 0%),  $D(2) = 6.00$ ,  $p = .049$ . There was also a significant effect of age group on the presence of negative emotion in the pragmatic condition (13–15 months: 8%, 18–20 months: 39%, 23–25 months: 17%),  $D(2) = 6.55$ ,  $p = .038$ .

**No-prohibition phase**—There was a significant interaction between age group and condition for the time spent in the prohibited area during the no-prohibition phase, Poisson GLM:  $D(2) = 91.85$ ,  $p < .001$  (Figure 3). For the moral condition, there was a significant effect of age group, as the youngest children spent more time in the prohibited area than the

two older age groups ( $M_{13-15} = 26.5$  sec,  $M_{18-20} = 12.0$  sec,  $M_{23-25} = 12.7$  sec),  $D(2) = 143.39$ ,  $p < .001$ . In contrast, there was no significant effect of age group for the pragmatic condition ( $M_{13-15} = 22.8$  sec,  $M_{18-20} = 23.5$  sec,  $M_{23-25} = 23.6$  sec),  $D(2) = 0.33$ ,  $p = .85$ .

Adding a term for the interaction between age group and vocal tone significantly increased the fit of the model,  $D(2) = 102.18$ ,  $p < .001$ . On average, 13- to 15-month-olds spent 10.5 sec longer the prohibited area after hearing a firm-stern vocalization than after hearing a non-firm-stern vocalization, while 18- to 20-month-olds spent 9.0 sec longer. In contrast, 23- to 25 month-olds spent 11.2 sec *less* time in the prohibited area after hearing a firm-stern vocalization than after hearing a non-firm-stern vocalization. Still, the age group by condition interaction remained significant after adding the group by vocal tone interaction ( $p < .001$ ).

In the no-prohibition phase, 36% of children socially referenced the mother immediately before or after entering the prohibited area. There were no significant effects of age group,  $D(2) = 0.38$ ,  $p = .83$ , condition,  $D(1) = 0.04$ ,  $p = .85$ , or the age group by condition interaction,  $D(2) = 0.11$ ,  $p = .95$ , on children's tendency to show social referencing during the no-prohibition phase.

**Responsiveness across both phases**—To calculate an index of responsiveness across phases, we noted whether each child (1) left the prohibited area after the first playback in the prohibition phase, (2) showed no negative emotional signs after the first playback in the prohibition phase, and (3) never entered the prohibited area during the no-prohibition phase.

The propensity to show all three forms of responsiveness depended significantly on the age group by condition interaction, logistic GLM:  $D(2) = 7.57$ ,  $p = .023$ . As expected given the findings reported above, older children in the moral condition were more likely to show such overall responsiveness (13–15 months: 10%, 18–20 months: 16%, 23–25 months: 44%),  $D(2) = 6.90$ ,  $p = .03$ . In contrast, while there was significant variability between age groups also in the pragmatic condition, there was no overall increase with age in the propensity to show all three types of responsiveness (13–15 months: 23%, 18–20 months: 0%, 23–25 months: 17%),  $D(2) = 7.05$ ,  $p = .029$ .

## Discussion

Study 1 studied infants' responsiveness to prohibitive reactions to moral and pragmatic violations. The data were generally consistent with the predicted interaction between age and experimental condition: When hearing a prohibition elicited by a (videotaped) moral violation, older children were more responsive than younger children in their tendency to move away from the prohibited object after prohibition, to show low levels of negative emotion, as well as to avoid the prohibited object even when no prohibition was played back (no-prohibition phase). In contrast, older children did not show greater responsiveness than younger children to prohibitions elicited by videotaped pragmatic violations. Children at all ages appeared to expect a reaction from the mother: The presence of social referencing was similar across ages and conditions, with most children looking toward the mother while entering the prohibited area during the prohibition phase. This suggests that the age group

differences in behavior were not simply due to younger children failing to attend to the prohibitive signal from the mother.

The findings from Study 1 indicate that, over the second year, children learn different things from different prohibitive experiences. Specifically, their experiences with prohibitive signals associated with moral (interpersonal harm) violations, but not with pragmatic (inconvenience) violations, may have lead infants to show greater compliance with parental prohibitions elicited by moral violations. Consistent with this finding, Smetana and her colleagues (2000) found greater compliance with moral prohibitions than with several other (e.g. pragmatic) prohibitions. The present findings are particularly striking since only non-verbal aspects of the prohibitive signals differed between conditions: In naturalistic interactions, interventions on moral violations differ from pragmatic and other violations in a number of ways beyond vocal tone (Dahl & Campos, 2013; Dahl et al., 2014; Smetana, 1989; Smetana et al., 2000). We hypothesized that vocal tone may be particularly important in infancy, when infants' linguistic understanding remains limited (K. C. Barrett & Campos, 1987; Fenson et al., 1994; Kaler & Kopp, 1990; Kochanska, 1994).

The contrast between behaviors in the moral and pragmatic conditions was partly explained by the fact that vocalizations in the moral condition were more often classified as firm-stern vocalizations, and as more intense firm, than those in the pragmatic condition, consistent with past work (Dahl & Campos, 2013; Dahl et al., 2014). However, condition remained a significant predictor even after including vocal tone classification in the regression model. This may indicate that children picked up on meaningful features of their own mother's vocal tones that the current vocal classification scheme did not capture. That is, each mother may have an idiosyncratic response profile with which children, unlike the researchers, have become familiar through repeated everyday interactions. In fact, the possibility of such idiosyncratic responses was one of the motivations for using vocal recordings from children's own mother, rather than vocalizations from another child's mother. To test this hypothesis, a study is needed in which children's responses to their own mother's vocalizations are compared to children's responses to another mother's vocalization.

Importantly, Study 1 did not show that children perceived and adopted a general *rule* against approaching the robot. While compliance with parental prohibitions is an important aspect of social development, compliance by itself does not demonstrate rule understanding (Kopp, 1982). For instance, it is quite possible that the older infants in the moral condition complied more with vocal prohibitions to avoid getting in trouble, and not because they understood and accepted a general rule against approaching the robot. In fact, children do not seem to express general judgments or enforce rules as third-party observers until the third or fourth year of life (Rakoczy et al., 2008; Schmidt, Rakoczy, & Tomasello, 2011; Schmidt & Tomasello, 2012; Smetana & Braeges, 1990).

A developed understanding of rules involves the ability to provide evaluative judgments and justifications (Dahl & Kim, 2014; Killen & Smetana, 2015; Nucci & Weber, 1995; Rakoczy et al., 2008; Schmidt et al., 2011; Smetana, 1985). These judgments and justifications differ from compliance, for instance because children can make third-party judgments about other people's actions without engaging in those actions themselves. Moreover, children could

comply (act in accordance) with a parental command and yet disagree with the command (Perkins & Turiel, 2007).

Study 2 investigated the relation between adults' prohibitive vocal tones and preschoolers' understanding of rule transgressions. This second study assessed whether children used prohibitive vocal tones to interpret situations involving moral (harming others) or pragmatic (creating inconvenience) actions, as well as whether children viewed these actions as moral or pragmatic rule transgressions.

## Study 2: Preschoolers' Use of Vocal Tones to Interpret Social Events

By their third birthday, most children have acquired distinct concepts of moral, pragmatic, and other transgressions. For instance, although preschoolers view hitting others (a moral violation), creating material disorder (e.g. spilling food), and wearing a bathing suit to school as wrong, they provide different justifications for these judgments. Children typically justify judgments about hitting with references to the welfare of the victim, while they justify judgments about spilling food with references to inconvenience for persons or the material consequences (disorder), and justify judgments about wearing a bathing suit to school with references to authorities or existing rules (Dahl & Kim, 2014; Nucci & Weber, 1995; see Smetana, 2013).

Children inevitably encounter ambiguities in applying moral and pragmatic concepts to social events (Turiel, 1989, 2008). For instance, if a child pours Legos onto the living room floor and hears the mother say, "Don't put your Legos there," the child may not know whether the mother is concerned with the risk of people stepping on the Legos and slipping (a moral consideration) or the material disorder (a pragmatic consideration). Determining the mother's perception may in turn inform the child's interpretation of the nature of the transgression (e.g. if the child forgot that others could slip on the Legos, [Wainryb, 1991]) and subsequent decisions about whether to challenge or comply with the mother's command.

Others' vocal tones may be one source of information that can help children resolve ambiguities in social situations. If the child in the example above associated different vocal tones with different transgressions, the mother's vocal tone could help the child infer whether the mother perceived a moral or pragmatic violation. More generally, vocal tones could inform children about how others perceive a potentially prohibited action, providing information beyond what is conveyed by the linguistic content of what the other person is saying (such as "Don't put your Legos there."). Illustrating how children can use alternative cues to interpret transgression related situations (not just prohibitory labels used by caregivers), Smetana (1985) showed that preschoolers' interpretations and evaluations of transgressions were influenced by verbal descriptions of the consequences of the transgressions, even though the actions themselves were unspecified. For instance, children viewed acts described with nonsense words as moral (harmful) transgressions if they made a victim cry. However, past research has not investigated whether children can use vocal tones in interpreting situations involving potential transgressions.

In the Study 2, we manipulated the vocal tone of a prohibitive message to investigate whether preschoolers can use such tones to interpret social events. The study presented 3- to 4-year-olds with two hypothetical events, one involving a moral violation (harming another child) and one involving a pragmatic violation (creating disorder). They then heard a vocal prohibitive reaction (“No, don’t do that”) associated with moral violations (intense *firm-stern*) or pragmatic violations (*positive*), obtained from the study by Dahl and colleagues (2014). While Dahl and colleagues distinguished between playful-laughing and warm-comforting tones, the Study 2 treated both tones as *positive* since both tones are associated with pragmatic violations (see Dahl et al. [2014], Study 2). After hearing either a firm-stern or a positive prohibitive vocalization, the experimenter asked children to guess whether the mother had been responding to the moral event or the pragmatic event. To check whether children viewed the events as transgressions, children were prompted to provide judgments and justifications about the guessed situation.

We hypothesized that after hearing a firm-stern vocalization most children would guess that the mother was responding to a moral event. In contrast, we hypothesized that after hearing a positive vocalization most children would guess that the mother was responding to a pragmatic event. We also hypothesized that children would judge the target actions in both moral and pragmatic events as wrong, but would provide different justifications for judgments about moral and pragmatic events, and rate moral events more negatively than pragmatic events (Dahl & Kim, 2014; Nucci & Weber, 1995). Despite expecting children to make differentiated use of the firm-stern and positive tones, we did not expect that children would use different emotion labels for these tones. Children at this age tend to give priority to circumstances over vocal tones when attributing emotional states to speakers (Morton & Trehub, 2001), and were therefore expected to view any prohibitive utterance as indicating that the mother was in a negative emotional state.

Study 2 recruited 3- and 4-year-olds. Although the age range for Study 2 was somewhat wider than that of Study 1, we did not hypothesize age effects on the dependent variables. By this age, children have a large number of experiences with a variety of transgressive events (Dahl & Campos, 2013; Dahl et al., 2014; Dunn & Munn, 1985; Kuczynski et al., 1987; Smetana, 1989; Smetana et al., 2000), and, as noted, are generally able to provide judgments and justifications about moral and pragmatic transgressions (Dahl & Kim, 2014; Killen & Smetana, 1999; Nucci & Weber, 1995; Smetana, 2013; Smetana, Rote, et al., 2012; Smetana & Braeges, 1990).

## Method

**Participants**—Children ( $N = 34$ , 16 female,  $M_{\text{age}} = 3.9$  years,  $SD_{\text{age}} = 0.5$  years, range: 3.0 – 4.6 years) were recruited from a university preschool.

### Materials

**Illustrations:** Six different hypothetical situations were generated: three involving a moral transgression (hitting, shoving, name calling) and three involving a pragmatic transgression (breaking a plate, getting the floor dirty, spilling food). Each transgression was illustrated by

a 5 by 6 inch picture card showing a child engaging in the given transgression (e.g. hitting another child). An adult female puppet (14 inches tall) represented the transgressor's mother.

**Rating scale:** For the purposes of asking children to rate the severity of the target action, a pictorial rating scale was prepared showing five cartoon-like faces ranging from very sad to neutral to very happy. This visual rating scale resembled scales used in past research on children's social judgments (Dahl & Kim, 2014; Killen, Mulvey, Richardson, Jampol, & Woodward, 2011; Lagattuta, Nucci, & Bosacki, 2010).

**Vocal recordings:** Vocal recordings were taken from the study by Dahl and colleagues (2014, Study 2) of mothers' reactions to videotaped infant transgressions. Each vocalization consisted of the mother saying, "No, don't do that!" The study by Dahl et al. found that positive tones of voice (playful-laughing and warm-comforting) were more common in response to pragmatic transgressions than in response to moral transgressions, whereas angry vocalizations (intense "firm-stern" vocalizations) were more common in response to moral transgressions than in response to pragmatic transgressions (see Introduction).

To select which vocal clips to use, we obtained both the audio clips and the coding data for positive and angry vocalizations from Dahl et al. (2014). Clips selected for the present study were those that had been consistently classified in only one vocal category across three separate coding passes and had the highest intensity ratings among vocalizations in their category (see Dahl et al. [2014] for details). In addition, for the present study, we did not use clips that had any background noise or where the phrase was uttered in a non-standard way (e.g. "No, no, don't do that"). The four positive clips and the four firm-stern clips that best fit the above criteria were used in the present study. Vocalizations were played back to the child using an iPod and a small portable speaker located behind the mother puppet during playback, creating the impression that the vocalization was coming from the puppet.

**Procedures—**In a warm-up session, the researcher first introduced children to the rating scale, showing children how to indicate whether they liked or disliked something (e.g. a type of food) by pointing to the different faces (Dahl & Kim, 2014; Killen et al., 2011; Lagattuta et al., 2010). The researcher trained the child on using the scale by asking the child to name types of food they liked and disliked and pointing to the appropriate face.

Next, the main part of the study began. Each child received two trials. In each trial, the researcher introduced children to two hypothetical situations, one involving a moral transgression and one involving a pragmatic transgression. The experimenter played back a vocal recording representing the mother's reaction and the child was asked to guess in which transgression the protagonist had engaged. Each child received one trial with an angry vocalization and one trial with a positive vocalization. The order of presentation of situation types (moral vs. pragmatic) and vocalization type (angry vs. positive) was counterbalanced across participants. A possible presentation of the hitting (moral) and spilling (pragmatic) situations would go as follows:

Johnny sometimes does things his mom doesn't want him to do. Sometimes, when Johnny is playing with Peter, Johnny hits Peter with one of his toys. Other times, when Johnny is eating yogurt, he decides to pour the yogurt onto the table.

The researcher then introduced the mother puppet and said: "One day, when Johnny's mom walks into the room and sees what Johnny is doing, she said this." The researcher then played back the vocal recording (firm-stern or positive) twice from the speaker located behind the mother puppet.

After presenting the situation and playing back the vocal recording, the researcher would ask the child a series of questions assessing the child's interpretation and evaluation of the situation: (1) "Do you think Johnny was [first situation, e.g. hitting] or [second situation, e.g. spilling]?" After the child had selected a situation, the experimenter removed the picture card representing the unselected situation. (2) "How do you think Johnny's mom felt about what he did?" (3) "Do you think it was okay for Johnny to \_\_\_\_\_?" (4) "Why/why not?" (5) "Can you show me on the face scale how much you like that Johnny \_\_\_\_\_?" When asking the latter question, the experimenter placed the face rating scale in front of the child and allowed the child to point to one of the five faces.

The experimenter transcribed the child's verbal responses to each question. In addition, the interview was videotaped to allow coders to check the child's response in the event of any uncertainty about how to classify the child's response.

**Coding**—The main coder classified the child's responses to questions about how the mother felt (Question 2) and why the child's action was okay or not okay (Question 5). The descriptions of the mother's emotions were classified as either *angry* (e.g. "angry", "mad"), *sad* (e.g. "sad", "crying"), *other*, or *no response*. The child's justifications for why the target act was okay or not okay were classified as either *damage* (reference to how the act damages property, e.g. "the plate will be broken"), *harm to others* (reference to negative consequences for others' welfare, e.g. "it hurts Peter"), *inconvenience* (reference to inconvenience to child or someone else, e.g. "his mom has to clean up"), *rule/authority* (reference to rules or authorities, e.g. "his mom said he shouldn't do it."), or *other* (e.g. "it's silly"). A second coder coded half of the data. Inter-rater agreement: Emotion attributions: Cohen's  $\kappa = .91$  (94% agreement). Judgments:  $\kappa = 1.00$  (100% agreement). Justifications:  $\kappa = .85$  (88% agreement).

**Data analysis**—Data were analyzed using Generalized Linear Mixed Models with logistic link function and binomial error distribution. Models included random intercepts for participants to account for non-independence of responses from the same child. In addition, models included fixed effects of vocal tone (firm-stern vs. positive) and scenario type (moral vs. pragmatic). Hypotheses were tested using likelihood ratio tests (Hox, 2010). Preliminary analyses did not reveal any significant difference between responses to playful-laughing and warm-comforting vocalizations, supporting our decisions to place two tones in the same category ("positive") for the purposes of design and analysis. As preliminary analyses revealed no significant effects of situation order, tone order, or child age, these variables were not included as predictors in the models reported below. When analyzing justifications,



separate models were fitted for each justification category predicting a dichotomous variable indicating whether a child used a given justification in a given trial.

## Results

Vocal tone of prohibition significantly influenced which transgression children thought the mother was prohibiting,  $D(1) = 4.19, p = .041$ . Children were more likely to say that the mother was responding to a moral transgression when they heard a firm-stern prohibition (62%), and more likely to say that she was responding to a pragmatic transgression when they heard a positive vocalization (62%).

Although children's interpretation of the prohibitions were influenced by mother's vocal tones, children typically thought that the mother was either angry or sad for all combinations of vocal tones and scenario types (overall: 79%, range 76% – 92%, see Table 1). Indeed, there were no significant effect on vocal tone or scenario type on children's tendency to label the mother as angry, binomial GLMMs: tone:  $D(1) < 0.001, p = .99$ , scenario:  $D(1) = 0.001, p = .97$ , or sad, tone:  $D(1) = 0.63, p = .43$ , scenario:  $D(1) = 0.13, p = .72$ , nor were there any significant two-way interactions between tone and scenario type,  $ps > .21$ .

All moral and pragmatic violations were judged as “not okay” by children. Also consistent with past research, children's justifications for their judgments depended heavily on the nature of the transgression, indicating that they viewed moral and pragmatic events as categorically different (Table 2). Children were significantly more likely to reference harm to others when justifying judgments about moral scenarios than when justifying judgments about pragmatic scenarios,  $D(1) = 31.44, p < .001$ , whereas the opposite was true for references to property damage,  $D(1) = 13.86, p < .001$ , and inconvenience,  $D(1) = 7.46, p = .006$ . There were no significant differences between moral and pragmatic scenarios in the use of rule/authority justifications,  $D(1) = 0.54, p = .46$ , or other justifications,  $D(1) = 0.17, p = .68$ .

The distribution of the severity ratings were highly skewed, with 52% of scenarios eliciting the most severe rating. Instead of analyzing the mean severity rating, we therefore analyzed children's propensity to provide the most negative rating vs. a different rating (a dichotomous variable) using logistic GLMMs.

There was a non-predicted significant interaction between vocal tone and scenario type, binomial GLMM:  $D(1) = 3.93, p = .047$ . When children heard a firm-stern vocalization, there was a significant effect of situation type,  $D(1) = 14.30, p < .001$ , as children were more likely to give the most severe rating when guessing a that the mother was responding to a moral situation (80%, vs. 15% for pragmatic situations). In contrast, there was no significant effect of situation type when children heard a positive vocalization,  $D(1) = 1.13, p = .29$  (61% gave most severe rating for moral, vs. 42% for pragmatic). When pooling across tones and situations, we found a significant main effect of situation type,  $D(1) = 8.36, p = .004$ , and no significant effect of vocal tone,  $D(1) = 0.06, p = .81$ , on children's propensity to give the most severe rating.

## Discussion

Study 2 showed that prohibitive vocal tones can inform preschoolers' interpretations of events involving transgressions. As predicted, most children guessed that the mother was responding to a moral event when she used an intense firm-stern vocalization. In contrast, most children guessed that the mother was responding to a pragmatic event when she used a positive (warm-comforting or playful-laughing) vocalization. As expected, children's own evaluative judgments indicated that they viewed the target actions in the moral and pragmatic situations as transgressions. These findings are consistent with the proposition that children can use others' vocal tones to interpret events involving moral and pragmatic rule transgressions.

Children's use of vocal tones to guess what the mother was responding to may be based on two experiential sources. First, they may have experienced that intense firm-stern vocalizations are associated with moral transgressions while positive vocalizations are associated with pragmatic transgressions (Dahl et al., 2014). Second, they may have come to view the moral violation of harming others as more severe than pragmatic violations, and hence expect more intensely negative prohibitions against moral violations (Dahl & Kim, 2014). Although we view both experiential sources as likely contributors to children's performance, the present study was not designed to test these explanations.

As expected, children's explicit emotion attributions did not significantly vary as a function of the vocal recording played back. Whether they heard an intense firm-stern or a positive vocalization, children tended to say that the mother was sad or angry. This is consistent with past research indicating that children give priority to the circumstances of the emotion (a transgression) over the non-verbal aspects of the emotional expression (Aguert et al., 2013, 2010; Morton & Trehub, 2001). However, the findings also show that children may make differentiated use of emotional expressions even when children do not provide systematically different labels for those expressions. Even though their emotion labels were similar for firm-stern and positive vocal tones, children's guesses for what the emotional reaction was about did differ by vocal tone.

The findings also supported past findings that children draw qualitative distinctions between moral and pragmatic violations (Dahl & Kim, 2014). When asked to explain why it was wrong to hit someone, most children referred to the intrinsic consequences to the victim's wellbeing (harm). In contrast, when asked why pragmatic transgressions were wrong, children were more likely to refer to property damage or inconvenience to themselves or others.

We do not expect that the vocal tones by themselves would lead children to view the target events as moral and pragmatic transgressions, nor that the absence of informative vocal tones would prevent children from judging that a transgression has taken place. On the contrary, preschoolers and older children do not view all actions prohibited by parents as transgressions (Lagattuta et al., 2010; Nucci, 1981; Nucci & Weber, 1995), nor do they require adult prohibitions in order to judge an action as wrong (Killen & Smetana, 1999; Schmidt et al., 2011; Smetana, 1989; Vaish et al., 2011). Specific prohibitive vocal tones, such as those used in the present research, appear to be neither sufficient nor necessary for

children's evaluative judgments about actions they encounter. Rather, these vocal tones provide one of many sources of information upon which children can draw when interpreting and evaluating social situations.

Study 2 detected a non-hypothesized interaction between vocal tone and transgression type in predicting severity rating. When hearing a firm-stern vocalization, children were significantly more likely to give the most severe rating for moral situation than for pragmatic situations. In contrast, when children heard a positive vocalization, the effect of situation type was not significant, although trending in the same direction. Consistent with past research, children overall rated moral transgressions more severely than pragmatic transgressions (Dahl & Kim, 2014; see also Smetana & Braeges, 1990; Tisak, 1993)

Since the tone by situation interaction was not predicted, we interpret it with caution. One possible explanation for this pattern of findings is that mismatch between transgression and tone leads children to make less severe ratings. That is, children were the least likely to give the maximally severe rating when the pairing of vocal tone and transgression was unusual (firm-stern response to pragmatic transgression or positive response to moral transgression). Perhaps children took this mismatch to indicate that there were relevant facts about the events that they were unaware of, and hence were reluctant to condemn the transgressor too strongly. However, since the study did not randomly combine tones and events it could also be that the children who made atypical guesses simply gave less severe ratings overall. In order to provide a convincing explanation, more research is needed on the interaction between tone and event type.

## General Discussion

These two studies demonstrated that children's reactions to prohibitions are influenced by the types of vocal tones they encounter in everyday life. By varying the vocal tone of the prohibition heard by the children, we found that infants were more compliant with vocal prohibitions elicited by moral transgressions (harming others) (Study 1) and that preschoolers used the vocal tone to determine whether another child's mother was responding to a moral or pragmatic transgression (Study 2).

These findings are consistent with the view that children use everyday social signals from others (along with their direct experiences of pain or inconvenience) to develop distinct conceptions of rules for how to behave (Killen & Smetana, 2015; Turiel, 1983, 2015). These conceptions include conceptions of moral rules, based on considerations of welfare, rights, and fairness, and of pragmatic rules, based on conceptions of convenience and material disorder, along with other rules, such as conventions and prudential rules (Dahl & Kim, 2014; Davidson, Turiel, & Black, 1983; Killen & Smetana, 1999; Smetana & Braeges, 1990).

Although it has been proposed that children use their everyday social experiences to construct conceptions of rules, few studies have directly tested this assumption. A number of studies have shown that children have different experiences with moral transgressions than with other transgressions from an early age (Dahl & Campos, 2013; Dahl et al., 2014; Nucci

& Turiel, 1978; Nucci & Weber, 1995; Smetana, 1984, 1989; Tisak et al., 1996). However, few studies have assessed relations between such experiences and children's perceptions of events. Davidson and his colleagues (1983) showed that children could distinguish between familiar moral and conventional events before they could distinguish between unfamiliar moral and conventional events. Siegal and Storey (1985) found that children who had been in daycare longer were more likely to distinguish daycare center conventions from moral rules. A third exception is the study by Smetana (1985), in which preschoolers used descriptions of the consequences of unspecified actions to distinguish between moral and conventional transgressions.

A key feature of the present research is that it experimentally varied social signals that children are likely to encounter in everyday life. This set the study apart not only from past research on children's rule understanding, but also from past research on children's use of emotional signals from others. As noted in the Introduction, much of the latter research has relied on posed canonical emotional expressions rather than emotional responses to naturally occurring situations (e.g. Morton & Trehub, 2001; Walker-Andrews, 1997; Widen & Russell, 2010). While such prototypical expressions are important, they do not necessarily correspond to the emotional expressions encountered in everyday life. In the present studies, the vocal recordings of mothers' prohibitions were obtained using a technique that yields vocal responses comparable to those recorded in everyday interactions (Dahl et al., 2014). Thus, when children in the present studies were using these vocal responses to guide their orientations toward rules, they faced a task that closely resembles tasks they may encounter in everyday life.

By only varying the vocal tone of the prohibition, this research focused on one of several aspects of caregiver reactions that can inform children about how others view transgressions (Dahl & Campos, 2013; Nucci & Weber, 1995; Smetana, 1984; Zahn-Waxler & Chapman, 1982). The focus on vocal tones served to isolate the effects of a single aspect of social interactions thought to be particularly important for the early development of children's rule understanding (Dahl et al., 2014; Kochanska, 1994). At the same time, the focus on vocal tones likely made it harder for children to respond differentially than would the simultaneous manipulation of multiple informative aspects of caregiver reactions, such as physical interventions or verbal explanations (Dahl & Campos, 2013; Smetana, 1984; Zahn-Waxler & Chapman, 1982). The relation between the child's reactions and caregiver reactions is probabilistic, not deterministic: A given caregiver does not respond to the same type of child transgression in the same way every time, and the same response can be elicited by multiple transgression types. Although past research has found caregivers to be especially likely to respond to moral transgressions with anger, caregivers do not always respond with anger to moral transgressions and they sometimes respond with anger to non-moral transgressions (Dahl & Campos, 2013; Dahl et al., 2014). Thus, the identification of different transgressions based on social signals can be far more accurate if relying on multiple signals, for instance both vocal and physical reactions from others. We therefore predict that the differences in responsiveness to the moral and pragmatic conditions would be even greater in studies including additional differentiating social signals.

Another area of extension concerns outcome variables. The present research assessed compliance (Study 1) and children's guesses and judgments about hypothetical events (Study 2). The crucial difference between compliance and rule understanding was noted in the Discussion of the findings from Study 1. A goal of Study 2 was to investigate whether children used the vocal tones to determine to which kind of event the mother was responding (moral or pragmatic). However, this question presumes that children already possess conceptions of moral and pragmatic rules and think, for instance, that it is wrong to spill because it creates inconvenience. Additional research is needed to investigate how children construct these general normative principles that allow them to infer that the creation of mess is a reason for negatively evaluating an action.

A third important extension of the present work is the inclusion of larger and more diverse samples. There are both differences and similarities in how caregivers respond to children's transgressions. For instance, although mothers in some communities, on average, express more positive emotion toward their children than mothers in other communities, caregivers in all communities tend to express positive evaluations of children when they act in accordance with standards and negative evaluations when they violate standards (Cole & Tan, 2015; Dennis, Cole, Zahn-Waxler, & Mizuta, 2002; Honig & Chung, 1989). There are also cultural differences in *how* positive or negative evaluations are expressed, for instance whether they are expressed through open criticism or negative evaluations coupled with an openness to negotiation (Cole & Tan, 2015; Wu et al., 2002). Thus, while we predict that emotional signals of negative evaluations will inform children's responses to prohibitions in all communities, there is likely cultural variability in when and how these prohibitions are expressed by parents and used by children (Briggs, 1971; Miyake et al., 1986; Rogoff, 2003). Importantly, as the present research has shown, not all prohibitions are the same: Differences between vocal expressions of different prohibitions (here: moral and pragmatic prohibitions) can be highly informative for children (see also Gendler-Martin et al., 2008; Walle & Campos, 2012, 2014).

The present research showed that emotional signals from others about transgressions can influence young children's compliance with and interpretation of caregiver prohibitions. These studies suggest new avenues of research on children's early construction of conceptions about rules and illustrate a methodological approach in which naturally occurring social signals are experimentally manipulated. Naturalistic observations and experimental manipulations serve complimentary roles in this research endeavor: Observations show that children's experiences with moral transgressions differ from their experiences with pragmatic and other transgressions, while experiments test whether children can make use of such differences as they navigate their social worlds.

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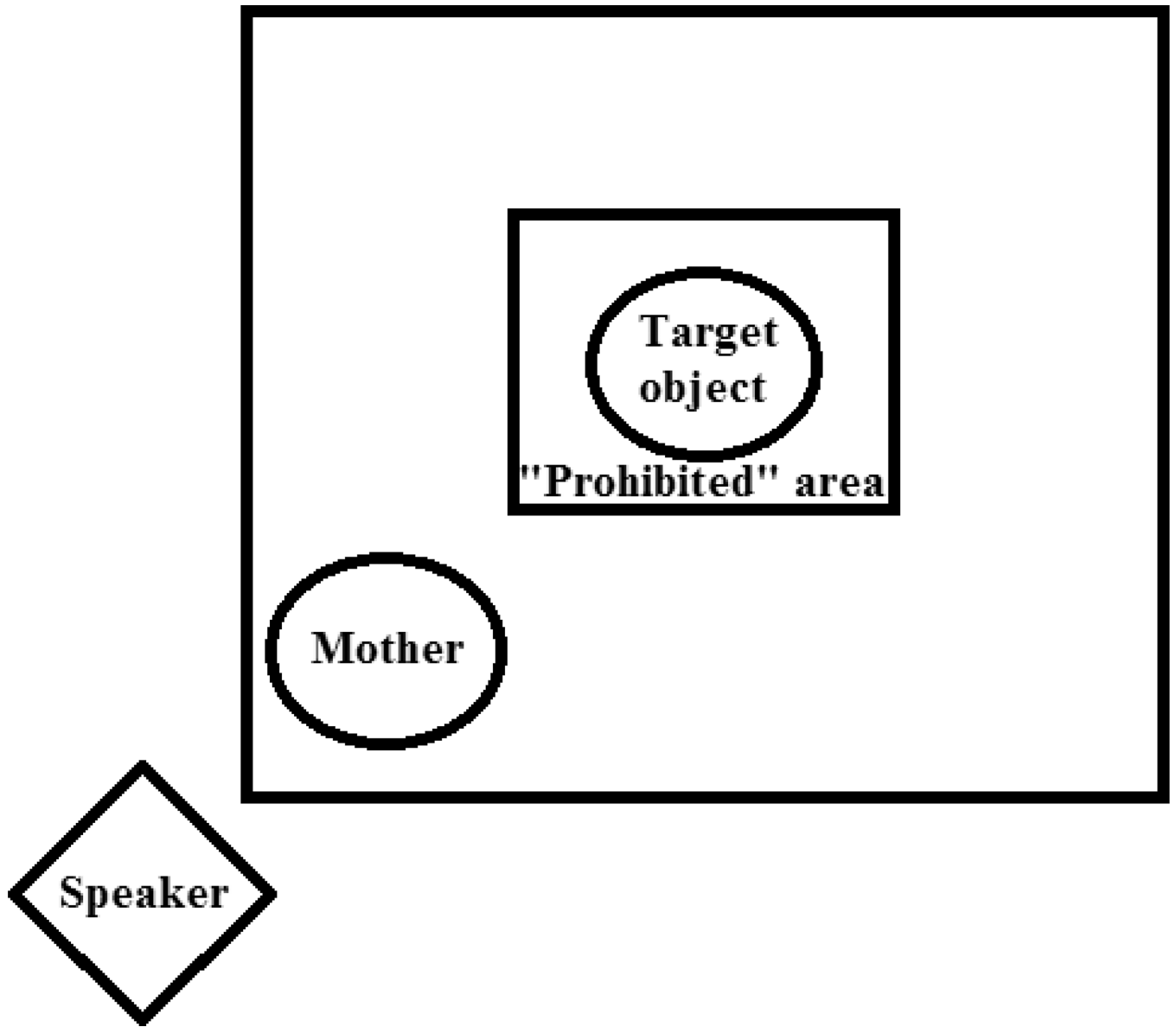
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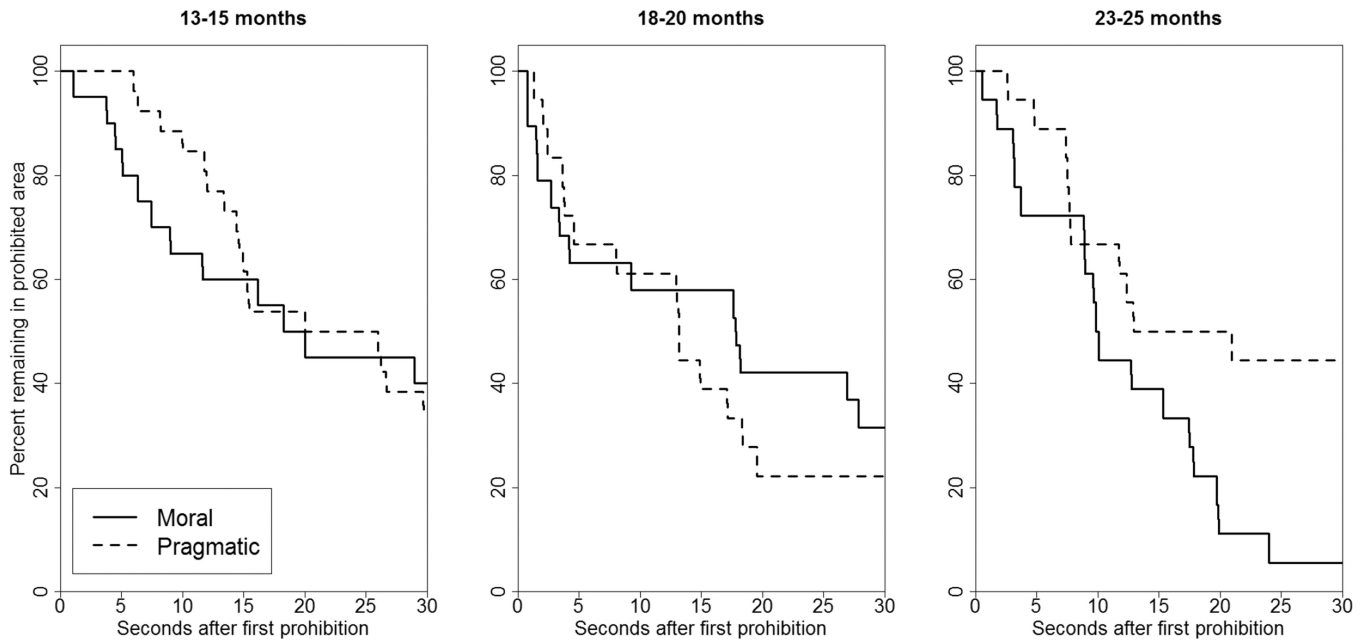
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### Highlights

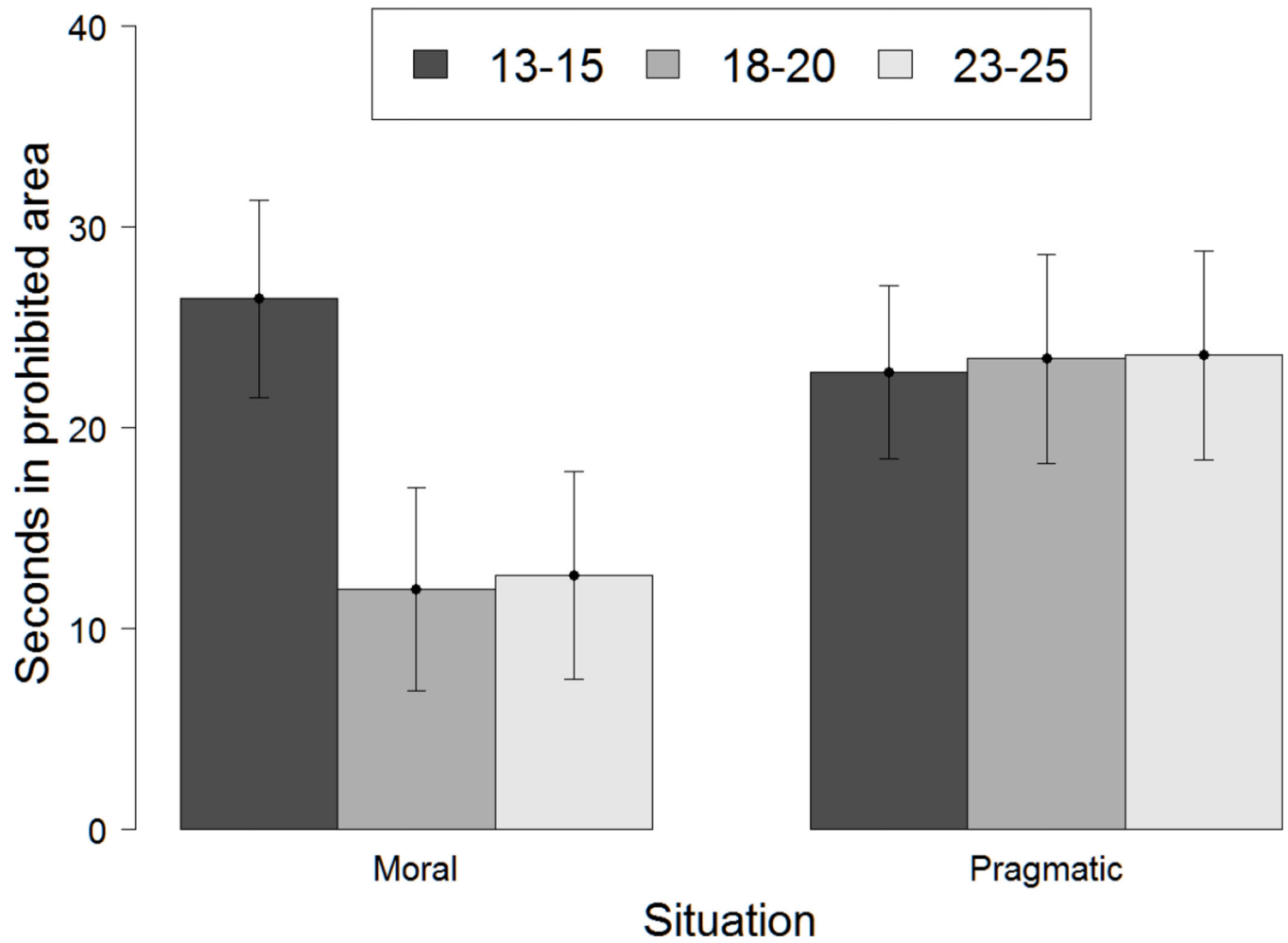
- Vocal signals convey information about rules
- Preschoolers distinguish between moral and pragmatic rules
- Two studies investigated children's use of adult vocal responses to transgressions
- Infant compliance was influenced by vocal tone of the prohibition (Study 1)
- Preschoolers interpretation of prohibitions also depended on vocal tone (Study 2)



**Figure 1.** Layout of experimental space (Study 1). The child was free to move around in the enclosed space indicated by the large rectangle.



**Figure 2.** Study 1 Prohibition phase: Percentage of children remaining in prohibited area. Lines show percentage of children remaining in prohibited area after the first playback of the prohibitive vocal recording for moral (solid line) and pragmatic (dashed line).



**Figure 3.** Study 1: No-prohibition phase: Time spent in the prohibited area. The height of bars show average time children spent in the prohibited area in the 13–15, 18–20, and 23–25 month age groups in the moral and pragmatic conditions. Error bars show mean  $\pm$  1 standard error.

**Table 1**

Study 2: Emotion Labels Provided by Children

Tone	Scenario							
	Pragmatic Emotion label				Moral Emotion label			
	Angry	Sad	Other	No label	Angry	Sad	Other	No label
<b>Positive</b>	.33	.43	.10	.14	.62	.15	.08	.15
<b>Firm</b>	.54	.38	.00	.08	.38	.38	.00	.24

*Note.* Cells show proportion of children using the given labels (or no label) as a function of tone and scenario type.

**Table 2**

Study 2: Use of Justification as a Function of Scenario Type

Justification	Scenario		Scenario effect
	Moral	Pragmatic	
Damage	.00	.26	***
Harm to others	.62	.03	***
Inconvenience	.03	.24	**
Rule/authority	.15	.24	
Other	.15	.21	

*Note.* The two middle columns show the proportion of participants who provided the given justification types. The rightmost column indicates statistical significance levels for likelihood ratio tests comparing binomial GLMMs with and without scenario type as a predictor:

\*\*\*  
 $p < .001$ ,

\*\*  
 $p < .01$