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Perceptions of distress in young children with autism compared to typically developing children: a cultural comparison between Japan and Italy

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Autism or Autistic Disorder (AD) is a disorder of neural development characterized by impaired communication, social skills, and by restricted and repetitive behavior. Symptoms of AD are present before the age of 3 years (APA, 2000). AD is one of three recognized disorders in the Autism Spectrum Disorders (ASDs); the other two are Asperger syndrome and Pervasive Developmental Disorder-Not Otherwise Specified (PDD-NOS), which is diagnosed when the full set of criteria for autism or Asperger syndrome are not met. In the absence of specific known biological markers, AD is commonly diagnosed using behavioral criteria. Normally, it is difficult to make a definitive diagnosis of AD before 18 to 24 months, and one consequence of this state of affairs is that we lack a good understanding of the early stages of development in infants who will later be diagnosed with AD. For example, little is known about early communicative and social skills in AD in early infancy. Nonetheless, some recent reports have indicated that analysis of cry in AD might provide such information because cries represent one of the first social behaviors with clear communicative valence (Bieberich & Morgan, 2004; Esposito & Venuti, 2010; Esposito, Venuti, & Bornstein, 2011; Iverson & Wozniak, 2007; Sheinkopf et al., 2000).

The most vital functions of crying in early infancy appear to motivate caregiver proximity, instigate social interactions, and express needs (Wood & Gustafson, 2001), and these functions apply equally to typical and atypical development as well as across cultures. In short, crying constitutes a universal basis for social development and a primary conduit for the expression of emotions (Rothganger, 2003). Cries possess a specific grammar, and their acoustical features convey specific messages to caregivers. Studies conducted in the United States have found that pitch (or frequency) and rhythm (influenced by the length of the pauses) of infant crying tend to modulate the responses of adults (Zeskind et al., 1992; Zeskind & Lester, 2001; Zeskind & Marshall, 1988). The pitch of cries influences caregivers' perceptions: Higher frequency cries are normally perceived as more aversive and distressing than lower frequency cries. These findings have emerged from experimental

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procedures in which acoustic parameters of the cry (duration and/or fundamental frequency, f_0 , which is generated from the vibration of the vocal cords and is heard as the pitch) were modified, and participants asked to judge the stimuli. Cries with higher fundamental frequencies and shorter pauses are more likely to elicit perceptions of urgency and distress compared to cries with lower fundamental frequencies.

The psychophysiological characteristics of crying may be similar in typically developing (TD) children but appear to differ in children with developmental disabilities (Esposito & Venuti, 2010; LaGasse et al., 2005). Studies that have examined cries of infants with specific medical conditions related to neurological damage have reported that the f_0 of the cry is particularly sensitive to neurological insult where it is characterized by higher levels and greater variability. The limited research to date on cry in children with ASD suggests that the expression of negative emotions in these children is impaired (Bieberich & Morgan, 1998). At a physiological level, the limbic system, which seems affected in AD, represents a core of socioemotional life. It is linked to the lower part of the brainstem, which controls the muscles of the larynx, and generates sound through vibration of the vocal folds. Vibrations of the larynx in turn generate the fundamental frequency (LaGasse et al., 2005; Rautava et al., 2007).

Connections among brain regions perhaps compromised in autism and those that produce and modulate crying suggest that cry in autism may be defined by identifiable acoustical features. Analyses of those features of cry have revealed a number of differences between children with AD and matched controls. In particular, cries of AD children are characterized by attenuated waveform modulation and more dysphonation (Sheinkopf et al., 2000) compared to cries of typically developing children. Sheinkopf and colleagues (2000) and Esposito and Venuti (2010a) reported that the cry of children with autism during the early years of life showed higher fundamental frequencies and shorter pauses compared with those of typically developing children and children with developmental delay. Furthermore, Esposito and Venuti (2010b) analysed developmental trajectories of acoustical parameters (i.e., fundamental frequency) of cries in children with autism as opposed to typically developing children and children with other developmental delays. The authors reported that at 5 months of age cries do not differ significantly across the groups, but by 13 and 18 months of ages cries of children with autism have higher fundamental frequencies than those of matching controls. These acoustical differences lead adult listeners to perceive the cries of infants with autism as being more negative than those of typically developing children. This was true at a behavioral level and at a neural level. Behaviorally, cries with higher f_0 in children with ASD evoke mental states of uneasiness and distress in adult listeners (Esposito et al., 2011; Esposito & Venuti, 2010). Neurally, findings from a fMRI study (Venuti et al., submitted) that aimed to measure brain activity during adult processing of cries showed differential patterns of brain activation to cries of infants with AD versus typically developing infants. AD cries elicited enhanced activity in the left inferior frontal gyrus/ anterior insula compared to cries of TD children. These regions of enhanced activation accord with AD cries eliciting more negative feelings and perceptions as more aversive and/or arousing. Together, the behavioral and neural findings suggest that analysis of how children with AD express distress and how this distress is perceived can provide insights in how caregivers understand and interact with children with autism.

Although studies conducted in Africa (Barr et al., 1991), America (LaGasse et al., 2005), Asia (Adachi et al., 1985; Kamiya, 2002), and Europe (Esposito et al., 2011) have reported that responses to crying typically reflect cultural norms as well as acoustical characteristics of infant cries (Zeskind & Lester, 2001; Zeskind & Marshall, 1988), no studies have employed a cross-cultural approach to investigate how adults in different cultures perceive typical versus atypical crying, as we do here. Furthermore, no studies have so far

investigated possible cultural variation in reactions to cries of children with autism. Cries of children with AD have been reported to elicit more distress in Western cultures (Esposito et al., 2011; Venuti et al., submitted), but it is not known whether similar findings would hold valid in Eastern societies. For this reason, we compared adult perceptions of AD cries in Italy and Japan.

The main aim of the present studies was to investigate how adults in two contrasting cultures perceive cries of children with autism. Italians and Japanese differ in modal personality (Bornstein et al., 2007) and in both expression and perception of social and emotional cues (Bornstein, 1989; Bornstein et al., 2010, 2012; Nisbett, 2004). Contrasting adults in these two societies therefore constitutes a strong test of a hypothesis that responses to AD might be universal. Here, we examined whether typical and atypical cries are perceived differently by members of two different cultures, and which acoustical parameters of cry differentiate their perceptions. Specifically, we modified acoustical parameters that in previous reports (e.g., Esposito & Venuti, 2010; Zeskind & Lester, 2001) have been identified as central in adults' perceptions: pitch (fundamental frequency) and rhythm (mediated by pause duration, and/or waveform modulation). Atypical cries are generally perceived to differ from typical cries, but the literature is almost entirely Western in origin. Are differences in perception of typical and atypical cry evident in cultures (Japan and Italy) where the social acceptance of expressing negative emotions differs? Are atypical cries perceived as more distressed than typical cries by adults in different societies?

To address these questions we conducted two experiments. In Experiment 1, we artificially modified structural parameters (fundamental frequency, duration of pauses, waveform modulation) of cries and asked Italian and Japanese adults to judge levels of expressed and felt distress in the cries. According to previous reports (Esposito & Venuti, 2010a; Zeskind & Lester, 2001; Zeskind & Marshall, 1988), we expected that higher fundamental frequency and shorter pause durations would render cries more distressed and distressing equivalently to Italians and Japanese. In Experiment 2, we asked Italian and Japanese adults to report levels of distress on hearing cries of AD and TD children. We expected that both Italian and Japanese participants would perceive cries of children with AD as more distressed and distressing than cries of typically developing children because of specific acoustic properties of cries of children with autism.

General Method

The two experiments were approved by the Ethical Committee of the Department of Cognitive Sciences of the University of Trento and the ethical board of the Faculty of Education at Chiba University (Japan). Informed consent was obtained from all participants.

Participants

A total of about 200 adults were recruited in the urban areas of two cities, Trento in Italy and Chiba in Japan. Participants in the two countries were matched for age, gender, and socioeconomic status. Invitation to participate to the study was made through telephone calls to people belonging to databases of volunteers available at University of Trento and Chiba University.

Procedure

Audio files were presented randomly to the participants (recorded at 44,100 Hz with a stereo resolution of 32 bit) using a personal computer and a headset. During stimulus presentation, no images were displayed on the computer screen. Participants were asked to rate the level of distress expressed in the cries (by which we mean the perceived distress of the child) and to rate the level of distress they felt (by which mean distress felt by the adult observer) while

listening to the cries. Participants used a 7-point Likert-type scale for both ratings, where 1 = *the lowest level of distress* and 7 = *the highest level of distress*.

Preliminary Analyses

Prior to data analysis, univariate and multivariate distributions of *Expressed Distress* and of *Felt Distress* scores were examined for normality, homogeneity of variance, outliers, and influential cases (Fox, 1997). All variables were normally distributed. The distance of each case to the centroid was evaluated to screen for multidimensional outliers (Fox, 1997). No significant differences emerged between parent and nonparent or between female and male participants. For this reason parents and nonparents as well as females and males were treated as a single group for analyses. As expected, the two dependent variables were moderately correlated, $r(98) = .27$, ns , but not sufficiently to cause us to treat them as the same; they left 93% of their common variance unaccounted for.

For each experiment we report descriptive statistics for participants' judgments of the level of distress expressed in the cries and the level of distress they felt while hearing the cries. In Experiment 1, we carried out a General Linear Model (GLM) with repeated measures (*stimuli*: acoustic modifications) and a between-subjects factor (*country*: Italy vs. Japan). In Experiment 2, we carried out a GLM with repeated measures (*stimuli*: TD vs. AD cries) and a between-subjects factor (*country*: Italy vs. Japan).

Experiment 1

Participants

A total of 100 Italian adults recruited in the urban area of Trento [50 parents (25 F age $M = 31.1$, $SD = 4.1$; 25 M age $M = 34.9$, $SD = 3.1$) and 50 non-parents (25 F age $M = 27.8$, $SD = 3.5$; 25 M age $M = 28.9$, $SD = 2.5$)] and 90 Japanese adults recruited in the urban area of Chiba [45 parents (23 F age $M = 31.9$, $SD = 5.6$; 22 M age $M = 31.3$, $SD = 2.9$) and 45 non-parents (23 F age $M = 27.9$, $SD = 3.0$; 22 M age $M = 27.1$, $SD = 5.8$)] participated. The participants in the two countries had a comparable socioeconomic status, ranging medium to high ($M = 49.56$, $SD = 11.98$), calculated using the Hollingshead (1975) Four-Factor Index of Social Status.

Materials

Cry stimuli were generated from digital audio files of cries generated by five 6-month-old boys (3 Italians & 2 Japanese) before the infants' scheduled feeding. The files belonged to a database of videos collected during a cross-cultural study conducted at the University of Trento in collaboration with the NICHD (NIH, USA). Although the cries of girls and boys may be similar, we used the cries of boys to hold stimulus characteristics constant.

The infants were born term and showed no signs of any clinical conditions at birth or at age 3 years. Three 25-s portions of a cry from each child were selected for their typical rhythmic quality. Then, 10 adults (5 Italian & 5 Japanese) judged on a 7-point Likert-type scale the portion of the file that was most representative of a "typical" cry. After selecting the most representative 25-s portion of a cry episode (the BASE), we experimentally manipulated each cry employing open source Audacity software (ver. 1.3.1) for audio editing to produce 7 separate audio files. First, we manipulated the fundamental frequency (f_0) to produce two cry stimuli of 15 s each: (i) First Spectral Peak (FSP is the frequency value in Hz of the first amplitude peak across the long-term average spectrum and is considered an estimate of the average fundamental frequency of the episode of crying) augmented by 250 Hz (FSP+250) and (ii) FSP decreased by 250 Hz (FSP-250). Second, we manipulated the durations of pauses in the cries to produce three stimuli: (iii) pauses lengthened by 50% (PAUSE+50);

(iv) pauses shortened by 50% (PAUSE-50); and (v) pauses cut and so shortened by 100% (PAUSE-100). Third, we manipulated the speed of the episode to produce two stimuli: (vi) speed increased by 50% (SPEED+50) and (vii) speed decreased by 50% (SPEED-50). Because the BASE stimulus and the 7 manipulated audio files had different durations, we normalized the duration of each stimulus by selecting only the first 15 s of each file.

Results

Expressed distress—Descriptive statistics for levels of expressed distress for different stimulus modifications for Italian and Japanese participants are reported in Table 1. A significant within-subjects effect was found for stimuli, $F(8,99) = 13.14$, $p = .0001$. Neither differences for country nor interaction effects emerged. Tukey HSD post-hoc tests indicated that three stimuli were perceived as significantly more distressed than the BASE in Italy: FSP+250 (M difference = 1.63, $SE = .22$, $p \leq .05$), FSP-250 (M difference = $-.98$, $SE = .21$, $p \leq .05$), and PAUSE-100 (M difference = .99, $SE = .15$, $p \leq .05$); no significant differences were found among the other stimuli. Tukey HSD post-hoc tests indicated that two stimuli were perceived as significantly more distressed than the BASE in Japan: FSP+250 (M difference = .69, $SE = .8$, $p \leq .05$) and PAUSE-100 (M difference = 1.01, $SE = .09$, $p \leq .05$); no significant differences were found among the other stimuli (Figure 1). Note that two stimulus manipulations (FSP+250 and PAUSE-100) were rated as expressing more distress than the BASE in both countries.

Felt distress—Descriptive statistics for levels of felt distress for different stimulus modifications for Italian and Japanese participants are reported in Table 2. A significant within-subjects effect was found for stimuli, $F(8,99) = 8.67$, $p = .0001$. Neither differences for country nor interaction effects emerged. Tukey HSD post-hoc tests indicated that some stimuli were felt as significantly more distressed than the BASE in Italy: FSP+250 (M difference = .58, $SE = .15$, $p \leq .05$), FSP-250 (M difference = .56, $SE = .09$, $p \leq .05$), PAUSE-100 (M difference = .32, $SE = .03$, $p \leq .05$), and SPEED-50 (M difference = .61, $SE = .08$, $p \leq .05$); no significant differences were found for the other stimuli. Tukey HSD post-hoc tests indicated that some stimuli were felt as significantly more distressed than the BASE in Japan: FSP+250 (M difference = .36, $SE = .20$, $p \leq .05$) and PAUSE-100 (M difference = .55, $SE = .07$, $p \leq .05$); no significant differences were found for the other stimuli (Figure 2). Again, two stimulus manipulations (FSP+250 and PAUSE-100) were felt as more distressing in both countries.

Experiment 2

Participants

A total of 80 Italian adults recruited in the urban area of Trento [40 parents (20 F age $M = 32.2$, $SD = 3.9$; 20 M age $M = 35.2$, $SD = 6.1$) and 40 non-parents (20 F age $M = 26.6$, $SD = 2.8$; 20 M age $M = 29.6$, $SD = 2.1$)] and 80 Japanese adults recruited in the urban area of Chiba [40 parents (20 F age $M = 31.5$, $SD = 5.9$; 20 M age $M = 30.9$, $SD = 6.2$) and 40 non-parents (20 F age $M = 28.3$, $SD = 5.1$; 20 M age $M = 26.5$, $SD = 3.6$)] participated in Experiment 2. The participants in the two countries had a comparable socioeconomic status, ranging medium to high ($M = 48.69$, $SD = 12.01$), as calculated using the Hollingshead (1975).

Materials

Cry stimuli were extracted from 20 retrospective home videos of unedited cry bouts of 20 firstborn Italian 13-month-olds who belonged to one of two groups: Autism Spectrum Disorders (ASD; $n = 10$, 5 boys/5 girls) and Typically Developing (TD; $n = 10$, 5 girls/5 boys). The home videos belonged to a database of videos collected during a longitudinal

study of early markers of autism conducted at the University of Trento. Children with ASD received a clinical diagnosis between 36 and 40 months of age from a child psychiatrist according to DSM-IV-TR criteria, confirmed by both ADI-R and ADOS-G. Infants with a diagnosis of Pervasive Developmental Disorder not otherwise specified (PDD-Nos) or Asperger Syndrome were not included. To prevent the presence in the sample of cases of secondary autism, children with AD were free from other medical conditions (e.g., seizures, Fragile X syndrome, etc.) and had no visual or hearing impairments. Their cognitive level was evaluated at the age of 4 years using the Wechsler Preschool and Primary Scale of Intelligence-II (WPPSI-II) ($M = 96$, $SD = 7$). Children with TD were part of a longitudinal research project and did not present any significant medical or developmental concerns as confirmed by Child Behavior Check-list (CBCL) normal scores and their WPPSI-II scores at the age of 4 years ($M = 106$, $SD = 3$). A research assistant, who was unaware of the purposes of the study and blind to children's group membership, gleaned video records of the two groups of children from home videos that had been made when they were 13 months of age. After independently screen the home videos, to optimize and equate for sound quality and volume, the assistant selected the first episode of cry that occurred after a feeding and when the baby was left alone. From this video the first 15 s were used. To ensure that the cries were representative of the typical range of cry sounds for the two groups (AD and TD), the cry sounds were digitized and analyzed using the Praat acoustic analysis software (Boersma & Weenink, 2005). A long-term average spectrum (LTAS) was employed to provide spectral information for the crying episode. LTAS is helpful in discriminating cry characteristics of different categories of children (Lin & Green, 2007). For all cries, the First Spectral Peak (FSP) of the LTAS was obtained. FSP is the frequency value (in Hz) of the first amplitude peak across the LTAS. It is an estimate of the average f_0 of an episode of crying (Lin & Green, 2007). The FSP (in Hz) of cries were used in Experiment 2 for AD: $M = 535.12$, $SD = 28.88$, and for TD: $M = 465.71$, $SD = 32.56$. Significant differences in f_0 emerged among the stimuli (TD vs. AD), $F(1,19) = 3.16$, $p = .03$. This result is consonant with previous findings (Esposito & Venuti, 2010a, b) that have indicated that cries of children with autism usually have higher f_0 .

Results

Expressed distress—Expressed distress in AD cries in Italy were $M = 4.72$ ($SD = 1.91$) and in Japan $M = 4.81$ ($SD = 1.73$) and for TD cries in Italy $M = 3.01$ ($SD = 1.52$) and in Japan $M = 3.65$ ($SD = 1.57$) (see Figure 3). A significant within-subjects effect was found for group. Cries of children with ASD were judged to express more distress than cries of typically developing children, $F(2,314) = 510.11$, $p = .0001$. Neither differences for country nor interaction effects emerged.

Felt distress—Felt distress for AD cries in Italy were $M = 4.50$ ($SD = 1.91$) and in Japan $M = 3.57$ ($SD = 1.81$) and for TD cries in Italy $M = 2.87$ ($SD = 1.11$) and in Japan $M = 2.68$ ($SD = 1.09$) (see Figure 4). A significant within-subjects effect was found for stimulus. Cries of children with AD made participants to feel more distress than cries of TD children, $F(2,314) = 390.84$, $p = .0001$. Neither differences for country nor interaction effects emerged.

General Discussion

In two experiments, we investigated how adults in two contrasting cultures perceive typical and atypical infant cries. As expected, in the first experiment we found that experimental manipulations of acoustical parameters of a cry episode modified listener perceptions of distress similarly in Italian and Japanese samples. In particular, cries with modified fundamental frequency or with shorter pauses were perceived as more distressed. These

findings accord with the observation that communicative and non-communicative sounds with higher pitch (higher fundamental frequency) and less rhythm (shorter pauses influence the rhythms of an episode of crying; Zeskind et al., 1992) are perceived as more aversive and distressed (see, e.g., Haas & Edworthy, 1996; Hammerschmidt & Jürgens, 2007)

To our knowledge, no studies have examined whether the same acoustical manipulations of infant cry influence adult perceptions in the same ways in different cultures. Moreover, considering the novelty of the cross-cultural comparison, these findings support earlier reports from Zeskind and Lester (2001) and from Esposito and Venuti (2008 Esposito and Venuti (2010) that exposed the role played by fundamental frequency and duration of pauses in determining the perception of distress expressed in crying (see also Schuetze et al., 2003; Zeskind & Marshall, 1988). Previous studies conducted in United States have determined that higher fundamental frequencies of cries are more likely to elicit perceptions of cries as more urgent and aversive than lower fundamental frequencies (Zeskind & Lester, 2001). This seems to be the case also for Italian and Japanese samples. Moreover, in the current experiments we found that Italians and Japanese alike perceive cries with higher fundamental frequencies and lower fundamental frequencies relative to normal elicit perceptions of greater distress. This result accords with previous studies in Italian samples that explored how episodes of crying with fundamental frequencies that deviate from norm are perceived as more urgent and distressing (Esposito & Venuti, 2010a). Reasons why call for further research.

In a second experiment, we found that Italians and Japanese alike perceive cries of children with autism as more distressed and distressing than cries of typically developing children. This result can be interpreted with respect to results of the first experiment and to the extant literature. The first experiment pointed to the central roles played by high fundamental frequency and short pauses in generating perceptions of higher distress. Indeed our findings agree with those reported elsewhere that communicative and non-communicative sounds with higher pitch and less rhythm are perceived as more aversive and distressed. Sheinkopf and colleagues (2000) and Esposito and Venuti (2010a,b) reported that cries of young children with autism show higher fundamental frequencies and shorter pauses compared with cries of typically developing and developmentally delayed children. These reports also speculated on how anomalies in cry modulations in children with autism were expectable considering the connection between crying and the functioning of the brainstem and limbic system, both of which that appear to be compromised in children with autism (Amaral et al., 2008; Schulkin, 2007). It could be that in some children with ASD anomalies of the functioning of the brainstem and/or limbic system contribute to producing cries with atypical features (e.g., higher fundamental frequency and shorter pauses).

One of the core symptoms of autism is the distortion of social and emotional expressivity. Moreover, because of the difficulties associated with making a reliable diagnosis of AD before the age of 18–24 months, very little is known about the expression of distress (cry) in the early infancy of children later diagnosed with AD. Cry is important to study because it is one of the first signals infants use to communicate. More information about the production of early episodes of crying and how they are perceived by infants' caregivers can provide insight into early child-caregiver interaction in AD. Our findings suggest that cries of children with AD at 13 months of age were perceived as more distressed and distressing, likely because of their special atypical acoustical features, and were in two contrasting cultural contexts, Italy and Japan, where the social acceptance of expressing negative emotions differs (Bornstein, 1989; Bornstein et al., 2010, 2012; Nisbett, 2004). A bias in judging levels of distress felt in AD cries could interfere with the adequacy of caregiver responses. Indeed, a caregiver's adequate behavioral response, which ideally satisfies the infant's needs, is a necessary first step towards establishing good future relationships but can

be compromised when children express atypical emotions (for example, when children express their distress through crying with higher fundamental frequency and/or with shorter pauses). Overestimating the level of distress expressed in an episode of crying may jeopardize caregiver responsiveness, whereas “successful recognition and evaluation of children’s vocalizations can be critical for bonding mechanisms and for offspring well-being and survival” (Seifritz et al., 2003, p. 1367).

Before concluding, it is useful to acknowledge some of limitations of these experiments as well as future directions where they might lead. One limitation of these studies is the fact that we only analysed two cultures as representative of East and West. Moreover, we should take into account that we found more similarities than differences between Italians and Japanese. Although this result constitutes a strong test of the hypothesis that responses to autism might be universal, it will be of interest to extend this study by testing in other cultural contexts. A further limitation of this work is the use of retrospective home videos to extract cry stimuli. A shortcoming of retrospective studies of children with autism (or with other psychopathologies) is the impossibility of clearly describing their developmental level at the time of the video. However, retrospective video analysis has so far proved an excellent option for accessing periods in development months or years before a child is formally diagnosed with autism (Baranek, 1999).

Our results also highlight the need of future research on responses of adults to infant crying and in specific to cries of infants with developmental concerns, with the goal of providing fresh insights into early caregiver-child interaction in typical and atypical circumstances. Furthermore, future studies should investigate whether higher pitched cries in autism can be used as a possible early marker of the disorder. It might also be of interest to differentiate the acoustical characteristics and effects on perceived and felt distress of cries of infants with autism from those of infants with other medical conditions or those prenatally exposed to cocaine.

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Research Highlights

1. Crying episodes with high fundamental frequency and short pauses are perceived as distressing and distressed in both Italy and Japan.
2. Episodes of crying of children with autism tend to be considered more distressed and distressing than those of typically developing children.
3. Contrasting adults in two different societies (Italy and Japan) constitutes a strong test of hypotheses that atypical responses to AD episodes of crying might be universal.

Figure 1.

Standardized mean of the level of judged distress in the stimuli in Italy and Japan. The different stimuli were the BASE stimulus (considered the baseline level and plotted in the figure with the dashed line representing the judged level of expressed distress of an episode of typical cry of a 6-month-old infant) and its 7 experimental manipulations (see Methods). *Statistically significant differences of the level of distress expressed for specific manipulations compared to the Baseline level emerged using Tukey HSD post hoc tests ($p < .05$).

Figure 2.

Standardized mean of the level of distress that participants felt while listening the acoustically manipulated episodes of crying in Italy and Japan. The different stimuli were the BASE stimulus (considered the baseline level and plotted in the figure with the dashed line, and representing the judged level of felt distress of an episode of typical cry of a 6-month-old infant) and its 7 experimental manipulations (see methods).

*Statistically significant differences of the level of distress felt while listening the specific manipulations compared to the Baseline level emerged using Tukey HSD post hoc tests ($p < .05$).

Figure 3.
Mean levels of judged expressed distress of crying of children with AD or TD by Italian and Japanese adults.
* $p < .05$.

Figure 4. Mean levels of distress that Italian and Japanese participants felt while listening to episodes of crying of children with AD or TD.
* $p < .05$.

Table 1

Descriptive statistics for levels of expressed distress for episodes of crying in Italy and Japan

	Italy		Japan	
	M	SD	M	SD
BASE	3.16	1.49	2.88	1.67
FSP+250	4.79	1.51	3.56	1.18
FSP-250	4.14	1.23	2.84	1.41
PAUSE+50	3.02	1.14	2.98	1.32
PAUSE-50	3.79	1.29	3.24	1.03
PAUSE-100	4.15	1.55	3.89	1.28
SPEED+50	3.82	1.76	2.94	1.86
SPEED-50	3.52	1.53	3.38	1.58

Note. Possible range 1–7.

Table 2

Descriptive statistics for levels of felt distress for episodes of crying in Italy and Japan

	Italy		Japan	
	M	SD	M	SD
BASE	2.09	.45	1.79	.89
FSP+250	2.67	.61	2.46	1.13
FSP-250	2.65	.76	2.11	.92
PAUSE+50	2.15	.55	2.29	1.08
PAUSE-50	2.30	.62	2.31	1.09
PAUSE-100	2.41	.82	2.64	1.34
SPEED+50	2.26	.64	2.43	1.19
SPEED-50	2.70	.75	2.18	.88

Note. Possible range 1–7.