

# Individuals with autism spectrum disorders benefit from the addition of coloured tints when discriminating intensities of facial expressions

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## Background

Perceptual impairments in the processing of facial expressions often occur in individuals with autism spectrum disorder (ASD) (Vlamings et al., 2009), possibly related to more general atypical sensory processing and/or visual stress.

Typically developing (TD) individuals who suffer from visual stress (e.g. blurring or apparent movement of text), have also been reported to have impaired recognition of facial expressions (Robinson & Whiting, 2003).

An established means of reducing visual stress and improving reading speed is the use of coloured tints (e.g. Wilkins, Jeanes, Pumfrey & Laskier, 1996).

Ludlow, Taylor-Whiffen and Wilkins (2012) found that, when viewing the eye area, coloured overlays improved recognition of complex emotions in individuals with ASD. However, different areas of the face have been found to be critical when encoding different facial expressions (Smith, Cottrell, Gosselin & Schyns, 2005).

Therefore, the present experiment extended previous research by examining what benefit a coloured tint has on judgements of the intensity of emotion over the entire face, rather than just the eyes.

## Methods

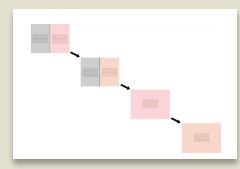
### Participants:

	Age (years; months)	VIQ*	NVIQ*	FSIQ*
TD (n=16)	11:06 (2.47)	88 (17.01)	91 (14.26)	88 (16.39)
ASD (n=16)	10:02 (2.38)	92 (12.32)	86 (13.78)	89 (12.49)

\* IQ scores taken from Weschler Abbreviated Scale of Intelligence (WASI)

### Tint selection task:

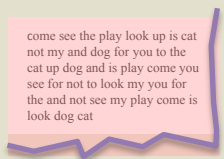
One of 16 coloured tints was presented, over text, on one side of the screen while a grey tint was presented, over text, on the other. Participants were asked to decide which was the clearest and most comfortable. The shortlisted colours were presented successively in randomly ordered pairs one after the other while the participant was required to select the best of the two until the clearest/most comfortable colour was ultimately selected.



### Rate of reading task (RRT):

Example of RRT procedure

Reading speed was measured by presenting text with a coloured selected tint or a grey "tint".

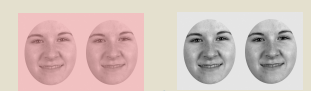


### Emotion intensity discrimination task:

Participants judged which of two simultaneously presented faces expressed the most intense emotion for face pairs displaying anger, sadness, disgust, fear, happiness or surprise. Faces were presented in grey level images with or without the addition of a selected tint superimposed upon the image.

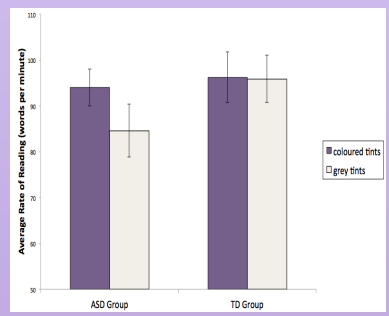
Example of materials (Montagne et al., 2006):

Example of face pair; coloured tint condition      Example of face pair; grey tint condition



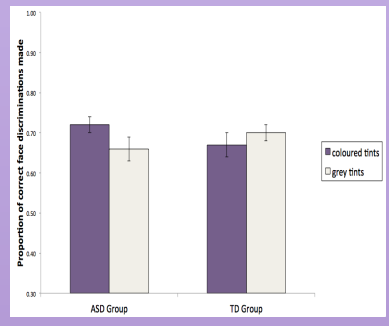
"which face gives the strongest emotion?"

## Results



### Effect of coloured tints on rate of reading:

Reading speed did not differ between groups with either the grey tint or the coloured tint ( $p > .1$ ). With the selected tint ASD children's reading speed improved significantly ( $t(29) = 2.62, p = .014$ ). In contrast, TD children showed no improvement from the addition of the coloured tint ( $t(29) = .212, p > .8$ ).



### Effect of coloured tints on discrimination of emotion intensity:

Emotion intensity discrimination did not differ between groups when either the grey tint or the coloured tint was used ( $p > .1$ ). However ASD children's accuracy of their judgments of emotional intensity was significantly greater than TD children's when viewing colour tinted faces ( $t(29) = 1.687, p = .06$ ).

With the selected tint ASD children's accuracy of their judgments of emotional intensity improved significantly ( $t(29) = -2.40, p = .030$ ). In contrast, TD children showed no improvement from the addition of the tint ( $t(29) = .995, p > .3$ ).

## Discussion

Our study is the first to investigate the benefit of coloured tints in the discrimination of different intensities of facial expressions of emotion. By displaying the whole face we were able to address whether there are difficulties pertaining to expressions that involve different features of the face (Calvo & Fernandez-Martin, 2013; Smith et al., 2005).

Consistent with previous research (Ludlow et al., 2006; 2008; 2012), the ASD group showed a significant improvement in reading speed and face perception with coloured tints. This improvement in discriminating social stimuli suggests that perceptual processing may relate to social impairments in ASD (Kliemann et al., 2010; Ludlow et al., 2012).

Our findings, coupled with previous research, highlight a link between visual stress and impairments in the processing of facial expression in individuals with ASD. Furthermore, we propose that differences in perceptual processing lead to atypical face perception (Deruelle et al., 2008; Leonard et al., 2011; Ludlow et al., 2012; Vlamings et al., 2009).