

Title Occupation choices of adults with and without symptoms of dyslexia

Running head Dyslexia and occupation

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Introduction

Developmental dyslexia is a neurodevelopmental learning disability which has been estimated to affect 5-10% of UK children (Stein et al., 2000). It is often argued that dyslexia, although traditionally associated with problems with reading, writing, and spelling, is in fact a more widely-ranging cognitive condition with a variety of signs and symptoms (Miles et al., 1998). Thus people with dyslexia may have weaknesses in processing written language, but they may also have talents in other areas (Geschwind and Galaburda, 1985; Miles, 1995), such as visuospatial processing (West, 1992) and music (McNamara et al., 1994). It is possible that this pattern of strengths and weaknesses may predispose people who have dyslexia towards adopting certain occupations and away from others (West, 1992). There is certainly evidence that occupational choice may be affected by learning disability (Biller, 1987; Rojewski, 1996). For reading disabilities, whether this predisposition involves a negative choice (for example, being barred from certain professions by a lack of formal qualifications) or a positive choice (for example, towards professions which emphasise creativity) remains to be determined. Our anecdotal experience suggests that both factors may be operative – to different degrees and at different stages in different individuals – but this has not to date been assessed formally.

To investigate the types of differences in career choice between adults with and without symptoms of dyslexia, we examined the occupations of adults with and without symptoms of developmental dyslexia. Results were analyzed using non-parametric statistics and illustrated with a case study.

Methods

Adult participants (n = 365) who were parents of children with dyslexia underwent screening as part of an ongoing study into the genetics of dyslexia (Fisher et al., 2002; Fisher et al., 1999a; Fisher et al., 1999b). Only adults whose date of birth was known were included in the analysis presented here, in order that age effects could be assessed. All participants came from the same geographic area (Central Southern England) and had a similar socio-economic background, although social class was not formally assessed.

Occupational coding: As part of the screening process, participants were asked about their occupation. All listed occupations were grouped into 25 categories using a widely-used categorisation developed by the United States Bureau of Labor Statistics: the Standard Occupational Codes (SOC) system (2002), as shown in Table 1 (below). This grouping was done by a researcher who was blind to the dyslexic status of each participant and also blind to which occupation matched which participant. Some gave occupations which were not easily classified in the system (n = 20), some subjects did not give an occupation (n = 24) and some defined their occupation in terms of parental role (n = 28). These additional categories were designated: -1 (not classified), 0 (not given) and 1 (“housewife”, “homemaker” or “mother”). Table 1 shows the numbers of participants in each group.

Table 1: Occupation categories

Category	N	Description
-1	1	Not Classified
0	2	Not Given
1	10	“housewife” or “mother”
11-0000	15	Management Occupations
13-0000	10	Business and Financial Operations Occupations
15-0000	23	Computer and Mathematical Occupations
17-0000	23	Architecture and Engineering Occupations
19-0000	8	Life, Physical, and Social Science Occupations
21-0000	5	Community and Social Services Occupations
23-0000	9	Legal Occupations
25-0000	11	Education, Training, and Library Occupations
27-0000	28	Arts, Design, Entertainment, Sports, and Media Occupations
29-0000	6	Healthcare Practitioners and Technical Occupations
31-0000	12	Healthcare Support Occupations
33-0000	10	Protective Service Occupations
35-0000	35	Food Preparation and Serving Related Occupations
37-0000	20	Building and Grounds Cleaning and Maintenance Occupations
39-0000	20	Personal Care and Service Occupations
41-0000	24	Sales and Related Occupations
43-0000	46	Office and Administrative Support Occupations
45-0000	3	Farming, Fishing, and Forestry Occupations
47-0000	8	Construction and Extraction Occupations
49-0000	8	Installation, Maintenance, and Repair Occupations
51-0000	9	Production Occupations
53-0000	19	Transportation and Material Moving Occupations
55-0000	0	Military Specific Occupations
TOTAL	365	

Dyslexia ratings: Participants were categorised by a trained clinician as 0 (not dyslexic), 1 (shows symptoms of dyslexia but not formally diagnosed) or 2 (formally diagnosed with dyslexia). Relatively few participants (N = 14 of 178, approximately 8%) have formally been diagnosed with dyslexia. As the mean age of the sample is 46.1 years (SD (standard deviation) = 6.41), this is perhaps unsurprising; at the time when our subjects were children dyslexia was far less commonly recognised than it is today (although some, like our case study, have been diagnosed in adulthood). Group 1 comprised participants who reported ongoing problems with reading, spelling, or writing, or who scored ≥ 9 on the ADO checklist (see below). Groups 1 and 2 were therefore amalgamated for the purposes of analysis, giving groups of 187 (51.2%) controls (83 males, 104 females, mean age 45.3, SD = 5.72) and 178 (48.8%) dyslexics (91 males, 87 females, mean age 46.9, SD = 6.98). Participants were also given the ADO (Adult Dyslexia Organisation) 20-question checklist of dyslexic-type symptoms (Vinegrad, 1994). Ratings of 9 or greater on this checklist may be indicative of “dyslexic-type” problems. ADO scores were available for all but 5 control subjects (n = 182) and for all dyslexic subjects (n = 178).

Tests for normality: Deviation from normality was assessed using a Kolmogorov-Smirnov test. The distributions of ADO scores ($p < 0.001$), SOC ($p = 0.001$) and age ($p = 0.023$) differed significantly from normality. Therefore nonparametric statistics (Mann-Whitney U) were used to compare mean scores between groups. Fisher’s Exact Test was used to compare the sex distribution between dyslexic and control groups.

Chi-square tests and odds ratios: Once occupations had been sorted into categories, they were matched to the correct person so that the distribution of persons across occupational category could be compared between dyslexic and non-dyslexic groups. A chi-square test was used to assess the hypothesis that the distribution of occupational category did not differ between groups. Significance was evaluated at $p = 0.05$.

Odds ratios for each SOC category, which reflect the relative proportions of dyslexics and controls in each category, were also calculated as follows:

$$\text{OR}(\text{category}) = \frac{\text{N}(\text{dyslexics in category})/\text{N}(\text{dyslexics not in category})}{\text{N}(\text{controls in category})/\text{N}(\text{controls not in category})}$$

An inverse odds ratio ($\text{IOR} = 1/\text{OR}$) was also calculated. An OR or IOR of 2 or greater was taken as tentatively indicative of significant differences between the dyslexic and control groups in favour of the dyslexic group (OR) or in favour of the control group (IOR).

Finally, the findings suggested by the pattern of the odds ratios were tested statistically using a chi-square test to assess the hypothesis that the distribution of dyslexics and controls was not significantly non-uniform, separately for each SOC category.

SOC category 55 (Military Specific Occupations) was excluded from testing since there were no members of this category in the sample. SOC category 23 (Legal

Occupations) was excluded since there was only one member of this category in the sample. SOC category 33 (Protective Service Occupations) was also excluded since there were no members of this category in the control group.

Results

Fisher's Exact Test indicated that the dyslexic and control groups did not differ on sex ($p = 0.21$). A Mann-Whitney test showed a trend level difference on age ($p = 0.07$), which did not however reach statistical significance. ADO scores differed significantly between control subjects ($n = 182$, mean = 3.2, SD = 2.6) and dyslexic subjects ($n = 178$, mean = 9.8, SD = 3.9), with the dyslexic group gaining a much higher mean score, as would be expected given the nature of the ADO checklist.

A chi-square test indicated significant differences in the distribution of dyslexics and controls between the various occupational (SOC) categories (Chi-square = 44.5, $df = 24$, two-sided $p = 0.007$).

Table 2 shows the numbers of dyslexics (Dx) and controls (Ct) in each group, the mean ADO (with standard deviation) and the odds ratio and inverse odds ratio for each category. Categories are listed in descending order of odds ratio, so that the categories in which dyslexic subjects predominate (in which mean ADO scores are higher) are at the top of the table and those in which control subjects predominate are at the bottom of the table.

Table 2: Odds ratios and mean ADO scores for SOC categories

Category	N	Dx	Ct	Odds Ratio	Inverse Odds Ratio	ADO Mean	ADO Standard Deviation
41-0000	10	9	1	9.91	0.11	9.90	3.63
47-0000	15	13	2	7.29	0.15	10.20	3.84
53-0000	10	7	3	2.51	0.43	6.10	3.67
17-0000	23	15	8	2.06	0.53	5.13	3.40
29-0000	23	15	8	2.06	0.53	7.17	5.10
37-0000	8	5	3	1.77	0.60	7.38	5.73
45-0000	5	3	2	1.59	0.67	5.60	5.18
35-0000	9	5	4	1.32	0.80	9.63	3.16
31-0000	11	6	5	1.27	0.83	7.09	6.25
1	28	14	14	1.05	1.00	7.89	4.91
21-0000	6	3	3	1.05	1.00	5.00	3.58
39-0000	12	6	6	1.05	1.00	8.83	5.17
49-0000	10	5	5	1.05	1.00	7.60	3.81
25-0000	35	16	19	0.87	1.19	6.63	5.35
43-0000	20	9	11	0.85	1.22	7.53	5.14
-1	20	8	12	0.69	1.50	5.25	4.47
0	24	9	15	0.61	1.67	5.42	5.12
11-0000	46	16	30	0.52	1.88	4.67	4.01
19-0000	3	1	2	0.52	2.00	2.00	1.00
15-0000	8	2	6	0.34	3.00	3.63	3.02
27-0000	8	2	6	0.34	3.00	7.63	5.21
51-0000	9	2	7	0.29	3.50	4.75	3.33
13-0000	19	4	15	0.26	3.75	4.37	3.10

Chi-square tests on the distribution of dyslexic and control individuals within each SOC category showed significant differences in distribution for categories 11 (Chi-square = 4.26, df = 1, p = 0.039), 13 (Chi-square = 6.37, df = 1, p = 0.012), 41 (Chi-square = 6.40, df = 1, p = 0.011), 47 (Chi-square = 8.07, df = 1, p = 0.005) and, at trend level, 51 (Chi-square = 2.78, df = 1, p = 0.096).

Figure 1: Numbers of dyslexic and controls in sample, by SOC category

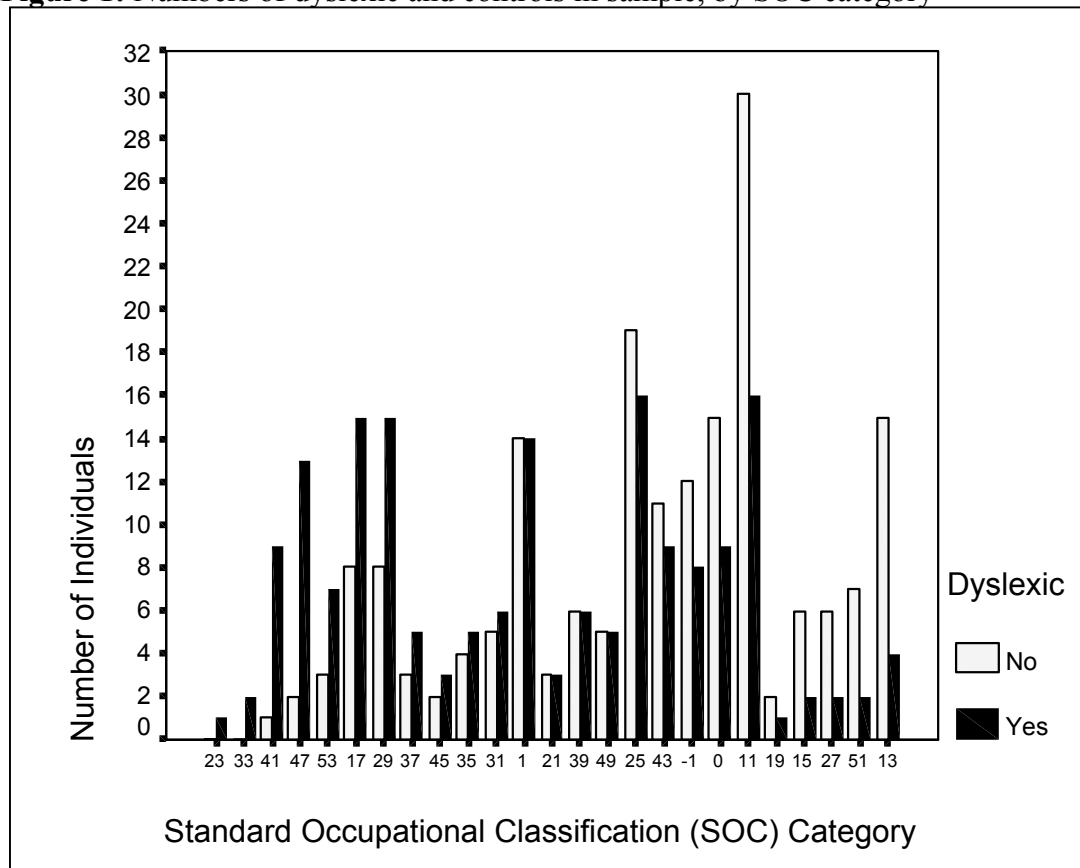


Figure 1 shows the number of individuals with dyslexia (grey bars) and without dyslexia (black bars) in each SOC category. Categories in which dyslexics predominate are to the left of the graph, and categories in which controls predominate are to the right of the graph.

Table 2 and Figure 1 provide evidence for the hypothesis that adults with and without dyslexia may tend to make different occupational choices. Adults with dyslexia are significantly overrepresented in SOC categories 41 (Sales and Related Occupations) and 47 (Construction and Extraction). To a lesser degree they also predominate in SOC categories 53 (Transportation and Material Moving), 17 (Architecture and Engineering) and 29 (Healthcare Practitioners and Technical Occupations). For

example, the 23 members of SOC category 29 included 16 nurses, of whom 13 (81%) were in the dyslexic group.

Adults with dyslexia tended to be significantly underrepresented in SOC categories 11 (Management), 13 (Business and Financial Operations), and to a lesser extent in SOC categories 15 (Computer and Mathematical) and 51 (Production).

Case Study

The results obtained above relate to our sample as a whole. To illustrate them at an individual level, we provide a case study as follows:

J.K. (date of birth 31 August 1955) is a 46 year-old art and textile teacher. She is right-handed, although her performance on the Annett pegboard task (Annett, 1985) suggested a tendency towards mixed-handedness, with a difference between the hands of only 0.5 seconds (the pegboard average time was 9.7 seconds). J.K. is married and has three children, two of whom are also dyslexic. Her score on the ADO checklist was 14.

Education:

At school, J.K. was said to have "word blindness". Attitudes to learning disabilities at her first, highly academic, school were unsympathetic; she recalls being humiliated in front of the class for getting her letters the wrong way round. She consequently moved to a less academically-oriented school, with a higher percentage of learning-

disabled students, which she felt was more adaptable and accommodating to her needs.

J.K. left school with A levels and went to university in London to read anthropology, but found the essay writing difficult and the course extremely stressful. She was formally diagnosed dyslexic while taking an HND course in 3D design at Reading University. She is currently doing an NQT course for teaching, and is finding some parts of the course (notably spelling and arithmetic) difficult to pass. Although she has developed strategies for reading and spelling, she has found all her academic work difficult.

Symptoms:

J.K. has developed strategies for reading and spelling: for example, she speed reads, a strategy which is successful if she understands the context of what she is reading. She continues to report severe difficulties with reading and spelling for technical or highly novel material. The educational psychologist who diagnosed her reports her spelling age as being in the 10th centile, and she describes herself as "verbally poor", although her verbal performance in the interview was fast and fluent. However, her visuospatial awareness is excellent: her performance on block design was in the top 2% of the population. She has poor handwriting, but her drawing skills are good. As a child, she suffered from migraines characterised by intense visual and auditory distortions ("aura"), and although the migraines no longer occur, she reports a continuing high level of visual disturbances when reading print (e.g., double vision, blurring, apparent

motion). She also reports some problems in the motor domain, notably with balance, catching or throwing a ball, and automatising new motor skills.

J.K.'s dyslexia appears to have had a component of number-colour synaesthesia, which confused her as a child to such a degree that she reports not being able to count or add up properly until her early twenties. Despite her problems with arithmetic, however, she found other aspects of mathematics, such as ratios and proportions, relatively easy. Her tendency to see numbers as colours has lessened with age, and she describes her cognitive style in general as becoming slower, calmer, more focused and more organised.

Career choice:

J.K.'s attitude to her experiences in school was predominantly negative. Asked whether she viewed her dyslexia as an advantage, a disadvantage, or both, she responded that she considered it a disadvantage. She reported low self-esteem and said that she felt that attitudes to people with dyslexia were still too often unsympathetic and denigrating: "if you can do it, it can't be any good". Nevertheless, she regards being dyslexic as part of her character.

J.K. teaches art and textiles in what she describes as a "low-status, rough" school with a high percentage of learning-disabled children. Academic achievement is relatively low, but the value added is high; the school does consistently better than predicted in exam results. J.K. reports having chosen art and textiles because of its minimal written content. She wanted to teach because of her interest in and empathy with

children who learn differently. She enjoys the feeling of helping them achieve and of bolstering their self-esteem.

Discussion

The analysis presented here was designed to assess the hypothesis that having dyslexia is associated with making different job choices from those made by people without dyslexia. The results provide some initial evidence in support of this hypothesis.

Table 2 indicates that dyslexic individuals are much less likely than controls to be involved in professions such as science/computing, management and finance. These occupations rely heavily on written work, numerical and symbolic processing; they also often entail short deadlines, forcing work to be done under severe time pressure. This finding is therefore perhaps not surprising. However, what the evidence suggests is that people with dyslexia are much more likely than controls to be involved in people-oriented professions such as nursing or sales, or in construction. We note that our case study J.K., a teacher, is highly people-oriented in her concern for her learning-disabled students, and also that she has deliberately chosen a branch of teaching which utilises her visuospatial and artistic talents while minimising written content.

Several caveats apply to this analysis. Firstly, the sample size is relatively small. Secondly, the adults in our sample did not undergo psychometrics, so the categorisation of them as "dyslexic" or "control" is not a formal one; rather, it is based

on signs and symptoms they exhibited at the time of assessment, and on self-report. Thirdly, the parents were assessed as part of the study into the genetics of dyslexia, in which the entry criteria included having at least one child with dyslexia. That is, even "control" parents may have some degree of genetic predisposition towards dyslexia. The fact that the mean ADO checklist score for the control group was greater than zero may perhaps be relevant here. However, one would expect that all of these caveats would tend to weaken the distinction between "control" and "dyslexic" groups, thus reducing the likelihood of finding significant results. Nevertheless, the findings are significant. Furthermore, parents were asked their occupations as part of the general screening procedure and prior to their being classified as "control" or "dyslexic". Since the emphasis on the study was on the genetics of dyslexia, there seems no obvious reason why reports of occupation should be biased by dyslexic status.

Unfortunately, resource limitations entailed that social class, age and qualifications upon leaving school, and occupational satisfaction, were not assessed in the study. Our sample was taken from what we suspect is a relatively homogeneous population: residents of Central and Southern England who had the resources and determination to get a potentially reading-disabled child referred, via a GP, to the research clinic from where they were recruited to the study. However, larger samples incorporating a more diverse range of participants are required, preferably run independently rather than as a small part of a larger study, and preferably including measures of occupational satisfaction and formal qualifications. We hope that future research will be able to address these issues.

Finally, it is also worth noting the age of the sample. Participants were parents with young or teenage children, so their job choices may not have reflected current options in the labour market. Dyslexia is much more widely recognised nowadays. In addition, entry qualifications for some professions, such as nursing, have changed in recent years (in the case of nursing they have become much more academically demanding). It would be interesting to speculate that the proportion of people with dyslexia entering nursing in recent years may have fallen for this reason.

To summarise, people with dyslexia, in this sample at least, appeared to be predisposed towards people-oriented professions, such as nursing, and away from professions such as management and finance. It may be that they feel barred from the latter by their lack of formal qualifications, or they may find the nature of the work involved uninteresting. Or they may actively prefer less structured occupations, in which they have greater control and in which they can be more creative and more directly involved with people.

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