Psychology & Neuroscience
2015, Vol. 8, No. 4, 467–478

1983-3288/15/$12.00 http://dx.doi.org/10.1037/h0101430

Child Emotions Picture Set (CEPS): Development of a Database of Children's Emotional Expressions

Aline Romani-Sponchiado, Breno Sanvicente-Vieira, Caroline Mottin, Débora Hertzog-Fonini, and Adriane Arteche
Pontifícal Catholic University of Rio Grande do Sul

The recognition of facial emotions plays an important role in establishing social interactions through nonverbal communication. This is particularly true during childhood because language skills are not yet fully developed. Nevertheless, few studies have focused on facial emotion processing in children. Moreover, studies that have addressed this issue commonly have the major limitation of using only adult facial stimuli, and stimulus sets with children's faces are rare. The present study sought to fill this gap by developing the Child Emotions Picture Set (CEPS). The CEPS is a database of the facial emotions of 17 children who posed or naturally expressed 6 basic emotions. A panel of expert judges rated each picture. The set is split into 3 age groups (6–7 years old, 8–9 years old, and 10–11 years old) and includes 225 photos of boys and girls who display facial expressions of happiness, sadness, anger, fear, disgust, and surprise at 3 different intensities (low, medium, and high) plus neutrality. This work contributes to the scientific field by constructing a set of child facial stimuli that is intended for use in further research on emotional processing in children. Additionally, the database may allow future studies on the mechanisms that are involved in processing facial emotions across childhood and investigating effects associated with psychiatric disorders.

Keywords: face recognition, emotional processing, children, facial stimulus set, database

The recognition of facial emotions is a core sociability function that facilitates interpersonal relationships through nonverbal communication (Batty & Taylor, 2006). Since the publication of Darwin's book *The Expression of the Emotions in Man and Animals*, in which the role of the accurate recognition of emotions was highlighted as a key factor for evolution and survival (Darwin, 1872), numerous studies have investigated the processing of facial emotions in healthy and clinical samples (e.g., autism and schizophrenia; Ekman et al., 1987; Kessels, Montagne, Hendriks, Perrett, & de Haan, 2014; Sachse et al., 2014). Such empirical studies claim that accuracy in the processing of facial emotions is associated with global social and psychological well-being (Benuzzi et al., 2014; Sachse et al., 2014). Facial emotion processing has been considered important for social life, and changes in the functioning of such processing have been established as a marker of disruptive psychiatric symptoms across development (Allott et al., 2014; van Rijn et al., 2011). However, a recent meta-analysis (Rhodes & Anastasi, 2012) found that few studies have focused on facial processing during childhood (Widen & Russell, 2008, 2013), likely because of the lack of data sets of children's facial stimuli.

Evidence indicates that facial emotion recognition (i.e., the ability to recognize emotions on the basis of facial expressions) is present beginning in early childhood and evolves over the years (Farroni, Menon, Rigato, & Johnson, 2007) along with brain maturation (Batty, Meaux, Wittemeyer, Rogé, & Taylor, 2011;

Aline Romani-Sponchiado, Breno Sanvicente-Vieira, Caroline Mottin, Débora Hertzog-Fonini, and Adriane Arteche, Psychology Department, Pontifícal Catholic University of Rio Grande do Sul.

This research report was supported by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES).

Correspondence concerning this article should be addressed to Aline Romani-Sponchiado, Psychology Department, Pontifícal Catholic University of Rio Grande do Sul, Avenue Ipiranga 6681, Building 11, Ninth Floor, Porto Alegre, RS 90619-900, Brazil. E-mail: alineromani@gmail.com

Batty & Taylor, 2006) and experience accumulation (Wright & Sladden, 2003). Ekman et al. (1987) indicated that affective expression and recognition are universal. However, recent reports have questioned the universality of expression components, because of cultural differences (Jack, Garrod, Yu, Caldara, & Schyns, 2012). Moreover, bias has been observed in facial emotion processing, including own-sex bias (McClure, 2000; Wright & Sladden, 2003) and own-culture/race bias (Tuminello & Davidson, 2011). The processing of facial emotions is more accurate when people process ingroup information. Evidence has suggested that children present an own-age bias (Rhodes & Anastasi, 2012), although conflicting findings have been reported (Macchi Cassia, 2011). The own-age bias of the recognition of facial emotions involves experience-dependent learning, suggesting that social interactions allow people to develop more-relevant personal and social schemas for own-age facial emotion processing to better cope with more-recent and significant peer relationships (He, Ebner, & Johnson, 2011; Rhodes & Anastasi, 2012). Language skills are not yet fully developed in childhood, and the first interactions with peers are only in incipient stages. Therefore, nonverbal abilities, including facial emotion recognition, are essential tools for social interactions (Cheal & Rutherford, 2011).

Biasing effects have been noted in the literature on facial emotion processing as a major concern in research that uses samples of children (Rhodes & Anastasi, 2012). Stimulus data sets that are used for facial emotion recognition tasks are often criticized for using pictures of only adults when assessing children. Other limitations include the exclusive use of posed pictures and disregard for cultural differences. Spontaneously delivered facial expressions are more symmetrical than are posed expressions and involve the contraction of more muscles in the regions around the eyes. Reports have indicated that without training, few people can contract some of these muscles, supporting the notion that the observation of these muscles contracting can be used to detect lies (Ekman & O'Sullivan, 1991). Moreover, in everyday life, people are often required to recognize spontaneous facial emotion expressions rather than posed ones, which supports the development of databases that include pictures of spontaneous facial expressions (Kanade, Cohn, & Tian, 2000). Notably, with regard to the intensity of facial expressions, when a person is asked to make a facial expression, such an expression hardly ever has a low or medium intensity. That is, pictures of posed expressions commonly show extremely intense emotional expressions.

In contrast, the intensity of spontaneous expressions varies, the same way people vary their inherent ability to express emotional intensity in their everyday lives (Elfenbein & Ambady, 2002; Motley & Camden, 1988). Moreover, studies on facial emotion recognition should consider different intensities of emotion because subtle differences can be found in less-intense expressions but not in prototypically intense expressions (Elfenbein & Ambady, 2002). Although pictures of posed expressions are useful for measuring facial emotion recognition, spontaneous stimuli have more construct and ecological validity (Motley & Camden, 1988; Russell, 1994).

Facial Emotion Recognition Data Sets

Given that a number of researchers assume that facial emotion recognition exhibits cross-cultural homogeneity, some studies have applied experimental tasks that consist of photographs of actors or nonprofessional people who portray facial expressions (Batty et al., 2011; Deeley et al., 2008). However, the results of these studies, which presented effects of bias and limitations in picture quality, led to an upgrade of methodological techniques, and standardized sets of facial emotions were developed, including the Pictures of Facial Affect (PFA; Ekman & Friesen, 1976), which is the most widely used database. The PFA database is composed of 110 black-and-white photographs of five male and six female Caucasian professional actors who display six spontaneous, high-intensity, basic emotions (happiness, sadness, anger, fear, disgust, and surprise) plus a neutral face (Ekman & Friesen, 1976). Subsequently, Matsumoto and Ekman (1988) sought to fill the ethnic gap by developing the Japanese and Caucasian Facial Expressions of Emotion (JACFEE) and Neutral Faces (JACNeuF). This database comprises 56 photos of two men and two women of either Japanese or Caucasian descent.

The PFA database has brought huge contributions to the facial emotion–processing field. To ensure a higher quality set of stimuli with a greater number of pictures, Ekman and Friesen (1978) developed the Facial Action Coding System (FACS), which has a coding system that maps muscular activity that produces changes in facial expressions and combines them to determine which emotion is being expressed. This system was subsequently updated (Ekman, Friesen, & Hager, 2002), and other high-quality stimulus data sets have been developed for facial emotion recognition tasks, such as the Karolinska Directed Emotional Faces (KDEF) data set (Calvo & Lundqvist, 2008) and the NimStim set of facial expressions (Tottenham et al., 2009). Gur et al. (2002) created a variation of the standard databases by collecting three-dimensional color photographs (posed and evoked) of a sample of 139 actors of both sexes (10–85 years old) and a vast ethnic background (91 Caucasian, 32 African American, six Asian, and 10 Hispanic) who express six basic emotions plus a neutral face at three levels of intensity (low, medium, and high).

Despite the striking relevance of stimulus sets of children's faces, to the best of our knowledge only a few such stimulus sets have been developed, and not all of them are openly available. Among the stimulus sets of children's faces, the National Institute of Mental Health Child Emotional Faces Picture Set (NIMH-ChEFS; Egger et al., 2011) consists of 482 high-resolution color pictures of child actors (10–17 years old). The children display expressions of fear, anger, happiness, sadness, and neutrality in two eye gaze conditions (direct and averted). However, this database is composed mostly of adolescents who do not express disgust or surprise. Therefore, the NIMH-ChEFS database is incomplete for use in studies on facial emotion processing in children. Another stimulus set of children's faces is the recently published Dartmouth Database of Children's Faces (DDCF; Dalrymple, Gomez, & Duchaine, 2013), which includes a large data set of photographs of 40 male and 40 female children (6–16 years old) who display eight posed expressions (they express contempt and neutrality in addition to the six basic emotions). Other stimulus sets of children's faces have been cited in previous studies (e.g., Reconnaissance des Emotions Faciales pour Enfants [TREFE]; Golouboff et al., 2008), but they are not publicly available and have been used by only the research groups that developed the data sets.

The present study sought to fill the gap in facial emotion recognition research by developing the Child Emotions Picture Set (CEPS). The CEPS consists of both posed and spontaneous facial emotions of Brazilian boys and girls (6–11 years old). It was designed to include pictures of the six basic emotions (happiness, sadness, anger, disgust, fear, and surprise) at three intensities (low, medium, and high) plus neutrality.

Method

This work was conducted in accordance with previous studies describing procedures that are assumed to be gold standards for the construction of databases of facial expressions of emotions (e.g., Tottenham et al., 2009). Three steps were followed: (a) image acquisition, (b) selection of photographs, and (c) expert ratings of the pictures.

Image Acquisition

Participants. Participants were contacted through associated researchers, using a snowball method (Heiman, 2002). Photographs were taken of 18 participants (nine boys and nine girls) who were split into three age groups: 6–7 years old ($n = 6$; mean age = 6.93, $SD = 0.3$), 8–9 years old ($n = 6$; mean age = 9.12, $SD = 0.57$), and 10–11 years old ($n = 6$; mean age = 10.72, $SD = 0.61$). The 6- to 11-year-old age range was used for two reasons. First, we were interested in studying school-age children, who are beginning to apply their cognitive skills to develop and maintain solid peer relationships. Second, we expected the children to be sufficiently literate to fully understand facial emotion recognition. The age groups were determined on the basis of inclusion criteria for school grades in Brazil, given that it is more likely for children to interact with same-grade peers.

On the basis of facial features, 77.78% ($n = 14$) of the children were Caucasian, 16.67% ($n = 3$) were Afro-American, and 5.56% ($n = 1$) were indigenous. The study was approved by the Ethics Research Committee of the Pontifícal Catholic University of Rio Grande do Sul, Porto

Alegre, RS, Brazil. All of the participants and their guardians provided written informed consent before image acquisition.

Procedures and stimuli. We took photographs of spontaneous and posed facial expressions. All of the procedures began with spontaneous pictures. The participants were seated approximately 60 cm from a 14.7-in. Dell Inspiron computer monitor. A Sony AVCHD Handycam was used to record the images. Natural expressions were obtained while the participants watched short video scenes or movies that were in the public domain on YouTube; video scenes and movies were presented using Microsoft Windows Media Player. Considering the absence of a validated emotion induction video database in Brazil, the videos were selected by a panel of health professionals with expertise in child development. The videos were the following: (a) happiness (scene of the *Chaves* series, in which characters are in an arithmetic class and funny situations occur), (b) fear (scene from the movie *Paranormal Activity*, in which two children are in a bedroom and objects begin to move on their own; at the end of the video clip, to neutralize negative emotions, a dog that is playing with a blanket appears, suggesting to the children that the dog caused the objects to start moving), (c) disgust (a cook dirties the food to be served in a restaurant), (d) surprise (images of an optical illusion without sound; subtly, the screen turns black, followed suddenly by a loud scream and a screen with the words *Congratulations! You have won a prize!*), (e) anger and sadness (the participants were asked to think about and ideate a specific experience that aroused the stated emotion in their past life), (f) a neutral feeling (a documentary about plants). An external committee of health professionals who work with children selected the videos subjectively on the basis of their experience.

Anger and sadness can be induced by videos, but the first two participants refused to watch these videos, and another participant did not show facial expressions. Therefore, for ethical reasons, we did not use videos to elicit anger or sadness. To elicit these facial expressions, we used, on the basis of Coan and Allen (2007), a secondary well-known method that requested the participants to think about situations in their life.

Spontaneous emotion induction has an inherent limitation because such emotions are by and large subjective. To minimize this limitation, after presenting the stimuli we asked participants to indicate which emotion they felt (i.e., "What did you feel?"). The participants were then asked to pose the very same expression (i.e., "Can you make a face of this feeling?"). To produce the facial expression at different intensities, we used as examples NimStim stimuli from Gao and Maurer (2010) and Tottenham et al. (2009). Children were shown pictures of different intensities of emotion and asked to mimic each intensity. After photographs of posed expressions were taken, the children were asked to say whether they agreed that their face represented the emotion they intended to display. At the end of this process, a neutral scene was shown to defuse the emotions (see Figure 1).

Image Selection and Processing

Initially, the best frames representing the target expressions of both the natural and posed emotions were selected on the basis of (a) child agreement that his or her face depicted the target emotion, (b) direction of the eyes at the moment the picture was taken, and (c) subjective sharpness and contrast (or gamma) assessments that were performed to select the best pictures for editing. In the selected pictures, the children should have been looking at the camera or close to it. All of the images of the children who were looking in different directions or whose eyes were not focused on the camera were discarded. Frames that children reported to express an emotion other than the target emotion were excluded. After selection, the pictures were converted to black and white. The selected pictures were edited in 300 $\times$ 300 pixel resolution (100 dpi). An example of a picture after editing is shown in Figure 2.

Experts' Ratings

To select stimuli for the final database, 30 psychologists with experience in child development and certified in Ekman SETT 3.0 software (www.paulekman.com; 80% minimum accuracy) labeled the photos. Ekman SETT 3.0 software is the only online software that is available for this purpose and is the gold standard. The raters were divided into six groups of five

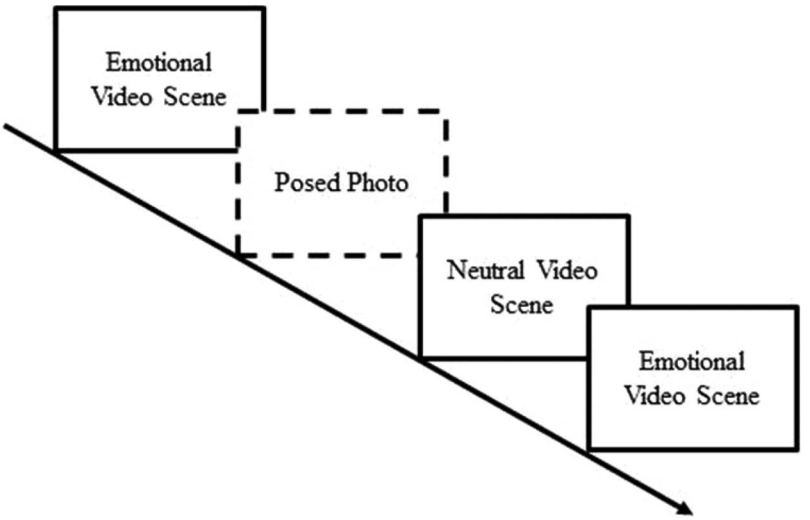

Figure 1. Order of stimuli presentation.

judges each, and the database was split into five versions with 50 pictures and one version with 23 pictures. Each group of raters received one version of the database. Pictures were presented with online SurveyMonkey software (www.surveymonkey.com), and the raters were asked to label each picture with an emotion and intensity using a forced-choice method (see Figure 3). After the experts made their ratings, pictures with ≥60% agreement for both emotion and intensity were considered eligible for inclusion in the data set.

Data Analysis

Initially, the ratings of the judges for all of the pictures that were included in the data set were computed. Images with less than 60% agreement were excluded. Descriptive statistics were used to analyze age, sex, emotion, intensity, and whether the depicted emotion was spontaneous or posed, and the reliability of the retained frames was computed. We calculated Fleiss's kappa interrater agreement by considering the raters as divided into six groups. The mean Fleiss's kappa value was also calculated by considering spontaneous and posed pictures and by considering pictures of different emotions. Because of the reduced number of stimuli, we could not calculate this value for all intensities or for spontaneous and posed pictures of each emotion. In such cases, the small number of observations and high concordance indices become intractable for calculating kappa values. A similar problem was reported by Tottenham et al. (2009). The proportion of spontaneous versus posed pictures that were included in the final data set was compared using the chi-square test.

Results

Image Acquisition

At the end of image acquisition procedures, a total of 717 pictures were obtained (330 spontaneous and 387 posed). One participant was excluded because he refused to have pictures taken of him, although he previously agreed to participate in the study. Spontaneous pictures of angry faces were more difficult to obtain than were pictures of all other emotions. Of the initial pictures, 444 were excluded (103 because the emotions the children felt or posed were different from the target emotions, 127 because the child was not looking at the camera, and 214 because image quality was poor). Considering the total number of photos that were initially taken, the final images that were selected for editing (273) included significantly more posed pictures than spontaneous pictures (163 vs. 110, respectively), $\chi^2(2) = 5.83$, $p = .015$. The inclusion of more photos of posed expressions

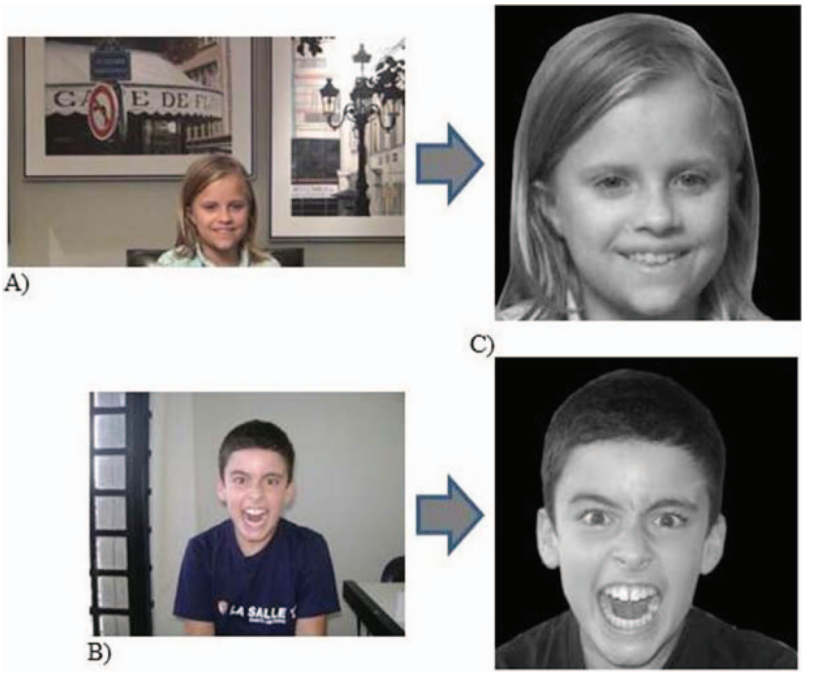

Figure 2. Photo editing. (A) Natural expression. (B) Posed expression. (C) Edited photos. All individuals whose faces appear in the Child Emotions Picture Set, including the two in this figure, gave consent for their likeness to be published in this article. See the online article for a color version of this figure.

was expected because spontaneous pictures were obtained from videos; thus, the children were more likely to move their heads while expressing the emotions or look in different directions (i.e., away from the camera).

Experts' Ratings

The percentage of raters who judged each of the seven emotions in the three intensity categories for each photograph was calculated. Of the 273 pictures that were rated, 48 were excluded because the percentage of agreement was less than 60%. Twenty-seven pictures mismatched the target emotion (i.e., the judges attributed a different emotion than the one that was initially intended). Twenty-one pictures mismatched the target intensity and were excluded. Of the excluded pictures, 20 were spontaneous and 28 were posed, revealing that the raters had more agreement with labeling emotions and intensities for spontaneous expressions than for posed expressions, but the difference in this proportion was not statistically significant, $\chi^2(2) = .045$, $p = .83$. No significant differences in sex, age, or ethnicity were found between the retained and excluded pictures.

The final version of the data set consisted of 225 pictures of eight boys and nine girlswho posed six emotions at three intensities and neutrality (see Table 1). Of the 225 pictures, 90 (40%) were naturally expressed, and 135 (60%) were posed. Among the included pictures, 146 were of Caucasian children, and 79 were of children of different ethnic groups.

The average agreement between judges was 85.06%. Table 2 shows the rates of agreement for the pictures for each emotion and intensity. We also calculated Fleiss's kappa interrater values and the mean concordance across stimuli, considering posed and spontaneous pictures and different emotions. Overall, the agreement between judges was strong across the groups of judges (mean kappa for all stimuli that were included in the database = .71, $SE = .01$). The mean Fleiss's kappa values for only posed pic-

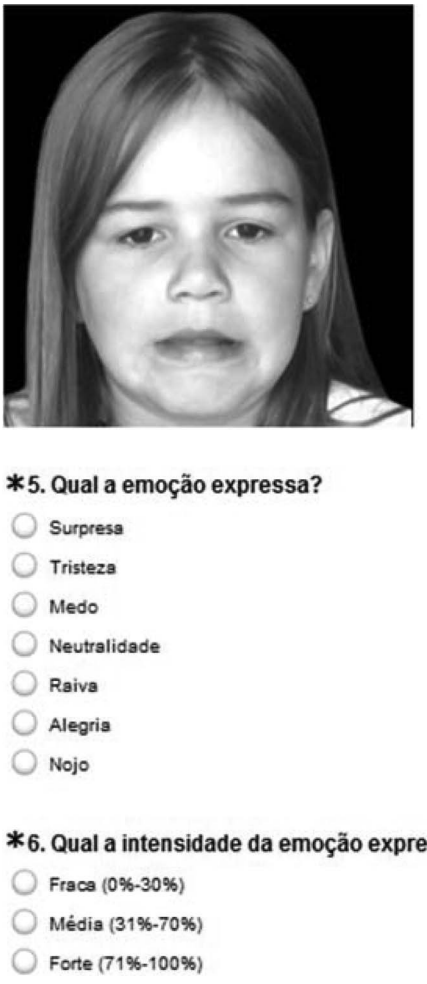

Figure 3. Picture ratings. The figure shows an example of an image and options that were presented to the raters. The photo appeared first, followed by the question "What emotion is being expressed?" The options were *Surprise, Sadness, Fear, Neutrality, Anger, Happiness, Disgust.* The next question asked "What is the intensity of the emotion?" The options were *Low (0%–30%), Medium (31%–70%), High (71%–100%).* All individuals whose faces appear in the Child Emotions Picture Set, including the one in this figure, gave consent for their likeness to be published in this article.

tures (M = .72, SE = .01) and spontaneous pictures (M = .68, SE = .01) were substantial. We also computed agreement across different emotions. The mean Fleiss's kappa value for pictures of faces that expressed happiness (M = .9, SE = .02) was nearly 100%. For anger (M = .72, SE = .03), surprise (M = .73, SE = .02), disgust (M = .66, SE = .03), and neutrality (M = .69, SE = .03), the kappa values were good. For sadness (M = .60, SE = .02) and fear (M = .59, SE = .03), the kappa values were moderate (Fleiss, Levin, & Paik, 2003). Examples of pictures of each emotion and intensity are shown in Figure 4.

Discussion

The main objective of this article was to present the development of the CEPS, a data set of facial expressions of emotions in children 6–11 years of age. We acquired images of facial expressions in children and determined the appropriate labels of emotions and intensities. The work included image acquisition, selection, and editing, followed by evaluation by a panel of experts. The final version of the CEPS consists of 225 photos of 17 children, both boys and girls (6–11 years old) from multiracial backgrounds who posed or naturally expressed six basic emotions (happiness, sadness, anger, fear, disgust, and surprise) at three intensities (low, medium, and high) and neutrality. Development

Table 1
Number of Images per Emotion Category by Sex

Emotion and intensity	Boys	Girls
Anger		
Low	3	3
Medium	3	3
High	10	8
Disgust		
Low	1	2
Medium	9	6
High	3	10
Fear		
Low	1	1
Medium	8	5
High	3	2
Happiness		
Low	8	8
Medium	7	15
High	11	7
Sadness		
Low	7	2
Medium	5	8
High	6	5
Surprise		
Low	2	2
Medium	5	6
High	6	10
Neutral	9	15

of the data set was performed in accordance with that for previous data sets of pictures of facial emotions, including pictures of different genders and ethnicities and of both spontaneous and posed emotions at different intensities. The CEPS makes a contribution to the scientific community by providing a data set of pictures of facial emotions in children, which has been a major limitation in neuroscientific research. The data set is available at no cost to the scientific community upon request from the authors of the present work.

Developmental and psychiatric research has recently focused on different psychological abilities that are involved in processing social information, including facial emotion recognition and theory of mind (i.e., the ability to interpret others' mental states, thoughts, beliefs, and intentions; Adolphs, 2009). The interest in investigating such abilities at early developmental stages arises from theories and preliminary findings that indicate that impairments in understanding social information (particularly

Table 2
Interrater Agreement on Emotional Expression by Category

Emotion and intensity	Average agreement (%)	Spontaneous emotion (*n*)	Posed emotion (*n*)
Anger			
Low	73.33	1	5
Medium	93.33	1	5
High	91.11	1	17
Disgust			
Low	73.33	1	2
Medium	86.67	5	10
High	78.46	5	8
Fear			
Low	60.00	1	1
Medium	75.38	5	8
High	76.00	0	5
Happiness			
Low	91.25	11	5
Medium	96.36	10	12
High	100.00	10	8
Sadness			
Low	71.11	4	5
Medium	81.53	6	7
High	85.45	7	4
Surprise			
Low	80.00	3	1
Medium	81.81	5	6
High	81.25	3	13
Neutral	79.17	10	14

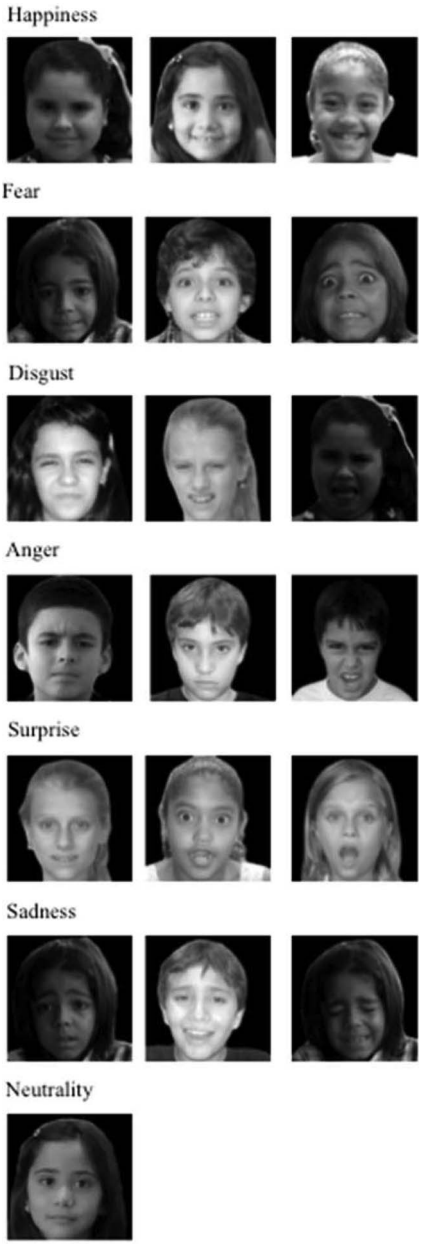

Figure 4. Examples of images from the Child Emotions Picture Set (CEPS). For each emotion set, from left to right the images convey low, medium, and high expressions of that emotion, respectively. All individuals whose faces appear in the Child Emotions Picture Set, including those in this figure, gave consent for their likeness to be published in this article.

emotional information) lead to a reduction of well-being, an inability to maintain good relationships, and vulnerability to mental disorders (Adolphs, 1999, 2009; Arsalidou, Morris, & Taylor, 2011; Baron-Cohen, Leslie, & Frith, 1985; Frith & Frith, 2012; Martins-Junior, Sanvicente-Vieira, Grassi-Oliveira, & Brietzke, 2011). However, the assessment of such abilities has long been a matter of concern for researchers (Calvo & Lundqvist, 2008; Egger et al., 2011; Gur et al., 2002; Harrington, Siegert, & McClure, 2005; Martins-Junior et al., 2011). Particularly regarding facial emotion processing, there has been a dearth of data sets to investigate this topic, which was previously noted by the NIMH (Egger et al., 2011). Moreover, despite the availability of data sets of pictures of facial emotions in children, they have limitations that deserve attention, including the exclusive inclusion of posed pictures, lack of multiracial pictures, absence of reliability or validity assessments, and unavailability of the data sets for free.

The CEPS is composed of posed and naturally expressed emotions, in contrast to the case with most databases, which used mainly professional actors who posed the emotions (Calvo & Lundqvist, 2008; Ekman & Friesen, 1976; Tottenham et al., 2009). Evidence indicates that spontaneous and posed emotions are different (Ekman & Friesen, 1975; Ekman & O'Sullivan, 1991). Although it is possible to correctly label the emotion that is expressed in a posed picture, raters are more likely to judge a posed expression as fake, masked, or suppressed, which can make facial emotion recognition difficult (McLellan, Wilcke, Johnston, Watts, & Miles, 2012). Consistent with assumptions about differences regarding spontaneous and posed expressions, the CEPS includes both posed and spontaneous emotions. Moreover, the CEPS was designed to be used in different emotional processing studies. Therefore, by including posed and spontaneous pictures, we allow researchers to investigate, for example, the detection of genuine and fake expressions of emotion.

The images that were selected for inclusion in the CEPS were rated by trained raters using SETT 3.0 software, which is a standard for training facial emotion recognition (Ekman & Friesen, 1978). We required that the raters achieve a minimum of 80% accuracy on the SETT 3.0 to provide uniformity among the raters. Moreover, we calculated interrater kappa coefficients, the values of which supported high concordance among the judges. The interrater kappa coefficients indicated high agreement among the experts according to criteria determined by Fleiss et al. (2003) for interrater reliability.

The present study has some limitations that should be mentioned. Some pictures were excluded for different reasons. For example, the children who participated in image acquisition were not actors. Some of them affirmed that they could not do everything that was expected of them (e.g., wrinkling the nose or raising and straightening the eyebrows). Nevertheless, some studies have indicated that such abilities develop before adolescence, and children can satisfactorily mimic emotions (e.g., Gosselin & Larocque, 2000). Moreover, it has been assumed that emotional processing evolves throughout development. Children may have difficulty correctly labeling emotions (Denham et al., 2012). After each picture was taken, we asked the children to say which emotion they felt or posed. If the emotion that was stated by the child was not the target emotion, then the picture was excluded. Several photos were also excluded because the children were not looking at the camera. Despite our use of a different methodology, functional magnetic resonance imaging studies also often mention motion problems when working with children (Yerys et al., 2009). Another limitation of the present study concerns problems associated with the induction of emotions. We could not ensure that the target emotion was actually the induced emotion. As mentioned previously, we questioned the children about which emotions they felt/mimicked to minimize this problem. Additionally, we did not use the same emotion induction method for all of the emotions. For example, because some participants might refuse to watch videos that display angry or sad content or might not display facial reactions to those videos, for ethical reasons we chose a second well-known method for inducing these emotions, which consisted of asking the children to think about situations that elicit sadness or anger. A further limitation of the present study was that some of the steps involved in image selection (i.e., analyses of the gaze direction at the moment the photo was taken and image quality) were not performed in a double-blinded manner. Yet another limitation was sub-

jectivity. The authors and experienced collaborators suggested which videos to present to the children. The results support the partial efficacy of the videos that were selected because several, albeit not all, spontaneous expressions were obtained. Another limitation was that all of the participants were originally from southern Brazil, which did not allow the inclusion of a variety of facial features, particularly those of Caucasian participants. The effects of ingroup cultural bias may also be a limitation. Nonetheless, we successfully developed a data set of pictures of a particular cultural group. Regarding the expert ratings, the compulsory choice design may have biased the choices of the raters because the evaluation did not include the option *the photo does not fit any of the six target emotions or neutrality.* Developers of other picture data sets included *none of the above* as an option (Tottenham et al., 2009) or such variables as "agreement/disagreement rate" and "representativeness" (Egger et al., 2011).

Despite these limitations, the present study has a number of strengths. It provides a complete set of reliable images of six basic emotions at three intensities that were both spontaneously expressed and posed by children. The CEPS contributes to the scientific field by making available a facial emotion data set of children that is intended to be used in further research on emotional processing in children. The CEPS addresses numerous limitations of previous data sets. For example, it contains pictures of both spontaneous and posed emotions at different intensities, and the participants are from a region (i.e., southern Brazil) that is not commonly used in other data sets. The process that was used to develop this database can be used in future research in developmental studies in Brazil, including neuropsychology, psychiatry, and pediatrics, and can foster the development of cross-cultural studies in the field. Such investigations are important for determining differences in social and emotional development and the identification of early signs of deficits in emotional processing.

References

Adolphs, R. (1999). Social cognition and the human brain. *Trends in Cognitive Sciences, 3,* 469–479. http://dx.doi.org/10.1016/S1364-6613(99)01399-6

Adolphs, R. (2009). The social brain: Neural basis of social knowledge. *Annual Review of Psychology, 60,* 693–716. http://dx.doi.org/10.1146/annurev.psych.60.110707.163514

Allott, K. A., Schäfer, M. R., Thompson, A., Nelson, B., Bendall, S., Bartholomeusz, C. F., . . . Amminger, G. P. (2014). Emotion recognition as a predictor of transition to a psychotic disorder in ultra-high risk participants. *Schizophrenia Research, 153,* 25–31. http://dx.doi.org/10.1016/j.schres.2014.01.037

Arsalidou, M., Morris, D., & Taylor, M. J. (2011). Converging evidence for the advantage of dynamic facial expressions. *Brain Topography, 24,* 149–163. http://dx.doi.org/10.1007/s10548-011-0171-4

Baron-Cohen, S., Leslie, A. M., & Frith, U. (1985). Does the autistic child have a "theory of mind"? *Cognition, 21,* 37–46. http://dx.doi.org/10.1016/0010-0277(85)90022-8

Batty, M., Meaux, E., Wittemeyer, K., Rogé, B., & Taylor, M. J. (2011). Early processing of emotional faces in children with autism: An event-related potential study. *Journal of Experimental Child Psychology, 109,* 430–444. http://dx.doi.org/10.1016/j.jecp.2011.02.001

Batty, M., & Taylor, M. J. (2006). The development of emotional face processing during childhood. *Developmental Science, 9,* 207–220. http://dx.doi.org/10.1111/j.1467-7687.2006.00480.x

Benuzzi, F., Zamboni, G., Meletti, S., Serafini, M., Lui, F., Baraldi, P., . . . Nichelli, P. F. (2014). Recovery from emotion recognition impairment after temporal lobectomy. *Frontiers in Neurology, 5*: 92. http://dx.doi.org/10.3389/fneur.2014.00092

Calvo, M. G., & Lundqvist, D. (2008). Facial expressions of emotion (KDEF): Identification under different display-duration conditions. *Behavior Research Methods, 40,* 109–115. http://dx.doi.org/10.3758/BRM.40.1.109

Cheal, J. L., & Rutherford, M. D. (2011). Categorical perception of emotional facial expressions in preschoolers. *Journal of Experimental Child Psychology, 110,* 434–443. http://dx.doi.org/10.1016/j.jecp.2011.03.007

Coan, J. A., & Allen, J. J. B. (2007). *Handbook of emotion elicitation and assessment*. New York, NY: Oxford University Press.

Dalrymple, K. A., Gomez, J., & Duchaine, B. (2013). The Dartmouth Database of Children's Faces: Acquisition and validation of a new face stimulus set. *PLoS ONE, 8*: e79131. http://dx.doi.org/10.1371/journal.pone.0079131

Darwin, C. (1872). *The expression of the emotions in man and animals*. London, United Kingdom: Murray. http://dx.doi.org/10.1037/10001-000

Deeley, Q., Daly, E. M., Azuma, R., Surguladze, S., Giampietro, V., Brammer, M. J., . . . Murphy, D. G. (2008). Changes in male brain responses to emotional faces from adolescence to middle age.

NeuroImage, 40, 389–397. http://dx.doi.org/10.1016/j.neuroimage.2007.11.023

Denham, S. A., Bassett, H. H., Way, E., Mincic, M., Zinsser, K., & Graling, K. (2012). Preschoolers' emotion knowledge: Self-regulatory foundations, and predictions of early school success. *Cognition and Emotion, 26,* 667–679. http://dx.doi.org/10.1080/02699931.2011.602049

Egger, H. L., Pine, D. S., Nelson, E., Leibenluft, E., Ernst, M., Towbin, K. E., & Angold, A. (2011). The NIMH Child Emotional Faces Picture Set (NIMH-ChEFS): A new set of children's facial emotion stimuli. *International Journal of Methods in Psychiatric Research, 20,* 145–156.

Ekman, P., & Friesen, W. V. (1975). *Unmasking the face: A guide to recognizing emotions from facial clues*. Englewood Cliffs, NJ: Prentice Hall.

Ekman, P., & Friesen, W. V. (1976). *Pictures of facial affect*. Palo Alto, CA: Consulting Psychologists Press.

Ekman, P., & Friesen, W. V. (1978). *Facial action coding system: Investigator's guide*. Palo Alto, CA: Consulting Psychologists Press.

Ekman, P., Friesen, W. V., & Hager, J. C. (2002). *Facial Action Coding System: The manual on CD ROM*. Salt Lake City, UT: A Human Face.

Ekman, P., Friesen, W. V., O'Sullivan, M., Chan, A., Diacoyanni-Tarlatzis, I., Heider, K., . . . Tzavaras, A. (1987). Universals and cultural differences in the judgments of facial expressions of emotion. *Journal of Personality and Social Psychology, 53,* 712–717. http://dx.doi.org/10.1037/0022-3514.53.4.712

Ekman, P., & O'Sullivan, M. (1991). Who can catch a liar? *American Psychologist, 46,* 913–920. http://dx.doi.org/10.1037/0003-066X.46.9.913

Elfenbein, H. A., & Ambady, N. (2002). On the universality and cultural specificity of emotion recognition: A meta-analysis. *Psychological Bulletin, 128,* 203–235. http://dx.doi.org/10.1037/0033-2909.128.2.203

Farroni, T., Menon, E., Rigato, S., & Johnson, M. H. (2007). The perception of facial expressions in newborns. *European Journal of Developmental Psychology, 4,* 2–13. http://dx.doi.org/10.1080/17405620601046832

Fleiss, J. L., Levin, B., & Paik, M. C. (2003). *Statistical methods for rates and proportions* (3rd ed.). Hoboken, NJ: Wiley-Interscience. http://dx.doi.org/10.1002/0471445428

Frith, C. D., & Frith, U. (2012). Mechanisms of social cognition. *Annual Review of Psychology, 63,* 287–313. http://dx.doi.org/10.1146/annurev-psych-120710-100449

Gao, X., & Maurer, D. (2010). A happy story: Developmental changes in children's sensitivity to facial expressions of varying intensities. *Journal of Experimental Child Psychology, 107,* 67–86. http://dx.doi.org/10.1016/j.jecp.2010.05.003

Golouboff, N., Fiori, N., Delalande, O., Fohlen, M., Dellatolas, G., & Jambaqué, I. (2008). Impaired facial expression recognition in children with temporal lobe epilepsy: Impact of early seizure onset on fear recognition. *Neuropsychologia, 46,* 1415–1428. http://dx.doi.org/10.1016/j.neuropsychologia.2007.12.019

Gosselin, P., & Larocque, C. (2000). Facial morphology and children's categorization of facial expressions of emotions: A comparison between Asian and Caucasian faces. *The Journal of Genetic Psychology: Research and Theory on Human Development, 161,* 346–358. http://dx.doi.org/10.1080/00221320009596717

Gur, R. C., Sara, R., Hagendoorn, M., Marom, O., Hughett, P., Macy, L., . . . Gur, R. E. (2002). A method for obtaining 3-dimensional facial expressions and its standardization for use in neurocognitive studies. *Journal of Neuroscience Methods, 115,* 137–143. http://dx.doi.org/10.1016/S0165-0270(02)00006-7

Harrington, L., Siegert, R. J., & McClure, J. (2005). Theory of mind in schizophrenia: A critical review. *Cognitive Neuropsychiatry, 10,* 249–286. http://dx.doi.org/10.1080/13546800444000056

He, Y., Ebner, N. C., & Johnson, M. K. (2011). What predicts the own-age bias in face recognition memory? *Social Cognition, 29,* 97–109. http://dx.doi.org/10.1521/soco.2011.29.1.97

Heiman, G. (2002). *Research methods in psychology* (3rd ed.). Boston, MA: Houghton Mifflin.

Jack, R. E., Garrod, O. G., Yu, H., Caldara, R., & Schyns, P. G. (2012). Facial expressions of emotion are not culturally universal. *PNAS Proceedings of the National Academy of Sciences of the United States of America, 109,* 7241–7244. http://dx.doi.org/10.1073/pnas.1200155109

Kanade, T., Cohn, J., & Tian, Y. (2000). Comprehensive database for facial expressions analysis. In *Proceedings of the Fourth IEEE International Conference on Automatic Face and Gesture Recognition* (pp. 46–53). Washington, DC: IEEE Computer Society.

Kessels, R. P., Montagne, B., Hendriks, A. W., Perrett, D. I., & de Haan, E. H. (2014). Assessment of perception of morphed facial expressions using the Emotion Recognition Task: Normative data from healthy participants aged 8–75. *Journal of Neuropsychology, 8,* 75–93. http://dx.doi.org/10.1111/jnp.12009

Macchi Cassia, V. (2011). Age biases in face processing: The effects of experience across development. *British Journal of Psychology, 102,* 816–829. http://dx.doi.org/10.1111/j.2044-8295.2011.02046.x

Martins-Junior, F. E., Sanvicente-Vieira, B., Grassi-Oliveira, R., & Brietzke, E. (2011). Social cogni-

tion and theory of mind: Controversies and promises for understanding major psychiatric disorders. *Psychology & Neuroscience, 4,* 347–351. http://dx.doi.org/10.3922/j.psns.2011.3.008

Matsumoto, D., & Ekman, P. (1988). *Japanese and Caucasian Facial Expressions of Emotion (JACFEE) and Neutral Faces (JACNeuF)*. San Francisco, CA: San Francisco State University.

McClure, E. B. (2000). A meta-analytic review of sex differences in facial expression processing and their development in infants, children, and adolescents. *Psychological Bulletin, 126,* 424–453. http://dx.doi.org/10.1037/0033-2909.126.3.424

McLellan, T. L., Wilcke, J. C., Johnston, L., Watts, R., & Miles, L. K. (2012). Sensitivity to posed and genuine displays of happiness and sadness: A fMRI study. *Neuroscience Letters, 531,* 149–154. http://dx.doi.org/10.1016/j.neulet.2012.10.039

Motley, M. T., & Camden, C. T. (1988). Facial expression of emotion: A comparison of posed expressions versus spontaneous expressions in an interpersonal communication setting. *Western Journal of Speech Communication, 52,* 1–22. http://dx.doi.org/10.1080/10570318809389622

Rhodes, M. G., & Anastasi, J. S. (2012). The own-age bias in face recognition: A meta-analytic and theoretical review. *Psychological Bulletin, 138,* 146–174. http://dx.doi.org/10.1037/a0025750

Russell, J. A. (1994). Is there universal recognition of emotion from facial expression? A review of the cross-cultural studies. *Psychological Bulletin, 115,* 102–141. http://dx.doi.org/10.1037/0033-2909.115.1.102

Sachse, M., Schlitt, S., Hainz, D., Ciaramidaro, A., Walter, H., Poustka, F., . . . Freitag, C. M. (2014). Facial emotion recognition in paranoid schizophrenia and autism spectrum disorder. *Schizophrenia Research, 159,* 509–514. http://dx.doi.org/10.1016/j.schres.2014.08.030

Tottenham, N., Tanaka, J. W., Leon, A. C., McCarry, T., Nurse, M., Hare, T. A., . . . Nelson, C. (2009). The NimStim set of facial expressions: Judgments from untrained research participants. *Psychiatry Research, 168,* 242–249. http://dx.doi.org/10.1016/j.psychres.2008.05.006

Tuminello, E. R., & Davidson, D. (2011). What the face and body reveal: In-group emotion effects and stereotyping of emotion in African American and European American children. *Journal of Experimental Child Psychology, 110,* 258–274. http://dx.doi.org/10.1016/j.jecp.2011.02.016

van Rijn, S., Aleman, A., de Sonneville, L., Sprong, M., Ziermans, T., Schothorst, P., . . . Swaab, H. (2011). Misattribution of facial expressions of emotion in adolescents at increased risk of psychosis: The role of inhibitory control. *Psychological Medicine, 41,* 499–508. http://dx.doi.org/10.1017/S0033291710000929

Widen, S. C., & Russell, J. A. (2008). Children acquire emotion categories gradually. *Cognitive Development, 23,* 291–312. http://dx.doi.org/10.1016/j.cogdev.2008.01.002

Widen, S. C., & Russell, J. A. (2013). Children's recognition of disgust in others. *Psychological Bulletin, 139,* 271–299. http://dx.doi.org/10.1037/a0031640

Wright, D. B., & Sladden, B. (2003). An own gender bias and the importance of hair in face recognition. *Acta Psychologica, 114,* 101–114. http://dx.doi.org/10.1016/S0001-6918(03)00052-0

Yerys, B. E., Jankowski, K. F., Shook, D., Rosenberger, L. R., Barnes, K. A., Berl, M. M., . . . Gaillard, W. D. (2009). The fMRI success rate of children and adolescents: Typical development, epilepsy, attention deficit/hyperactivity disorder, and autism spectrum disorders. *Human Brain Mapping, 30,* 3426–3435. http://dx.doi.org/10.1002/hbm.20767

Received September 30, 2014
Revision received May 28, 2015
Accepted July 18, 2015 ■