



Atypical Sensory behaviours in children with Tourette's Syndrome and in children with Autism Spectrum Disorders



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ABSTRACT

Certain visual disturbances make it difficult to read text and have been attributed to visual stress, also called "pattern-related visual stress". 12 Children with ASD, 12 children with Tourette's syndrome and without ASD and 12 controls, all matched on age and non verbal ability, participated in an experiment exploring sensory behaviours and visual stress. Reading rate and accuracy were assessed with the Wilkins Rate of Reading test with and without the Intuitive Overlays. Both the children with Tourette's and the children with ASD showed a higher prevalence of atypical sensory behaviours and symptoms of visual stress than the typically developing control children. Six out of twelve children with Tourette's syndrome (50%) read more accurately and over 15% more quickly with a coloured overlay. Four of the 12 children with ASD and none of the control children read over 15% more quickly with an overlay. The findings are discussed in relation to problems in sensory modulation.

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What this paper adds?

Tourette's Syndrome and Autism Spectrum Disorders have been shown to overlap clinically and prevalence rates for the comorbidity of Tourette's syndrome and ASD are high. Yet despite the many research papers addressing how children with ASD attend to sensory stimuli, there is a paucity of research in other developmental disabilities. To our knowledge this is the first paper to directly assess sensory experiences both in children with ASD and in children with Tourette Syndrome who do not have ASD.

Many of the perceptual atypicalities reported in ASD such as hyper- sensitivity to lights and colours and experiences of visual distortion are often classified in the literature as sensory abnormalities (Dunn, 1999). However, some of these symptoms are reminiscent of those referred to in other literature as visual stress and treated using coloured filters (Wilkins, 1995, 2003). Visual stress here refers to perceptual distortions and discomfort, most notably when reading printed text. If visual stress and sensory difficulties are related problems, then the prevalence of visual stress is likely to be higher in children with sensory disorders. Our findings show the beneficial effect of colour overlays in two different clinical populations associated with sensory atypicalities. Both groups of children showed similar levels of atypical sensory behaviours, and higher levels of sensory avoidance behaviours were correlated with symptoms of visual stress in both groups. It is suggested that colour overlays may be particularly beneficial to children showing a higher prevalence of sensory behaviours.

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1. Introduction

Abnormalities in visual processing are one of the most commonly reported sensory symptoms in children with Autism Spectrum Disorders (Lord, Storoschuck, Rutter, & Pickles, 1993; Mottron et al., 2007). Many of these children demonstrate poor eye contact, looking through or beyond objects, extreme aversion to light and/or unusual reaction to visual stimuli (Kanner, 1943; Ritvo & Laxer, 1983; Chawarska, Klin, & Volkmar, 2003). Whilst some of these symptoms can be caused by undiagnosed vision problems such as binocular vision anomalies (eye co-ordination problems) (Wilson, Paterson, & Hutchinson, 2015), there is also evidence to suggest that the visual difficulties are attributable to the processing of sensory information in the environment. The focus of this paper is on visual sensory abnormalities and their potential remediation.

Visual sensory symptoms in ASD are generally characterized by a hypersensitivity to environmental stimulation. For example, individuals with ASD may show an enhanced ability to select and process visual stimuli (Happé & Frith, 2006; Mottron, Dawson, Soulieres, Hubert, & Burack, 2006) including searching for objects and distracters and/or noticing subtle changes in the scenery (Simmons et al., 2009). Bright lights may cause visual pain and can be distracting to a child (Kleinhans et al., 2010; Doherty-Sneddon et al., 2002). In contrast, other children with ASD are also reported to be hyposensitive and show a diminished response to visual stimuli (O'Neil & Jones, 1997). They may require additional sensory input to register and to be aware of what other children would usually perceive normally. Common autistic symptoms such as stereotyped behaviour, when a child repeats movements like rocking or waving their hands have been attributed to “underactive” senses (Mottron et al., 2006).

Whilst these perceptual behaviours are commonly referred to in anecdotal and autobiographical accounts from individuals with ASD (Grandin, 1992; Williams, 1999), empirical studies addressing atypical visual behaviours are scarce (O'Neil & Jones, 1997). To date, visual behaviours have mainly been categorised as reactions to sensory events and measured by use of parental questionnaires (Dunn, 1999). Items in these questionnaires focus on visual processing abnormalities commonly reported in ASD including hyper-sensitivity to lights and colours (Myles, Cook, Miller, Rinner, & Robbins, 2000; Olney, 2000; Attwood, 2006) and experiences of visual distortion, which may, for example, alter the perceived dimensions of rooms (White & White, 1987).

Many of the perceptual atypicalities reported in ASD are reminiscent of those referred to in other literature as visual stress and treated using coloured filters (Wilkins, 1995, 2003). Visual stress refers to perceptual distortions and discomfort, most notably when reading printed text. Associated symptoms such as discomfort with bright lights are similar to those classified previously in the ASD literature as sensory atypicalities (Dunn, 1999). This apparent overlap between sensory symptoms and visual stress merits further exploration.

Children experience symptoms of ‘visual stress’ most commonly when reading. The symptoms include discomfort and a variety of perceptual distortions of text (e.g. illusory colours, and instability). Placing a coloured overlay on top of a page whilst reading has been shown to be beneficial in reducing these symptoms and increasing reading speed. For example, 5% of 7–8 year old school children show an increase of 25% or more in reading speed when one is used (Wilkins, Lewis, Smith, Rowland, & Tweedie, 2001). The benefits of coloured filters in reducing symptoms have also been found to be greater in neurological disorders in which is reasonable to hypothesise a cortical hyperexcitability: photosensitive epilepsy (Wilkins et al., 1999), migraine (Harle, Shepherd, & Evans, 2006), head injury (Jackowski, Sturr, Taub, & Turk, 1996) and stroke (Beasley & Davies, 2013). The cortical hyperexcitability theory proposes that different colours cause a shift in the major locus of activation away from hyperexcitable areas of the visual cortex to areas that are less hyperexcitable (Wilkins, 2003).

In children with ASD it has been shown that when using overlays having a colour chosen individually to increase the “clarity” of text, the increase in reading speed is substantially greater than in controls matched for age and verbal intelligence (Ludlow, Wilkins, & Heaton, 2006). Several small-scale studies have suggested that the increase in reading speed is not readily attributable to placebo effects and demand characteristics (Ludlow, Heaton, & Wilkins, 2008; Jeanes et al., 1997). In one study involving children with ASD and matched controls, a rate of reading test was carried out in five different conditions: (1) with an overlay chosen for clarity of text, (2) with an overlay of their favourite colour, (3 and 4) with two other coloured overlays from the same set, and (5) without an overlay. Children's performance on the rate of reading was superior only with the overlay chosen for clarity (Ludlow et al., 2008).

Perceptual improvements have also been found to extend to visual search and matching to sample tasks (Ludlow et al., 2008). Beneficial effects of the overlays in ASD have been also been shown on the “reading the eye in mind task” (Baron-Cohen, Joliffe, Mortimore, & Robertson, 1997). Children were presented with photographs of the periocular region of various faces and were asked to judge which emotion was being expressed in the eyes. In children with ASD, the perception of the emotion was significantly improved when using a coloured overlay, providing further evidence that perceptual impairment may contribute to wide range of impairments in ASD, such as their social difficulties (Ludlow, Taylor-Whiffen, & Wilkins, 2012). These results were given further support by a recent study by Whitaker, Jones, Wilkins, & Roberson (2015), who showed that the judgement of emotional intensity in faces by individuals with ASD improved significantly with the addition of a coloured tint. Evidently there may be potential benefits of colour filters in alleviating a range of perceptual distortions in ASD.

If visual stress and sensory difficulties are related problems, then the prevalence of visual stress is likely to be higher in children with sensory disorders. For example, sensory behaviours can also occur in disorders other than ASD, such as Tourette's syndrome. Tourette's syndrome (TS) is a condition characterized by the occurrence of chronic multiple motor and vocal tics, with onset usually around school age (4–6 years) and with a fluctuating course (APA, 2013). It is a complex

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