How is crying perceived in children with Autistic Spectrum Disorder

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Abstract

Autistic Spectrum Disorder (ASD) is a disorder that affects language and social skills to varying degrees. While many studies have concentrated on examining patterns of behavior and development on the context of speaking and interacting, very few researchers have investigated the parameters of crying in infants with ASD. This finding is surprising since crying can be viewed as both the first communicative and social structure in human development. The aim of our study was to investigate how the crying of children with ASD, as opposed to children with intellectual disability (ID) was perceived. In particular, we tested a questionnaire to verify whether the atypical structure of autistic crying can bias parent perceptions. The atypical structure of autistic crying was highlighted. In autistic children, crying was inexplicable for their parents who could not identify causative factors. These results support the view of autism as related to a problem of expressing and sharing emotions. Parents’ reactions to autistic crying were qualitatively different from non-autistic children of the same age. This difference was compounded parental attempt to share feelings and developing inter-subjectivity processes with their children.

Keywords: ASD; Episode of cry; Distress

1. Introduction

From their first moments after birth, newborns exhibit distinctive social behaviors, which are driven by genetically predetermined factors. These variables shape the infant’s modes of expression; in turn, the baby’s signals induce from the mother particular types of responses (Acebo & Thoman, 1992, 1995; Zeifman, 2004). Of these signals commonly seen during infancy, the two expressions which convey the highest communicative function are the baby’s smiling and
crying (and is interesting to notice that they are both associated with the right insula, see also Sander & Scheich, 2005). Indeed, as examples of social preadaptation (Schaffer & Emerson, 1964), the smile and cry are found in all the members of the human species, age notwithstanding. These emotions represent patterns of communicative behaviors and can first be detected in the link created between infant and parent (Bowlby, 1969). Thus, crying and smiling are not just infant behavior, but rather these expressions of feeling are a part of a behavioral system in the human species that assures survival of the helpless neonate by alerting others to meet basic needs (Furlow, 1997).

As an automatic reaction prompted by the sight of the caregiver’s eyes, the baby’s smile is observable during the 1st week of life. Because caregivers feel pleasure upon registering the infant’s smile, their tendency is to encourage the baby to interact socially. By contrast, crying behavior, especially pain-related cries, stimulate the parents to behave most rapidly and intently. Therefore, these genetically determinate signals set the stage for the newborns’ first form of social interaction.

While the smile begins to emerge at the 3rd week of life, episodes of the infant’s cry are readily apparent from birth and drive caregivers from the onset to nourish, protect, or soothe.” Infant crying signals distress to potential caretakers who can alleviate the aversive conditions that gave rise to this behavior. The crying signal results from coordination among several brain regions that control respiration and vocal cord vibration from which the cry sounds are produced” (LaGasse, Neal, & Lester, 2005). The function of an episode of crying is primarily to request the caregiver proximity (Bowlby, 1969; Wood & Gustafson, 2001) and also achieves the social function to start the interactions with the environment. At once, said provocation essentially activates the persons listening to the cry to take measures in order to eliminate the cause of the uneasiness shared both by newborn and adult (Gustafson, Wood, & Green, 2000). Through the caregiver’s production of responsiveness behavior, not only will the baby’s expressions of discomfort be quelled but additionally, environment equilibrium will be restored. In this respect, infant crying and parental response is the first language of the new dyadic relationship. Researchers hypothesize that infant cries have both infant and caretaker in a state of strong sympathetic nervous system activation (LaGasse et al., 2005).

An episode of crying as expressed by the child turns out to be a highly organized and complex communicative system. When the system functions optimally, parents with small infants can seem to know what their crying baby needs even before they check the diapers and feeding-time schedules. One clue that parents may use in determining the wants of their baby lies within the manner in which their baby is crying. Researchers suggest that three styles of crying are widely observed in infants: the anger cry (loud and prolonged vocalization), a hunger and basic cry (rhythmic and repetitive vocalization), and a cry of pain (sudden onset, initial long cry, and extended breath holding) (Wolff, 1969). These styles of crying are present in children who exhibit typical development; despite their being born and raised into very different cultures, the shape in sound patterns of the children’s cry remain remarkably the same (Barr, 1991; Wolff, 1969). For this reason, arguing that the production of an episode of crying has a domain in a specific brain area is possible. In particular LaGasse et al. (2005) have stated that neonatal cry arises from aversive internal or external stimulation and is produced by coordination among several brain regions, including the brainstem, midbrain, and limbic system. The lower brain stem controls the muscles of the larynx (Lester & Boukydis, 1990). The limbic system and the hypothalamus participate in crying initiation; the midbrain in the configuration of crying patterns (midbrain), and the reticular activating system in the motor coordination of respiration, larynx, and articulation (Zeskind & Lester, 2001).
Soon after birth, the cry becomes an automatic reaction to signal biological needs (hunger, pain, and visceral colic). In this stage, crying can be stopped with some specific behavioral responses, universally utilized by caregivers from a vast array of varying backgrounds. These responses are the results of caregiver characteristics (e.g., Frodi, 1985) and cultural norms (Barr, 1991), infant cry characteristics influence responses to crying as well (e.g., Wood & Gustafson, 2001).

The caregiver’s adequate behavioral response, which ideally satisfies the newborn’s needs, is a mandatory step for good future relations. Deviations in the signal and/or misunderstanding the message can compromise infant care, parental effectiveness, and undermine the budding relationship (LaGasse et al., 2005). Not surprisingly, the needs of an infant do not remain stagnant; on the contrary, the baby’s needs generally follow a course of development, as does the expression of crying. Initial cries requesting basic wants soon evolve into solicitations rooted outside of biology. Day by day, the causes of a crying episode become more social. These bouts will communicate enough importance to keep the caregiver in their proximity. Around the 2nd and 3rd months, episodes of crying can occur for a sudden change in the environmental stimulation; an example can be when the caregiver goes out of the visual field of the child or when the caregiver stops singing or talking. In these scenarios, restoring the environmental stimulation or distracting the baby with new stimulus in order to stop the crying is often successful. Generally speaking, the behaviors that cause distress or offer consolation to the child often match the subtle aspects of crying, which are being expressed at that moment. These different aspects of crying and caregiver responses help define the nature of their relationship (Dunn, 2002), and also reflect: (i) the new competence of the child to face the world; (ii) the child’s ability to modulate the internal stimuli; (iii) some other factors such as parental age and personality (Ziefman, 2003) and age of infant (Schuetze, Zeskind, & Eiden, 2003).

At 8 months, babies can have a specific relationship with their caregivers and a better understanding of the world around them; on the whole, infants are more aware of their needs and they are also more aware of the implications of their cries. During this stage, to be aware of the power of their cries means that babies are responsive to the effects that their crying can produce: a change in the behavior of others and especially in that of the caregiver. Infants also develop, at about 7 or 8 months, both a stronger attachment to the mother and an increased sense of “stranger fear” (Bell & Ainsworth, 1972; Trevarthen, Aitken, Papoudi, & Robarts, 1998). Usually stranger fear is expressed through the “stranger fear cry,” a specific modality of crying activated when the caregiver is not in eyeshot and another person is closely approaching the child. At 12 months, the cry is an effective and efficient communicative routine, with a narrative and a turn-taking system. In short, crying is a base and a guide for the development of the language and will be, for the rest of life, a primary communicative approach to express deep and strong feelings (Rothganger, 2003).

As clearly shown above, several studies have examined the cries of infants who, for all intents and purposes, show the signs of typical development. But what of those newborns who may be developing atypically? Some researchers have explored whether or not an infant’s crying can indicate additional information to basic needs and emotions (Fisichelli & Karelitz, 1963; Lester & Boukydis, 1985). Psychophysiological characteristics of the episodes of crying, remarkably similar in children with typical development, change in children with disability. Several studies support the relationship between neurological status and crying (Corwin, Lester, & Sepkoski, 1995; Fisichelli & Karelitz, 1963, 1966; Michelsson & Sirvio, 1976; Thoden & Michelsson, 1979). For example, studies using behavioral measures have found that brain-damaged and Down’s syndrome infants require more pain to elicit crying, have longer cry latency, and produce
a less sustained and more arrhythmical construction than typical infants (Fisichelli & Karelitz, 1963). For example, a pattern called “cri du chat,” a steady crying at approximately 800 cycles, is a distinctive cry of brain-damaged infants. This steady crying contrasts to the previously discussed crying, which starts at 200 cycles and rises to 600 cycles, holds steady, and then drops off (Lester & Boukydis, 1985).

Researchers have been able to differentiate 80 measures of infant crying, but frequency (pitch) is the most important aspect that facilitates adult recognition of infant needs (Zeskind & Marshall, 1988). Malnourished babies have high-pitched, arrhythmic crying that is low in intensity but high in duration (Angier, 1984). Babies with Down’s syndrome have pain cries that are lower in pitch than those of typically developed infants (Zeskind & Marshall, 1988). Male neonates undergoing circumcision undergo an increase in the pitch of their cries (Porter, Porger, & Marshall, 1988). Asphyxiated babies have shorter cries, higher fundamental frequencies, and less stable crying signals (Campos, Barrett, Lamb, Goldsmith, & Stenberg, 1983). These data highlight the importance of crying as an early indicator of risk during the first stage of child development.

In this study, we focused on episodes of crying as expressed by children with Autistic Spectrum Disorder (ASD). ASD afflicts individuals by compromising their abilities in language, sociality, and motor behavior. Despite the efforts made, the actual aetiological causes of the disorder are still unknown, which by extension has hindered the development of an effective treatment, including the opportunity to provide an early diagnosis. Generally, a diagnosis for ASD will not be made until the first clear signs of the disease are evident, at the end of the 2nd year of life when a lack of communicative skills and social deficiencies are most noticeable.

Children with ASD appear to show insufficiencies not only in the perception of affective cues but also in affective expressions (Bauminger, 2004; Ozonoff, Pennington, & Rogers, 1990). Nonetheless, the limited research on affective expression in children with ASD indicate that these children undoubtedly have impairments in affective expression, but the specific deficit and contextual components of their affective expression are still unclear (Bieberich & Morgan, 1998). Affective expression has been investigated mostly for positive articulation. Reddy, Williams, and Vaughan (2002) analyzed the phenomena of sharing humor and laughter in children with autism and Down’s syndrome. In the autism group, laughter was rare in response to events such as funny faces or socially inappropriate acts, but was common in strange or inexplicable situations. In addition, the children with autism showed higher frequencies of unshared laughter in interactive situations and lower frequencies of attention or smiles in response to others’ laughter (Reddy et al., 2002).

While many researchers have concentrated on examining the patterns of behavior and development in the context of speaking and interacting among young children and adolescents or on the expressions of positive affect, few studies have investigated the specificity of crying in infants with ASD (Bieberich & Morgan, 1998; Venuti, Esposito, & Giusti, 2004). This dearth of research is notably considering that crying can be viewed as both the first communicative system and the first social structure in human development.

The clinical assessments of children who have been diagnosed with ASD often report the parents’ accounts in which they recalled great difficulty in decoding the emotional signals of their children during the 1st year of life; in particular, parents referenced problems with understanding the causes of the crying episodes. These misunderstandings about the causes of an episode of crying can lead the caregiver–child dyad into a vicious cycle, with the caregiver failing to recognize the child’s needs, resulting in inadequate feedback to the child.
Our aim, for this study then was to investigate how parents perceive crying of children with ASD compared to children with typical development and children with intellectual disability (ID). In children with ASD, the presence of an atypical cry may reflect the general dysfunction in regulating emotional states. We argue that atypical crying shown by these children may impair parents’ ability to be responsive to their children’s cues. Therefore, we set out to test whether the atypical structure of an autistic child’s cry could bias parental perception overall.

2. Procedure

We carried out two studies on whether the atypical structure of the autistic crying can bias parents’ perception. For study 1, we gathered data by means of a survey of parents’ responses in order to investigate how parents of children with ASD and parents of children with typical development or with ID describe their own child’s crying episodes. Study 2 was a “Listen-and-Response” experiment whereby the participants (a group of adults) were asked to listen to audio files of crying episodes and to guess the age of the children who were crying, to guess the reasons which led the children to cry, and to describe what they felt upon hearing this response.

3. Study 1

3.1. Survey participants

Participants were 120 parents with children from 3 to 5 years of age. The sample included: (1) 50 parents with children of typical development (child mean-age = 3.5 years); (2) 35 parents with children who had already received a diagnosis of Autistic Spectrum Disorder (child mean-age = 4.8 years; mean of mental age = 3.2 years); (3) 35 parents of children who had already received a diagnosis of intellectual disability (child mean-age = 4.4 years; mean of mental age = 2 years). The average ages of participants were: 30.08 years (2.21 S.D.) for the group of parents of children with TD; 33.67 years (3.18 S.D.) for the group of parents with children having ASD; and 36.32 years for the group of parents with children having ID. The three groups were homogenous for the Socio Economic Status level calculated with the index SES of Hollingshead (1975) did not differ in a statistically significant way.

3.1.1. Survey structure and scoring procedure

The survey was comprised of four sections: the first section (eight items) pertained to socio-cultural status of the child. The second section (seven items) included items on way episodes of crying were expressed, both at a morphologic level (e.g. the presence of tears and the presence of screams), and at the level of adequacy to the social context. The third section (nine items) asked parents to judge how relevant the role of a specific stimulus would play in the provocation of an episode. Essentially, this section framed crying episode with the following wording: “How often does your child cry for…” The stimuli proposed are “for hunger,” “for pain,” “for tiredness,” “for whim,” “for frustration,” “for separation from the parent,” “for fear,” and “for no understandable reason.” The parent must respond to each stimulus by means of choosing from a

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1 The ASD diagnosis was carried out using the DSM IV-r in a diagnosis center in the Trento district (north of Italy) and in another center in the Macerata district (central part of Italy); the diagnosis was subsequently verified from an investigator of the Observation and Functional Diagnosis Lab of the University of Trento, using ADOS.
four-point Likert scale, measured in the following degrees: “never,” “sometimes,” “often,” and “always.” Finally, section four analyzed the feelings experienced by parents during their child’s crying episodes. The question was open-ended: “What did you feel mostly during your child’s crying episode?” To this question, the participants’ responses have been codified into three categories based on the expressed content.

Two independent coders, who were blind to the hypothesis of our study, classified the participants’ answers into three categories: the first positive emotional state consisted of the participant’s expressions of positive emotion and the desire to proactively respond in the interest of the child’s well-being, e.g. to caress and to cuddle. Neutral emotional state was the second category. The participant did not report any particular emotional state, either positive or negative. Some answers that have been classified in this category were: “nothing,” or “no particular feeling.” The third category was negative emotional state. The participant conveyed answers that expressed highly distressful feelings. Some responses that have been classified in this category were: “anguish,” “desperation,” and “moodiness.”

3.2. Results

Agreement between the two coders was calculated with the Cohen Kappa, and was $k = 0.87$.

The descriptions of crying episodes were not statistically significant different among parents groups for duration, frequency, or rhythm of crying (see Table 1 for more details). Statistically significant differences existed in the questions about the presence of screaming and shedding of tears. In particular, 38% of the parents with children having ASD asserted that the episode of crying exhibited by their children were without tears, as opposed to 9% of the parents with children having TD and 11% of the parents with children having ID ($\chi^2 = 21.41$, d.f. = 2, $p < 0.05^2$). Also, the presence of screaming in crying episodes differed across groups. While most parents with children having ASD (71%) reported crying episodes with screaming, the majority of parents with TD children (58%) and ID children (62%) asserted the opposite ($\chi^2 = 19.5$, d.f. = 2, $p < 0.05$). Parents emphasized that the crying of children with ASD appeared more unexpected and inexplicable ($\chi^2 = 45.87$, d.f. = 2, $p < 0.05$), less appropriate to the social

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For the inferential analysis of this section, we used $\chi^2$-test with Bonferroni adjustment procedure for the multiple control.
context ($\chi^2 = 19.53$, d.f. = 2, $p < 0.05$) and harder to quell, compared to children with TD and ID ($\chi^2 = 35.91$, d.f. = 2, $p < 0.05$).

We analyzed answers for the next section of the survey, where parents were asked to judge, on a four-point Likert scale (coded into two classifications: “never/few times” and “often/very often) how relevant a given stimulus was to crying.

Different patterns of answers emerged for the three groups (Table 2). None of the parents with ASD children reported crying as “often” for pain or tiredness. Additionally, 46% of the parents with ASD children reported their kids cried “often” for no understandable reason, compared to the 0% of parents with TD children and 7% of parents with ID children.

Feelings expressed by the parents during their children’s episodes of crying were open-ended: “What do you feel mostly during your child’s crying episode?” Parents of children with ASD expressed mainly negative emotional responses compared to control (TD and ID); the differences were once again statistically different ($\chi^2 = 39.61$, d.f. = 5, $p < 0.001$) (Fig. 1).

### 3.3. Discussion

Parent responses reveal two patterns that describe crying episodes of their children. The answers of parents with ASD children followed a pattern; the episode of crying was characterized by screaming, a near to total absence of tears, often provoked by unexpected and inexplicable causes. These patterns seemed to be in agreement with the results of previous research (Venuti et al., 2004), though designed and executed with different methodologies (Waveform Analysis

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**Table 2**
Relative frequencies to the part of the survey where we asked to the parents of children belonging to three groups (ASD children, TD children and MR children) to judge how much some stimuli were the causes of episodes of cry.

<table>
<thead>
<tr>
<th>How often did your child cry...</th>
<th>ASD (%)</th>
<th>TD (%)</th>
<th>ID (%)</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Few times</td>
<td>Often</td>
<td>Few times</td>
<td>Often</td>
</tr>
<tr>
<td>For hunger</td>
<td>45</td>
<td>55</td>
<td>52</td>
<td>48</td>
</tr>
<tr>
<td>For pain</td>
<td>100</td>
<td>0</td>
<td>65</td>
<td>35</td>
</tr>
<tr>
<td>For tiredness</td>
<td>100</td>
<td>0</td>
<td>72</td>
<td>28</td>
</tr>
<tr>
<td>For whim</td>
<td>46</td>
<td>54</td>
<td>41</td>
<td>59</td>
</tr>
<tr>
<td>For separation</td>
<td>71</td>
<td>29</td>
<td>84</td>
<td>16</td>
</tr>
<tr>
<td>For frustration</td>
<td>36</td>
<td>64</td>
<td>44</td>
<td>56</td>
</tr>
<tr>
<td>For not understandable reason</td>
<td>54</td>
<td>46</td>
<td>100</td>
<td>0</td>
</tr>
</tbody>
</table>

![Fig. 1. Feelings of parents during the episodes of crying for the three groups (ASD, TD and ID episodes of cry).](image)
and Observational Analysis). Episodes of crying started with an amplitude peak and continue on high amplitude. This finding was very similar to the acoustic shape of the episodes of crying of ASD children as perceived by the parent. However, these crying episodes were unexpected because they lacked an “introduction” phase. The introduction phase (also called inspiratory phase) is a starting point and constitutes a narrative between child and environment. This introduction is made of complaining and deep breaths, and it is typical of the other typology of episodes of crying (of hunger and protest). Because this pattern of crying lacks the introduction phase, it seems unexpected, and this crying appears also inexplicable and not adequate to the context.

A different interpretation for episodes of crying may be that the child is hard to comfort. This characteristic could have two causes. It is possible that the parent did not understand the motivations for crying and thus did not know how to respond. However, it is also possible that the children with ASD, because of a perceptive-sensory deficit, need specific sensory attention. According to this view even if the parent succeeds in identifying the reason for their child’s crying, they may be not be sure how to comfort them.

The answers to the questionnaire highlight another point. In particular episodes of crying, the child with ASD was often associated with frustration on the part of the parent. Such data was unexpected, because the children with ASD often did not cry at separation from the caregiver.

Statistical differences in the emotional state during crying episodes were also noted. In particular, parents of children with ASD expressed many more negative emotions relative to controls (TD and ID). This result could be interpreted as a mnemonic bias. Because of this bias parents of ASD children know that their child has developed a disorder dominated by negative emotional states, referring to the global behavior of the child more than to a specific episode of crying. However, parents of children with ID do not express such negative states as the parents of children with ASD.

4. Study 2

4.1. Experimental task participants

A total of 40 women, of age comprised between 25 and 35-year-old (mean = 31; S.D. = 3.2) participated in study 2. The sample was composed of 20 non-parents and 20 parents (one inclusion criteria in this subgroup was to have a child younger than 3-year-old).

4.1.1. Experimental task

We carried out this study testing whether the atypical structure of autistic crying could bias parents’ perception. In particular, we carried out a “Listen-and-Response” experiment recording retrospective home video of children with ASD, ID and TD, using 12 episodes (audio file) of crying at different ages (13 and 20 months). The average duration of crying episodes was 15 s and was recorded at 44,100 Hz with a stereo resolution 32 bit. Stimuli were presented using a personal computer and a headset. During the presentation of the stimuli, there were no images on the screen, only a light-blue screen. Participants were asked to listen to 12 stimuli, randomly presented, and then answer three questions. (1) To guess the age of the children who was crying; (2) to guess the reasons which led them to cry; (3) to describe what they felt in hearing the episode of cries. The first question was analyzed for accuracy of the participants in guessing the age of the children when they listened the episode of cry. Accuracy was given in absolute values between the real age of the child and the participant’s guessing. Therefore, the closer it is to 0 the more
accurate the guess. The second question, the one about the identification of the causes of the crying episode has been codified with two categories: “correct” and “wrong.”

The episodes of crying belonged to two categories: (1) hunger and (2) frustration. The two categories of crying were balanced between the three groups (cries of children with ASD and cries of children with TD and ID). Also the answer of the third question was coded into specific category. In particular, the feelings the participants of the samples felt in listening to the crying episodes have been grouped in five categories: (1) positive emotional state: with this category are coded all the answer that express positive emotion (e.g. calm and joy); (2) positive action: with this category are coded all the answer where the participant express their wish to do a positive action for the child’s well-being, e.g. to caress and to cuddle; (3) neutral emotional state: the participant does not report any particular emotional states, neither positive or negative. Some answers that have been classified with this category are “nothing” and “no particular feeling”; (4) uneasy state: in this category are coded all the answer where the participant report feeling of discomfort; (5) negative emotional state: with this are coded all the answer that express distressful feelings. Some answers that have been classified with this category are: “anguish”, “desperation”, and “moodiness.”

4.2. Results

The first step in the data analysis for the experimental task was the construction of a Hierarchical Log-Linear model. The model built with a “Backward Elimination” type procedure (10 steps) starting from a sature model resulted in significant interaction (Likelihood ratio $\chi^2 = 8.09$, d.f. = 16, $p = 0.946$). In particular, the final model generated the following two interactive classes:

- $P \times AA \times AC$
- $G \times AA \times AC \times FF$\(^3\)

Therefore, this model has shown statistically relevant interactions (i) for the variable Parenthood (P—being parent or not) and the variables: Accuracy on the Guess of the Age (AA) of the child that belonged to the episodes of cry listened; Accuracy on the Guess of the Cause (AC) that led the child to cry; and for (ii) the variable Group (G) with the variables: Accuracy on the Guess of the Age (AA) of the child that belonged to the episodes of cry listened, Accuracy on the Guess of the Cause (AC) that led the child to cry and Feelings Felt (FF) during the listening of the episode of cry.

Considered the interaction classes highlighted by the model we proceeded in analyzing the entity of such interactions. The first data analyzed involve differences between the two groups of our sample, parents and non-parents.

Relevant differences exist in guessing age and what caused the children to cry ($\chi^2 = 14.793$, d.f. = 1, $p < 0.001$). In particular, parents showed more accuracy than non-parents in identifying causes of crying episodes and in guessing the child’s age. No difference was found regarding feelings. Both groups, parents and non-parents, identified crying episodes in different ways. As

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\(^3\) The variables mean: Parenthood (P): to be a parent or not, an inclusion criteria of the group of parent was to have a child younger than 3-year-old; Accuracy on the Guess of the Age (AA) of the child that belonged the episodes of cry listened; Accuracy on the Guess of the Cause (AC) that led the child to cry; Group (G): if the episode of cry belonged to a child with ASD, TD or ID; Feelings Felt (FF) during the listening of the episode of cry.
far as accuracy in identification of the child’s age, participants mistakenly guessed the age of children with ASD. In particular, the accuracy for the age, that is the distance in absolute value between the real age of the child and the age guessed from the participant, averaged 5.3 (S.D. = 3.1) for the children with typical development and of 14.2 (S.D. = 5.1) for the children with ASD, and 7.1 (S.D. = 3.4) for the episodes of cry of children with intellectual disability. The two groups differ in statistically relevant way \( p < 0.001 \).

The next step in the data analysis was to analyse the Accuracy of the Guess about the Cause of the crying episodes. Considering the whole sample: the participants have been more accurate in guessing the episodes of cry of the children with TD and ID. In particular, the people of our sample have been successful in identifying the motivation of episodes of cry of children with ASD only 11.7% of the times against 54.3% of the accuracy for the cry of the children with TD and 48% of the accuracy for the cry of the children with ID. Also in this case the differences are statistically relevant \( \chi^2 = 39.78, \text{ d.f.} = 3, p < 0.001 \). At the end we analyse the answers to the last question, the one relative to the mental states evoked. To listen to a crying episode of a child with ASD provokes different pattern regarding the listening of crying episodes of children with TD or with ID. In particular, listening to the episodes of cry of a child with ASD has produced mainly mental states of uneasiness and stress. The crying episodes of children with ID and TD have generated mainly the wishing to do a positive action for the child’s well being. Once again, differences were statistically significant \( \chi^2 = 28.48, \text{ d.f.} = 6, p < 0.001 \) (Fig. 2).

4.3. Discussion

The sample was composed of 20 non-parents and 20 parents of ASD children (one inclusion criteria in this subgroup was to have a child younger than 3-year-old). Parents of this sample showed more accuracy in guessing the age and the causes that led the children to cry.

These data are in agreement with many studies (e.g. Wolff, 1969, or more recently, LaGasse et al., 2005) that hypothesize the existence of a specific and genetically determined predisposition for comprehension of crying episodes; such predisposition does exist in a latent form in every human being but it becomes manifest in young children. Such mechanism supplies a support, biologically determined, for parenting. Such results are also in agreement with the

![Fig. 2](image-url)
study of Wasz-Höckert, Michelsson, & Lind (1985); Wasz-Höckert, Partanen, Vuorenkoski, Michelsson, & Valanne (1964) that says that crying episodes are better recognized from adults who have direct experience with children, as an example parents or nurses. According to this hypothesis the function of parenting, as ability of the person to manage the needs of the child is present in every human being because of his genetic patrimony, but this skill become more evident when the individual is parent of a young child. The results extend also some previous studies carried out from Gustafson et al. (2000). In these studies the authors argued that the intensive experience of caring for an infant of one’s own fine tune skills and behaviors that many adults bring to the tasks of parenthood. In particular in these studies, mothers were somewhat better than nonmothers at guessing causes for crying. Additionally, they spent a greater proportion of their time engaged in activities that might soothe the infant’s distress.

Another interesting result is the fact that our data does not show relevant differences between the two groups (parents and non-parents) as far as the emotional states felt during the listening of the crying episodes. These data represent proof for that, in order to feel a specific emotion there is no need for previous knowledge of the phenomena. What is important is the morphologic and qualitative characteristics of the phenomena.

The result about guessing the age of the child based on crying episodes suggests less accuracy for children with ASD. In particular, a qualitative analysis of the accuracy for age showed that participants of our sample tend to underestimate the age of ASD children. The episodes of crying for the ASD group were considered to be of children of a younger age. We can argue that for their acoustic qualities (the presence of little pauses and little phase of aspiration/expiration) the ASD episodes of crying look like crying episodes of younger children with TD.

While listening to an ASD crying episode participants in our sample have felt mainly uneasiness and negative states. More positive mental states have been felt during the listening of the others kind of crying episodes (belonged to children with ID and with TD). These different patterns, from our point of view, may be interpreted as result of a wrong codification of an acoustic stimulus. In particular, because of the acoustic characteristics (few peaks, small modulation, small rhythm and absence of turn-taking) the crying episodes of the children with ASD cannot be interpreted and for this reason as evoking mental states of uneasiness. This interpretation agrees with the results of Zeskind and Marshall (1988) that found cry with shorter pauses were perceived to be more arousing and aversive (see also Zeifman, 2004).

The analysis of the acoustic structure of the crying episodes also seems to explain why cries of the children with TD have mainly evoked the wish to engage in positive actions (e.g. to cuddle). This result is in fact in agreement with numerous researches supporting the idea that the numbers of peaks in the waveform of a cry’s episode modulate the caregiver’s behavior. More peaks result in greater motor activation of the caregiver (Thompson, 1998). As noted very few peaks are present in the crying episodes of children with ASD.

5. General conclusion

“Crying is a biological siren, alerting the caregiving environment about the needs and wants of the infant and motivating the listener to respond (Zeskind & Lester, 2001, p. 149).” If this “siren” does not work properly (either because the cry acoustic signal may be poor or atypical, or because the caretaker may have atypical reaction to the cry), it can create a bias in the child/caretaker relationship.

Our study, which investigates the episodes of crying as seen in children with ASD, shows great potential in yielding insight about a stage of this disorder that has gone largely overlooked.
Indeed, data highlight that the cries of children with autism are not well identified (less accuracy in identifying age and reasons). Moreover, the autistic cries elicited negative feelings.

The results of this study support the view of autism as related to a problem of expressing and sharing emotions and problems in building adequate relations between the child with ASD and the caregiver (Greenspan, 1996; Greenspan & Wieder, 1998; Trevarthen et al., 1998). In particular, Trevarthen et al. (1998) asserts that the child with ASD is not neutral to the other people’s emotions and he/she is also able to have positive forms of attachment but does not show an intense desire in sharing emotion. ASD children show very precise emotional reactions to situations of fear and distress; such reactions are qualitatively different from those expressed by TD children of the same age (Trevarthen et al., 1998). Therefore, more than having a lack of emotions, children with ASD are qualitatively different in their expression of these emotions. We can say the same for the episodes of cry. ASD children show crying episodes but these episodes are qualitatively different from the ones of TD and ID children. Autistic cries have ambiguous patterns, and therefore may not seem understandable. Parents’ reactions to autistic cries are qualitatively different from their responses to cries of children without autism of the same age. This difference is an additional cause of difficulty in sharing feelings and developing intersubjective processes. Autism involves a communication deficit and, since the cry is the first communication mode in children, the autistic cry appears different from what is normally observed in typically developing infants.

In conclusion, the ASD children–caregiver relation is often prey to a vicious circle for which: the various acoustic qualities of a crying episode may not be easily understood by the caregiver. This misunderstanding creates a state of uneasiness and distress. Because of this distress, there is a risk the caregiver may give inadequate feedback to the child in order to reduce the cause of that specific crying episode.

In turn, the caregiver does not receive an adequate response from the child, and so the parent starts to feel inadequate insofar as providing a sense of well being to the child. In an effort to correct what seems intuitively amiss, he/she will modify his/her parenting skills. The child, on his/her part, cannot adequately communicate with his/her caregiver and could, therefore, express other kinds of compensatory behaviors (such as, isolation, stereotyped behavior, hyper–hypocinesia, etc). In this process, something (for example crying) related to a neurological disorder becomes the starting point for a problem in the fundamental interaction that lays the foundation for the overall relationship between the caregiver and child with ASD. In these cases, special forms of communicating and sharing of experience are required to compensate for this loss (Trevarthen & Daniel, 2005). Many research projects in the field of ASD have proven that early intensive treatments can lead to a substantial improvement in the life conditions of children with ASD. Some studies have shown that children with ASD, diagnosed within the 2nd year of life, have been able to reach a satisfactory living standard, autonomy (Osterling & Dawson, 1994; Osterling, Dawson, & Munson, 2002), and to perform cognitive skills with competency (Rogers, 1996, 1998). According to this evidence, the further study of predictors of the syndrome to better provide parents with an early diagnosis is paramount and cannot be overstated. Studies on early predictors of ASD (before 18 months of age) were initially directed at some precursors to social-communicative development, which represents a notably significant area of impairment in older children with autism. Specifically, many studies focused on typical behaviors, like pointing and symbolic play, as early manifestations of the underlying ability to share attention with others (Baron-Cohen et al., 1996; Lord, 1995). Absence or delay in proto-declarative skills (e.g. pointing), joint attention (e.g. showing objects), affect behaviors, and imitation have been investigated as potential markers of autism in young children (Baranek, 1999; Osterling et al.,...
2002). However, there is little research support for these or other predictors before 18 months of age (Baird et al., 2006; Baron-Cohen et al., 1996). Among the precursory signs, crying, which we consider the earliest communicative signal, could be investigated in order to have some indication pertinent to a diagnosis during the 1st year of life.

Finally, an outcome of this project will be to investigate the activation sites in the brain during the listening of episodes of cry, collecting our data by using fMRI technique. The study would examine the varied acoustic patterns of crying which would be generated by different activation.

References


