



Determination of Emotion Recognition and Imitation of Participants with Autism Spectrum Disorder

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To Cite this Article

Dr. Payel Dey Ghosh and Dr. Anwesha Chakrabarti. Determination of Emotion Recognition and Imitation of Participants with Autism Spectrum Disorder. International Journal for Modern Trends in Science and Technology 2023, 9(04), pp. 432-439. <https://doi.org/10.46501/IJMTST0904064>

Article Info

Received: 29 March 2023; Accepted: 24 April 2023; Published: 28 April 2023.

ABSTRACT

The present study comprises three experiments. The purpose of the first experiment was –i) to determine the recognition ability of persons with autism spectrum disorder (ASD) from videos and static pictures depicting emotional expressions. 18 participants (Male= 11 & Female= 7) with ASD, matched by receptive and expressive language ability, participated in this experiment. Videos showing the emotional expressions of one actor, and one actress and static pictures of emoticons (both concrete and abstract expressions) were presented to the participant. Results revealed that recognition of emotions was significantly better from dynamic expressions than abstract static emoticons. Further recognition of sad expressions was better in the case of concrete emoticons compared to abstract ones.

The second experiment aimed to measure the effect of gender in recognizing emotional expressions. Twenty-Six individuals (10 females and 16 males) matched by receptive and expressive language as well as the severity of autism participated in this study. No significant effect of gender was observed in the case of emotion recognition.

In the third experiment, the primary objectives were to find out the ability to imitate of emotional expression ability of persons with ASD and the effect of gender on the imitation of emotional expression. 12 participants with ASD (male-7 & female-5) took part in this study. They were instructed to imitate the emotional expressions of one actor and one actress. Participants' facial expressions were recorded. It was found that participants imitate the sad expressions of actor significantly better than the actress. It was also revealed that male participants' same-gender imitation of sad expressions was significantly better than cross-gender imitation. Thus, the effect of gender was observed in the case of imitation but not in the recognition of emotion.

Key Words: emotion recognition, imitation, facial expression, Autism, gender

1. INTRODUCTION

The development of interaction in social life requires children to learn to recognize others' emotions successfully as well as express emotions properly. Human beings are sensitive to facial expressions from a very early stage of life. Infants start responding to

emotional signals as early as 2 months of age (Tanguay, 1990). In social situations, we need to understand the perspectives of others. We need to recognize others' emotions to understand their perspectives. Therefore, recognition of emotion is a very crucial skill in the socialization process. Children learn to

express emotions by imitating others. Therefore, imitation of emotional expression is also a vital part of one's development.

Autism Spectrum Disorder is a neurodevelopmental disorder (DSMV). The main features of autism are a deficit in social communication and the exhibit of repetitive behaviors.

Individuals with Autism Spectrum disorder (ASD) have a deficit in recognizing emotions. In a study Hayo, Berggren, Lassalle et. Al (2016) found that individuals with ASD have a deficit in recognizing both basic and complex emotions. Wallace, Case, Harms, Silver, and Kenworthy (2011) found that adolescents with ASD have difficulty recognizing sad expressions. Similarly, Borastone, Blakeman, Chilvers and Skuse (2007) also conducted a study. Their purpose was to find out whether persons with ASD used motion as a cue for recognizing emotions. They used both computerized animators and facial expressions. The result showed that adults with ASD have deficits in recognizing sadness from both facial expressions and movement patterns. This study also revealed that individuals with ASD do not use motion as a cue.

Kuusiko, Haapsoma, Janssen-Verkasalo, Hurting, Mattila, Ebeling, Jussilo, Boolte, and Moilenan (2009) conducted a test to compare the ability to recognize the basic emotions of individuals with ASD and typical control. They used the Frankfurt Test and Training of Facial Affect (FEFA)- a standardized computerized measurement for this purpose. Their findings also support the fact that individuals with ASD face difficulty in recognizing emotions. Humphreys, Minshnew, Leonard, and Behrmann (2007), conducted a study to test whether individuals with Autism have impairment in recognizing basic facial expressions, and if impairment exists, they have impairment in expression processing in general or to certain expressions. For this purpose, they used the 'facial expression megamix' paradigm. In this paradigm, adults with autism and the typical development group have performed six-alternative forced-choice responses to morphs of all possible combinations of six basic expressions identified by Ekman. It was found that the two groups differed significantly, especially in recognition of fear, disgust, and happiness.

Therefore, from the above discussion, it is observed that individuals with ASD have deficits in recognizing

simple emotions such as sadness, and fear as well the complex emotions such as disgust. This deficit may be one factor that hinders their social interaction.

However, not all studies support that view. There are also some studies that show that individuals with ASD have no deficits in recognizing emotions (Ozonoff, Pennington & Rogers, 1990; Capps, Yirmiya & Sigman, 1992; Gepner, Deruelle and Grynfeldt, 2001). Researchers used different approaches like sorting and matching tasks to assess the ability of individuals with ASD to recognize emotional expressions. In the case sorting task researchers observed that individuals with ASD did not differ from their intellectually impaired counterparts when they must sort by emotional features (Jennings, 1973; Weeks and Hobson, 1987). Ozonoff, Pennington, and Rogers. (1990) also observed that individuals with ASD did not differ in sorting tasks of emotion recognition from 'typical' children matched by verbal mental age. In a matching task, Gepner, Deruelle, and Grynfeldt (2001) asked participants to match videotaped emotional and non-emotional facial expressions with photographs. There were 3 types of expressions- still, dynamic, and strobe. They observed that if individuals with ASD get enough time to process dynamic stimuli, they can recognize the emotion.

Evers, Kerkhof, Steyaert, Neons, Wagemans (2014) conducted a study where they used hybrid facial expressions. They used two groups of participants - 6 to 8 years old boys with ASD and a typically developing control group. Both groups were matched by intelligence. They found that there is no difficulty in emotion recognition in ASD.

Researchers also observed that individuals with ASD have difficulty in recognizing emotional expressions from dynamic stimuli. In a study work, Enticott et.al (2016) observed that individuals with ASD have a deficit in recognizing sad expressions from dynamic stimuli compared to static ones. Grosso, Bossi, and Ricciardelli (2015) also observed that individuals with ASD can recognize sad expressions better from static stimuli. In a study, Stagg, Huan Tan and Kodakkadan (2021) observed that individuals with Autism can recognize static emotion just like their non-autistic counterparts. However, they have difficulty considering contextual cues during recognizing emotions.

The above discussion clearly reveals that researchers have different views regarding the emotion recognition

abilities of individuals with ASD. Some research shows these individuals have a deficit in emotion recognition, while others found no difficulty at all. Further, according to some researchers, these individuals have a deficit in recognizing emotion from dynamic stimuli, not static ones. Considering these controversies, the present study tries to find out the emotion recognition abilities of individuals with ASD from dynamic and static stimuli.

Besides the nature of the stimulus, another factor that may affect the recognition of the emotion is the gender of the participants. Studies have shown the effects of gender on emotion recognition. Females are better than male in face recognition (Yonker, Eriksson, Nilsson and Herlitz, 2003). In a study, Hall (1978) found that females understand visual and auditory cues better than males. Besides Wright and Sladden (2003) also observed „own gender bias“ i.e., individuals can better identify same-gender faces than cross-gender faces. It is expected that all these gender differences may also be present in the case of individuals with ASD. Research also suggests that individuals with ASD have difficulty in face processing (Dawson, Webb & McPartland 2002). It has a negative impact on their face perception and memory of faces (Ellis, Ellis, Fraser & Deb, 1994; Klin Sparrow, Blildt, Cicchetti, Cohen, & Volkmar 1999; Hauck, Fein, Matby, Waterhouse and Feinstein, 1998). Because of all these difficulties, they also have problems with their perception of gender (Hobson, 1987; Njokiktjien et al., 2001). The discussion reveals that gender may have an impact on emotion recognition. Therefore, another aim of the study is to determine the same-gender and cross-gender emotion recognition of individuals with ASD.

Imitation is another important aspect of emotional development. The underlying mechanisms of imitation may be the precursor of Theory of Mind (ToM) development (Rogers and Pennington, 1991). Meltzoff and Gopnik (1993) also proposed that imitation is the first step of ToM. Researches show that individuals with ASD have difficulty imitating others' (McIntosh, Decker, Winkelman, & Willbarger, 2006, Loveland, Tunali-kotoski, Pearson, & Brelsford, 1994) However, there are very few studies that explore the role of gender in imitation in case of this population. Therefore, another objective of the present study is to explore the role of gender in the imitation of emotional expression in the case of this population.

Method

The present study comprises of three experiments.

Experiment 1

Participant: Eighteen participants (male 11 and female 7) with mild ASD participated in this study. They were matched by receptive and expressive language ability. They were selected from a special school in Kolkata. Informed consent was obtained from their parents.

Tools:

Communication DEALL Developmental Checklist: Developed by Karanth (2007) to assess the receptive and expressive language ability of persons with ASD.

Autism Diagnostic Checklist: Developed by Banerjee (2007) to assess the severity of autism.

Emotional Expression videos: Developed by Dey Ghosh, Chakraborty, Chanda et. al (2018)

Procedure: Researchers selected eighteen participants with ASD. They were matched by receptive and expressive language and the severity of Autism. All participants had mild levels of autism. At first, four static pictures of emotional expressions (happiness and Sadness) were presented to the participants. Both concrete and abstract emoticons of happy and sad expressions were used for this purpose. Concrete expressions were presented followed by abstract ones. Researchers asked the participants to recognize those expressions.

After that two standardized videos (dynamic stimulus) of happy and sad expressions of both actor and actress were presented to them. Participants first saw same-gender expressions followed by cross-gender expressions. They were again asked to recognize those expressions. Their responses were noted.

Experiment 2

Participants: Twenty-Six individuals (10 females and 16 males) with mild ASD participated in the study. Participants were matched by receptive and expressive language as well as the severity of autism participated in this study.

Tool:

Same as the experimenter 1

Procedure: Participants were matched by their receptive and expressive language as well as severity level. The participants had a mild levels of autism. Four standardized videos of happy and Sad expressions (both male and female individuals) were presented to the participants. Same-gender emotional expressions were

presented first followed by cross-gender expressions. The responses of the participants were noted.

Experiment 3

Participants: Twelve participants with mild ASD (male-7& female-5) took part in this study. All of them are students at the same school. Researchers obtained informed consent from their parents.

Tools:

Same as experiment 1

Procedure: Emotional expressions of twelve participants with ASD were captured. A laboratory was prepared for capturing facial expressions. In this lab, illumination was controlled by using artificial light. A specially made chair was used to stop body tilt and a chin rest was used to control head tilt. Stimulus videos of happy and sad expressions used in experiment 1 were also used here. Participants were instructed to imitate those expressions. Their expressions were captured by using the webcam.

Result

In all three experiments, nonparametric statistics were used as the data failed to meet the assumption of normality and homogeneity.

Experiment 1

Participants' ability to recognize emotional expression from dynamic and static stimuli.

Table 1 shows the comparison between the participants with ASD in recognizing sad expressions from male videos, female videos, concrete emoticons and abstract emoticons by using the Kruskal-Wallis test.

Stimulus	Mean	SD	p-value
Male sad	0.7059	0.47	0.04
Female sad	0.8235	0.39	
Emoticons concrete sad	0.8235	0.39	0.01
Emoticons abstract sad	0.4706	0.51	

Table 1 shows that there is a significant difference between participants in recognizing sad expressions from two videos and two emoticons.

Table 2 shows the comparison between the response of participants with ASD in recognizing sad expressionism concrete and abstract emoticons by using the Mann-Whitney Test:

Stimulus	Mean	SD	p-value
Emoticons concrete sad	0.8235	0.39	0.01
Emoticons abstract sad	0.4706	0.51	

Participants recognize sad expressions better from concrete emoticons than abstract one

Table 3 shows the comparison between the response of participants with ASD in recognizing sad expressions from female videos and abstract emoticons by using the Mann-Whitney Test

Stimulus	Mean	SD	p-value
Female video sad	0.8235	0.39	0.01
Emoticons abstract sad	0.4706	0.51	

Participants recognize sad expressions better from the videos of an actress than abstract one.

Table 4 shows the comparison between the response of male participants with ASD in recognizing sad expressions from concrete and abstract emoticons by using the Mann-Whitney Test.

Stimulus	Mean	SD	p-value
Emoticons concrete sad	0.7273	0.47	0.05
Emoticons abstract sad	0.3636	0.25	

Table 4 shows that in the case of male participants recognition of sad expressions was much better from concrete emoticons compared to abstract ones.

Table 5 shows the comparison between the response of male participants with ASD in recognizing happy expressions from female videos and abstract emoticons by using the Mann-Whitney Test

Stimulus	Mean	SD	p-value
Female happy(cross-gender)	1.0000	0.00	0.05
Emoticons abstract happy	0.6364	0.50	

Table 5 shows that male participants' cross-gender recognition of happy expressions was much better than recognition of abstract emoticons.

Table 6 shows the comparison between the response of male participants with ASD in recognizing sad expressions from female videos and abstract emoticons by using the Mann-Whitney Test

Stimulus	Mean	SD	p-value
Female sad	0.8182	0.40	
Emoticons abstract sad	0.3636	0.50	0.03

Table 8 shows that male participants' cross-gender recognition of sad expressions was much better than recognition of abstract emoticons.

Experiment 2

Participants' ability to recognize emotions (happiness and sadness) from the same gender and cross-gender expression:

Table 1 shows the Mean, SD, and Wilcoxon signed Rank test of the score of female participants with ASD in recognize-gender and cross-gender emotional expressions.

	Actress		Actor		Z	p-value
	Mean	SD	Mean	SD		
Happiness	0.78	0.44	0.78	0.44	0.00	1.00
Sadness	0.78	0.44	0.88	0.33	-5.77	0.56

Table 2 shows the Mean, SD, and Wilcoxon signed Rank test of the score of male participants with ASD in recognizing same-gender and cross-gender emotional expressions.

	Actress		Actor		Z	p-value
	Mean	SD	Mean	SD		

	Mean	SD	p-value	value		
Happiness	0.71	0.47	0.76	0.43	-0.378	0.71
Sadness	0.78	0.44	0.88	0.33	-1.134	0.257

Tables 2 and 4 reveal that both female and male participants' same-gender and cross-gender recognition of happiness and sadness do not differ from each other. Therefore, gender has no significant effect on emotion recognition in the case of participants.

Experiment 3

Participant's ability to imitate emotions from dynamic stimuli.

Table 1 Comparison between the score of imitation of participants with ASD in case of sad expressions of actor and actress

	Mean	SD	p-value
Video of the Actor	2.05	1.8	0.02
Video of the Actress	0.83	1.4	

Participants' imitation of sad expressions is much better in the case of the video of the actor than the actress.

Table 2: Comparison between the score of imitation of male participants with ASD in case of sad expression

	Mean	SD	p-value
Same gender imitation	1.78	0.9	0.02
Cross-gender imitation	0.006	0.02	

Male participants' same-gender imitation is better than cross-gender imitation.

Discussion

Emotion recognition and imitation both are vital parts of emotional as well as social development. Individuals with ASD have deficits in emotional components. As described by Leo Kanner (1943) Autism is a 'disturbance of affective contact'.

In the present study, at first, the emotion recognition ability of individuals with high-functioning ASD from both dynamic and static expressions was assessed. It was

observed that this group of high-functioning ASD recognizes both happy and sad expressions. However, their generalization ability is poor. Their recognition is better in the case of dynamic expressions compared to static ones. Dynamic expressions are more related to real-life situations. This may have enhanced their recognition of expressions presented through videos. Further, it is also observed that participants with ASD are more comfortable with human expressions than emoticons. Besides, their ability to recognize happiness is better than sad expressions.

The second experiment focuses on participants' same-gender and cross-gender emotion recognition abilities were assessed. Studies have shown the effects of gender on emotion recognition. Females are better than male in face recognition (Yonker, Eriksson, Nilsson, and Herlitz, 2003). In a study, Hall (1978) found that females understand visual and auditory cues better than males. Besides Wright and Sladden (2003) also observed „own gender bias“ i.e., individuals can better identify same-gender faces than cross-gender faces. It is expected that all these gender differences may also be present in the case of individuals with ASD. Research also suggest that individuals with ASD have difficulty in face processing (Dawson, Webb & McPartland 2002). It has a negative impact on their face perception and memory for faces (Ellis, Ellis, Fraser & Deb, 1994; Klin Sparrow, Bildt, Cicchetti, Cohen, & Volkmar 1999; Hauck, Fein, Matby, Waterhouse and Feinstein, 1998). Because of all these difficulties, they also have problems in the perception of gender (Hobson, 1987; Njiokiktjien et al., 2001). However, contrary to previous research, the present study finds that both male and female participants' ability to recognize same gender and cross-gender expressions are equal. In other words, gender of that stimulus has no effect on participants' recognition of emotional expressions.

The third experiment tried to assess the imitation ability of the participants with high-functioning ASD and the effect of gender in imitation is also observed. Findings reveal that gender influences the imitation of emotional expression especially the imitation of sad expression. This effect is more prominent in the case of male participants than their female counterparts.

Finally, these experiments reveal that these high-functioning individuals with ASD have deficits in both recognition and imitation of sad expressions. Gender influences the imitation of expressions but not the recognition.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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