# GREAT talks

The use of artificial intelligence to assess attention in children with autism spectrum disorder

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# Introduction



#### **Children with Autism Spectrum Disorder**

They are characterized with neurodevelopmental disorders, social and communication deficit as well as *atypical attention*.

#### Attention

It is the ability to focus on a relevant information while ignoring other irrelevant contents.

#### **Types of Attention**

- 1. Focus: Engaging and re-engaging to a stimulus
- 2. Sustained: Continuous engagement to a stimulus
- 3. Selective: Continuous engagement to a stimulus in the presence of distracting stimuli
- 4. Shifting: Continuous engagement to different tasks of the same level of cognition.
- 5. Divided: Simultaneous response to different tasks of different levels of cognition



#### Why Selective ?

### Introduction (contd.)

Technologies for Attention Measurement

Obtrusive







#### Unobtrusive





## Introduction (contd.)

#### **Emotions**

It is a way of expressing inner feelings using facial action units

#### The Seven Universal Facial Expressions of Emotion



www.MicroExpressions.co.nz, www.facebook.com/sdlmicroexpressions & www.StuDunn.com



### **Introduction** (contd.)







Negative

Displeasure



Indifferent emotion



Educators and psychologists suggest that emotions of children with ASD can affect their ability to maintain attention on a task.

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**Positive** 

• Surprise



- Sadness
  - Disgust

• Anger

- Fear
- Contempt

## **Recent Studies on Emotions and Attention**

#### **Emotion and Attention Assessment**

Recent studies have shown that emotions can impact the level of engagement or attention <sup>1</sup>. Other studies showed that emotion does not affect attention <sup>2,3</sup>

#### **Emotion in ASD**

- Positive and negative emotions of children with ASD can measure duration of engagement <sup>5</sup>. The positive emotion explored by this study was happy while the negative emotion is anger
- Children with autism spectrum disorder (ASD) may experience difficulties in expressing emotions compared to typically developing (TD) children <sup>4</sup>





Attention

Inattention

### **Research Gap / Current Study**

#### **Research Gap on Emotion and Attention Assessment**

Based on these studies, it is not clear how the basics emotion can serve as potential measures for assessing selective attention.



Understanding how the expression of emotions in children with ASD differs from that of TD children could enhance attention assessment in ASD.

#### **Research Questions**

The following research questions were generated to achieve the objective of the current study :

- 1. Are there significant differences in emotions of children with ASD and TD peers?
- 2. What is the correlation between emotion and attention (performance score)?



# Methodology



Virtual Classroom forAttention Task



Real-Time Emotions Recognition

IMOTIONS

https://imotions.com/

Validation of Task Performance

> (Statistical Analysis)





**Attention Assessment** 



### Methodology (contd.)



**Capturing emotions in real-time** 



# Result

#### Table 1: Comparison of emotions between ASD and TD

	ASD group (n=18) Mean(SD)	TD group (n=18) Mean(SD)	t	P
Demonschie				
Demographic				
Age	8.57(1.40)	8.78(1.36)		0.946¶
Gender				1.000¶
Male	14(77.8%)	14(77.8%)		
Female	4(22.2%)	4(22.2%)		
Emotions				
Anger	0.70(1.83)	12.20 (36.16)	-1.310	0.207
Sadness	3.07(6.43)	0.41 (1.46)	1.671	0.111
Disgust	6.12(10.80)	11.32 (36.10)	-0.569	0.576
Joy	114.39(140.12)	101.75 (238.83)	0.188	0.852
Surprise	47.13(41.01)	87.17 (116.83)	-1.333	0.198
Fear	0.94(3.33)	10.15 (29.99)	-1.258	0.225
Contempt	22.02(23.13)	60.28 (67.12)	-2.222	0.037*
Neutral	1862.28 (619.36)	2235.94(419.07)	-2.060	0.048*

**¶**- Pearson chi-square. , \*p<0.05, two-tailed test.



# **Result** (contd.)

Table 2: Correlation between emotions and performance score

Emotions	ASD group (n=18)			TD group (n=18)		
	Mean(SD)	R	Sig	Mean(SD)	R	Sig
Anger	0.05(0.13)	-0.316	.202	0.37(1.10)	-0.351	0.153
Sadness	0.10(0.21)	0.074	.773	0.01(0.03)	-0.472	0.050
Disgust	0.19(0.31)	0.106	.675	0.26(0.83)	0.173	0.492
Joy	4.91(6.51)	-0.206	.413	4.49(10.87)	0.300	0.228
Surprise	2.93(3.16)	0.211	.400	4.15(6.92)	-0.187	0.457
Fear	0.02(0.07)	0.122	.630	0.37(1.17)	-0.293	0.273
Contempt	0.86(1.10)	-0.017	.946	2.21(2.21)	-0.252	0.312
Neutral	73.71(16.40)	0.691	.001**	88.01(15.11)	-0.197	0.432



# **Conclusion and Future work**

#### Conclusion

This current study show that facial muscle activity that defines neutral and contempt emotions in ASD and TD differs while other emotions are similar.

#### Limitation

This study has only considered mild and moderated ASD. Thus, generalization across severe level of ASD needs to be used with caution.

#### **Future Work**

- Low-level emotions such as facial action units describing neutral and contempt emotions in children with ASD and TD peers needs further investigation on attention assessment.
- This study needs to be replicated with ASD subjects consisting of all the three levels of ASD i.e. severe, mild and moderate.



### References

1.) E. A. Phelps, S. Ling, and M. Carrasco, "Emotion facilitates perception and potentiates the perceptual benefits of attention," Psychological science, vol. 17, no. 4, pp. 292–299, 2006.

2.) R. C. Bendall, and C. Thompson, "Emotion does not influence prefrontal cortex activity during a visual attention task. A functional near-infrared spectroscopy study." pp. 36-43.

3.) R. C. A. Bendall, and C. Thompson, "Emotion has no impact on attention in a change detection flicker task, " Frontiers in Psychology, vol. 6, no. 1592, 2015-October-20, 2015

4.) S. Yoshimura, W. Sato, S. Uono, and M. Toichi, "Impaired overt facial mimicry in response to dynamic facial expressions in high-functioning autism spectrum disorders," Journal of autism and developmental disorders, vol. 45, no. 5, pp. 1318-1328, 2015.

5.) L. Escobedo, M. Tentori, E. Quintana, J. Favela, and D. Garcia-Rosas, "Using Augmented Reality to Help Children with Autism Stay Focused," IEEE Pervasive Computing, vol. 13, no. 1, pp. 38-46, 2014.





