

Letter to the editor

Case report: Color as a therapeutic intervention

J.G. is a 13-year old boy diagnosed when he was 4 years 6 months with “High Functioning Autism” (HFA) in February 1999 at an Autism Spectrum Disorders Clinic of a Child and Family Mental Health Service, by a consultant and senior lecture in child and adolescent psychiatry. The assessment was conducted by a paediatrician and an educational psychologist. In addition J.G. had “four out of nine features of inattention, five of five features of hyperactivity, and four of four features of impulsivity on the diagnostic checklist. He therefore had Attention and Hyperactivity Disorder (ADHD) according to the US criteria, but not according to the more stringent British criteria. At diagnosis, medication for ADHD was deemed inappropriate for his age and his mother has since refused for him to commence medication. When examined in 2005 at age 10 his receptive vocabulary (Dunn, Whetton & Pintilie, 1997) was 96 and his nonverbal IQ (Raven, Court & Raven, 1992) 106. Despite his average IQ J.G. is not able to function in a mainstream school.

From the age of four he reported “hot eyes” in response to bright colors in his environment. He disliked artificial lights and his room at home remains unlit. He suffered headache and nausea in response to colors of walls, food or other people’s clothing. He was also unable to tolerate strobe lighting, and light from reflective surfaces such as mirrors, plates and glass, and when doors were opened. He suffered from projectile vomiting on leaving the house, which interrupted his schooling. From the age of two, J.G. exhibited strong obsessions for blue and purple, and refused to travel in cars or to wear clothes that were not blue. J.G. opted for white foods, and between the ages of 1-9 years the majority of meals were given to him between two slices of bread. J.G. continually walked into doors, failed to locate the chair when sitting, tripped over and had difficulties placing objects on a table. He felt nauseated when exposed to light reflected from water. Strong smells were a source of discomfort, particularly those of food. His mother recalls taking him to the doctor in both July and November 1995 over concerns about his erratic sleeping patterns, which she refers to as ‘burn out’ periods. He would sleep 4-5 days at a time and wake with a

high temperature. The episodes would occur at regular intervals every 4-6 months. In addition to the 'burn out' periods, J.G. appeared to have fretful and violent dreams and often fell out of bed.

When J.G. was aged 10 years 6 months, he took part in a research study. The study included color naming, color discrimination and color memory (in preparation) and an assessment using the Intuitive Overlays (version with 14pt typeface, Wilkins, 1994; ioo Sales Ltd), the Rate of Reading Test (Wilkins, Jeanes, Pumfrey & Laskier, 1996; ioo Sales Ltd), and the Speed and Capacity of Language Processing Test (SCOLP; Baddeley, Emslie, Nimmo-Smith, 1992). The Wechsler Intelligence Scale for Children (Revised) was also administered. The overlay selection procedure was the same as that used previously (Ludlow, Wilkins & Heaton, 2006; Wilkins, 2003). Symptoms of visual stress (movement or blurring of the letters, glare and discomfort) were assessed at the outset and after overlay selection. For the overlay selection two passages of identical text as used for the Rate of Reading or SCOLP were positioned side by side and one of the overlays was placed over one of the passages. If the overlay improved the clarity of the text, it was left in place and another overlay placed beside it, until, by a process of elimination, the best overlay had been selected. If a single overlay selected by this method was insufficient to eliminate the symptoms, two overlays of similar color were placed one upon another to increase the saturation of color. J.G. chose a single purple overlay for use on the Rate of Reading Test and a double purple overlay for use with the SCOLP.

Children who benefit from a coloured overlay usually also benefit from coloured glasses, and do so in a wider variety of contexts (Wilkins 2003). Because of the marked improvement in visual function with a colored overlay, J.G. was referred for an assessment using the Intuitive Colorimeter (Wilkins & Sihra, 2000), an instrument used to guide the selection of optimally tinted glasses. Blue glasses prescribed using the Colorimeter have been worn consistently by J.G. over the last 27 months. Figure 1 shows the percentage of light transmitted by the glasses as a function of wavelength (spectral transmission).

FIGURE 1

In a subsequent assessment, when aged 11 years 4 months, J.G. was asked to undertake the Rate of Reading Test without his glasses but with an overlay chosen for clarity, an overlay chosen for preference, a yellow overlay and with no overlay. The overlay chosen for preference was chosen in the same way as an overlay selected for clarity except that the overlays were shown for comparison on an empty white page. All overlays were included in both overlay selection for clarity and for preference so that J.G. was able to choose the same color on both occasions. His final selection was the blue overlay for color preference and the purple overlay for clarity. J.G. showed the greatest benefit from a colored overlay selected for clarity when observing the text of the Rate of Reading Test. Whilst he reported that the page was too bright and painful to look at for all of the presented stimuli, only the text of the Rate of Reading test appeared blurred and unstable. The words in this particular passage of text were smaller and closer together than those used in the comprehension study.

The Rate of Reading Test was administered four times and, in order of testing, the scores were as follows: no overlay 71 wpm; yellow overlay 70 wpm; purple overlay 83 wpm; blue overlay 80 wpm. Compared to no overlay, the increase in reading speed with the overlay chosen for clarity (purple) was 35%.

In Table 1, J.G.'s scores for the rate of reading and SCOLP, from Ludlow et al. (2006) and Ludlow (2006) are presented together with those of 13 children with high functioning autism and 13 with typical development matched to J.G. on age and Verbal IQ (BPVS). Table 1 shows the percentage increase of scores with a single purple overlay for Rate of Reading and double overlays of purple for the SCOLP. J.G. showed larger benefits on both reading and comprehension tasks than the autism and typically developing controls. He was very slow at the comprehension task but made no errors.

TABLE 1

With the glasses, J.G. is now nauseated only in situations where he feels particularly stressed, such as in crowds. He feels more able to control his behavior and reactions and although he may still just occasionally vomit he is able to do so with more control. He has a better understanding of both his and other people's personal space. He less frequently walks into doors and is generally more coordinated. He has been

able to catch a ball for the first time, which has allowed him to participate in a variety of sports. Possibly as a result, he is more confident and his social skills have improved: he has joined a card game club where his parents can leave him by himself for the first time. Restaurants are one particular place where J.G. feels unable to cope if he does not have his glasses with him, due to the smell and noise.

Six months after receiving the glasses J.G. was able to enjoy Christmas festivities for the first time. Previously he had shut himself in his bedroom until the festive period was over, complaining of too much noise, color, smell and people.

15 months after he received his glasses J.G.'s Standardized Attainment Tests improved from level 2 to level 4. He is now at reading and comprehension levels average for a child his age. Interestingly, he showed poor performance on one exam in which he forgot to wear his glasses. When asked to resit this exam, but this time with his glasses, he performed at a considerably higher level. His teachers have now made it a requirement that he keeps his glasses with him at all times.

His sleep is now more controlled and he has suffered only one 'burn out period' since the glasses were introduced, and this occurred when both pairs of colored glasses were broken.

Figure 2 summarises the frequency of various behaviors throughout J.G's lifespan, and the influence of the glasses.

FIGURE 2

To assess the changes with the colored lenses, the Adolescent/Adult Sensory Profile (Brown & Dunn, 2002) was completed by J.G. 24 months after receiving the glasses. The purpose here was to allow J.G to identify his sensory abnormalities and to describe any effects of the glasses on his life. The self questionnaire contains 60 items that describe responses to everyday sensory experiences. J.G. was asked to fill in the questionnaire twice, first responding in terms of how he deals at present with situations if he does not wear his glasses and then how he responds when wearing them.

TABLE 2

J.G.'s scores with and without glasses across the four sensory quadrants are included in Table 2 and are compared to the norms for typically developing children (Brown & Dunn, 2002). J.G. showed differences across the four sensory quadrants compared to typical development. As can be seen, there is a categorical change with respect to sensation seeking and sensation avoiding.

Using the Sensory Profile (Dunn, 1999) for carers, J.G.'s mother rated his behaviour when he first participated in the research study and before the glasses were prescribed. After he had been wearing the glasses for 24 months his mother again completed the Sensory Profile twice, first concerning behavior without the glasses then again for behaviour with the glasses. The behaviours were rated on a five-point scale and the average ratings for each scale are shown in Figure 3. Behaviors that occurred always or frequently without glasses but appeared either seldom or never with glasses included: "Appears to not hear what you say, appears to ignore you"; "Holds hands over ears to protect from sound"; "Has difficulty putting puzzles together (compared to same age children)"; "Becomes anxious or distressed when feet leave ground"; "Becomes disorientated after bending over sink or table (falls or gets dizzy)"; "Rocks unconsciously" (while watching TV); "Avoids eye contact"; "Has difficulty tolerating changes in plans and expectations"; "Has difficulty tolerating changes in routines". One behavior occurred seldom or never without glasses but frequently with: "He looks carefully or intensely at objects/people".

FIGURE 3

Of particular interest is the striking similarity between J.G. and the two autobiographical accounts of Williams (1999) and Jackson (2002) who also report benefits from colored glasses. All three have shown color obsessions and heightened sensory awareness. One very striking similarity between J.G. and Williams (1999) is that both individuals opted for dark purple bedrooms without lighting. J.G. also kept curtains closed and prior to receiving colored lenses he carried sunglasses with him at all times.

Sensory processing difficulties are well-established, common and disabling, particularly sensory sensitivities. These are more usually auditory, but when visual can be severe (Wing, 1969; Leekam, Nieto, Libby, Wing & Gould, 2007).

It is important to stress that spectral filters will not necessarily remove the symptoms of ASD and may not be applicable in every individual with such a diagnosis. It is likely that some of the benefits are a secondary result of an increase in confidence or a reduction in anxiety. Nevertheless the effects described occurred immediately upon receipt of the glasses, and when the glasses were not worn the previous behaviors returned.

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References

- Baddeley, A. D., Emslie, H., & Nimmo Smith, I. (1992). *The speed and capacity of language processing (SCLOP) test*. Bury St Edmunds: Thames Valley Test Company.
- Brown, C. E., Dunn, W. (2002). *Adolescent/Adult Sensory Profile*. San Antonio, TX: Psychological Corporation.
- Dunn, W. (1999). *Sensory Profile*. San Antonio, TX: Psychological Corporation.
- Dunn, L.M., Whetton, C., & Pintilie, D. (1997). *British Picture Vocabulary Scale*. Windsor: NFER-Nelson.
- Intuitive Colour Overlays. *Coloured Overlays for people with reading difficulty and visual discomfort*. i.O.O. Sales Limited, London.
- Jackson, N. (2002). *Standing Down and Falling Up*. Bristol: Lucky Duck Publishing Ltd.
- Johnson, C. R. (1996). Sleep problems in children with mental retardation and autism. *Child and Adolescent Psychiatric Clinics of North America*, 5, 673-83.
- Leekam, S.R., Nieto, C. Libby, S., Wing, L. & Gould, J. (2007). Describing the sensory abnormalities of individuals with autism. *Journal of Autism and Developmental Disorders*, 37(5), pp. 894-910.
- Ludlow, A.K. (2006). Color processing in autism spectrum disorders. Unpublished PhD thesis, University of London.
- Ludlow, A. K., Wilkins, A.J., & Heaton, P. (2006). The effect of coloured overlays on reading ability in children with autism. *Journal of Autism and Developmental Disorders*, 36(4), 507-516.
- Raven, J. C. M., Court, J. H., & Raven, J. (1992). *Standard Progressive Matrices*. OUP: Oxford Psychologists Press.
- Wilkins, A. J., (1994). *Overlays for classroom and optometric use*. *Ophthal. Physiol. Opt.*, 14(4), 97-99.
- Wilkins, A. J. (2003). *Reading through colour*. Chichester: Wiley.
- Wilkins, A. J., Jeanes, R. J., Pumfrey, P. D., & Laskier, M. (1996). Rate of Reading Test: Its reliability and its validity in the assessment of the effects of coloured overlays. *Ophthal. Physiol. Opt.*, 16, 491-497.

Wilkins, A.J., & Sihra, N. (2000). A colorizer for use in determining an optimal ophthalmic tint. *Color Research and Application*, 26(3), 246-253.

Williams, D. (1999). *Like Color to the Blind*. London: Jessica Kingsley Publishers Ltd.

Wing

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Table 1: Percentage increase (and standard deviation) in visual performance on the Wilkins Rate of Reading test and the Speed and Capacity of Language-Processing Test (SCOLP) with a colored overlay: J.G. vs. other children of similar age with autism and normally developing children

	Rate of reading	SCLOP
J.G.	34.6*	25.8**
Autism†	16.3 (18.4)	6.2 (16.5)
Controls†	-5.8 (13.4)	-2.7 (18.7)

* single purple overlay

** double purple overlay

† taken from Ludlow (2006)

Table 2: J.G.'s raw scores on the Adolescent/Adult Sensory Profile with and without the glasses (maximum 75) and, in parentheses, scores relative to similarly aged children with normal development (-2 much less than most children; -1 less than most; 0 similar to most; +1 more than most; +2 much more than most) from Brown & Dunn (2002).

Sensory Quadrants	Without glasses	With glasses
1. Low registration	56 (+2)	52 (+2)
2. Sensation seeking	38 (-1)	51 (0)
3. Sensory sensitivity	50 (+2)	55 (+2)
4. Sensation avoiding	54 (+2)	47 (+1)

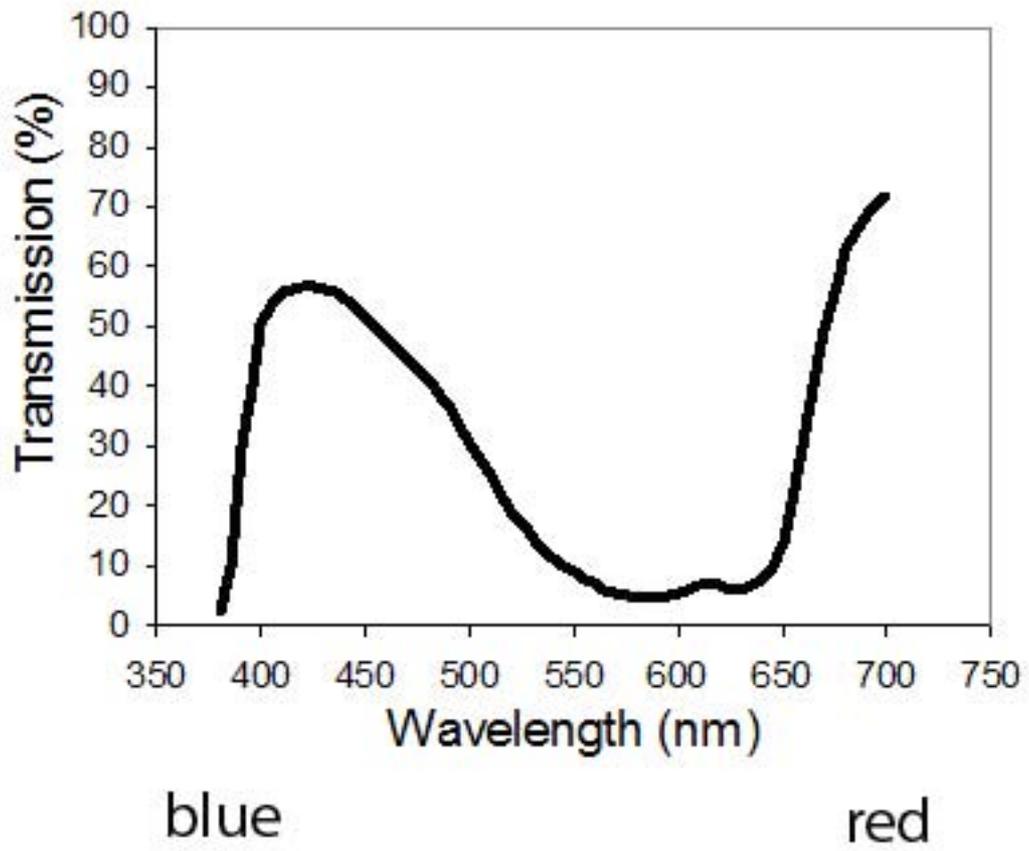
Figure Captions

Figure 1. Spectral transmission of glasses supplied to J.G.

Figure 2. Frequency of behaviors before and after the glasses were issued. The shaded areas show the periods when the glasses were available, together with the brief period during which both pairs were returned for repair. The period coincided with an episode of “burn out” and the position of point on the second panel has been altered to reflect this.

Figure 3. Average ratings for categories of behavior on the Sensory Profile Caregiver Questionnaire (Dunn, 1999). Ratings are given before and after the provision of glasses for behaviour without and with the glasses.

Figure 1



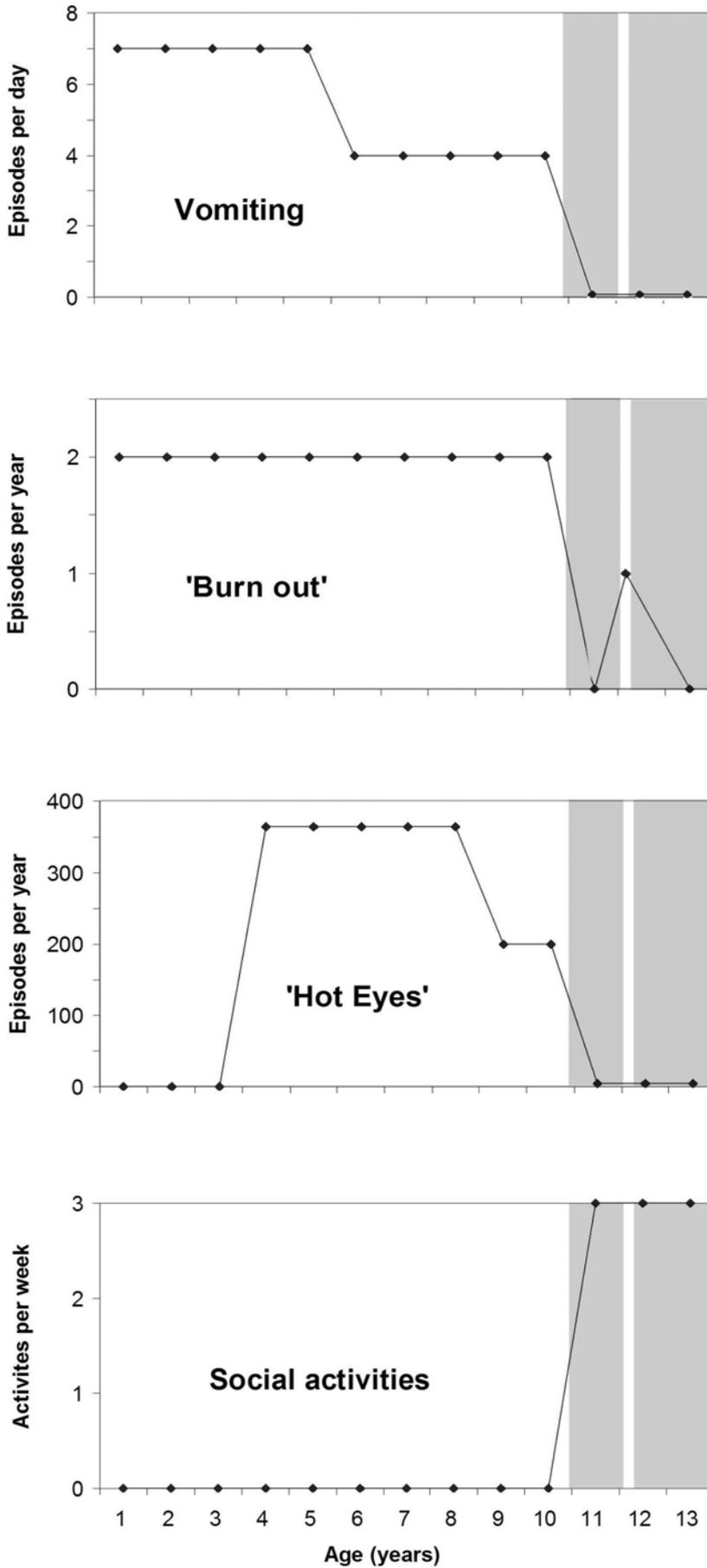


Figure 3

