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Emotion Recognition Task in typically developing Children: Design and Psychometric Properties

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Abstract
Facial expression is one of the most important social indicators that allows people to know our emotions. Emotion recognition is mostly defining as an ability to understand facial expressions. The study is aimed at designing a test to measure emotion recognition and determining its psychometric properties. A test consists of 44 (male/female and mild/intense) facial expressions that were designed to measure 6 basic emotions. 240 students were selected using cluster sampling method. Split-halves and Kuder-Richardson coefficients were used to assess reliability of the test. In order to assess the construct validity of the task the Pearson coefficients were calculated between total score and 6 scales. Relationships between total score of Emotion Recognition Task, Interpersonal Reactivity Index (IRI) and Theory of Mind test (ToM) were calculated to show convergent construct validity. The results showed that the test is reliable and valid.

Keywords: Recognition, emotion, Child, Psychometric properties.

1. Introduction and preliminaries

The ability to understand and express emotions is one of the most important aspects of our social life. People with high emotional ability, have a better function in two main areas of producing or expressing

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emotions and interpreting them in terms of emotional mechanics. The ability to express emotion refers to proper changes in gesture and behaviors as a compatible answer to events which make organism successfully confront the consequents while the ability of emotion interpretation point to understanding and interpretation of others emotions in social interaction. These abilities are recognized as the main source of emotional intelligence [1].

Decoding the emotional expression from the faces is a basic and fundamental matter in social interaction. There is a belief that elements and factors of facial recognition which include nonverbal and urgent recognition of facial repressions reflect evolutionary mechanists that enable a person to predict other's emotions and subsequent activities [2]. Ekman (1997) has argued there is a limited set of facial expressions that are universal which represent anger, disgust, fear, happiness, sadness, and surprise. Although the labels, words and cultural values that govern these emotional expressions may vary, they worth the same universal message. Therefore, that is widely believed that both facial expressions and emotion interpretation are inherent in nature [3].

Researchers believe that women are more powerful in recognizing facial expressions of emotions than men. In explaining this, gender inequality power and social status are mentioned. The evolutionary explanation also points to the universal responsibility of women in child-rearing and nutrition. According to this explanation, women show adaptation which increases child survival because of their evolutionary role in child care. These adaptations in the human being can include decoding facial emotions that are considered an important tool in establishing communication especially with the child (before the speech) [4].

The concept of theory of mind is one of the aspects of social cognition which refers to one's ability to infer and understand the beliefs, desires, and intentions of others given the knowledge that one has available [5]. Researchers consider two kinds of theory of mind representations; affective theory of mind which relates to emotions of others and cognitive theory of mind which relates to mental states, beliefs, thoughts, and intentions of others [6]. The other structure in social communication is reactivity which occurs when individuals alter their performance or behavior when exposed to external stimuli. On the other hand, mindfulness skill has a role in interpersonal reactivity. Thus these concepts have cognitive aspects that have a common point with emotional recognition [7].

Psychologists in the study of emotion recognition mainly use facial and verbal expressions. One of the classic tests in this field is the Benton Facial Recognition Test (BFRT) which is available in two versions with 27 and 54 items in each. In this task, there are black-and-white photographs of adult faces depicted in full frontal orientation (but without shoulders and other identifying cues) are presented serially. In each item, there is a target face in the top and six other faces in the below as choices. For the first six items, only one choice face in each array matched the target; for the last seven items, three choice faces shown in each array matched the target. The respondent is asked to identify which choice face (or faces) in each array is (are) identical to the target face [8].

One of the other common tests on this field is Ekman and Friesen's task (1976) in which 60 pictures are used for measuring six basic emotions [9]. In some of the other tasks other types of emotion stimuli are used, for example, Baenziger, Grandjean and Scherer (2009) in Multimodal Emotion Recognition Test (MERT) measured this ability by actors' pictures showing 10 emotions (two types for five emotion categories) using four kinds of combination of visual and auditory sense include visual/auditory, only

visual, only video, and pictures [10]. It is possible that in measuring emotion recognition, facial expression recognition is not enough and body gesture and voice are also used. For instance, Geneva Emotion Recognition Test (GERT) which is a performance test has been created to measure the ability of face, voice and body gesture recognition. This test includes 83 short video clips that have been extracted from databases and participants are asked to choose which one of 14 emotions are expressed by the actors (in this test 14 difference emotions include 6 positive emotions is consider for comprehensive investigating of emotion recognition and only basic emotion aren't emphasized) [11].
The other difference besides the number of measured emotions, is related to gender and race of people and balance among them, in this regard we can point to short form of Japanese and Caucasian Brief Affect Recognition Test (JACBART) in which, seven basic emotions are measured and emotions are expressed by two completely different races [12, 13].
Given that in this regard measuring emotion recognition with a suitable number of questions and options that are balanced in terms of intensity and gender, there is no test appropriate with Iran culture. The main purpose of this research is using the databases and weaknesses and strengths of previous tests for designing an emotional recognition task and determining its psychometric properties. For reliability of this test, the Split-halves method with Spearman-Brown and Guttman coefficient and also internal consistency with the Kuder-Richardson coefficient are used. After calculating internal consistency between different aspects of emotions recognition with each other and with total score, correlation coefficient between emotional recognition score with interpersonal reactivity and theory of mind is calculated for determining convergent validity. Since the literature confirmed that there are gender differences in emotional recognition, the performance based on gender has been considered for testing the construct validity of the task.

2. Material and methods

The sample of this research includes 240 students (120 girls and 120 boys) who were chosen from 19 regions of Tehran with a cluster sampling method. These students were chosen randomly from different grades of elementary school. Since the participants were under legal age, before starting the experiment, their headmasters were instructed about the experiment, they then sign the consent form and participants entered this research. The students were free to participant or to withdraw from the experiment at any time. The following tasks were used for collecting the data:

Emotional recognition task: This is a researcher-made task that consists of 44 pictures of face that shows six basic emotions. The emotional facial pictures are divided in terms of gender to man and woman and in terms of intensity to low or high intensity. These pictures are extracted from the NimStim set of facial expressions databases. By showing pictures of emotional faces to the participant, they were asked to say the name of emotion in the picture.There is a pre-determined list of emotions that consist six basic emotions including anger, happiness, sadness, disgust, fear and surprise and participant chooses an emotion among these emotions for each picture. The psychometric properties of this task are discussed in result.

Theory of mind: The test includes 36 pictures and every participant is asked to choose an opinion that describes the picture among four options after looking at each picture carefully.

Interpersonal reactivity index: This questionnaire is a self-report comprising 28-items answered on a 5-point Likert scale ranging from "Does not describe me well" to "Describes me very well which created by Davis (1983) for the first time. He considered the four aspects of empathy in this test including perspective-taking (person's ability to consider others point of views), fantasy (put yourself the place of fantasy characters of books and movies), empathic concern (showing empathy towards people and being worried for other helplessness), and person desires (self-centered emotions, personal concern, and stress in the interpersonal conditions). The Cronbach's alpha for these four subscales in David's study were between 0.62 to 0.80 [14]. The Cronbach's alpha of four subscales of taking perspective, fantasy, emphatic concern, and personal were 0.68, 0.70, 0.68, and 0.71 respectively in the Faizabad, Farzad, and Shahrarae study [15].

3. Results

In this study, data were analyzed in the number of ways; first, the descriptive statistics of each task are discussed individually, then for testing the reliability of the emotion recognition task, three types coefficient are used and finally t-test is used to investigate the difference between two gender in emotional recognition test and six basic emotions with the purose of investigating cunstruct validity. The participates distribution based on grade and gender are in below.

First grade 39 students (20 girls, 19 boys), second grade 43 students (21 girls,22 boys), third grade 40 students (20 girls, 20 boys), fourth grade 39 students (19 girls, 20 boys) fifth grade 39 students (20 girls, 19 boys) sixth grade 40 students (20 girls, 20 boys) overall 240 students participated in this study.

The mean and standard deviation of the total score of facial recognition task and six emotions for all participants and with gender segregation are shown in table 1 separately.

Table 1: Descriptive statistics of the emotion recognition task

		Emotion recognition (total)	Sadness	Anger	Disgust	Happiness	Fear	Surprise
All participants	**M**	26.36	3.77	5.19	4.29	6.71	2.92	3.03
	SD	8.20	1.79	2.23	1.82	2.12	1.75	1.20
Boys	**M**	29.27	4.67	5.64	5.02	7.53	2.88	3.53
	SD	5.46	1.76	1.84	1.89	0.84	1.72	0.67
Girls	**M**	23.30	2.94	4.72	3.70	5.96	2.97	2.59
	SD	9.41	1.47	2.51	1.48	2.57	1.74	1.40

The mean and standard deviation of the interpersonal reactivity questionnaire and theory of mind are shown in table 2.

Table2: Descriptive statistics of the interpersonal reactivity questionnaire and it's four dimensions and theory of mind

	Interpersonal Reactivity Index (total)	Perspective-taking	Fantasy	Empathic concern	Personal distress	Theory of mind
M	88.09	22.42	21.41	23.39	20.83	15.89
SD	11.07	5.41	4.40	4.60	3.78	5.25

To test the reliability of the emotion recognition task three coefficient have been used. The reliability of the total emotion recognition task with the split-halves method with Spearman-Brown's coefficient is equal 0.857 and Guttman's coefficient is equal 0.852. The reliability coefficient with Kuder-Richardson method for total score of emotion recognition task and six basic emotions are shown in table 3.

Table 3: Kuder-Richardson coefficient for the emotion recognition task.

	Emotion Recognition	Sadness	Anger	Disgust	Happiness	Fear	Surprise
Kuder-Richardson coefficient	0.898	0.625	0.729	0.547	0.870	0.559	0.653

For studying the validity of emotion recognition tasks, the internal correlation of different aspects of the questionnaire with each other and also each emotion category correlation with total score has been calculated. These correlations are shown as correlation matrix in table 4.

Table 4: correlation matrix between different emotions of the emotion recognition task.

	Total score	Sadness	Anger	disgust	Happiness	Fear	Surprise
Total score	1						
Sadness	**0.71	1					
Anger	**0.83	**0.50	1				

Disgust	**0.69	**0.44	**0.48	1			
Happiness	**0.83	**0.51	**0.62	**0.42	1		
Fear	**0.66	**0.35	**0.53	**0.30	**0.46	1	
Surprise	**0.75	**0.48	**0.53	**0.48	**0.72	**0.34	1

According to the results in table 4, all correlations between six emotions with each other and with total score are significant in the %99 confidence level. In the next step, to test the construct validity, the correlation between total emotion recognition task with total interpersonal reactivity score and its subscales and theory of mind has been calculated and the result shown in table 5.

Table 5: correlation coefficient between Emotion recognition and emotion categories with the theory of mind and interpersonal reactivity and its subscales.

Correlation	Theory of mind	Interpersonal Reactivity Index (total)	Perspective-taking	Fantasy	Empathic concern	Personal distress
Total Emotion recognition	**0.43	**0.22	0.09	0.11	**0.26	0.02
Sadness	**0.42	**0.25	**0.19	0.06	**0.34	-0.05
Anger	**0.26	**0.20	0.08	0.11	**0.20	0.06
Disgust	**0.46	*0.17	0.06	0.07	**0.21	0.07
Happiness	**0.32	**0.16	0.07	0.10	**0.19	-0.003
Fear	**0.20	0.06	0.07	0.04	0.06	-0.06
Surprise	**0.36	**0.21	-0.02	*0.15	**0.25	*0.14

The coefficients with stars in table 5 are significant (two stars are significant at 0.01 confidence level and one star at 0.05 confidence level). According to the results in table 5, the correlations between the theory of mind score with total emotion recognition and the emotion categories are significant ($p<0.01$). In addition, the correlation between the total score of interpersonal reactivity and total score of emotion recognition was positive and significant and among the emotion categories, it is not correlated only with fear.

The empathic concern subscale had also a significant correlation with total emotion recognition and all emotion categories except fear. The correlation between perspective-taking with emotion recognition of sadness, fantasy and personal distress with emotion recognition of surprise are significant as well ($p<0.05$). The result has shown there is no correlation between perspective taking, fantasy and personal distress with total emotion recognition and its categories.

The correlation coefficients between positive, negative, and neutral of the theory of mind with total emotion recognition calculated and they were 0.40, -0.16, and -0.16 respectively. The first coefficient at 0.01 confidence level and the other two at 0.05 level are significant which show between the positive theory of mind with emotion recognition is positive and significant correlation while there is negative correlation between negative and neutral theory of mind with emotion recognition. In other words, higher scores in negative and neutral theory of mind are associated with lower emotional recognition.

For studying the difference between the two genders in emotional recognition and its categories, independent t-test is used and the results of the test shown in table 6. The homogeneity of variance is one of t-test assumption which has not been fulfilled with the two samples in this research, consequently the Welch's t-test is used. The results shown in table 6 are with this correction since the two samples have unequal variances.

Table 6: The results of Welch's t-test to studying the difference between two genders in emotional recognition and its emotion categories.

	T	Sig	SE
Total Emotion recognition	**5.05	**0.0000**	**1.18**
Sadness	**7.37	**0.0000**	**0.23**
Anger	**2.88	**0.005**	**0.31**
Disgust	**5.37	**0.0000**	**0.25**

Happiness	**5.75	**0.0000**	**0.27**
Fear	**-0.39**	**0.62**	**0.25**
Surprise	**5.97	**0.0000**	**0.16**

According to the results of table 6, there is a significant difference between the two genders in emotion recognition except for fear and women got higher scores in emotion recognition but there is no significant difference between men and women in emotion recognition of fear.

4. Results

According to the result of the split-halves method and Kurd-Richardson, the emotion recognition task and its emotion categories have favorable internal consistency. The correlation between the emotion categories of this test with each other and with the total score is significant which shows that this test has favorable internal consistency and there is relationship between its parts. The high correlation between the total score of emotion recognition task with theory of mind test and interpersonal reactivity shows convergent validity at this test.

The difference between men and women in total emotion recognition score, and higher performance of women in this regard, which is congruent with literature and evolutionary perspective shows the construct validity of the emotion recognition task [16].

One of the results of this recent research is emotion recognition of fear which doesn't show the same process as other categories of the test. Although the correlation between recognition of fear and theory of mind is significant the lowest correlation belongs to this emotion. In addition to there is no significant correlation between recognition of fear with interpersonal reactivity and its subscale unlike other categories of emotion recognition tasks. There is no difference between men and women in this emotion as well. Considering the low reliability of recognition of fear (0.56), it seems like this result can be discussed in several different ways.

Studies show that with aging the ability to recognize the negative emotions reduces. There are other studies that show the highest level of emotion recognition is related to happiness and lowest level of recognition is related to disgust and fear. Horing and colleagues (2012) did research on 732 persons and demonstrated that with aging the ability to recognize negative emotions such as fear and sadness reduces [17]. West and Colleagues (2012) did research on 428 people and found out with age the ability to recognize emotions such as fear, anger, and sadness decrease [18].

Previous researches (De Sonneville, 2002; Kharrazi and colleagues, 2012; Camras and Allison, 1985) confirm this finding that among different emotions, happiness has the highest rate of correct recognition and fear and disgust have the lowest rate. As the result shows, the findings of this research which show lower performance of participant in recognition of fear compared to the other emotions is congruent with previous research [19, 20, 21].

Investigating gender differences in emotion recognition is one of the main purposes of this research to claim the construct validity of the task. Findings are in agreement with previous studies in a way that women and girls have better performance in identification and recognition of emotions than men. Campbell and colleagues (2002) shown that generally, the woman has better performance in emotional recognition than men and particularly for emotions such as anger and disgust woman are more precise [22]. In addition to that Montagne and colleagues (2005) indicated gender differences are beneficial for woman that is women can perform better than men in emotions such as sadness, surprise, anger, and disgust [23].

5. Conclusion

The results showed that the test is reliable and valid. Therefore, it can be used in developmental studies and those research with the purpose of investigating emotion recognition especially in children

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Conflict of interest

No competing financial interests exist.

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