

Identification of degrees of anxiety in children with three- and five-face facial scales

Juan Manuel Ortigosa Quiles¹, Gloria García-Banda García², Karin Chellew², Esperança Ponsell Vicens², Antonio Riquelme Marín¹ and María Pilar Nicolás Carrasco¹

¹ Universidad de Murcia and ² Universidad de las Islas Baleares

Abstract

Background: Facial scales are used in the assessment of emotional states. The scales present different numbers of faces to measure the varying levels of intensity of children's emotional responses. This paper seeks to analyze whether the subjects are able to match the appropriate descriptors of a degree of anxiety with the corresponding facial image. **Method:** A sample of 463 children aged 6 to 12 years was taken from the Autonomous Communities of Murcia and the Balearics. **Results:** Significant differences were obtained among the six-year-olds, $M = 2.58$ ($SD = 0.85$), in the three-face scale and $M = 2.98$ ($SD = 1.52$) in the five-face scale. From 7 years on, there were no significant differences in the number of correct responses between the two scales. In general, girls scored higher than boys on both the three-face scale ($M = 2.89$, $SD = 0.50$ vs. $M = 2.75$, $SD = 0.70$) and the five-face scale ($M = 4.08$, $SD = 1.41$ vs. $M = 3.76$, $SD = 1.56$). **Conclusion:** The three-face scale is more appropriate for the correct matching of descriptors to different degrees of anxiety for children aged 6 to 12 years, whereas the five-face scale is more suited to children over 6 years.

Keywords: Age, anxiety, assessment, children, faces, facial affective scale (FAS), hospital.

Resumen

Identificación de grados de ansiedad en niños con escalas faciales de tres y cinco caras. **Antecedentes:** las escalas faciales son utilizadas para la evaluación de los estados emocionales. Estas escalas presentan un número diferente de caras para medir diferentes niveles de intensidad de la respuesta emocional infantil. El propósito del presente estudio es conocer si los participantes son capaces de hacer coincidir los descriptores vinculados al grado de ansiedad con su correspondiente imagen facial. **Método:** se reclutó una muestra de 463 niños y niñas de 6 a 12 años de edad procedentes de las comunidades de Murcia e Islas Baleares. **Resultados:** se obtuvieron diferencias significativas en los participantes de seis años con $M = 2.58$ ($DT = .85$) en la escala de tres caras y $M = 2.98$ ($DT = 1.52$) en la escala de cinco caras. A partir de los siete años no hay diferencias significativas en los aciertos si utilizan la escala de tres o la de cinco caras. En general, las niñas tienen un mayor acierto que los niños en la escala de tres caras ($M = 2.89$, $DT = .50$ y $M = 2.75$, $DT = .70$) y en la de cinco ($M = 4.08$, $DT = 1.41$ y $M = 3.76$, $DT = 1.56$). **Conclusiones:** la escala de tres caras es más apropiada para discriminar correctamente descriptores vinculados a diferentes grados de ansiedad por niños de 6 a 12 años, mientras que la escala de cinco caras para niños mayores de seis años.

Palabras clave: ansiedad, caras, edad, evaluación, facial affective scale (FAS), hospital, niños.

Measuring anxiety in children remains a problematic issue due to the difficulty in their self-reporting at that age. The reasons are: cognitive development, which means that it is difficult to understand the construct being evaluated; the capacity to internalize, which complicates discrimination between different emotions; the ability to rate the intensity of the emotional manifestation. As well as these, there is the matter of methodological questions, that is, a lack of valid, reliable tests of the success of new instruments used with small children (Sadhasivam et al., 2010).

As anxiety has a subjective component, it is advisable to obtain a self-report on the child's perception of a response, and

again, this is no easy task in the case of very small children. Many questionnaires with suitable psychometric properties for this age group are in use (ASI, *Anxiety Sensitivity Index*; Peterson & Reiss, 1992; Spanish version, Sandín, Chorot, Valiente, Santed, & Lostao, 2004; SCAS, *Spence Children's Anxiety Scale*; Spence, 1998; Catalan version, Tortella-Feliu, Servera, Balle, & García de la Banda, 2005; Spanish version, Godoy, Gavino, Carrillo, Cobos, & Quintero, 2011; IAE, *Inventario de Ansiedad Escolar* by García-Fernández, Inglés, Martínez-Monteaudo, Marzo, & Estévez, 2011; STAIC, *State-Trait Anxiety Inventory for Children*; Spielberger, 1983; Spanish version, Seisdedos, 1990). However, all these instruments require time and effort, which can sometimes impede valid, reliable application (Schisler, Lander, & Fowler-Kerry, 1998), as occurs with hospitalized children undergoing invasive medical procedures.

Psychological evaluation in the hospital presents several difficulties, some proper to the scenario itself and others common to infant-juvenile evaluation: (a) only short evaluation periods

are available, (b) a developmental focus has to be adhered to when selecting the evaluation tool, (c) specific evaluation tests are required, and (d) the evaluation tests must be attractive to the child (Quiles & Pedroche, 2000). To this, we would add the child's previous familiarity with the test.

One psychological evaluation tool for use in hospital environments is the visual analog scale in numerical format (Bringuier et al., 2009; Crandall, Lammers, Senders, Saavedra, & Braun, 2007), or in graphic form with colored or facial scales (Abu-Saad & Holzemer, 1981; Hicks, von Baeyer, Spafford, van Korlaar, & Goodenough, 2001; McGrath et al., 1996; Meisel et al., 2010; Miró, Huguet, Nieto, Paredes, & Baos, 2005; Quiles, vander Hofstadt, & Quiles, 2004; Stinson, Kavanagh, Yamada, Gill, & Stevens, 2006). Facial scales start from common conceptual base but they present differences in format according to the number of faces included (from 3 to 9 faces), the elements of expression (forehead, eyebrows, eyelids, number of tears and mouth) and the orientation (horizontal or vertical) (Salas, Gabaldón, Mayoral, & Amayra, 2002).

According to Méndez (1999), the use of a scale of drawings, materials or gesture helps small or disabled children to score an emotional state numerically. These scales, also known as single item scales, usually include instructions for the child to choose from a series of graded responses using adverbs of intensity, frequency, duration or probability which allow the child to value the magnitude of his or her emotional state. The evaluator then translates the child's response to a numerical scale in order to give a score to the choice.

Whereas there has been a number of works on validation and application of facial scales that measure the intensity of pain in various medical conditions (Chambers, Hardial, Craig, Court, & Montgomery, 2005; Goodenough et al., 1997; Tomlinson, von Baeyer, Stinson, & Sung, 2010), the same does not hold for measures of anxiety response in the face of medical procedures, even though this is one of the most described responses and among the most used in empirical studies (Bringuier et al., 2009; Buchanan & Niven, 2002; Kain, Mayes, O'Connor, & Cicchetti, 1996; Teichman, Ben Rafael, & Lerman, 1986; Tiedeman & Clatworthy, 1990).

The Facial Affective Scale (FAS) was designed by McGrath to evaluate not just the *pain intensity*, but also the *discomfort* associated with pain in children (McGrath et al., 1996). Most studies have used this scale to evaluate pain in this population (Jensen, 2012; St-Laurent-Gagnon, Bernard-Bonnin, & Villeneuve, 1999). Others use the scale to measure both aspects (Page et al., 2012; Perrot, Goodenough, & Champion, 2004). Recent studies, however, have used the FAS to assess only the affective component, understood as both *negative/positive affect* (Affect; Nilsson, Kokinsky, Nilsson, Sidenvall, & Enskar, 2009), and *emotional distress* (Distress; Connelly & Neville, 2010). Thus, we believe that the FAS visual scale could be used to evaluate the degree of child anxiety quickly and reliably.

The main aim here is to adapt and validate a facial scale to measure anxiety in children undergoing medical procedures, and the first work with the multiphase study is presented. This study seeks to determine whether participants are capable of matching the descriptors associated to the degree of anxiety with the corresponding facial image, according to the number of faces presented (three or five), to the quantifiers used (none, a little, some, etc.), and to the age and sex of the participants.

Method

Participants

A sample was taken of 463 school children, 241 boys (52%) and 222 girls (48%) with an average age of 8.82 years ($SD = 1.81$) from the Region of Murcia and the Balearic Islands, in three state schools and in one semi-subsidized school, in urban areas, the majority of middle class social and economic means (73.3% upper middle class and 26.7% lower middle class).

The sample is non-probabilistic (incidental), as the schools chosen were those that had previously expressed interest in collaborating with research groups. Exclusion criteria included difficulties in completing the tasks due to language or cognitive disability.

Instruments

The facial scale used in this study was developed by McGrath et al. (1996) and is known as the Facial Affective Scale (FAS). The FAS comprises nine drawings of children's faces whose expressions vary according to the level of discomfort (Figure 1). Although this scale has been mainly be used to measure pain intensity in children in hospitals it was originally designed to measure their affective discomfort too (associated emotional distress). The original order of the nine faces ranges from a smiling face to a frowning one with eyes closed, wailing and mouth turned down (which shows the highest level of discomfort). Three and five of these faces were chosen for our study. These fulfilled criteria of equidistant progression in the expressive elements of eyebrows, eyelids, tears and smile (so respecting the degree of emotional intensity) (Figure 2).

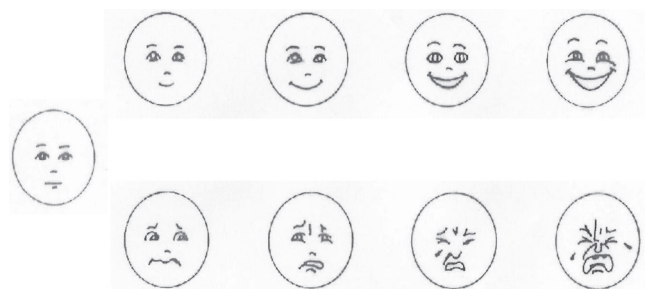


Figure 1. Original nine-face FAS

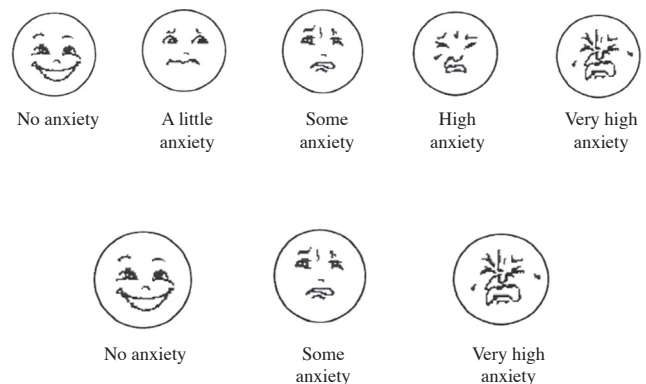


Figure 2. Modified FAS using 5 and 3 faces and their corresponding descriptors

Three and five quantifiers were then selected on the basis of a progressive grading from lower to higher anxiety. The descriptors chosen for the three-face scale were *no anxiety*, *some anxiety*, *high anxiety*, whereas for the five-face scale they were *no anxiety*, *a little anxiety*, *some anxiety*, *high anxiety* and *very high anxiety*.

Two sheets were prepared for classroom application of the task. On each, there was the three- or five-face scale, and at the lower part of the sheet there was a box with the categories of the different degrees of anxiety, randomly distributed.

Procedure

After obtaining permission from the school directors and parents, the tasks were performed with the children during tutorial hours. A protocol was established for the presentation of the sheets and the following instructions were given for the three-face scale: “We have three faces here. We’d like you to choose the word in the box below that you think best describes each face, and write it below that face”. For further clarification the instruction was rephrased: “Decide which of the faces looks the most or least anxious, and use one of the words below to describe them”. The children were then allowed a short time to ask questions and if they asked about the meaning of the word *anxiety*, we explained to all the students that it meant “being nervous” or “being worried.”

After the first task had been performed, we moved on to the five-face scale. The following instructions were given: “Now we have five faces! Again just like before, we’d like you to choose the word in the box below that you think best describes each face, and write it below that face.”

Counterbalancing (randomized presentation of sheets) was used to control for any bias in the order of presentation. Using feedback from the teachers, those pupils who had difficulties in performing the task correctly were allowed to complete them but were not included in the database and therefore were not taken into account in the statistical analysis.

Data analysis

First, the Chi-square test was used to analyze the composition of the sample in terms of age and sex.

It was then tested that the assumptions of homogeneity of variances and normality were fulfilled using the Levene and Kolgomorov-Smirnov tests, respectively, as follows: (a) if fulfilled, a two-factor ANOVA was run with age and sex as independent variables and task performance as the dependent variable 3 and 5 face scale); (b) if the ANOVA assumptions were not fulfilled, the non parametric Kruskal-Wallis *H* and the Mann-Whitney *U*-tests were applied for age and sex, respectively.

If the age factor was statistically significant, the post-hoc multiple comparison of means test was used which, depending on whether or not the assumption of homogeneity of variances was fulfilled, was the Tukey or Games-Howell *T*-test, respectively.

The program used for the analysis was the Statistical Package for the Social Sciences (SPSS), version 18.

Results

Distribution by sex throughout the age groups was homogeneous according to the Chi square test calculated on the corresponding contingency table, $\chi^2(6) = 4.227, p = .300$ (see Table 1). The order

of presentation of the tasks did not significantly affect performance according to the results of the Student T tests (3 faces: $p = .367$; 5 faces: $p = .118$).

Since the Levene and Kolgomorov-Smirnov tests returned statistically significant results, the Kruskal-Wallis test was applied to study the effect of the variable age on the number of correct matchings in both scales. There were differences both in the 3-face, $\chi^2(6) = 13.904, p = .031$, and the five-face scale, $\chi^2(6) = 38.623, p < .001$. Six-year olds scored 86% success in the three –face scale and 57% in the five-face scale.

As age affected the performance outcome in both scales, the Games-Howell test for multiple comparisons was applied to ascertain the direction of this effect, and a statistically significant difference was found between 6-year olds and the other age groups for the 5-face scale (see Tables 2 and 3). Nevertheless, it should be noted that whereas the Kruskal-Wallis test was significant for 3 faces, the post-hoc comparisons with the Games-Howell test revealed no significant differences between 6 year olds and the other ages for this scale.

In the case of the variable sex, the results were analyzed using the nonparametric Mann-Whitney *U*-test, and statistical significance appeared for the 3-faces scale ($Z = -2.362, p = .018$) whereas there was marginal significance for that of 5 faces ($Z =$

Table 1
Sample distribution by age and sex (%)

Age	Sex		Total
	Boy	Girl	
6	34 (14.1%)	26 (11.7%)	60 (13.0%)
7	37 (15.4%)	33 (14.9%)	70 (15.1%)
8	40 (16.6%)	36 (16.2%)	76 (16.4%)
9	32 (13.3%)	45 (20.3%)	77 (16.6%)
10	37 (15.4%)	41 (18.5%)	78 (16.8%)
11	44 (18.3%)	28 (12.6%)	72 (15.6%)
12	17 (7.1%)	13 (5.9%)	30 (6.5%)
Total	241 (100.0%)	222 (100.0%)	463 (100.0%)

Table 2
Means and standard deviations of correct responses in the three and five-face scales, according to age and sex

Age	3 faces			5 faces		
	Boy	Girl	Total	Boy	Girl	Total
	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)
6	2.53 (.86)	2.65 (.85)	2.58 (.85)	2.76 (1.62)	3.27 (1.37)	2.98 (1.52)
7	2.62 (.89)	3.00 (.00)	2.80 (.67)	3.78 (1.57)	4.12 (1.05)	3.94 (1.35)
8	2.68 (.80)	2.94 (.33)	2.80 (.63)	3.55 (1.77)	4.25 (1.25)	3.88 (1.58)
9	2.94 (.35)	2.84 (.60)	2.88 (.51)	4.06 (1.48)	4.38 (1.05)	4.25 (1.25)
10	2.72 (.72)	2.90 (.44)	2.83 (.59)	3.71 (1.53)	3.78 (1.35)	3.79 (1.43)
11	2.91 (.42)	2.89 (.57)	2.90 (.48)	4.27 (1.15)	4.43 (0.92)	4.33 (1.06)
12	2.88 (.49)	3.00 (.00)	2.93 (.37)	4.12 (1.27)	4.23 (1.01)	4.17 (1.15)
Total	2.75 (.70)	2.89 (.50)	2.82 (.62)	3.76 (1.56)	4.08 (1.21)	3.91 (1.41)

-1.774, $p = .076$). In general, girls were more successful than boys in both scales. Specifically, girls scored higher in the 3-face scale at all ages except 9 and 11 years. In contrast, girls performed better than boys in the 5-face scale at all ages except 10 years.

A descriptive analysis of the success rate for both facial scales reveals how boys and girls behave when correctly placing each face in its appropriate category. It was observed that 6-year olds were less effective in grading *no anxiety* (80% correct) and *high anxiety* (81% correct) in the 3-face scale. In the 5-face scale, children of all ages were clearly less effective at grading *some* and *high*, especially the 6-year olds (31.67% and 48.34% correct, respectively).

Table 3
Games-Howell Test for the variable age. Multiple comparisons between six-year-olds and the other ages for the three and five-face scales

Age (years)	3 faces		5 faces	
	Means differences	Sig.	Means differences	Sig.
7	-.220	.687	-.960	.005
8	-.220	.639	-.900	.017
9	-.300	.205	-1.260	.000
10	-.250	.455	-.810	.029
11	-.320	.142	-1.350	.000
12	-.350	.128	-1.180	.002

Discussion

The aim of this study was to ascertain whether age influences children's effectiveness when using facial scales to measure degrees of anxiety. A task was planned whose aim was to study whether children from 6 to 12 years are able to identify degrees of anxiety and correctly associate them to the faces representing them.

The task assumes that the child has a cognitive development that enables correct use of the Piaget components to measure magnitudes (comparison, classification, correspondence and seriation). Moreover, the child will have sufficient linguistic development to be able to assess and correctly qualify different degrees of emotional response using quantifiers. Finally, the child should be sufficiently developed psychologically to have enough introspective capacity to be able to identify an emotion and measure it correctly (Besenski, Forsyth, & von Bayer, 2007).

Our results indicate that children aged 6 to 12 years can be equally effective in identifying and classifying different degrees of anxiety on a 3-item facial scale, as the results present no clear differences between ages. In contrast, when the task is extended to five faces, 6-year olds are significantly less effective than the other schoolchildren, so this tool is recommended for use by children of 7 years or more. The original 9-face FAS was built for use with children of five and over. We know that children under 7 have difficulties understanding the FAS, even when it comprises only five faces (Chellew, Pol, Pérez, Picardo, & Matas, 2011). The original scale would, therefore, be of little use to measure pain or psychological anxiety in children under six (Meisel et al., 2010).

Our results also show that, according to the percentage of correct responses, children have greater difficulties in distinguishing between *some* and *high* anxiety, especially 6-year olds, and tend to be better at classifying the degrees *none*, *some* and *very high* anxiety. Chambers & Johnston (2002) found that children aged 5-6 years tend to give more extreme responses the more options they are offered. A high percentage of the children answered correctly for the extreme categories (*none*, *high*, *very high*) on both the 3-face and the 5-face scales. Indeed, when the degree *high anxiety* is placed at the end of the 3-face scale, the child scores better than when it is placed in a middle position in the 5-face scale.

The tendency for 6-year olds towards extreme categories has two readings. On the one hand, when they respond using a 5-face scale, they bias their response as if they were using a 3-face scale, thus scoring higher at the two extremes of the scale (*none* and *very high*) and at the mid-point (*some*). On the other hand, it is observed that with the 5-face scale, there is a decrease in the number of correct responses at all ages in the categories *some* and *high*, which suggests there may be some confusion between the terms. Indeed, in some cases, the children interchanged the two.

Differences due to sex were also found with girls, who were, in general, more accurate in the tasks. The influence of this variable is a controversial issue, because the finding is in contrast in terms of ordering and seriation to those of other studies (Bingham-Newman & Hooper, 1974; Shih & von Baeyer, 1994). However, when we refer to recognition of emotional expression, girls and adolescents are more skillful (Herba & Phillips, 2004; Proverbio, Matarazzo, Brignone, del Zotto, & Zani, 2007). A recent study (Hoffman, Kessler, Eppel, Rukavina, & Traue, 2010) reported that men and women performed equally in their recognition of faces with intense expressions, although women performed better when the changes were more subtle. It may be that the ease with which women recognize facial emotions is determined by biological-evolutionary or even cultural components.

Our study has several limitations which advise viewing the result with some prudence. First, the composition of the sample needs to include more 12-year olds. Second, the nonprobabilistic sampling procedure limits any generalization of the results to the population as a whole. Third, the use of faces from a scale that was originally conceived to measure children's perception of pain may not be very appropriate for measuring anxiety. Finally, the choice of quantifiers used for the degrees of anxiety may lead to some confusion in some categories.

Given the results and the limitations of the study, future research should focus on: (a) extending the lower age range to determine up to what age the use of 3-face scales is viable; (b) determining what descriptors are appropriate for grading anxiety; (c) ascertaining which facial expression, placement of faces and descriptors are most suitable to avoid extreme responses when measuring anxiety in situations that need to be administered quickly and with reliable measures.

In conclusion, our findings confirm the usefulness of the facial scale comprising five faces and quantifiers for measuring various degrees of anxiety from seven years on. At lower ages, a response bias was detected towards choosing extremes as well as confusion between *some* and *high*. We therefore recommend using the 3-face scale for six-year olds.

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