

## Consequences and 'treatment' of colour vision deficiencies

By Monika Formankiewicz

### References

1. Steward JM, Cole BL (1989) What do color vision defectives say about everyday tasks? *Optometry and Vision Science* 66(5): 288-95.
2. Cole BL (2004) The handicap of abnormal colour vision. *Clinical and Experimental Optometry* 87(4-5): 258-275.
3. Nathan J, Henry GH, Cole BL (1964) Recognition of colored road traffic light signals by normal and color-vision-defective observers. *J.Opt.Soc.Am.* 54(8): 1041-1045.
4. Atchison DA, Pedersen CA, Dain SJ, Wood JM (2003) Traffic signal color recognition is a problem for both protan and deutan color-vision deficient's. *Hum. Factors* 45(3): 495-503.
5. Verriest G, Neubauer O, Marre M, Uvijls A (1980) New investigations concerning the relationships between congenital colour vision defects and road traffic security. *International Ophthalmology* 2(2): 87-99.
6. Gattegno C (1969) Reading with words in colour: a scientific study of the problems of reading. *Educational Explorers, Reading*.
7. Espinda SD (1971) Color vision deficiency in third and sixth grade boys in association to academic achievement and descriptive behavioural patterns. *Dissertation Abstracts International* 32.
8. Grassivaro Gallo P, Panza M, Viviani F, Lantieri PB (1998) Congenital dyschromatopsia and school achievement. *Percept.Mot.Skills* 86(2): 563-569.
9. Cumberland P, Rahi JS, Peckham CS (2004) Impact of congenital colour vision deficiency on education and unintentional injuries: findings from the 1958 British birth cohort. *BMJ* 329(7474): 1074-1075.
10. Lampe JM, Doster ME, Beal BB (1973) Summary of a three-year study of academic and school achievement between color-deficient and normal primary age pupils: phase two. *J.Sch.Health* 43(5): 309-311.

11. Mandola J (1969) The role of color vision anomalies in elementary school achievement. *J.Sch.Health* 39(9): 633-636.
12. Dwyer JI (1991) Colour vision defects in children with learning difficulties. *Clinical and Experimental Optometry* 74(2): 30-38.
13. Snyder CR (1973) The Psychological Implications of Being Color Blind. *Journal of Special Education* 7(1): 51-54.
14. Cole BL (2005) Impact of congenital colour vision deficiency: congenital colour vision deficiency does cause problems. *BMJ* 330(7482): 96; author reply 96.
15. Birch J, Chisholm CM (2008) Occupational colour vision requirements for police officers. *Ophthalmic Physiol.Opt.* 28(6): 524-531.
16. Home Office. Eyesight Standards for Police Recruitment. 2003; Available at: [http://www.policecouldyou.co.uk/officers/Eyesight\\_25-2003.pdf](http://www.policecouldyou.co.uk/officers/Eyesight_25-2003.pdf). Accessed 10/11, 2009.
17. Sloan LL, Habel A (1955) Recognition of red and green point sources by color-deficient observers. *J.Opt.Soc.Am.* 45(8): 599-601.
18. Steen JA, Lewis MF (1972) Color defective vision and day and night recognition of aviation color signal light flashes. *Aerosp.Med.* 43(1): 34-36.
19. Civil Aviation Authority. Minimum Colour Vision Requirements for Professional Flight Crew. 2009; Available at: <http://www.caa.co.uk/docs/33/200904.pdf>. Accessed 10/11, 2009.
20. Civil Aviation Authority. Civil Aviation Authority. 2009; Available at: <http://www.caa.co.uk>. Accessed 10/11, 2009.
21. Civil Aviation Authority. JAR Class 1 (Professional Pilot) Initial Examination Visual Standards. 2009; Available at: <http://www.caa.co.uk/docs/49/InitialJARClass1Sep09.pdf>. Accessed 10/11, 2009.
22. Civil Aviation Authority. JAR Class 2 (Private pilot) Visual Standards – Initial Examination. 2009; Available at: <http://www.caa.co.uk/docs/49/JARClass2VisStdsSep09.pdf>. Accessed 10/11, 2009.

23. Vingrys AJ, Cole BL (1983) Validation of the Holmes - Wright lanterns for testing colour vision. *Ophthalmic Physiol.Opt.* 3(2): 137-152.
24. Kinney JA, Paulson HM, Beare AN (1979) The ability of color defectives to judge signal lights at sea. *J.Opt.Soc.Am.* 69(1): 106-110.
25. Vingrys AJ, Cole BL (1993) The ability of colour vision defective observer to recognise an optimised set of red, green and white signal lights. In: Drum B, editor. *Colour Vision Deficiencies XI*. Kulwer, Dordrecht. p. 87-95.
- 26 Maritime and Coastguard Agency. Seafarer Medical Examination System and Medical and Eyesight Standards. Available at: [http://www.mcga.gov.uk/c4mca/msn1765\(m\).pdf](http://www.mcga.gov.uk/c4mca/msn1765(m).pdf). Accessed 11/10, 2009.
27. Hovis JK, Oliphant D (1998) Validity of the Holmes-Wright lantern as a color vision test for the rail industry. *Vision Research* 38(21): 3487-3491.
28. Rail Safety and Standards Board Limited. GO/RC3561 Recommendations for Train Movement – Staff Suitability and Fitness Requirements RACOP. 2009; Available at: [http://www.rgsonline.co.uk/Railway\\_Group\\_Standards/Traffic%20Operation%20and%20Management/Codes%20of%20Practice/GORC3561%20Iss%203.pdf](http://www.rgsonline.co.uk/Railway_Group_Standards/Traffic%20Operation%20and%20Management/Codes%20of%20Practice/GORC3561%20Iss%203.pdf). Accessed 10/19, 2009.
29. Spalding JA (1999) Medical students and congenital colour vision deficiency: unnoticed problems and the case for screening. *Occup.Med.(Lond)* 49(4): 247-252.
30. Spalding JA (1995) Doctors with inherited colour vision deficiency: their difficulties in clinical work. *Proceedings of the International Research Group for Colour Vision Deficiency*. Kluwer. p. 483-489.
31. Campbell JL, Spalding JA, Mir FA (2004) The description of physical signs of illness in photographs by physicians with abnormal colour vision. *Clinical and Experimental Optometry* 87(4-5): 334-338.
32. Campbell JL, Spalding AJ, Mir FA, Birch J (1999) Doctors and the assessment of clinical photographs--does colour blindness matter? *Br.J.Gen.Pract.* 49(443): 459-461.
33. Campbell JL, Griffin L, Spalding JA, Mir FA (2005) The effect of abnormal colour vision on the ability to identify and outline coloured clinical signs and to count stained bacilli in sputum. *Clinical and Experimental Optometry* 88(6): 376-381.

34. Poole CJ, Hill DJ, Christie JL, Birch J (1997) Deficient colour vision and interpretation of histopathology slides: cross sectional study. *BMJ* 315(7118): 1279-1281.
35. Gouldie RB (1998) Colour deficient vision should not prevent a career in histopathology. *British Medical Journal* 316: 1750.
36. Cockburn DM (2004) Confessions of a colour blind optometrist. *Clinical and Experimental Optometry* 87(4-5): 350-352.
37. Wasson W, Schuman N (1992) Color vision and dentistry. *Quintessence Int.* 23(5): 349-353.
38. Davison SP, Myslinski NR (1990) Shade selection by color vision-defective dental personnel. *J.Prosthet.Dent.* 63(1): 97-101.
39. Olson IA (1971) The use of colour filters by students with congenital colour defects in the learning of histology. *Med.Biol.Illus.* 21(1): 52-53.
40. Office of the Deputy Prime Minister. Medical and Occupational Evidence for Recruitment and Retention in the Fire and Rescue Service. 2004; Available at: <http://www.communities.gov.uk/documents/fire/pdf/130418.pdf>. Accessed 10/19, 2009.
41. Joint Industry Body for the Electrical Contracting Industry. Electrical Installation Apprenticeship Medical Form. Available at: <http://www.jib.org.uk/publications/JIB344.pdf>. Accessed 10/19, 2009.
42. The Defence Council. Handbook of Naval Medical Standards . 2009; Available at: <http://www.royalnavy.mod.uk/upload/package/62/BR1750/brd1750abook/prelims.pdf>. Accessed 10/19, 2009.
43. Association of Optometrists. Vision Standards. 2009; Available at: [http://www.assoc-optometrists.org/services/services\\_visual.html](http://www.assoc-optometrists.org/services/services_visual.html). Accessed 10/19, 2009.
44. Harris RW, Cole BL (2007) Abnormal colour vision is a handicap to playing cricket but not an insurmountable one. *Clinical and Experimental Optometry* 90(6): 451-456.
45. Cole BL, Nathan J (2002) An artist with extreme deuteranomaly. *Clinical and Experimental Optometry* 85(5): 300-305.

46. Pickford RW (1964) A Deuteranomalous Artist. *Br.J.Psychol.* 55: 469-474.
47. Harris RW, Cole BL (2005) A great cricketer who was colour blind. *Clinical and Experimental Optometry* 88(6): 405-409.
48. Pickford RW (1972) Colour-defective art students in four art schools. *Br.J.Physiol.Opt.* 27(2): 102-114.
49. Fletcher R, Voke J (1985) Assistance for colour vision defects. *Defective Colour Vision: Fundamentals, Diagnosis and Management.* Adam Hilger Ltd, Bristol. p. 417-434.
50. Egan DJ (1982) The Application of Selected Broadband Red Filters for Red-Green Deficiencies. *Canadian Journal of Optometry* 44(1): 50-57.
51. Schmidt I (1976) Visual aids for correction of red-green colour deficiencies. *Canadian Journal of Optometry* 38: 38-47.
52. Richer S, Adams AJ (1984) An experimental test of filter-aided dichromatic color discrimination. *American Journal of Optometry and Physiological Optics* 61(4): 256-64.
53. Richer S, Adams AJ (1984) Development of quantitative tools for filter-aided dichromats. *American Journal of Optometry and Physiological Optics* 61: 246-255.
54. Hovis JK (1997) Long wavelength pass filters designed for the management of color vision deficiencies. *Optometry and Vision Science* 74(4): 222-30.
55. Sagawa K (1982) Dichoptic color fusion studied with wavelength discrimination. *Vision Research* 22(8): 945-52.
56. Cornsweet TN (1970) Chapter 8. *Visual Perception.* Academic, New York. p. 194-198.
57. Polizzotto L (1981) Dichoptic color perception and the X-chrom lens. *American Journal of Optometry and Physiological Optics* 58(12): 1180-6.
58. Taylor SP (1986) Binocular colour interaction. *Ophthalmic and Physiological Optics* 6(3): 321-3.

59. Maxwell JC (1855) Experiments on Colour, as perceived by the Eye, with remarks on Colour-blindness. Transactions of the Royal Society of Edinburgh 21: 275-298.
60. Schlanger JL (1985) The JLS lens: an aid for patients with color vision problems. American Journal of Optometry and Physiological Optics 62(2): 149-51.
61. Heath GG (1974) The handicap of color blindness. Journal of the American Optometric Association 45(1): 62-69.
62. Sheedy JE, Stocker EG (1984) Surrogate color vision by luster discrimination. American Journal of Optometry and Physiological Optics 61(8): 499-505.
63. Formankiewicz MA, Mollon JD (2009) The psychophysics of detecting binocular discrepancies of luminance. Vision Res. 49(15): 1929-1938.
64. Sharpe LT, Jagle H (2001) I Used To Be Color Blind. COLOR Research and Application 26(Supplement): S269-S272.
65. Richer SP, Adams AJ, Little AC (1985) Toward the design of an optimal filter for enhancement of dichromat monocular chromatic discrimination. American Journal of Optometry and Physiological Optics 62(2): 105-10.
66. Kovacs G, Kucsera I, Abraham G, Wenzel K (2001) Enhancing Color Representation for Anomalous Trichromats on CRT Monitors. COLOR research and application 26 (Supplement): S273-S276.
67. Zeltzer H (1971) The X-Chrom Lens. Journal of the American Optometric Association 42(9, September): 933-939.
68. Siegel IM (1981) The X-Chrom lens. On seeing red. Survey of Ophthalmology 25(5): 312-24.
69. Taylor SP (1984) The X-Chrom Lens - patients see red! The Optician : 24-31,34.
70. Ditmars DL, Keener RJ (1976) A contact lens for the treatment of color vision defects. Military Medicine 141(5): 319-22.

71. Welsh KW, Vaughan JA, Rasmussen PG (1979) Aeromedical implications of the X-Chrom lens for improving color vision deficiencies. *Aviation, Space, and Environmental Medicine* 50(3): 249-55.
72. Taylor SP (1982) The X-chrom lens-a case study. *Ophthalmic and Physiological Optics* 2(2): 165-70.
73. Matsumoto ER, Johnson CA, Post RB (1983) Effect of X-Chrom lens wear on chromatic discrimination and stereopsis in color-deficient observers. *American Journal of Optometry and Physiological Optics* 60(4): 297-302.
74. Kassar BS, Dresner SC, May JG, Marx MS, Safir A (1984) Evaluation of the X-chrom lens and color deficiency. *CLAO Journal* 10(1): 100-3.
75. Paulson HM (1980) The X-Chrom lens for correction of color deficiency. *Military Medicine* 145(8): 557-60.
76. Zeltzer HI (1974) Recommended procedure for fitting the X-Chrom lens. *Journal of the American Optometric Association* 45(1, January): 72-75.
77. Swarbrick HA, Nguyen P, Nguyen T, Pham P (2001) The ChromaGen contact lens system: colour vision test results and subjective responses. *Ophthalmic and Physiological Optics* 21(3): 182-96.
78. Harris D (1998) ChromaGen Clinical Procedures. Cantor & Silver Ltd, Northants,.
79. Harris D (1997) Colouring sight: A study of CL fittings with colour-enhancing lenses. *Optician* 231(5604): 38-41.
80. Cantor&Nissel-Limited. ChromaGen (CD-Rom); 2002.
81. Hodd NB (1998) Putting ChromaGen to the test. *Optometry Today* : 39-42.
82. Dougherty B, Wade A. Vischeck simulates colorblind vision. 2008; Available at: <http://www.vischeck.com/>. Accessed 10/19,2009.
83. Miyazawa K, Onouchi T, Oda H, Shinomori K, Nakauchi S (2006) Functional spectral filter optically simulating colour discrimination property of dichromats. *Perception* 35(ECVP Abstract Supplement).
84. Mancuso K, Hauswirth WW, Li Q, Connor TB, Kuchenbecker JA, Mauck MC, et al (2009) Gene therapy for red-green colour blindness in adult primates. *Nature* 461(7265): 784-787.

85. Neitz J, Neitz M. Neitz Color Vision Website - Gene Therapy. 2009;  
Available at: <http://www.neitzvision.com/content/genetherapy.html>. Accessed  
10/19, 2009