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Test of Emotion Comprehension: Exploring the underlying structure through Confirmatory Factor Analysis and Similarity Structure Analysis

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Abstract: Some decades of research on emotional development have underlined the contribution of several domains to emotional understanding in childhood. Based on this research, Pons and colleagues (Pons & Harris, 2002; Pons, Harris & Rosnay, 2004) have proposed the *Test of Emotion Comprehension* (TEC) which assesses nine domains of emotional understanding, namely the recognition of emotions, based on facial expressions; the comprehension of external emotional causes; impact of desire on emotions; emotions based on beliefs; memory influence on emotions; possibility of emotional regulation; possibility of hiding an emotional state; having mixed emotions; contribution of morality to emotional experiences. This instrument was administered individually to 182 Portuguese children aged between 8 and 11 years, of 3rd and 4th grades, in public schools. Additionally, we used the *Socially in Action-Peers* (SAp) (Rocha, Candeias & Lopes da Silva, 2012) to assess TEC's criterion-related validity. Mean differences results in TEC by gender and by socio-economic status (SES) were analyzed. The results of the TEC's psychometric analysis were performed in terms of items' sensitivity and reliability (stability, test-retest). Finally, in order to explore the theoretical structure underlying TEC a Confirmatory Factor Analysis and a Similarity Structure Analysis were computed. Implications of these findings for emotional understanding assessment and intervention in childhood are discussed.

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1. Introduction

For Harris (1989; 2008), children's understanding of emotion enables them to alter their experience of emotion, which, in turn is considered a good predictor of emotional competence. Saarni's (1999) model of emotional competence considers that this competence is inextricable from of social competence. Emotional understanding is one relevant domain of emotional competence, and is conceptualized as a children's general sociocognitive understanding of perspective taking, desire believes, intentions understanding related to emotions in their selves and others (Harris, 1989).

In order to have an understanding of emotions there are two essential aspects: awareness (manifested in different forms: reporting, anticipating, hiding or change the emotional state) and the identification and understanding of others' emotions. Harris (1989, 2008) proposes a number of types of consciousness: (a) about 1 year of age, children begin to recognize the emotional states that are directed, (b) by 3 years they begin to realize that people choose what they do according to their beliefs / desires, as well as begin to make sense of emotion (in self and others), (c) 4-6 years: understanding that emotional expression may not be a direct reflection of the emotional state (e.g., are able to perceive the concealing of expressions), (d) from 6/7 years: the moral standards begin to be important in understanding that children have about emotion, (and) finally, later arises the understanding that it is possible to modify the emotion, first by hiding the expression and then by modifying the state itself.

The existence of a large panoply of definitions of emotional competence, in general, and understanding, in particular, has led to a lack of consensus and, consequently, to methodological limitations in research plans, and also to assessment and intervention in emotional competence. Several decades of research on emotional development has underlined the contribution of several domains to emotion understanding in childhood. Based on this research, Pons and colleagues (Pons & Harris, 2002; Pons, Harris & Rosnay, 2004) have proposed the Test of Emotion Comprehension (TEC) which assesses nine domains of emotion understanding, namely the recognition of emotions, based on facial expressions; the comprehension of external emotional causes; impact of desire on emotions; emotions based on beliefs; memory influence on emotions; possibility of emotional regulation; possibility of hiding an emotional state; having mixed emotions; contribution of morality to emotional experiences. These nine components have a developmental orientation, following 3 stages: one external phase (3-6 years old), one mental phase (5-9 years old) and one reflexive phase (8-11 years old).

TEC was initially validated with a sample of 100 English children aged 3, 5, 9 and 11 years old, equally divided by sex in each age group. According to data collected, Pons and colleagues (Pons & Harris, 2002; Pons, Harris & Rosnay, 2004;

Pons & Harris, 2005) have detected an evolution of a meta-emotional competence, organized in three developmental areas: 1) emotional categorization in relation to its nature; 2) comprehension of the emotional causes; 3) the control of emotions.

This instrument is being used worldwide, has been translated to 21 languages[1], and is now being tested in the Portuguese-speaking countries (Brazil and Portugal, so far), under the coordination of Roazzi doing the process of translation, adaptation and validation of this test.

In this study, we used a Portuguese sample of 182 children attending 3rd and 4th grades in public schools. The aim of this paper is to present some of the first results of its psychometric properties, analysis of its theoretical structure, through Confirmatory Factor Analysis (which has never been performed, as far as we know) and Similarity Structure Analysis, as well as its external validation in relation to age, gender and social competence.

There have been two previous studies in Portugal with TEC, which focused on 1st to 4th graders and on kindergartners (Santos, 2012; Silva, 2013; respectively).

2. Method

2.1. Sample

Data was collected in three public elementary schools in a Portuguese city (Évora - 50.000 habitants). Students from 10 classes from 3rd and 4th grade (5 classes each grade) were invited to participate in this study. 88,5% obtained parental consent to participate. Students with severe educational needs were excluded from sample.

The final sample is constituted of 182 children aged between 8 and 11 years (M = 8,81; SD = 0,77); 52,7% (n=96) are boys and 47,3% (n=86) are girls; 51,6% (n=94) are from 3rd grade and 48,4% (n=88) from 4th grade. 7 children (3,85%) are from nationalities other than Portuguese (e.g., from eastern Europe countries, or Germany, Holland or Brazil), but all are fluent in Portuguese. Finally, regarding the schooling (number of years) of the children's mothers (which is considered a good index of socioeconomic status), 1,1% (n=2) are illiterate; 16,48% (n=30) went to elementary school; 10,99% (n=20) went to middle school; 32,97% (n=60) went to secondary school; 36,81% (n=67) have a university degree (8,96%, n= 6, of which have a masters degree; and 2,99%, n=2, have a PhD), and 2,2% (n=4) have not responded. A group of 5 children of 11 years old, has been inserted into the group of 10 year olds.

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[1] Arabic, Catalan, Cantonese, Danish, Dutch, English, Fongbé, French, German, Greek, Icelandic, Italian, Macedonian, Mandarin, Norwegian, Polish, Portuguese, Quechua, Roumanian, Spanish & Turkish.

2.2. Instruments

2.2.1. Test of Emotion Comprehension

The Test of Emotion Comprehension (TEC, Pons & Harris, 2000; Pons, Harris & Doudin, 2002; Pons, Harris & de Rosnay, 2004) is divided into a set of stories in an established order. The test evaluates the following components (corresponding to the theoretical dimensions of understanding of emotions): understanding of the (1) recognition of emotions based on facial expressions, (2) external causes of emotions (e.g., being sad when a pet dies), (3) assigning a desire as cause an emotion; (4) the role of believes in determining emotions, (5) the influence of memory in circumstances of assessment of emotional states, (6) the ability to regulate emotions, (7) the ability to hide or conceal an emotion; (8) that a person can have mixed emotions (e.g., happiness and fear at the same time) in relation to a given situation, and (9) the role of morality in emotions.

There is a version for boys and girls, and it consists of a booklet of illustrations with a story that is read for each situation and in every sheet are presented four possible outcomes represented by emotional facial expressions (there five options: happy, sad, angry, afraid, OK). The children are asked to assign an emotion represented by a facial expression to the situation. The instrument is also available in computerized format, where questions and stories are narrated by a female voice. The scoring is made automatically by the computer application. In this study we used the computerized format, only the male version, since this is the only available up to now for the European Portuguese.

Children's responses are nonverbal, considering that cross-cultural studies establish that facial expressions related to situations are similar across cultures. This test has been used in many countries around the world, being translated into 21 languages, is now being adapted into Portuguese (Portugal and Brazil).

This test can be used with children aged 3 to 11 years. Each child can get a score between 0 and 9.

2.2.2. Socially in Action-Peers

The instrument consists of six critical hypothetical social situations (one of them is an example for training) that require a variety of behavioral, emotional and cognitive skills. This version Socially in Action-Peers (SAp) (Candeias & Almeida, 2005; Candeias, Rebocho, Pires, Franco, Barahona, Franco, Santo, Oliveira & Pereira, 2008; Candeias & Rocha, 2012) was prepared taking into account issues of social development in terms of social interaction with peers relevant for this stage of development (Denham, 2007; Dodge, McClasky & Feldman, 1985; Waters & Sroufe, 1983). In general terms, the SAp assesses social

competence in children in critical social situations with peers in the school context, in intimate and informal situations: E. Spokesman situation (example); 1. Group work situation; 2. Integrating a new classmate situation; 3. Leading a group situation; 4. Visiting a sick classmate situation, and 5. Conflict situation.

Each child was evaluated in each situation by the three sources in order to obtain a panoramic assessment. Firstly, the child makes a self-assessment of her perceived competence in each of the situations, using a Likert-type scale (bad -1, medium - 2 and good - 3). In other versions of the SAp children were also asked about the perceived difficulty of each situation, which has been eliminated in this version to facilitate the questions comprehensibility, since children tended to confuse performance with difficulty. Then, each child is asked to nominate three colleagues (boys or girls, without needing to rank them) in her class perceived as the most competent to resolve each situation. Finally, the teacher evaluates the performance of each child using the same scale as the one used in self-evaluation version. In the format of peer assessment, we used the method of positive nominations instead of the evaluation of all classmates, because we felt that in developmental terms it would be difficult for these children to do it in a discriminant way to all colleagues.

For the instrument's scoring, the sample situation is not considered in the calculation of scores, as long as it has been used in order to help children to get familiarized with the test and the answer format. Several scores may be obtained for each child: (1) scores per rater, which consists of the sum of the five situations made by each rater (self, peers and teachers); (2) scores by situation, which consists of the mean of three sources scores in each situation; (3) composite score of social competence: which consists of the global mean of the three sources in all situations. In the case of peer assessment we counted the number of nominations that each child had in each situation. Since the classes in which children were placed had different number of students, t scores were calculated for each situation raw result. Cumulatively, considering that this procedure was going to generate different magnitudes in inter-rater metrics, we also calculated t scores for the self and teacher's ratings.

Finally, and to increase the predictive ability of the instrument, since each rater has systematic biases in their assessment, as result of the perceived (ir)relevance of certain behavioral data and the same selective attention, and considering the recommendations of previous studies (Ford, 1982; Waters & Sroufe, 1982); we calculated the composite score of social competence. Thus, it is possible to have a composite vision and also a specific one according to the perspective of different social actors.

2.3. Procedure

Prior to data collection, authorization for this study was obtained from the Ethical Panel of the Portuguese Ministry of Education, the National Commission

for Data Protection, the three schools' principals, and finally, permission from parents of each child.

Data collection took place between March and June 2012. The administration of these tools is part of a larger study that sought to examine the relationship between the understanding of emotions, social competence and emotion regulation in children.

Regarding the administration of TEC, it was done individually with each child in a quiet place, using a laptop computer. The instructions were explained to the child and were clarified their doubts. The stories of the instruments and their questions were in European Portuguese by a female voice. After each question, the child chose the correct answer, and automatically passed to the next story. The computer application automatically recorded and quoted the child's response, which were then exported to SPSS. The administration of TEC took about 15 to 20 minutes with each child. Scoring procedure on component IV (belief) was changed in order to make the results more similar to the original ones, the same way the Italian adaptation did (both answers happy or OK were considered correct). This decision has been made because about 30% of all children answered OK, which seems also a plausible answer to us due to the fact that is also possible in terms of content (it's possible for the rabbit to feel ok) and to the fact that the Portuguese word for OK ("bem") may be used as a synonym for happy.

The SAp was administered in a classroom group in the presence of the class teacher. We explained the study purpose to the children, assuring data confidentiality and voluntary participation. The instructions and situations were read aloud by the researcher and the children accompanied the reading. Firstly, the children made their self-assessment, and then they did the nominations of peers for each situation, situation to situation sequentially. Finally, a form was distributed to the teacher with the same situations.

The administration of this instrument took approximately 30 to 45 minutes per class. Scoring was done according to the procedure described above. Finally, children's results were reported back to their parents who have expressed will to know about it.Data analysis was performed on SPSS 20.0 and on MPlus 6.

3. Results and discussion

3.1. Descriptive statistics and reliability analysis

The items (here named as components) of each TEC were submitted to a descriptive analysis, as follows in Table 1. Generally, all the items have an adequate distribution along the likert scale used and adequate Skewness and Kurtosis values (bellow 3 and 7, cf. Kline, 1998), which indicate that the results follow a normal

distribution. This does not stand for components I (recognition) and II (external causes), which have unacceptable values, that are due to the high success rates. These results are according to the developmental and hierarchical nature of TEC: first components of emotional understanding emerge earlier. Even though these values are unacceptable in psychometric terms, it's defensible that they are used among older children, in order to have them familiarized with the test purpose and contents. The discriminative power of the items on different versions also has acceptable results (corrected item-total correlations - CITC), although they were lower in this two components.

Table 1. Descriptive statistics of Test of Emotion Comprehension components.

Component	M	SD	Range	Skewness	Kurtosis	CITC
Recognition	,99	,105	0-1	-9,46	88,46	,180
External causes	,97	,179	0-1	-5,28	26,11	,259
Desire	,76	,429	0-1	-1,22	-,526	,334
Belief (recoded)	,82	,386	0-1	-1,67	,791	,385
Reminder	,80	,399	0-1	-1,53	,344	,270
Regulation	,76	,429	0-1	-1,22	-,526	,367
Hiding	,69	,465	0-1	-,812	-1,36	,459
Mixed	,69	,465	0-1	-,812	-1,36	,509
Morality	,42	,495	0-1	,337	-1,91	,493

In terms of reliability analysis, we've studied stability of results doing a test-retest 3 months later with 30 children. The correlation between first and second application is of rs=,750 (p<,000), showing us that test results are stable over time. Analyzing the correlations of each component, the most stable over time were component 2 (external causes; V=,695; p<,000) and 6 (regulation; V=,636; p<,000); and the least stable was component III (desire; V=,088; p<,645). Our general correlation is similar to that found by Pons and colleagues: with a 3-month r (18) = ,83 (Pons, Harris & Doudin, 2002), and a 13-month delay, r (40) = , 68 and r (38) = ,54, when the effects of age and gender were controlled (Pons & Harris 2005).

As shown in Table 2, considering the relationships among the several components, they were only significant between components I (recognition) and II (external causes) (V=,276; p<,000); component I and 4 (belief recoded) (V=,244; p<,000); component 2 and 4 (v=1,53; p<,039); component 7 (hiding) and 8 (mixed) (V=,183; p<,014), and component 8 and 9 (morality) (V=,163; p<,027). This results show us that the different components are distinguishable dimensions of emotional understanding. Comparing with previous studies our correlations are weaker than the Italian ones (Albanese & Molina, 2008).

Table 2. V Cramer correlation matrix of Test of Emotion Comprehension results

Component	1	2	3	4	5	6	7	8
1.Recognition	1							
2.Causes	,276**	1						
3.Desire	,064	,039	1					
4.Belief (recoded)	,224**	,153*	-,033	1				
5.Reminder	,080	,063	-,023	,017	1			
6.Regulation	,064	,111	,101	,101	-,087	1		
7.Hiding	-,071	,074	-,022	,020	,081	-,022	1	
8.Mixed	,042	,074	,034	,143	-,097	,034	,183*	1
9.Morality	,089	,094	-,016	,051	,029	,062	-,005	,163*

$* = P\text{<}.05; ** = P\text{<}.01$

The success rates of our sample are similar to those of English and Italian previous studies (English – Pons, Harris & Rosnay, 2004; Italian - Albanese & Molina, 2008 – see Table 3 for UK and Portugal results comparisons), lower than the Brazilian ones in private schools, but higher than the Brazilian ones in public schools (Roazzi, Dias, Minervino, Roazzi & Pons, 2009) and then Peruvian Quechua ones (Tenenbaum, Visscher, Pons & Harris, 2004).

Table 3. % of correct answers for each component according to age for the UK sample (N=60) and our sample (n=140) per age groups.

Type of Sample /	Components								
Age (years)	N	I	II	III	IV	V	VI	VII	VIII	IX
British	Pons et al. (2004)									
7	20	90	100	75	85	80	35	65	20	30
9	20	100	100	80	95	100	60	80	65	50
11	20	100	100	100	100	100	80	95	90	90
Mean		97	100	85	93	93	58	80	58	57
Portuguese	This study									
8	70	99	96	80	54(81)	81	79	67	66	29
9	82	99	96	72	49(82)	77	76	74	72	44
10	30	100	100	77	53(83)	87	70	57	57	67
Mean		99	97	76	52(82)	80	76	69	69	42

Note: The data in parentheses about Component IV from our sample represent the re-codified data in order to obtain compatible results with the English data. Both the answer "happy" and the answer "normal" were considered correct. In this table there are only the results of similar age range from the UK sample.

The organization of TEC's components follows a hierarchical structure. In Table 4 is shown the general rate of success in all components, which is somewhat different from the original UK results, as shown in table 4. This difference may be concerned to methodological issues: different size samples, different age groups (7-9-11 years for the UK sample, and 8-9-10 years for the Portuguese one).

Table 4. Hierarchical organization of TEC's components

Portuguese sample (8-9-10y)	% success N = 182	UK sample (7-9-11 y)	% success N = 60
I - Recognition	99	II - External causes	100
II - External causes	97	I - Recognition	97
IV – Belief (recoded)	82 (52*)	IV – Belief	93
V - Reminder	80	V - Reminder	93
III - Desire	76	III - Desire	85
VI -Regulation	76	VII - Hiding	80
VII - Hiding	69	VI -Regulation	58
VIII - Mixed	69	VIII - Mixed	58
IX - Morality	42	IX – Morality	57
Mean	76,67	Mean	80,11

*non recoded

3.2. Confirmatory Factor Analysis

A Confirmatory Factor Analysis (CFA) was performed in order to test the adjustment of the theoretical model underlying TEC. No previous study has yet done this type of analysis. According to TEC's theoretical and empirical model (tested with Multidimensional Analysis), it assesses emotional understanding through 9 components, that can be grouped into three factors: external (recognition, external causes and belief), mentalist (desire, reminder and hiding) and reflexive (regulation, mixed and morality).

Considering that TEC's items are nominal and dichotomical, CFA was performed based on tetrachoric correlations. The analysis has been performed with MPlus v.6. The data was previously standardized into z scores. We used the procedure of Weighted Least Squares (WLMSV) as an estimation method, which is better suited in terms of the statistical processing for relatively small samples (200 to 500 subjects) than with other statistical estimation procedures. Fit indices chosen were chi-square analysis, GFI (Goodness-of-Fit Index), CFI (Comparative Fit Index), TLI (Tucker Lewis Index) and RMSEA (Root Mean Squared Error of Approximation), taking the indices suggested in the literature (Marôco, 2010). We've considered the following values indicative of good fit: CF, GFI e TLI above to ,90; $\chi 2/gl<2$ and RMSEA inferior to ,60.

CFA hierarchical structure of TEC organized according to the original model (three related factors: external, mentalist and reflexive) had a good adjustment to this sample ($\chi 2/gl =$,997; GFI = ,973; CFI = 1,000; TLI = 1,006; RMSEA = ,000). Finally, no adjustment to the initial model was needed. No modification indices above the minimum value.

Figure 1 shows factorial loadings and individual reliability of items (components) of each factor. All three factors are positively correlated: external and reflexive (r=,37); external and mentalist (r=,28) and mentalist and reflexive (r=,23). Not all trajectories between the factors and the items are statistically significant (e.g., reminder to external; hiding to mentalist; regulation to reflexive). There is a paradoxical mismatch between the general fit index of the model and the existence of some low loadings, which may be due the size and homogeneity of this sample.

These paradoxical results demand another kind of data analysis that may help to understand the distribution of emotional understanding components. This may be achieved using SSA, which may be more suited for dichotomous variables that do not fulfill normality requisites.
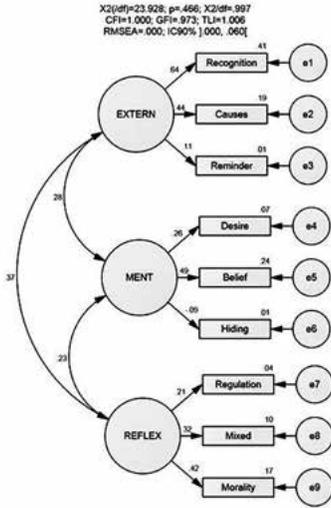
Fig. 1. Confirmatory Factorial Model of Test of Emotion Comprehension (x2/gl = ,997; GFI = ,973; CFI = 1,000; TLI = 1,006; RMSEA = ,000).

3.3. Similarity Structure Analysis

In this section we present results concerning the facets of the Test of Emotion Comprehension. For this analysis we relied on a multidimensional scaling approach using the SSA (Smallest Space Analysis - Guttman, 1965; or Similarity Structure Analysis - Borg & Lingoes, 1987). Considering that TEC has dichotomous items, we used Jaccard's coefficient (Table 5). Figure 2 shows the SSA projection of the first two vectors of the three-dimensional space. The coefficient of alienation, which is the stress measure applied in SSA for assessing the goodness of fit was 0,066, indicating a good fit between the SSA solutions and the input correlation matrices. In this figure each point represents an aspect of the TEC items.

Table 5. Correlation matrix (Jaccard Coefficient) of the nine TEC components

TEC (Components)	1. Recog.	2. Ext. Cause	3. Desire	3. Belief (r)	5. Remin.	6. Regul.	7. Hiding	8. Mixed
1. Recognition	100							
2. External Cause	97	100						
3. Desire	76	75	100					
4. Belief (recoded)	83	81	64	100				
5. Reminder	80	79	65	72	100			
6. Regulation	76	76	67	66	63	100		
7. Hiding	68	69	59	67	64	59	100	
8. Mixed	69	69	61	60	58	61	65	100
9. Morality	43	44	45	48	46	48	47	54

Note: Decimals were omitted

A polar structure can be observed dividing the space in three regions according to the structural organization pointed out by Pons, Harris and Rosnay (2004). In the right side of the plot are located the first group of components, which may be labeled as "**external**", being the easiest. It focuses on external aspects of emotions, including the recognition of facial expressions (Recognition), understanding of the impact of situational causes on emotions (Cause), and understanding of the impact of associated external events or reminders on emotions (Reminder).

In the bottom region of the plot, closer to the center, are located two components characterized by the understanding of the various mental aspects of emotion which may be labeled as "**mental**": the understanding of the role of beliefs (Belief) and the distinction between outwardly expressed and privately felt emotions (Hiding). The third mental component – understanding the role of desires (Desire) on emotions that should be located in this region together with hiding and belief, is situated in the upper right part of the plot.

The last group of components which may be labeled as "**reflective**" is located in the left region. It focuses on children's understanding of the way by which an individual can think about a particular emotionally charged event from more than one perspective, including the appreciation of concurrent mixed feelings (Mixed), cognitive control strategies (Regulation), and the effect of rumination about an unacknowledged misdemeanour (Morality).

The components of "external" facet of emotional understanding are more densely clustered, showing us that they are highly correlated (1x2=,97; 1x5=,80

and 2x5=,79), besides the fact that our sample had success rates higher in these components.. According to the theoretical model proposed by Pons and colleagues (2004), Desire should be located in the "Mental" facet, even though it appeared closer to Recognition (r=,76) and Cause (r=,75).
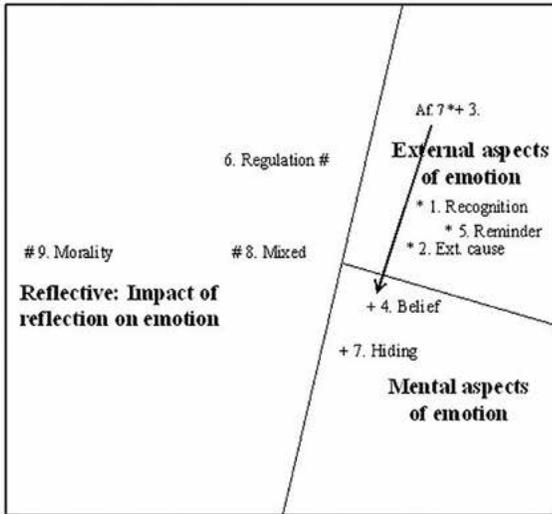
Fig.2. Two Dimensional SSA projection of the nine TEC components (coefficient of alienation .066).

In summary, according to these results, this structure suggests the existence of an hierarchical organization of TEC's results: understanding of external components of emotion (recognition, causes and reminder) is a prerequisite for understanding the psychological/ mental aspects of emotions (belief, desire and hiding); in turn, understanding these internal aspects is a prerequisite for understanding the impact of reflection on emotions (regulation, mixed and morality). This way, emotional understanding in children is organized in an hierarchical fashion, with the earlier components of understanding being a necessary condition for the emergence of the later ones.

3.4. Validity evidence based on relations to other variables

3.4.1. Age and gender

In general, previous studies with TEC have found an effect of **age** on emotion understanding (Albanese & Molina, 2008; Pons & Harris, 2005; Morra, Parrella & Camba, 2010; Pons, Harris & Rosnay, 2004; Pons, Lawson, Harris & Rosnay,

2003; Ornaghi & Grazzani, 2012; Roazzi and colleagues, 2008, 2009; Santos, 2012; Silva, 2013; Tenenbaum, Visscher, Pons & Harris, 2008). In our study, in general there were no significant differences between age groups (8, 9 and 10 years) (F=,532; p<,588), with the 10 years group having higher results (M=7,07; DP=1,44). Indeed, our sample is small and relatively homogeneous in ages. There were significant differences in only one component: *morality* (F=6,78; p<,001), the 10 years group having higher results (M=,67; DP=,479). This difference may be due to the effect of moral reasoning development, which can be easily seen analyzing both questions of this component. The first question of this component had a small percentage of success (32,9% in the 8 years group; 46,3% in the 9 years and 70% in the 10 years), but higher on the second question (90% in the 8 years group; 95,1% in the 9 years and 90% in the 10 years). The second question seems to be more related to compliance to authority figures (mother), and the first one to the acknowledgment of the inner value of acting correctly

 Similar to a vast amount of results in this domain, our results about **gender** differences were not consistent. We performed Analysis of Variance (ANOVA) and t tests for independent samples in order to compare means by gender in the TEC global score and in its components. We have found a small number of significant differences in all comparisons. In general, there were no significant differences between boys and girls (F=2,574; p<,099), with boys having slightly higher results (M=7,04; DP=1,28 vs. M=6,71; DP=1,42). Considering results in the 9 components, we have only found significant differences in *hiding/concealing* emotions (F=3,08; p<,053), boys having higher results (M=,75; DP=4,35 vs. M=,62; DP=,489). This difference may be due to different socialization practices related to gender in respect to emotional expression: boys are thought to hide or conceal emotion expression more.

3.4.2. Criterion-related validity: Social competence

 Considering criterion-related validity, we've focused on the social competence variable. Several theoretical and empirical evidences have underlined the connection between social competence and emotional competence in children (Alves, 2006; Denham, Blair, DeMulder, Levita, Sawyer, Auerbach-Major & Queenan, 2003; Halberstadt, Denham, & Dunsmore, 2001; Hubbard & Coie, 1994; Izard, Fine, Schultz, Mostow, Ackerman & Youngstrom, 2001; Machado, Veríssimo, Torres, Peceguina, Santos & Rolão, 2008; Mostow, Izard, Fine & Trentacosta, 2002; Santos, 2012; Saarni, 1999).

 Our results confirm that TEC is significant and positively correlated to social competence, assessed by *Socially in Action-Peers* (r = ,281; p<,001). Considering the several evaluators used in this instrument, peers' assessment seems to be the one which has an higher level of correspondence with emotion understanding level

(r = ,309; p <,001), followed by self-evaluation (r = ,168; p<,023) and teachers (r = ,165; p<,026) . All situations of SAp, except situation 5 (conflict resolution situation) have a significant positive correlation with TEC's overall result. Finally, considering TEC's components, only components IV (*belief*; r=,246; p<,001), VII (*hiding/concealing emotion*; r = ,190; p < ,010) and VIII (*mixed emotions*; r = ,199; p < ,007) are significant and positively correlated to social competence composite score.

The Belief component of TEC is related to the understanding of the role of belief in determination and that requires the comprehension of false belief, which is considered a good indicator of perspective taking, useful in social competence. Hiding/concealing component of TEC is related to the understanding of the possibility that internal experience and external expression of emotion may not coincide; so this component may be positively related do social competence as far as for being socially accepted, sometimes, we should not be too much emotionally expressive. The 8th component (mixed emotions) is about the understanding that a person can present multiple or even contradictory emotional answers in relation to a determined situation. This component may be relevant in social behavior as long as it may allow children to have a more flexible recognition of other's emotions and behaviors, and therefore better able to adjust behavior in social interaction.

In our study, we've obtained similar results to those found by previous Portuguese studies, such as those of Alves (2006), Machado, Veríssimo, Torres, Peceguina, Santos and Rolão (2008), Santos (2012) and Silva (2013) who (the last two ones) also used TEC for assessing emotion understanding.

4. Conclusion

TEC use among the Portuguese children has proven to be a relevant instrument for the assessment of emotion understanding, in its several facets. Our results have shown its reasonable psychometric properties within the Portuguese middle childhood population. Results also fit its theoretical structure, which gives inputs for a developmentally informed assessment and intervention in the domain of emotional competence. Results also showed us that the more complex components of emotional understanding (hiding, mixed and morality) are those that are more useful for differentiating children, as long as they are obviously associated with gender, social competence and age, respectively.

The use of **MDS and SSA**, in particular, enabled us to do a more comprehensive analysis of data. Unlike factor analysis, the dimensions work as a means to enable the verification of different projections of the total configuration, having theoretical considerations in mind in order to decide about the usefulness and appropriateness of a multidimensional solution. Besides, SSA compared with

CFA, is less restrictive about the variables: it is not necessary that data have metric characteristics, or that association coefficients to be linear, allowing monotonic coefficients to be used also. In sum, in this type of analysis, looking for facets distribution facilitate the laborious work of theory construction and modification.

Within the practical relevance of this instrument, it allows us to identify children at risk of emotional maladjustment, and based on the strengths and weaknesses will be possible, at a later stage, outline intervention plans according to the specific emotional understanding skills to consider. For example, the evaluation made by a researcher or a psychologist can use the results collected with TEC to outline an intervention plan. Likewise, in the prevention context, TEC can be used as a control measure to use in pre-and post-intervention. Intervention may be tailored according to children's level of emotion understanding and development. TEC is an instrument of easy and fast administration, and children are amused to participate in its tasks.

This study has limitations, the most notable one is the sample size and homogeneity, which is small and unrepresentative. Another limitation is that we have not used another measure of emotional understanding or emotional competence for external validation of the TEC. In **future studies**, a larger sample should be used and with a wider range of ages. Finally, the factorial structure of CFA has paradoxal results, which may be related to sample's size and homogeneity.

There are some limitations in the instrument that should be considered in a revision of TEC. For instance, the older and the more developed children (in terms of cognitive development) find the tasks a bit childish; components I and II items are considered too easy for the majority of children above 8 years, which may decrease motivation to answer, even though we consider it important, as we've mentioned earlier; the wording for "OK" emotion should be adapted to a more neutral one, since some children consider it a synonym for "happy", leading to wrong answers (which was quite obvious on component 4); the answers to the several situations are not univocal: the same situation may trigger different emotions in different people, depending on the appraisal made; all components should have the same number of items, which has led to psychometric deficits; answer options should have 5 emotions, not 4, in order to have all possible emotions represented; on component VI (hiding), a more appropriate toy for girls should be used, something that they play with as much as boys play with marbles; on component VI (regulation) the type of answer is different from the rest of the TEC; finally, and in general and qualitatively, we've noticed that the linguistic and cognitive level of children seem to influence TEC's results.

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Facet Theory

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Editora UFPE

Facet Theory (FT) is a meta-theory for designing structural and other theories in the behavioral sciences. Basic assumptions of FT are that social and behavioral concepts are complex constructs and that their study, therefore, requires a systematic design for defining observations and for examining the correspondence between the observations and the theory. Because such a definitional design should facilitate the evaluation of systematic relations between the data and the theory, it should lead to cumulative results. In the above sense, FT is a systematic approach for coordinating theory and research.

FT comprises the universe of observations, the population of respondents, and the range of observations. It stratifies these universes by facets and integrates the design by means of a mapping sentence which guides the construction of items and the formulation of hypotheses. Finally, particular multivariate data analysis methods (such as SSA, POSAC, MSA) have been developed to test these hypotheses. Facet Theory has been successfully applied to a large number of research areas where it has significantly contributed to the discovery and refinement of empirical laws.

Our aims in this book are:

1) To review recent and innovative research results arising from the application of the Facet Theory approach to complex social and psychological issues;

2) To present methodological advances in comparative studies and applications of Similarity Structure Analysis (SSA), Multidimensional Scalogram Analysis (MSA), Factor Analysis (FA), Confirmatory Factor Analysis (CFA), Partial Order Scalogram Analysis (POSAC), and other multivariate procedures and techniques related to FT;

3) To present theoretical advances in Facet Theory and related approaches;

4) To present new reflections on the role of Facet Theory in modern science and in the emergence of new scientific paradigms.

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