Research Journal of Recent Sciences _____ ISSN 2277-2502
Vol. **4(6),** 18-25, June **(2015)** *Res.J.Recent Sci.*

A Comparison between Facial Emotional Expressions Recognition in Children with High Function Autismand typical7 to 11 years peers

Navid Mirzakhani Araghi[1], Akbar Zahedi Barough[1], Mehdi Alizadeh Zareie[2], Alireza Akbarzadeh Baghban[3], Maryam Oraki[4] and Zahedi Barough A[1]

[1]Department of Occupational Therapy, Shahid-Beheshti University of Medical Sciences, Tehran, IRAN
[2]Department of Occupational Therapy, Iran University of Medical Sciences, Tehran, IRAN
[3]Department of Basic Sciences, Faculty of Rehabilitation, Shahid Beheshti University of Medical Sciences, Tehran, IRAN
[4]Deptt. of Psychology of Exceptional Students, Science and Research Branch, Islamic Azad University, Tehran, IRAN

Available online at: www.isca.in, www.isca.me
Received 12th December 2013, revised 16th February 2014, accepted 10th May 2014

Abstract

Autistic Spectrum Disorder (ASD) is a neuraldevelopmental-cognitive disordercharacterized by problems in thinking, feeling, language, and communicating with others.The process of understanding feeling and others` facial emotion is considered as an important factor in social performance. In other words, Social cognition is an effective factor in social performance implicated mental operations as the basis of interactions. The main purpose of the present study is to compare the facial expressions recognition in childrenwith High Function ASD (HF ASD) and Typical Developing (TD) 7 to 11 years peers. The statistical sample includes 28 children withHF ASDboys and 28 TDaged 7-11 years which are at the same level in terms of age and intelligence (practical, verbal and overall). The facial expression of neutral, fear and surprise have been compared using researcher-made task in MATLAB software. The obtained data has been analyzed using repeated measures ANOVA and independent t-test through SPSS software, version 19.

Keywords: High function autism, emotional recognition, facial expression.

Introduction

Many researchers have studied the damage to social cognition domain in people with autism[1]. It seems that people with autism are not able to use facial information including facial expression and gaze directionto regulate social interaction. These people have problem in their social judgment on others and their emotion recognition[2]. Although speech is a direct tool to communicate with others, recognizing messages such as eye contact, posture, gesture, and facial expression are vital for social communication. Facial emotion recognition (especially basic emotions such as fear, Disgust, happiness, surprise, anger, and sadness) has been of widely investigated cognitive processes[3]. Other studies have investigated facial emotion recognition based on two approaches of top-down (i.e. based on social cognition) and bottom-up (i.e. the visual perception defect or integration of visual information).The results of facial emotions recognition for people with ASD are inconsistent. Some of the findings reveal that facial emotions recognition is intact in ASD children[1,4,5]. Various factors other than recognition defect may direct these studies to different results. One of these factors is demographic factor; age of the samples is one demographic factor. In typicalpeoples, emotional decoding is changed during the development. The typical trend of emotional development depends on emotion[4,5]. Among six basic emotions happiness is recognized first of all while fear and surprise are recognized last[4]. Therefore, the age of the considered specimen should be selected based on the research objective. Additionally, for social-emotional capabilities, there is a need of a minimum level of verbal and non-verbal mental ability in order that person can fulfill facial emotion discrimination task; and the differences of the groups may be spuriously overestimated or underestimated if each of groups are in a level lower than the necessary level in each verbal and non-verbal intelligence index[1,4].

The present study has attempted to comparerecognition of three facial emotions including fear, surprise based on matching paradigm. One of the limitations of the previous reported studies is to use "happiness" as baseline to compare emotional states[5]. For the first time, neutralface was considered as baseline to compare other emotions. The emotion of fear was also selected due to the fact that its weak recognition may be as the result of Amygdala dysfunction[6] which may be lead to bias towards social stimuli and especially eyes in children with autism. For example, several studies have investigated the decrease of attention to eyes and the decrease of attention to mouth. Processing the eye area is specifically associated with fear emotion recognition and needs to pay attention to eye and eyebrows areas [5]. On the other hand, "surprise" is the only facial emotion required evaluating the metal status of the other "he/she predicts that there is something different, so he/she is surprised" and such judgment needs facial emotion processing [7]. Thus, recognition of surprise should also be affected in children with autism. The above mentioned factors are the reasons leading to investigating these emotions in the present study.

Considering aforementioned, the main hypotheses of the study

indicate the significant difference in recognition and reaction time of fear, surprise and neutral facial expressions between HF ASD children and TD peers.

Methodology

The present research has been conducted as a comparative study on a sample includes 28 children with HF ASD boys and 28 TD aged 7-11 which are at the same level in terms of age and intelligence (practical, verbal and overall). Children with HF ASD have been selected from the exceptional schools of Tehran and typical peers have been sampled based on Simple random sampling from region 5 and Shahid Motahari School located in Tehran. The inclusion criteria for the study are being ASD based on Diagnostic and Statistical Manual of Mental disorders-IV-TR (DSM-IV-TR; American Psychiatric Association, 2000) Based on a child psychiatrist at the schools profile, beinghigh functioning based on The High-functioning Autism Spectrum Screening Questionnaire (ASSQ)[8], the age range of 7-11 years, intelligence of 80 and above(practical, verbal and overall), right-handedness[9], Visual and auditory acuity, lack of other neurological disorders, lack of seizures during the last two years, and lack of taking medication for 24 hours with supervision of their psychiatrist. The exclusion criteria are lack of child`s cooperation and the parents or child`s tendency to leave the tasks.

By referring to exceptional and typicalschools of Tehran and after studying the files, parents of those children having the necessary inclusion criteria were invited to interview. In case of the parents` consensus, ASSQ was distributed among the parents or Exceptional Children Teacher; and handedness questionnaire was distributed among the parents of both HF ASD and TD. By confirming being HF ASD in the affected group and right-handedness in both, four subtests of Wechsler Adult Intelligence Scale (WISC) (Similarities, Vocabulary, Block design and Picture Arrangement) was used to estimate practical, verbal and overall intelligence[10,11]. For 44 affected participants, 28 children with high function autism were identified; and out of 34 typical children, 28 children were included into facial emotion recognition task. Demographic information was collected through interview with one of the parents.

The data gathering tools: The researcher-made questionnaire includes demographic information such as age and gender of child, age and education of parents, age of child at the time of diagnosis, medication, and the lack of seizure during the last two years.

The autism spectrum screening questionnaire (ASSQ) involves 27 items, 3 scoring scales for each item (0=no, 1=almost, and 2=yes). The scores range from 0 to 54 designed for 7-16 years children. ASSQ is a valid and reliable questionnaire to screen high function autism in which cut points of 19 and 22 are acceptable scores for parents and children, respectively[8]. Considering the consistency of the Persian transcription of the questionnaire with its English version, it can be used to screen HF ASD children with high confidence[12].

Edinburgh questionnaire has also been used to determine handedness of children. In Iran, the reliability and validity of the questionnaire has been confirmed by Ali Pour and Agah (α=0/97 and r=0/92)[13].

TheMain and practical task were created on a laptop ASUS-Notebook SKU version S400CA that worked with Windows 8 as operating system with a 15-inch touch-screen with capacitive 10 simultaneous touch screen technology. Screen resolution was 1024 * 768 pixels (64-bit color) and MATLAB Version 7.11.0.584 was used to run the practical and main tasks. This software lunched a recognition task by Toolbox Cogent 2000. The size of the task images used in the trials was 6 degree of visual angle with equal distance from each other and the edges of the screen frame.

The first slide is a gray screen with a white color fixation cross (+) in the middle of the screen that was 2.5degree of visual angle. Alert sound (default for Windows) was played simultaneously with the trials for increasing participant's attention. Gray Slides to be displayed, randomly between 1000 and 1500 ms between each trials (exceptionally, the first slide was displayed for 5 seconds).These fluctuations was used to minimize the influence of habituation. 1000ms was an interval of between trials. The trials screen was presented, consisting of five static images presented side-by-side in the top half of the screen and the target image in the bottom half of the screen. By touching location on the screen, each participant had to indicate which image in the top half matched the target below. The test screen was presented until a response was recorded. Both accuracy and reaction time were registered in MATLAB automatically.

The images used in this study were selected from a bank faces called Radboud Faces Database (RaFD). The RaFD is a set of pictures of 67 models (including Caucasian males and females, Caucasian children, both boys and girls, and Moroccan Dutch males) displaying 8 emotional expressions. The RaFD in an initiative of the Behavioral Science Institute of the Radboud University Nijmegen, which is located in Nijmegen (the Netherlands), and can be used freely for non-commercial scientific research by researchers who work for an officially accredited university. Two images were selected from this collection that one male and one female, who were matched in terms of Valence and Arousal. These images are used with university permission. The RaFD is a high quality faces database, which contain pictures of eight emotional expressions. Accordingly to the Facial Action Coding System, each model was trained to show the following expressions: Anger, disgust, fear, happiness, sadness, surprise, contempt, and neutral. Each emotion was shown with three different gaze directions and all pictures were taken from five camera angles simultaneously[14]. Considering that the images used include basic emotions and these emotions are universal [15], and culturally are independent[16].

Procedure: Each of the participants sat upright on a chair

individually with a constant viewing distance of approximately 30 cm from the monitor and the task stages were explained for them simply. Before implementing the task, a rehearsal task with eight trials was implemented in the form of target picture matching with the options to ensure the subjects understanding.

The options above the displays were out of all six basic emotional states and one neutral state, and the target option was played at the display randomly out of the three investigated states in these five options through the software. Participants should match facial expression of the target at the bottom of the screen with one of the top choices. The pictures used in the rehearsal were other than the main emotions investigated in the study. Each subject accomplished 36 trials totally: 3 facial expressions×2 genders of target pictures × 6 repeated measures. During the experiment, the next trial was not displayed until the response had recorded.Both accuracy and reaction time were recorded automatically by the MATLAB software (figure-1).

Results and Discussion

The collected data was recorded in MATLAB software automatically.To analyze the data related to two main dependent variable, accuracy and reaction time using programming in the main software was ordered for each subject based on gender of the target (2 states) and emotional state (3 states)and then transferred into SPSS software, version 19. For each subject, all the reactions time below 1 second was deleted (missed trials) and out of range data was also deleted through Boxplot (totally, 2/7% of all efforts). Then, the mean of six repetitions was calculated for each dependent variable. Finally, based on variables factors, 6 dependent variables were computed. Table 1 presents the accuracy and reaction time (only for correct responses). In the evaluation of speed-accuracy trade-off, it was revealed that the correlation between accuracy and reaction time of "neutral" withmale gender of picture was significant for the TD group (r=-0/384, p=0/44). Further, the correlation between accuracy and reaction time was obtained only for "surprise" with female gender of picturein HF ASD group (r=-0/455, p=0/015).

Table 2 indicates the main effect of intra-group factors interactions.

To investigate the main effect of interaction between factors in General Linear Model, repeated measures ANOVA was performed only for the correct responses at several levels including group factor between subjects at two levels (group: HF ASD against TD) with two factors within subjects and the gender of the target stimulus (at two levels of male and female) and facial expression (at three levels of neutral, fear and surprise).

Table-1
Accuracy and Total Reaction Time (ms) for All Three facial expressions in both HF ASD and TD Group

Group	**Typical Developing(28)**		**High Function ASD (28)**	
	Mean	Standard Deviation	Mean	Standard Deviation
Accuracy	0/98	0/3	0/93	0/7
Reaction time	4/183	0/945	4/735	1/207

Table-2
The Main Effect of Intra-Group Factors Interaction

Effect		**Variable**	**Degree of freedom**	**Mean of squares**	**F**	**Sig**
Intra-Group	Main	Gender of the targeted picture On accuracy	1	0/000	0/010	0/920
		On reaction time	1	0/284	0/365	0/549
	Main	facial expression on accuracy	2	0/001	0/095	0/905
		On reaction time	2	0/731	1/070	0/347
	Interactional	Gender * Group on accuracy	1	0/007	0/619	0/435
		On reaction time	1	5/489	7/061	0/010
	Interactional	Gender of the picture* facial expression on accuracy	2	0/003	0/466	0/629
		On reaction time		0/025	0/042	0/959
	Interactional	Group * facial expression on accuracy	2	0/003	0/463	0/631
		On reaction time	2	0/181	0/266	0/767
	Interactional	facial expression * Gender* group on accuracy	2	0/002	0/414	0/662
		On reaction time	2	0/404	0/674	0/512
Inter-Group	(Group) Accuracy		1	1/555	17/368	0/000
	On reaction time		1	15/130	1/287	0/262

Also, the main effect of intelligence (verbal, practical and overall), age and intelligence (overall) of subjects included as covariance in analyses, was not significant on accuracy (F(1/54)=0/65, p=0/799), accuracy and on reaction time (F(1/54)=2/521, p=0/118), respectively; as well as intelligence on accuracy (F(1/54)=0/135, p=0/714) and on reaction time (F(1/54)=2/820, p=0/99) and on reaction time, respectively.

The main group factor on the accuracy of responses was also significant (F (1/54) =7/201 p=0/010). Moreover, the main group factor on reaction time was significant (F (1/54) =4/087, p=0/048). By conducting independent t-test, it was revealed that there is a significant difference between two groups in terms of accuracy of two groups in neutral state and the picture of female gender (t=-2/277, p=0/27). The difference was also significant for the picture of male gender in all three states of "fear" (t=-2/203, p=0/032), "neutral" (t=-2/277, p=0/27) and "surprise" (t=-2/798, p=0/007). The main effect of facial expression within groups was not significant on accuracy of response and reaction time; (F (2,110) =1/070, p=0/347) and (F (2,110) =0/095, p=0/909), respectively.

The main effect of gender factor of the stimulus picture as intra-group factors was not significant on accuracy and reaction time, respectively; (F (1/54) = 0/365, p=0/549) and (F (1/54) = 0/010, p=0/920), respectively.

The interactional effects between two groups and gender was not significant on accuracy (F (2/110) = 0/619, p= 0/435) while it was significant on reaction time (F (2/110) = 7/061, p= 0/010), respectively.

The interactional effect of three factors of group, facial expression and gender on accuracy and reaction time was not significant; (F (2/110) = 0/414, p= 0/662) and (F (2/110) = 7/674, p=0/512), respectively.

The interaction of facial expression states on accuracy and reaction time in the picture of male and female gender have been presented in the figures 1 to 4 and figure 5 also shows the percentage of mistake matching of HF ASD group for other emotions.

Conclusion

The results obtained from statistical test of repeatedmeasures ANOVA revealed that there is a significant difference between two HF ASD and TD group in terms of facial emotion recognition, both in accuracy and reaction time. By using independent t-test, it was revealed that this significant difference occurs only when the gender of the picture is female and the state of the face is neutral.

The difference in "neutral" state recognition was proposed regarding autistic children for the firsttime. Such limitation is due to the fact that in all studies related to facial emotions recognition between typical and affected groups, researchers have used "happiness" as baseline state to compare the accuracy and reaction time between them[5].

"Local bias" is another subject investigated by many researcherswith facial emotion recognition tasks and facial expression[17]. In this strategy, children have been less influenced by texture and visual search is based on differences rather than similarities [1]. Of course, such tendency does not seem to be a complete defect but it is an atypical method which can be sometimes led to inappropriate performance. As autistic group spend much time to recognize three facial states and only in the pictures of males, this difference also is derived from the same minor strategy instead general and autistic children spend much time to provide proper responses in this effort to investigate other regions of the picture such as the distance and the shape of eyebrows, mouth, nose, forehead lines, and so forth[18].

In other facial states, there was no difference between two groups in terms of proper emotion recognition. It is consistent with the findings of Capps et al., 1992; Castelli, 2005; Wright et al., 2008; and Camfferman et. al., 2002(1). However, such lack of difference may be due to saliency of minor characteristics in facial emotion pictures but not directly. Facial emotion recognition related to fear, surprise, and especially in mouth area caused the lack of difference between two groups[18].

However, intact performance on some emotion processing tasks does not reject atypical process strategy, leading to the disorder in performing some tasks and compensating this disorder in tasks.

It seems that the stimulus type plays an important role since anomaly in facial emotions recognition in autistic children, especially in negative, complex and delicate emotions or the stimuli are social and dynamic[1,4].

In this study, inclusion criteria such as practical, verbal and overall intelligence, gender, and age were controlled Notably, unlike the findings of Everset al (2012), no evidence was found on the effect of age in facial emotional recognition in both autistic and typical groups. It was expected that autistic children outperformed by increasing the age. In the affected children, age directly and indirectly provides the opportunity for more experiences, learning through compensatory and rehabilitation strategies, and neural system maturity. Maybe, the lack of difference in terms of age is due to the fact that such children do not still receive rehabilitation or training in this regards and families pay attention to verbal skills more than communicative skills.

Another important issue is that children with HF ASD may do not reveal any difference in facial emotions recognition due to the use of compensatory strategies, so it is recommended to increased applied tasks to show the differences. Finally, based on the evidence of this study, there is no difference in facial

emotion recognition between two groups, except than neutral state when the targets stimulus was female. Maybe, the lack of difference is due to the fact that applied task in this experiment was not sufficient complex to reveal differences between two groups.

Acknowledgements

This study was funded by Shahid Beheshti University of Medical Sciences. The authors thank all children, parents and schools for participating in this experiment, and Doctor Malahat Akbarfahimi for permission of Radboud Faces Database.

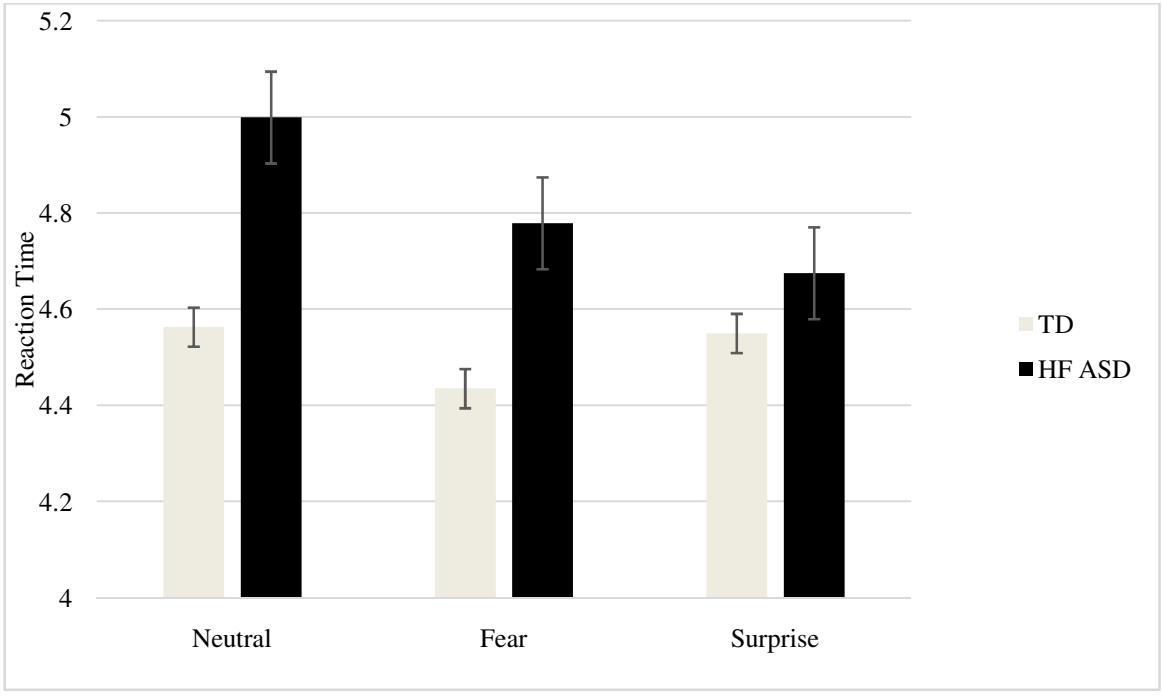

Figure-1
The interaction between facial expression of female gender of target and group on Accuracy

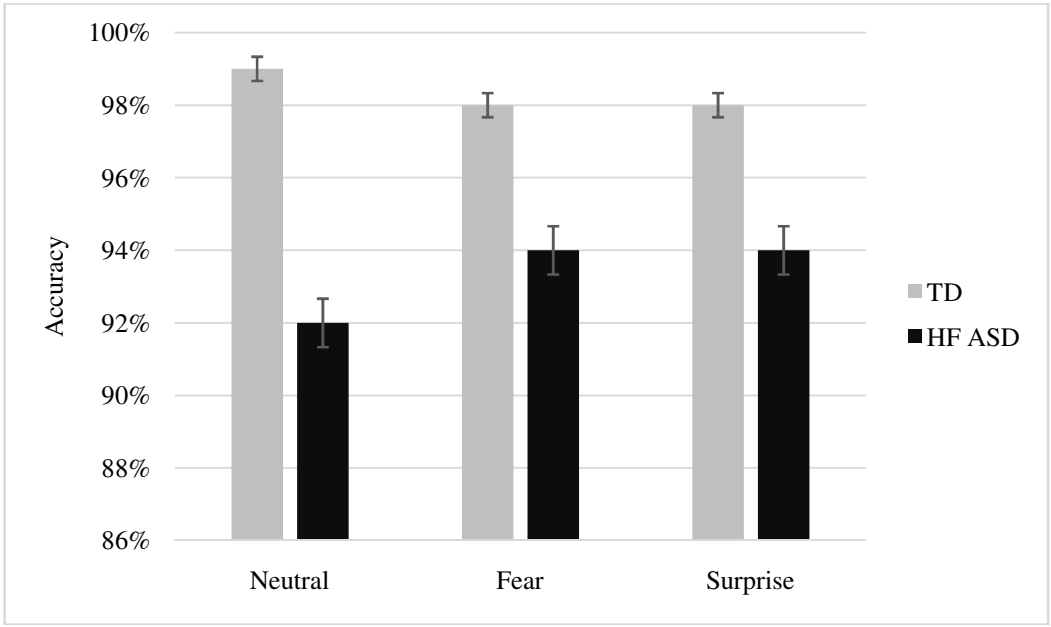

Figure-2
The interaction between facial expression of male gender of target and group on Accuracy

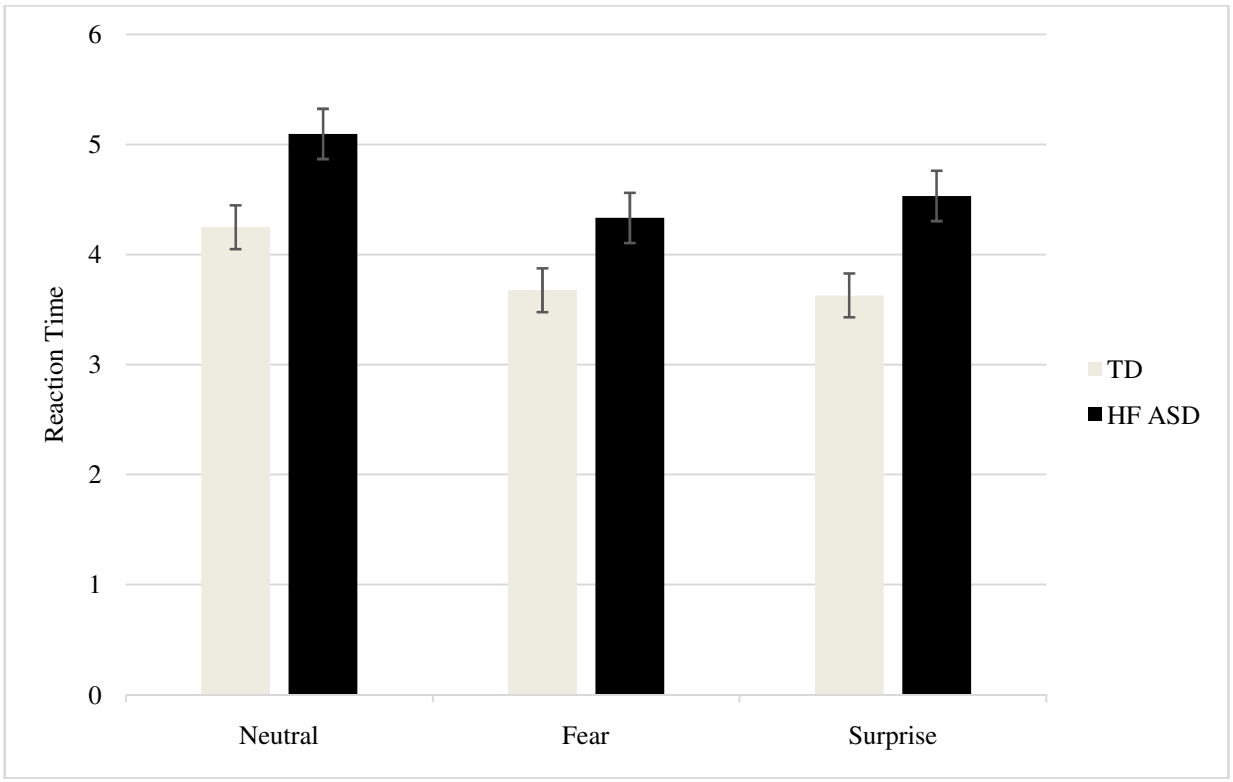

Figure-3
The interaction between facial expression of female gender of target and group on Reaction Time

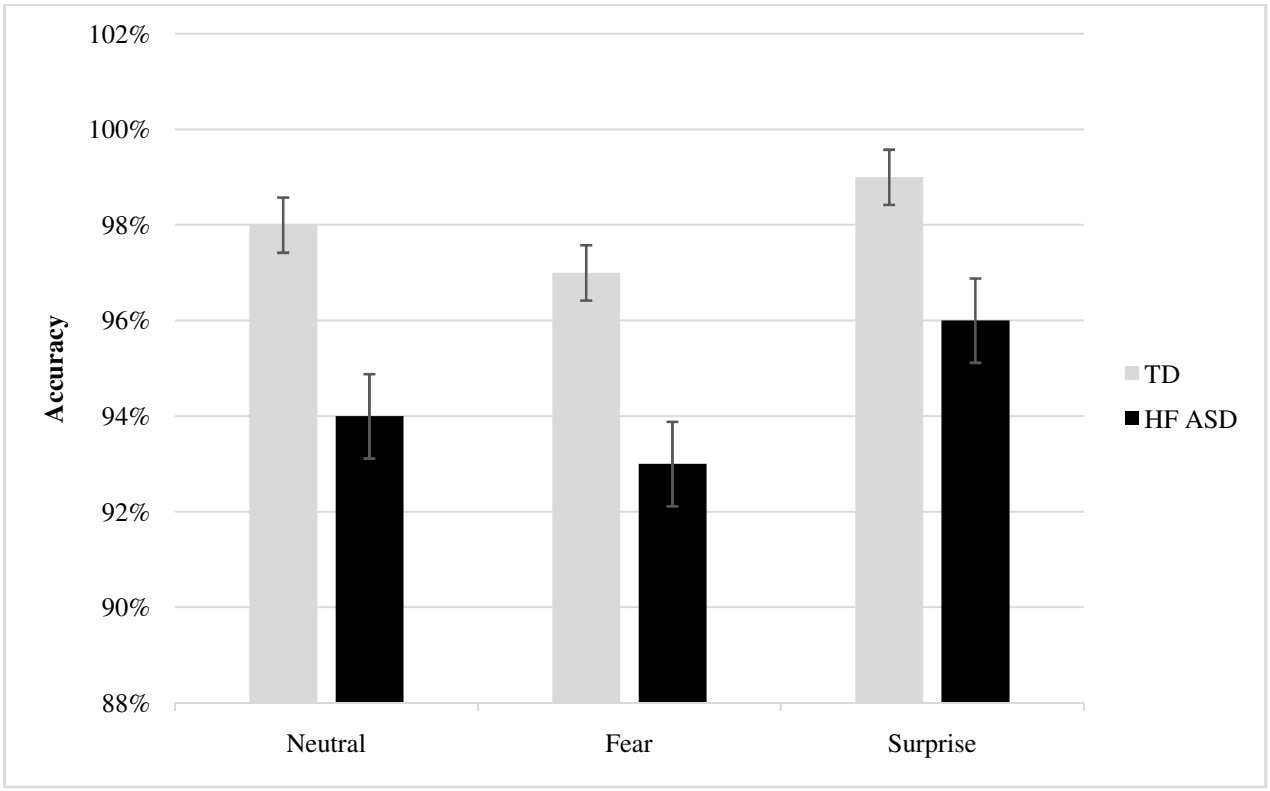

Figure-4
The interaction between facial expression of male gender of target and group on Reaction Time

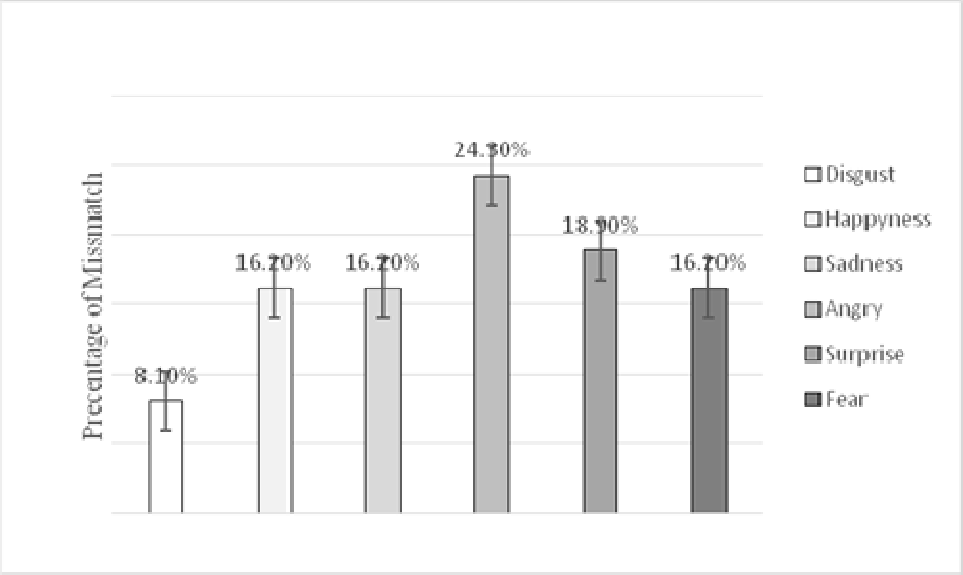

Figure-5
The percentage of mismatching target with other basic facial expressions

Figure-6
An example of the trials of a facial emotional recognition task when target is fear with male gender

Reference

1. Evers K, Noens I, Steyaert J and Wagemans J, Combining strengths and weaknesses in visual perception of children with an autism spectrum disorder: Perceptual matching of facial expressions, *Research in Autism Spectrum Disorders*, **5(4)**, 1327-42 **(2011)**

2. Hadjikhani N, Mirror neuron system and autism, In: Carlisle PC. Progress in Autism Research, First ed. New York, *Nova Science*, 151-66 **(2007)**

3. Golan O, Ashwin E, Granader Y, McClintock S, Day K and Leggett V et al, Enhancing emotion recognition in children with autism spectrum conditions: An intervention using animated vehicles with real emotional faces, *Journal of Autism and Developmental Disorders*, **40(3),** 269-79**(2010)**

4. Harms MB, Martin A and Wallace GL, Facial emotion recognition in autism spectrum disorders: a review of behavioral and neuroimaging studies*, Neuropsychol Rev*, **20(3)**, 290-322 **(2010)**

5. Uljarevic M and Hamilton A, Recognition of Emotions in Autism: A Formal Meta-Analysis, *Journal of Autism and Developmental Disorders*, **43(7)**, 1517-26 **(2013)**

6. Ashwin C., Chapman E., Colle L. and Baron-Cohen S, Impaired recognition of negative basic emotions in autism: A test of the amygdala theory, *Social Neuroscience*, **1(3-4),** 349-63 **(2006)**

7. Baron-cohen S, Spitz A and Cross P, Do children with autism recognise surprise? A research note, *Cognition and Emotion,* **7(6),** 507-16 **(1993)**

8. Ehlers S, Gillberg C and Wing L, A screening questionnaire for Asperger syndrome and other high-functioning autism spectrum disorders in school age children, *Journal of Autism and Developmental Disorders*, **29(2),** 129-41 **(1999)**

9. Oldfield RC, The Assessment and Analysis of Handedness: The Edinburgh Enventory, *Neuropsychologia*, **9,** 97-113 **(1971)**

10. Shahim S, Investigation of short forms children Wechsler scale for use in Iran, Persian, *Humanities and Social Sciences*, Shiraz University, **9(2),** 67-80 **(1994)**

11. Sattler JM., Assessment of children: Cognitive applications (4th edition), San Diego, CA: Jerome M Sattler Publisher Inc, **(2001)**

12. Minshew NJ., Turner CA. and Goldstein G., The application of short forms of the Wechsler intelligence scales in adults and children with high functioning autism, *Journal of Autism and Developmental Disorders*, **35(1)**, 45-52 **(2005)**

13. Kasehchi M., Validity and reliability of persian version of high-functioning Autism Spectrum Screening Questionaire age 7-12 (ASSQ) (Persian), Tehran: University of Social Walfare and Rehabilitation, 16-20 **(2012)**

14. Alipoor AAM, The validity and reliability of Edinburgh handedness inventory in Iran (Persian), *Journal of Psychological Science*, **6(2),** 117-33 **(2007)**

15. Langner O., Dotsch R., Bijlstra G., Wigboldus DH., Hawk ST. and Van Knippenberg A., Presentation and validation of the Radboud Faces Database, *Cognition and Emotion,* **24(8),** 1377-88 **(2010)**

16. Baron-Cohen S., Golan O. and Ashwin E., Can emotion recognition be taught to children with autism spectrum conditions?, *Philosophical Transactions of the Royal Society B: Biological Sciences*, **364(1535),** 3567-74 **(2009)**

17. Ekman P and Friesen WV, Unmasking the face: A guide to recognising emotions from facial expressions, Malor ed: Los Altos CA, 23-27 **(2003)**

18. Drake JE., Redash A., Coleman K., Haimson J. and Winner E., Autistic local processing bias also found in children gifted in realistic drawing, *Journal of Autism and Developmental Disorders,* **40(6),** 762-73 **(2010)**

19. Schultz RT., Developmental deficits in social perception in autism: The role of the amygdala and fusiform face area, *International Journal of Developmental Neuroscience*, **23(2),** 125-41 **(2005)**

20. Muhammad Hussain, Sajid Ali Khan, Nadeem Ullah, Naveed Riaz and Muhammad Nazir, Computationally Efficient Invariant Facial Expression Recognition*, Res. J. Recent Sci.,* **3(2),** 61-68 **(2014)**

21. Hicham Mokhtari, Idir Belaidi and Said Alem, Performance Comparison of Face Recognition Algorithms based on face image Retrieval, *Res. J. Recent Sci.,* **2(12),** 65-73 **(2013)**

22. Parvin Genji and Mahmoud Yaghoubi Doust, Examining the Effect of the Social Confidence, *Research Journal of Recent Sciences*, **2(9),** 25-28 **(2013)**

23. Alamgir Amjad Ali, Sajjad Ahmad Khan, Dost Muhammad Khan and Umair Khalil, A New Efficient Redescending M- Estimator: Alamgir Redescending M-estimator, *Res. J. Recent Sci*., **2(8),** 79-91 **(2013)**

24. Iyer K. and Khan Z.A., Depression: A Review*, Res. J. Recent Sci*., **1(4),** 79-87 **(2012)**