IRLEN COLOURED FILTERS FOR READING

A Six Year Follow-up

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ABSTRACT

Irlen coloured filters have been the subject of debate and research for some years. An early study (Whiting & Robinson, `1988) followed up subjects who had used the filters for more than one year, and found that there was a highly positive response after that time.

The present study surveyed the same subjects after six years, and again found a positive response to the filters.

Ninety-four percent of subjects reported continuing improvements, and 58% reported overall large improvements in at least three areas of performance related to written text. Responses, categorised in different areas of improvements, are compared with other surveys that have used similar methods.

In 1985, media publicity based on reports from Hong Kong and California suggested that the use of coloured filters might assist persons who had difficulty with reading and other near-point tasks associated with the interpretation of print (spelling, handwriting). It was suggested that sensitivity to high contrast (black-on-white) was the reason that some visually sensitive individuals found reading and similar tasks difficult. These individuals perceived print as unstable, and were not as easily able to keep it in focus, or to register, at one fixation, a clear image of as much print as normal readers.

Irlen (1983) has called these difficulties "scotopic sensitivity syndrome" because of the hypothesized role of the rods of the retina in producing the anomalous visual effects. Although there is some evidence that dyslexics have a different distribution of rods and cones on the retina, and that they make more use of parafoveal information when reading than do normal readers (Geiger & Lettvin,1987; Grosser & Spafford, 1989; Spafford & Grosser, 1991; Solman, Dain & Keech, 1991), current theories favour an explanation which looks at the operation of the parvo- and magnocellular visual pathways in the brain (Livingstone, Rosen, Drislane, Galaburda, 1991). Because of this, the group of symptoms is now often referred to as Irlen syndrome.

In descriptive papers, Whiting (1985, 1993a) has specified five areas of difficulty experienced by children and adults who claimed to have these problems. The first area was *photophobia*, usually experienced as finding white paper too bright, or competing with the print for the reader's attention. Many readers alleging this difficulty also had problems with bright sunlight, fluorescent lights, and headlights and street lights at night.

The second area of difficulty was *visual resolution*, usually experienced as perceiving the print to distort in some way. It might seem to vibrate as the reader stared at it, to move in some other way, or to fade, become elongated, or to thicken until it looked like a solid black block. Thirdly, such readers reported that they perceived only small portions of the print at one fixation. This apparently *restricted focus* varied from perceiving only one letter at a time, to seeing slightly more than a short word. Normal readers see more than this, and some claim to be able to see half a page at one fixation, at least well enough to be able to register those visual cues necessary to interpret the meaning of the print in that area.

The fourth area of difficulty described was *sustaining focus* where the print seemed to blur after a short period of time. Experiences of this effect ranged from immediate blurring of the print (though eyesight was good or corrected) to blurring after a few minutes of reading. The fifth area was *eyestrain*. Again, this was experienced when reading, even though eyesight had been tested as normal or had been corrected using optical lenses.

In addition, some subjects reported difficulties with *depth perception*, experienced as difficulty in accurately judging distance when driving a car, parking a car, catching a ball on the full, walking down stairs, escalators, or just in walking through doorways, with another person, etc.

Irlen (1983, 1991) suggested that, where a number of such difficulties occurred in one person, they could be alleviated in a majority of cases by the use of precisely tinted filters, applied to the normal or corrected vision of the subject. Her clinic at the University of California had trialed this method on adult subjects with some apparent success. Clinical trials in Australia also seemed promising, according to surveys carried out after subjects had used filters for more than twelve months (Whiting, 1988; Whiting & Robinson, 1988).

In the past eight years, a number of research papers on the subject have appeared (Lea & Hailey, 1991, Whiting, 1993b). A useful summary of the state of research specifically related to Irlen filters up to 1990 is Lea and Hailey (1991). Some research has produced negative or inconclusive findings (Stanley, 1987; Winter, 1987; Cotton & Evans, 1990; Martin, Mackenzie, Lovegrove & McNicol, 1993), while other research has produced positive results, sometimes remarkably so (Adler & Atwood, 1987; Chan & Robinson, 1989; Fricker, 1989; O'Connor, Sofo, Kendall & Olsen, 1990; Robinson & Conway, 1990; Burgess, 1991, Robinson and Conway, 1994). However, most of the studies producing negative findings did not use Irlen filters; the studies producing positive findings did.

When coloured overlays applied to the page were used rather than lenses, both negative and positive findings have resulted. Robinson and Miles (1987) found significantly improved performance in word-matching and number- and letter-recognition tasks for preferred as compared to placebo colours. O'Connor and Sofo (1988) and Williams et al (1992) found that preferred colours resulted in significant improvements in reading, especially reading comprehension. On the other hand, Saint-John and White (1988) found no improvements on a timed reading passage using colours. However, in this study the subjects had not been prescreened for sensitivity to colour, and thus some of the sample may not have been responsive to the use of colour.

General psychological research on the use of filters to reduce visual perceptual difficulties (not specifically related to the use of Irlen filters) has generally been positive (Solman, Dain & Keech, 1991; Williams, Lecluyse & Rock-Faucheux, 1992).

Most of the studies, positive and negative, have been criticised for lack of rigour (see, eg., Robinson 1990 for a critique of a negative study), and there appear to be other, unexplained problems with some studies. (One of the most recent studies found no effect for Irlen filters, but also found that there was no improvement in the control group over a 12 month period of schooling (Martin, Mackenzie, Lovegrove & McNicol, 1993). This finding is not referred to in the study, however.

It is certain, however, that to carry out empirical research that satisfies everyone on such a subject is very difficult. For one thing, it is virtually impossible to control for the subjects' commitment to the outcome being positive. The only way in which appropriate colours and densities can be determined is by reporting of symptoms, followed by reporting of changes as various combinations are applied. When the filters are used, the changes are present. When the filters are removed, the changes disappear, and all the old difficulties are present once again. It is thus not possible to determine and apply the prosthesis without the subject being involved in that determination. This makes a placebo-controlled study very difficult (though one such study is currently under way which attempts to keep the colour of the filter visually similar to the chosen combination, while altering its light-transmission characteristics).

Another problem is the fact that Irlen filters or their formulas are patented and thus not readily available for trial by independent observers, though independent psychological studies of the effects of colour filtering, some of which are referred to above, have helped to overcome this problem to some extent. The numbers of studies also tend to be small because the procedure for correct specification of Irlen filters is time consuming and requires special training (the diagnostic and specification session takes about 2 hours for each individual: training takes one week or more). It is thus difficult for researchers to build up a large body of controlled data which can be followed up in an empirical study.

One of the major objections to the idea of using colour filtering to improve reading performance has been that there was no theoretical rationale for believing that such a prosthesis could have the effects described by those who alleged its effectiveness. Recent research, however, has suggested strongly that colour filtering modifies the way in which visual signals are transmitted from the retina to the cortex, (Williams, Lecluyse & Rock-Faucheux, 1992). In particular, physiological research on the visual pathways in the brains of dyslexic and normal readers has shown that there are apparently consistent differences in the operation and cellular structure of the visual pathways (Lehmkuhle, Garzia, Turner, Hash & Baro, 1993; Livingstone, Rosen, Drislane & Galaburda, 1991). These differences appear to explain why many dyslexics have such difficulty with the visual processing of print, and why, if the processing is modified using appropriate filtering of colour and density, the visual image appears to be clarified, and reading made easier as a consequence.

SURVEY RESEARCH

There have been a number of attempts to follow up clients from the clinics offering treatment for reading problems using Irlen filters. As mentioned above, Whiting (1988) and Whiting and Robinson (1988) attempted to follow up some 465 subjects who had been provided with Irlen filters more than twelve months previously. They asked subjects to respond to a questionnaire asking whether they had previously had a problem with a number of factors related to reading, and whether they had experienced any improvements since using Irlen filters.

The factors were things such as fluency, overall difficulty (reading is a task that requires effort), comprehension, concentration, eyestrain, visual confusions, tendency to skip lines, etc. Questions were also asked about handwriting and spelling, as well as overall self-confidence, and tiredness. Improvements were rated as "none", "some" and "large". Subjects were considered to have experienced a large measure of help overall from the filters only if they rated three or more factors as having shown a large improvement. If fewer than three factors were rated as having shown a large improvement, the overall result was rated as "some" improvement. There was also a percentage of people who experienced no improvements at all.

Of the 213 responses examined, 93% had experienced improvement since wearing the filters, and 57% of the respondents experienced a large

improvement. The main areas of improvement were fluency, eyestrain, concentration and comprehension. The area showing least improvement was handwriting (28% indicated no improvement, while 14% had not had a problem in this area). The fact that this is largely a motor skill would lead one to expect that improvements in visual perception might not have a great effect on handwriting.

Stokes & Stokes (1990) surveyed 160 subjects in Louisiana, Alabama and Mississippi who had worn Irlen filters for at least three months (mean length of time using filters was 6.69 months). Sixty-nine responded to the questionnaire. Of these respondents, 7% stated that the filters did not help their reading. Ninety-three percent stated that the filters definitely helped their reading. Improvements were also reported in incidence of headaches while reading (49% stated that they no longer got headaches while reading), and sleepiness (67% stated that they no longer became sleepy while reading).

Burgess (1991) replicated and extended the Whiting and Robinson study, using 306 subjects randomly selected from a clinic population of 1500 in Canberra. She obtained 175 responses (57%), and concluded that her results were very similar to those of Robinson and Whiting. She also asked questions about improvements in mathematics, depth perception and coordination, and motion sickness. In these areas, 48% reported improvements in mathematics, 41% in depth perception, and 24% in motion sickness. Because she used a five-point scale, it was not possible to compare overall improvements directly, but 83% stated that they had experienced "great benefits" from wearing Irlen filters.

The areas of greatest improvement in her study were overall difficulty of reading ("reading is hard" - 91%), eyestrain (86%) and fluency (85%) and tiredness. Tendency to skip lines and visual confusions were also significantly improved, according to her statistics. A summary of these results is in Table 2, for comparison with other studies.

In 1993, Westergard (1993) surveyed 149 respondents who had obtained Irlen filters and were living in Washington, Idaho, Montana and Oregon. The respondents had used Irlen filters for an average of 36 months. Of these subjects, 61% indicated that the filters had been very helpful to them, while 86% indicated that they had been somewhat or very helpful. Seven percent had found no help at all from the filters. A further 7% had not used the filters at all for a variety of reasons. (One man commented, "I just haven't given them a chance. I don't like or need glasses to read, so that's that!") In this study, the area of greatest improvement was eyestrain, followed by difficulty of reading, then concentration, fluency, skipping lines, and visual confusions.

SIX YEAR FOLLOW-UP

The present study followed up 267 clients who had been surveyed in the earlier study (Whiting & Robinson, 1988), and who had had Irlen filters for a minimum of six years, to see the extent to which they now rated the filters a help. Although it was felt that a period longer than a year was sufficient to minimise possible placebo effects, an even longer period would give more confidence in the results.

Subjects were surveyed by mail. Initially, 31% replied. As in the survey reported in 1988 (Whiting & Robinson, 1988), others were followed up by telephone, so that 114 (43%) of those surveyed eventually responded. The instrument used was identical to that used in the 1987 survey.

RESULTS

The results are summarised in Table 1.

TABLE 1: NUMBERS AND PERCENTAGES OF SUBJECTS REPORTING IMPROVEMENTS IN VARIOUS CATEGORIES OF DIFFICULTY ASSOCIATED WITH READING AFTER HAVING IRLEN FILTERS FOR SIX YEARS OR MORE.

	BEFORE FILTERS		IMPROVEMENT SINCE FILTERS					
	PROBLEM		NONE		SOME		LARGE	
	No.	%	No.	%	No.	%	No.	%
It is very hard to read	93	83	11	10	44	42	51	48
Reading is very slow or word-by word	103	92	12	11	44	45	47	43
Problems understanding what is read	102	93	17	16.5	52	50.5	34	33
Cannot read for very long without losing concentration	104	95	14	12	46	39	57	49
Eyes become sore, strained, tired, etc.	93	82	23	22	35	34	45	44
Avoid reading - never read for pleasure	96	86	25	24	50	48	30	28
Lines are skipped or reread	100	91	11	10.5	41	39.5	52	50
Often mistakes words and letters having similar shapes	99	88	8	8	33	33	60	59
Performing at school below ability level	52	69	15	24	19	30	29	46
Handwriting	80	71	39	39	36	36	25	25
Spelling	100	90	31	29	55	51	21	20
Low opinion of self - lacks confidence	79	71	22	23	39	42	33	35
Gives up when things become difficult -often gets discouraged	85	75	28	30	28	30	37	40
Not doing as well at school or in career as would like	87	78	19	20	37	38	40	42
Tires very quickly	80	73	30	32	39	41	25	27

(For a few of the questions above, respondents registered improvements in factors they had not perceived as problems before they had the lenses. In these cases, the total ns in the "improvement" column will exceed the number in the "before lenses " column.)

The problems most often reported are concentration, comprehension, fluency, skipping lines, spelling, confusion of words or letters, as well as overall difficulty and eyestrain. These are the typical dyslexic symptoms (Aaron, 1990). The factor least often reported was "performance at school below ability level", partly because many respondents did not answer the question, but perhaps also reflecting the common confusion of dyslexic or specific reading problems with assessments of general ability.

As with the earlier studies (see Table 2), the most obvious areas of reported improvements are overall difficulty of reading ("reading is hard"), visual confusions, tendency to skip lines, fluency, concentration, and comprehension. These are all areas where improvements would be expected if part of the subject's difficulties was with visual perception. Most "large" improvements were in similar areas: visual confusions, skipping lines unintentionally, concentration, overall difficulty of reading, and fluency. The order is different, but the factors are the same, with the exception of comprehension. Comprehension, being a factor involving complex processes, would be expected to take longer to show large improvement, especially in cases where decoding skills were particularly weak (Blaski et al, 1990; Robinson & Conway, 1990). Given the subjective nature of the ratings of "some" and "large", however, it seems most useful to limit observations to the ratings that combine the two categories. (See Table 2) below.

The rate of overall usefulness of the filters, as described by respondents, was calculated using the same method as used in the earlier study. In that study, Whiting & Robinson (1988) used a criterion of three or more "Large" responses to determine that the filters had been of considerable help to a subject. Fewer than three "large" responses, with any number of "some" responses indicated that the filters had been of some help to the subject, while a consistent response of "none" indicated that the filters had been of no help at all. As in the earlier study, there were a number of reasons given for "no help", including that the subject had never worn the filters because of peer pressure. In this study, 104 respondents (94%) reported that the filters had been of "some" or "large" help (as defined above), while 7 (6%) indicated no help at all. Sixty-six (58%) indicated that they had received a "Large" degree of help, while 41 (36%) indicated they had received "Some" help. While these figures are higher than Burgess's (1991) results, they are almost identical with Robinson & Whiting's (1988) results using the same sample. Burgess speculated that her figures might be different because her subjects had had the filters for only six months, while Whiting & Robinson's had had them for at least 12 months. The six-year study however, tends to support the earlier figures obtained by Whiting and Robinson (1988).

The telephone follow-up of non-responders suggested that they were much like those who responded to the mail survey, except that for various reasons they did not return the forms. Of those surveyed by telephone, 56% indicated a "large" degree of help from the filters, 35% indicated "some" help, and 9% indicated no help at all. The figures for the mail sample were 58%, 36% and 5% respectively. Thus there may have been slightly more non-respondents who had experienced no help, but the difference was not great. It seems reasonable to conclude that better than 90% experienced definite help from the filters.

Table 2 combines the categories "some" and "large" and presents a comparison of results from the two earlier studies discussed above (Whiting & Robinson, 1988; Burgess, 1991). Though there are obvious similarities in results, there are changes which are worth noting. For simplicity of comparison, only percentages have been given.

TABLE 2: SURVEY RESEARCH ON IRLEN FILTERS: COMPARATIVE SUMMARY OF RESULTS FROM WHITING & ROBINSON (1988), BURGESS (1991) AND THE PRESENT STUDY

FACTOR	%OF SUBJECTS REPORTING IMPROVEMENTS			
	1988	1991	1993	Change
Overall Improvement	93	83*	94	(+1)
Reading:				
difficulty	91	91	90	(-1)
fluency	91	85	88	(-3)
comprehension	84	73	84	(=)
concentration	85	71	88	(+3)
Spelling	69	63	71	(+2)
Handwriting	58	54	61	(+3)
Mathematics		48		
Visual anomalies:				
skip lines	82	78	90	(+8)
confusion (inc. reversals)	81	76	92	(+11)
eyestrain	82	86	78	(-4)
tiredness (while reading)	56	81	68	(+12)
glare		77		
Self confidence	68	54	77	(+9)
Perseverance		51	70	
Performance (school or career)		62	80	(children:76)
Depth perception, coordination		41		
Motion sickness		24		

* *To obtain this figure, Burgess (1991) asked subjects to respond to the statement: "I/ my child have experienced great benefits from wearing Irlen tinted lenses". The statement would naturally result in a lower figure because of the word "great" which excludes "some", included in the other figures.*

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