THE EFFECTS OF DYSLEXIA UPON PERSONAL TRAVEL: EMPIRICAL RESULTS OF A QUALITATIVE STUDY

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ABSTRACT

This paper considers access to the transport system for those with dyslexia, with a specific focus upon the role of travel information provision in preventing and facilitating travel by this group. The paper reports results from an in-depth qualitative investigation, which finds the inaccessibility of pre- and in-trip information as insurmountable barriers, excluding dyslexic people from the transport system. The research indicates that the task of planning and undertaking a journey is affected by dyslexia, with this relationship associated with and exacerbated by a lack of appropriate informational support. It is either unavailable, of little use, being difficult to access and decipher. In consequence, the travel choices and travel behaviour of dyslexic people are restricted. These individuals continue to use familiar routes and modes and face limited travel horizons because of an inability to explore available choices and opportunities.

The research calls for greater recognition and awareness of dyslexia across the transport industry, particularly within travel information provision, throughout the journey lifecycle. Greater awareness of and support for dyslexia in the provision of travel information services would mean that dyslexic travellers are able to find them more useful, more usable and thus use them more, which could broaden the travel horizons of this group. Owing to this, the paper highlights proposals for transport supply improvements, to facilitate greater inclusion for dyslexic travellers in the transport system.

INTRODUCTION

Transport has a significant impact upon quality of life for disabled people. The ability to access opportunities, services and other goods is highly dependent upon the ability to access public and/or private transport. However, there are many barriers to transport access for disabled people, with the causes relating most strongly to the disabling nature of the transport environment, an example being a lack of acceptable and available transport options informed by a lack of information. Emerging as an issue at almost every stage, information is a barrier not only to disabled people's ability to make effective journeys, but also to their

desire to travel (SEU, 2003; Hine, 2007; cited Lamont and Kenyon, 2010). This can result in exclusion from the transport system.

All travellers have a need for information, both pre- and in-trip, regardless of mode or individual characteristics. However, disabled people have greater needs *for* and *from* information than non-disabled travellers in terms of journey planning to assess travel options and to assist in undertaking and completing their journey (TRG 2000, cited Lyons, 2006). The information provided must be accessible to disabled people (Geehan, 1996). Although there have been some improvements in recent years (DPTAC, 2000; Kenyon et al, 2001), the MAPLE Consortium (2005) and Rosenkvist et al (2009) highlight that many transport providers fail to meet the needs of disabled people, in terms of both the accessibility of information and the nature of the information provided. In particular, transport providers still do not recognise people with a learning disability (either specific or non specific) in the development and delivery of travel information and often fail to meet their needs at the most basic level. Information is difficult to access, overwhelming and fails to give people with a learning disability the knowledge, understanding and confidence that they need in order to travel effectively or the desire to seek and implement alternative travel choices (Lamont and Kenyon, 2010).

This paper considers access to the transport system for those with dyslexia, a specific learning disability that affects the ability to read, spell, listen and write. The paper reports results from an in-depth qualitative investigation, understood to be the first of its kind within this group[1], with the aim of assessing the extent to which dyslexic people face exclusion from the transport system and the role of travel information provision in preventing and facilitating travel by this group. This paper primarily draws upon the UK evidence base, reflecting the advanced position of the UK in this field and the setting for the primary data collection. However, it is suggested that the analysis that follows is applicable outside of the UK.

The paper progresses through the following sections. Firstly, dyslexia is defined. Next, the research method is presented. Results and discussion illustrate the complex ways in which people with dyslexia interact with travel information and the extent to which this prevents and facilitates travel by this group. A series of proposals for transport supply improvements to facilitate the inclusion of people with dyslexia in the transport system are provided, with an emphasis upon actions to create more accessible information. A conclusion follows the Results.

DYSLEXIA

For most people, difficulties with learning and information processing are not routinely experienced. Yet for a proportion of the population, these difficulties occur regularly. These individuals are referred to as having a *learning disability*. Johnson and Peer (2003) refer to two main types of learning disability:

[1] The author has been unable to locate any previous studies focusing upon the travel information needs and issues associated with dyslexic people, or the experience of mobility-related exclusion of this group.

1. Non specific learning disability - general problems spanning a number of aspects of learning.
2. Specific learning disability – a condition which affects a specific area of learning. For example, Dyspraxia (organisation, motor skills and voluntary movement), Dysphasia (communication), and Autism/Asperger's (social interaction and communication).

Dyslexia is also a specific learning disability. It affects the interpretation and use of written language, including words spelt, read, pronounced, written, and association of meaning between words (Pollock and Waller, 1997).

There have been significant advances in research into dyslexia over the past two decades. Advances in MRI and other forms of brain imagery have helped to aid explanations of dyslexia, support policy and practice, and shape modern definitions (Reid, 2009a). However, a single definition of dyslexia escapes us (Solan, 1993; Miles, 1995). The following definition of dyslexia underlies this paper:

> [Dyslexia is] A specific learning difficulty which mainly affects the development of literacy and language related skills. It is likely to be present at birth and to be lifelong in its effects. It is characterised by difficulties with phonological processing, rapid naming, working memory, processing speed, and the automatic development of skills that may not match up an individual's other cognitive abilities. It tends to be resistant to convention teaching methods, but its effects can be mitigated by appropriately specific intervention, including the application of information technology and supportive counselling.
> British Dyslexia Association (2009)

Although the above definition provides a medicalised discourse of deficits, it is considered to best reflect current thinking in the field. It concentrates on the specific symptoms of dyslexia, and mentions additional areas of physical functioning that may be affected.

Dyslexia is a complex disability and there is much debate, not only regarding its definition, but also its root causes. A substantial body of evidence supports a core phonological deficit as the main identifier and descriptor of dyslexia, that is difficulty in learning and organising the sounds needed for clear speech, reading and spelling (Murphy, 2003; Ramus, 2003). However, the view that a phonological deficit is the only core deficit in developmental dyslexia is questionable, considering the evidence highlighting the heterogeneity of the dyslexic population. Recent studies by Reid et al (2007) and Ziegler et al (2008) revealed a striking heterogeneity of psychophysical and cognitive profiles amongst the people involved in the studies.

Sub-typing analyses by Ziegler et al (2008) suggests that dyslexics almost always have more than a single underlying deficit, further highlighting the importance of considering dyslexia at the individual level rather than as a unitary disorder. However, from a policy perspective, a common classification is sought. Considering this, Brunswick (2009) argues that it is useful to classify individuals with common dyslexic difficulties in to two main sub-types, with the majority of people with dyslexia displaying a combination of the two:

- *Phonological dyslexia*: characterised by a difficulty in converting written letters into their corresponding sounds. Individuals have difficulty reading non-words.
- *Surface dyslexia*: characterised by a difficulty in recognising words visually, as whole units. Individuals have difficulty reading irregular words.

This sub-typing informs the understanding of dyslexia applied in this paper.

Dyslexia is a worldwide issue. It affects at least 8 per cent of the world population and 6 per cent of the UK population (European Dyslexic Association, 2007), affecting using alphabetic-style languages and those whose languages are based upon symbols rather than letters (Miles, 1993; Beaton, 2004). Gender differences in the incidence of dyslexia exist: a ratio of 3 or 4 males to 1 female is quoted in the literature (Beaton, 2004; Miles, 2004). No other socio-demographic factors relating to the incidence of dyslexia are discussed in the literature.

As previously mentioned, this paper takes as its focus the role of information in the exclusion of people with dyslexia from the transport system. From this, the research aimed to uncover the reasons for exclusion from information systems, with the aim of providing guidance to information providers. The paper now turns to describe the research undertaken, highlighting the research method used, before discussing the results.

METHOD

There are many methodological paths available to the researcher, and different approaches are appropriate for different research questions (Lockyer, 2006). Given the paucity of existing understanding in the research literature surrounding dyslexia and personal travel, a qualitative exploration was necessary. Exploratory research to chart the dimensions of previously unstudied social settings and intensive investigations of the subjective meanings that motivate individual action are well-served by such a technique (Schutt, 2006). Although a quantitative-based survey would have highlighted the prevalence of the problem, the findings would have been of little use to the transport sector in learning about the complex needs of dyslexic people from travel information provision in depth. A qualitative approach allowed the author to gather and represent human phenomena with words and the meanings attached by participants to events and their lives (Schutt, 2006). Participants were able to express themselves in their own words, illuminating factors of importance to them, free from control of a fixed research schedule (Lamont and Kenyon, 2010).

A focus groups study was undertaken by the author. A focus group typically brings together a group of individuals for a face-to-face discussion on a topic of interest. Hence, they are an effective way of gathering the views of a number of people simultaneously. Participants provide a flow of input and interaction related to a particular topic, bringing their opinions and perspectives to the surface, with the opportunity to diversify onto other related topics if appropriate (Edmunds, 1999). Considering that dyslexia is particularly related to written language and is exacerbated by stress, focus groups offer a way of placing dyslexic people in a suitable environment where they can comfortably share their attitudes and experiences, without the need for the use of written language and with peer support.

Six focus groups were undertaken, with each group consisting of between six and ten participants. The six focus groups were held at six different locations across the UK, with each discussion lasting approximately 90 minutes. 52 participants were recruited through local dyslexic support groups using non-probability sampling techniques as explained in Schutt (2006). This was not a comparative study with non-dyslexics. For that reason, recruitment was solely with people who have received an official diagnosis of dyslexia. Diagnosis was verified prior to the focus groups using the Adult Dyslexia Checklist, designed by Vinegrad (1994) and adopted by the British Dyslexia Association. Figure 1 below summarises the results obtained from the checklist, presenting the items (in order of importance) that best discriminate between dyslexic and non-dyslexic people.

	Percentage of 'Yes' Responses (%)
Mistakes are made when writing cheques	65
Numbers are mixed up when dialling a telephone number	77
Poor spelling	93
Dates and times are mixed up and appointments are missed	72
Form-filling is difficult	84
Writing down telephone messages correctly is difficult	63
Numbers are mixed up	51
Incorrect sequence for months going forwards	23
Learning multiplication tables at school was difficult	81
Reading is inefficient	88
Difficulties with left and right	77
Getting the sounds in the wrong order when saying a long word	60

***Figure 1** – Results of the adult dyslexia checklist*

Whilst socio-demographic factors are not discussed in the literature as influences upon dyslexia, many such factors influence travel behaviour. Therefore, a maximum variation sample was sought. A good spread of age (18-60) was achieved. There was an equal mix of gender (see Figure 2 below). All participants were either dependently or independently mobile, with a mix of modal experiences to draw upon (see Figure 3 below). Although the experiences of immobile dyslexics would be valuable, no participants of this nature were recruited.

Group Number	**Location**	**Number in group**	**Gender**	**Age**	**Current modes of travel**
1	Newbury	8	4 male 4 female	Mixed	6 car: - 2 local/familiar only - 3 long distance/unfamiliar only

					- 1 both 2 bus frequently[2] 1 train frequently 6 frequent long distance travel[3]
2	Bromley	9	6 male 3 female	Mixed	6 car: - 3 local/familiar only - 3 both 3 bus frequently 3 train frequently 9 long distance travel
3	Birmingham	10	4 male 6 female	Mixed	6 car: - 1 local/familiar only - 2 LD/unfamiliar only - 3 both 5 bus frequently 3 train frequently 4 long distance travel
4	Bristol	8	4 male 4 female	Mixed	5 car: - 2 local/familiar only - 1 LD/unfamiliar only - 2 both 4 bus frequently 1 train frequently 7 long distance travel
5	London	9	4 male 5 female	Mixed	4 car: - 4 both 8 bus frequently 8 train frequently 9 long distance travel
6	Newbury	8	4 male 4 female	Mixed	5 car: - 2 local/familiar only - 2 LD/unfamiliar only - 2 both 4 bus frequently 2 train frequently 8 long distance travel

***Figure 2** – Focus group profiles*

[2] 'Frequently' has been interpreted as daily or weekly travel.
[3] Frequent' has been interpreted as travel once a month or every 2-3 months.

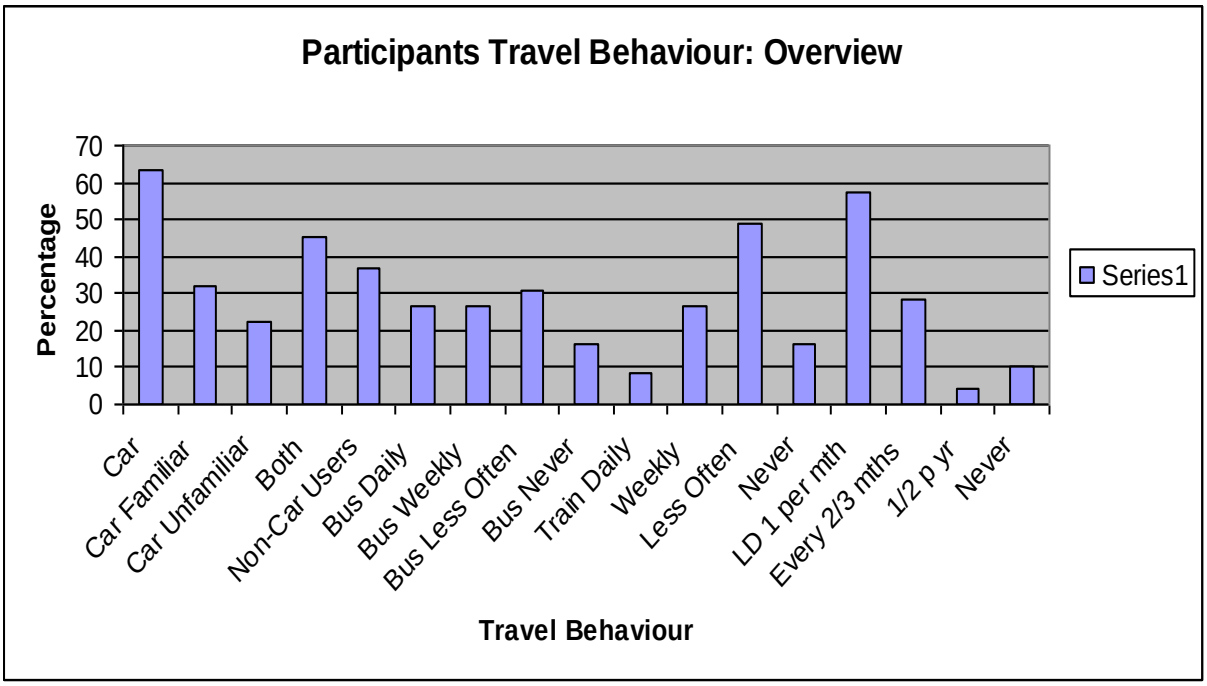

***Figure 3** – Participants' travel behaviour*

A topic guide was used to structure the discussion, designed around the factors hypothesized to be important to the research. The guide was flexibly used, to ensure that participants had the freedom to discuss issues of importance to them. The initial discussion focused upon the participants' experience of dyslexia, before turning to focus upon experiences of travel and transport. Participants discussed their travel patterns and mode use, and were guided to consider reasons for these. Participants were encouraged to discuss their travel in terms of the journey lifecycle (that is, the series of stages that an individual encounters from planning a journey to arriving at its destination), considering travel by car and/or public transport for unfamiliar local or long distance journeys. Attitudes towards different modes were also explored. Information use emerged naturally through discussion. By examining these issues, the perceived constraints on travel choice and behaviour and the barriers to modal change emerged.

Data was collected using a digital recorder and transcribed prior to analysis, leaving the author free to reflect upon what was transpiring (David and Sutton, 2004). Analysis was principally content-based and empirically-driven, involving a systematic evaluation of the needs of dyslexic people. The primary aim was to draw out the significance of what is being experienced by (and the relevance of the challenges to) someone with dyslexia. The chosen sub-headings reflect how the particular functional implications of dyslexia relate to the difficulties experienced when using travel information. Links to the formalised body of knowledge are made where appropriate, along with the use of pertinent quotations from the participants. Proposals for transport supply improvements are also highlighted, which may facilitate greater ease of use of private and public transport for those with dyslexia.

RESULTS AND DISCUSSION

Travel Behaviour and Mode Choice

Participants were encouraged to consider their interaction with the transport system during a journey lifecycle. Through discussion of travel experience, considering both journeys made and unmade, it emerged quickly and clearly that participants *do* feel excluded from the transport system, considering both private and public transport. It emerged equally strongly that travel information is fundamental in facilitating and supporting progress through the journey, influencing travel choices and behaviour, as hypothesised in relation to other groups by Hine (2007) and SEU (2003; cited Lamont and Kenyon, 2010).

Participants are highly cautious in their travel behaviour, rarely exploring alternative modes, or routes. Travel information emerged as having a considerable influence upon this. Travel information is a key support mechanism across the entire journey lifecycle, vital to managing the symptoms of dyslexia and physical and psychological well-being. Consequently, it is considered essential in being able to explore alternative travel choices. The participants explained that they continue to use familiar routes and modes and exhibit low level of inclination to seek alternative mode choices because information is either unavailable, or unusable. This is particularly the case for travel by public transport. Information is consequently seen as a significant barrier to travel via these modes. On account of this, the majority of the participants exhibit a preference for travel by car as driver or passenger. Nevertheless, it emerged that use of the car was not without its problems.

Participants highlighted the particular functional implications of dyslexia and how they related to their difficulties when using traveller information, both pre- and in-trip. The discussion considered: learning; listening; numerical processing; reading; speech; spelling; wayfinding; and the psychological and emotional effects of dyslexia. Each of these factors was seen to contribute towards an inability to use travel information in its present form, which acts to inhibit the use of the transport system by people with dyslexia. This paper now considers each of these functional implications in turn, along with proposals for transport supply improvements.

Learning

Dyslexic people experience difficulties which impact upon the learning process. Rather than being slow learners, dyslexics possess *alternative* learning styles and use alternative strategies during the learning process (Corrigan, 2001).

Learning emerged as a particularly important element of pre-journey planning for those with dyslexia, lessening the need to access travel information en-route, which can be difficult (discussed below) and reducing the stress associated with travel which, as mentioned, can exacerbate the symptoms of dyslexia. Rather than rational/analytical explanation, dyslexics tend to learn visually and intuitively, using the relationship between meaning and association of ideas to fix memory (Corrigan, 2001; Hoyles, 2007). The participants explained that learning is more effective if information provision supports this, for example, providing symbols and pictures rather than text, or text which provides a meaningful visual description.

However, participants suggested that existing information sources are predominantly text-based and do not support the dyslexic learning style. Consequently, the individual faces limited travel horizons, because they are unable to explore available travel options.

A majority of the participants expressed a preference for a practical/experiential approach to learning and visualisation, as supported by Corrigan (2001). Discussions exposed the common use (and need) to practice a journey prior to taking an unfamiliar journey, which lessens the need to access travel information en-route. The participants placed considerable emphasis on this, suggesting that this allows them to build a more visual picture of the journey, influencing their ability to undertake unfamiliar journeys:

> If I have to go somewhere new, my husband always has to take me there first on a dry-run. By performing a dry-run I remember the route by looking at the shops and pubs rather than all the street names and road numbers.
> (Rachel)

The technology exists for Internet-based information sources to support this visual learning process, through graphical displays of routes and text-based descriptions of local landmarks. This would greatly help people with dyslexia in the route-learning process, which would provide them with the opportunity to consider a wider range of travel choices, particularly for independent travel. More crucially, this could widen the opportunities for activity participation (Lamont and Kenyon, 2010).

Listening

Phonological weaknesses and impaired auditory skills can affect hearing and listening for dyslexic people (Rost, 1994; Corrigan, 2001). The process of listening is long and complex, with problems related to sequencing and understanding. Short-term and working memory are linked to listening. Someone with dyslexia may be unable to coordinate the listening task with choosing and retaining the correct information (Miles, 1993; Corrigan, 2001; Pollock, 2004). Reflecting this, a large number of participants experience difficulties with auditory tasks during a journey lifecycle:

> Information is never provided in short steps which you might remember. I lose sight of the words that are important if speech extends beyond one or two words.
> (TJ)

> They'll say turn here, go up there. By the time he's walked away, I've forgotten what he said.
> (Deborah)

Despite these problems, participants exhibited a preference for receiving travel information via auditory channels because they experience more problems using written language. However, it emerged that participants feel excluded from certain routes and modes because of a lack of appropriate audible information. This exclusion affects travel choices and resultant travel behaviour, with participants either unable to access certain routes and modes or avoiding those where audible information is inappropriate or lacking.

A number of suggestions for supporting the auditory weaknesses of people with dyslexia can be put forward. Audible information is already provided on some modes of public transport and it is suggested that this medium should be fully embraced. This type of information should be delivered clearly and at a reasonable pace, using important words only.

Numerical processing

It emerged that dyslexia affects the grasp of numerical skills (commonly known as 'dyscalculia'), including number recognition (particularly in relation to similar-looking numbers such as 6 and 9) and understanding numerical concepts and relationships (supported by Miles, 1993; Johnson and Peer, 2003).

Processing the 24-hour clock is a common problem for dyslexic people (Birmingham City University, 2008). Participants suggested that they are unable to easily process time represented in this way.

A further numerical problem surrounds an inability to correctly and efficiently process numbers displayed on electronic variable message signs. Dyslexic people find scrolling numbers difficult to process and feel anxious because they are unsure that they are processing the information correctly, especially if they are in a time-constrained situation and forced to act quickly. The fact that numbers are presented very close together and displayed in combination with unfamiliar place names makes decision-making all the more difficult:

> I have to be very careful boarding the correct bus when the bus number contains 6s or 9s. I can easily mix them up.
> (Deborah)

Participants explained that routes and modes where numerical information is provided audibly are favoured, because they can more easily process numbers in this format. This is because numbers presented in this way can only appear in succession, whereas visually-presented numbers can be presented either in succession or simultaneously. The latter puts greater demands on information processing skills (Miles, 1993).

The transport industry needs to recognise and support the numerical processing weaknesses of dyslexic people. Being able to correctly process numbers is an important skill that we regularly use during a journey lifecycle. Therefore, poor numerical skills will lead directly to route and mode exclusion. The representation of time needs to be more visual, for example, displayed as a clock face, or displayed in 12-hour format. In addition, text-to-speech and speech recognition could be made available.

Reading

Phonological deficits prevent dyslexics from developing effective reading strategies. They rely heavily on sight vocabulary, and in doing so make a large number of visual errors (Snowling and Stackhouse, 1996). As a consequence, participants experience considerable difficulties reading travel information. Participants explained that they find it almost

impossible to identify the key journey details from amongst a wealth of information provided and that there is a lack of trust in their ability to process the information correctly. Subsequently, as a coping strategy, participants explained that they will seek assistance or verification from someone who is not dyslexic. However, this isn't always possible. Some participants stressed that if they are unable to find help, they will consider modifying their travel behaviour, which may not necessarily be the most efficient or effective alternative. Some abandon the journey altogether, resulting in reduced activity participation.

It emerged that public transport information poses considerable reading difficulties for dyslexics. Problems with timetables emerged strongly, for reasons including:

- Amount of information displayed
- Colour contrast
- Font size
- Font style
- Information presented horizontally/linearly
- Timetables printed on glossy paper

Electronic variable message signs are challenging for similar reasons, with the addition of the scrolling feature. Participants suggested that the information does not remain static for long enough for them to process it correctly:

> When you have to read the screen where it's got all the place names and numbers. It's down to colour contrast, font, it's all horizontal and presented together. I can't process the information.
> (Lynn)

The difficulties dyslexic people experience with reading continue once on-board public transport. Asking a fellow passenger for information is a common coping strategy, with participants also relying upon audible information. However, participants explained that if this is not possible, they must decide for themselves when to alight. In such situations, they are likely to make the wrong decision because they have misread the information. Participants expressed real anxiety associated with this, with heightened levels of psychological unrest exacerbating their symptoms of dyslexia and further affecting their ability to process information and make decisions. Getting lost and subsequently getting back on track emerged as a significant concern, both practically and emotionally.

Considering car travel, participants' concerns surrounded text-based directions, particularly those produced by web-based journey planners. Participants explained that there is a substantial amount of information to process, which is often presented in lengthy, complex lines of text. The information is sometimes presented completely in upper case lettering, which is problematic because the shape of the letters makes the outline of the words appear too uniform. Visual problems are frequently experienced, for example, distortions, double vision, vibrating words and changes to the sequence of letters. As discussed above, learning directions is not really an option for people with dyslexia. However, reading directions whilst

driving is especially difficult, because of difficulties managing multiple tasks and an inability to process the information quickly.

A large number of participants are unable to read road maps. The font and colour contrast used and the amount of information displayed on maps make them difficult to process. In addition, a strong feeling was that they fail to provide the right detail:

> Maps would be easier for me if I could see that the next thing I'm looking out for after the Red Lion pub is the Esso garage.
> (Deborah)

Participants also explained that they are unable to easily and efficiently process road signs whilst driving (supported by Brachacki et al, 1995). Participants discussed losing their way and avoiding travelling through certain areas, because of difficulties with road signs, in terms of the amount of information on a single sign and the presence of multiple signs at junctions, particularly roundabouts.

In order to assist dyslexic travellers through an entire journey lifecycle, it is important to support their reading abilities. The Internet offers the opportunity to provide dyslexic-friendly timetables and directions. Audible information is already provided on some modes of public transport and it is suggested that this medium should be fully embraced by the industry. Although guidance exists on the design of information on electronic variable messaging signs, a review is strongly recommended in order to verify how to better accommodate people with a specific learning disability such as dyslexia. Ensuring that travellers can access useful and usable journey information en-route via a mobile device is suggested in order to lessen (or even negate) the need to refer to traditional forms of information.

Speech

Dyslexics can exhibit speech production weaknesses (otherwise known as 'verbal dyslexia'). Poor phonological awareness and/or weak phonological representations in memory are at the centre of these weaknesses (Hales, cited Miles, 2004; Beaton, 2004). Correct speech sounds can be produced in isolation, but are not easily sequenced into words (Snowling, 1987; Townend, 1999). A number of areas of speech processing emerged as having a direct impact upon the participants' ability to ask for travel information, thus affecting the information received and how it is used. Articulatory problems, misuse of words, word-finding and word sequencing emerged as common occurrences. It became apparent that speech difficulties lead to mobility exclusion because the individual's ability or desire to ask for information is affected. Thus, so are their travel choices and travel behaviour.

Travel information which better supports the needs of dyslexics will lessen the need of these individuals to ask for information. Staff training should emphasise how the industry can effectively and empathetically deal with the needs of dyslexic travellers. This would ensure that dyslexics are attended to more appropriately, which would have a positive effect upon their ability to ask for information in situations where it is unavoidable. As a consequence of this, people with dyslexia may find they feel more comfortable about disclosing it to others,

which in turn could broaden travel horizons and hence opportunities for greater activity participation.

Spelling

Research indicates that spelling poses a significant problem for dyslexic people (also known as 'dysgraphia') because they do not possess the necessary skills:

- Recall of words, to be precise, an accurate mental image;
- Auditory discrimination, more specifically, an accurate awareness of letter-sounds, syllable-sounds and word-sounds;
- Kinesthetic skills, that is, a feel for the patterning of the word through the movement of the hand while writing or typing it (Brown and Ellis, 1994; Pollock and Waller, 1997).

This was substantiated by many participants. Web-based journey planners are particularly problematic. Having to correctly spell the origin and destination on a journey planner, where the user must be close to the correct spelling in order to locate the word, emerged as particularly challenging.

If a list of similar place names is presented, it is unlikely to be of use. Participants suggested that they are unable to recognise differences between words. Therefore all options look quite similar, which results in misinterpretation: for example, 'Regents Street' and 'Regents Park'. Given that spelling poses a significant challenge to dyslexic people, it is recommended that weaknesses in this area are supported, through spell-checking facilities, or speech-to text/speech recognition software within journey planners. Whilst a clickable map would not negate the need to correctly recognise place names, it would eliminate the need to write them and provide a visual clue which could support correct identification.

Wayfinding and Orientation

Wayfinding refers to how people find their way in the physical world: what they need to find their way, how they communicate directional information and how people's verbal and visual abilities influence wayfinding (Raubal, cited Campbell and Lyons, 2008). Effective wayfinding and orientation requires sophisticated decision execution and information processing skills, which people with dyslexia do not necessarily possess. Difficulties can occur during journeys by car and public transport, particularly at interchanges and the end-leg stage. Participants with severe difficulties explained that they feel totally lost and unable to relate themselves to other objects. The participants with less severe problems possess a language-based difficulty with 'connectives' - a word used to describe the relative position of one object to another, with a relationship between the objects. The wrong responses originate from verbal labelling and naming weaknesses and are particularly exposed where one term has to be distinguished from another, such as left and right or north and south (Miles, 1993). For participants, missed or incorrect turnings are routinely experienced as a result.

It was clear that satellite navigation systems (both in-car systems and personal devices) are a help to wayfinding and orientation, particularly during the end-leg of a journey, where directions become more complex:

> I purchased a road navigation system and it help tremendously. It 'points' which way to go, it talks, and turns the map so it is easy to follow.
> (Terry)

Such systems are seen as a 'person' looking after the user, facilitating travel and travel choice and assisting if/when the journey changes unexpectedly. The participants with the most severe cases of dyslexia even classed these systems as essential to independent mobility, because without them, unfamiliar journeys would be dependent upon another person or would not be undertaken.

These systems are attractive because they support the dyslexic traits which make wayfinding difficult, providing:

- 2D and 3D maps and instructions using visual points of interest and universally recognised/culturally-accepted symbols
- Audible information
- Real-time traffic alerts
- Rerouting if circumstances change
- The ability to store contact information

Although useful, satellite navigation systems are not a necessary panacea. Many of the features which appeal to the dyslexic traveller could be incorporated into other information forms. Maps and instructions which use visual points of interest and universally recognised/culturally-accepted symbols provide a low-tech alternative to navigation systems. Interchange signage which makes use of symbols and visual clues can facilitate journeys by public transport. Making a visual plan of the interchange available to allow forward planning and in-journey guidance would also be useful.

The Psychological and Emotional Effects

Dyslexic people can suffer emotionally because of dyslexia. For instance, frustration, nervousness, a lack of confidence and low self esteem. Naylor (cited Maughan, 1995) refers to feelings of inferiority. Johnson and Peer (2003) allude to confusion and embarrassment. A cyclical relationship between dyslexia and stress exists, which can further exacerbate the physical and practical difficulties experienced (Hampshire, cited Miles, 2004).

Participants expressed that living day-to-day with dyslexia is a real challenge, psychologically and emotionally. Consequently, many individuals feel profoundly negative about their condition. Participants also felt that the attitudes of non-dyslexic people towards them highlight a lack of awareness and understanding of dyslexia, reflecting a principal reason why dyslexic people are excluded from the transport system. Transport providers, policymakers and staff are largely unaware of the true nature of dyslexia and how to

accommodate dyslexic travellers' needs. It was expressed that education and awareness-raising could lead to real change, directly facilitating travel by this group.

Participants expressed a preference for obtaining information from a human source as opposed to other types of information media: referring to 'someone' rather than 'something'. Despite this preference, many participants feel uncomfortable about disclosing their condition, therefore inhibiting their ability to ask for assistance whilst travelling and hence their ability to travel effectively. The negative attitudes of staff were cited as one of the main barriers to asking for travel information. Members of staff often appear unsympathetic to the problems that the individual is facing and lack the inclination and knowledge to help them. This leads directly to an avoidance of routes and modes which negatively affect the traveller's emotional state, which means that certain choices and opportunities are not available to them.

Journeys that change unexpectedly lead to intensely negative psychological feelings, because the inherent skills needed in order to manage stress and deal with changes to travel circumstances, i.e., using travel information, cannot be drawn upon. This can lead to an avoidance of certain routes and modes and the abandonment of journeys, if circumstances change.

Creating a greater awareness of dyslexia through training and information initiatives would help to eradicate the misconceptions surrounding this disability and lead to a more positive attitude towards dyslexic people. Society would better understand the nature of the difficulties these individuals face and how to accommodate them. As a consequence of this, dyslexic people may find living with this disability less of an emotional challenge and feel more comfortable about disclosing it to others, which in turn could broaden the travel horizons of dyslexics and hence opportunities for social inclusion.

The above discussion has highlighted the particular functional implications of dyslexia and how they relate to the difficulties faced by dyslexic people when using traveller information, both pre- and in-trip. Each of these factors contributes towards an inability to use travel information in its present form by people with dyslexia, which acts to inhibit the use of the transport system. The paper will now conclude with a series of recommendations to facilitate the inclusion of people with dyslexia in the transport system, with an emphasis upon actions to create more accessible information.

CONCLUSIONS

This study has focussed upon dyslexia as a factor in exclusion from the transport system, with specific reference to the role of information in preventing, and facilitating, travel by this group. A systematic analysis and evaluation of needs concluded that information that does not cater fully for the needs of dyslexic travellers, which can lead to exclusion from the transport system. Where exclusion is not experienced, it certainly makes use of the transport system more difficult and may discourage greater levels of use than are absolutely necessary, albeit that the system continues to be used.

The task of planning and undertaking a journey is affected by dyslexia, with this relationship associated with and exacerbated by a lack of appropriate informational support. This results in dyslexic people facing poor accessibility to the transport network. Although there will be differences in the way dyslexia manifests itself across modes, similar symptoms and root causes are at the centre of the difficulties faced. Concurrent travelling and comprehension of information, together with complex transport systems and street layouts require sophisticated processing skills, which dyslexics do not necessarily possess. The situation is intensified because travel information does not always support these weaknesses. It may be unavailable, of little use, or difficult to access and decipher. In consequence, the travel choices and travel behaviour of people with dyslexia can be restricted. This group continue to use familiar routes and modes and face limited travel horizons because they are unable to explore the choices and opportunities available to them.

This study calls for greater recognition and awareness of dyslexia across the transport industry, particularly within travel information provision, throughout the journey lifecycle. Greater awareness of and support for dyslexia in the provision of travel information services would mean that dyslexic travellers are able to find them more useful, more usable and thus use them more, which could broaden the travel horizons of this group. Much remains to be done if dyslexic people, numbering a substantial percentage of the population, are to be empowered to make fully informed choices about whether, when and how to travel and if they are to be assisted in successfully undertaking and completing their journeys. The above discussion highlighted a number of proposals for transport supply improvements, to facilitate greater inclusion for dyslexic travellers, with a wide range of needs, in the transport system[4]. Of course, some of the difficulties reported in the focus groups may equally be experienced by people without dyslexia, including difficulties with timetables and map use. Therefore, it is suggested that implementation of more accessible information systems could also help to include, or make travel easier for, a greater number of non-dyslexics.

As previously mentioned, this paper has provided valuable insight into dyslexia and the role of information in facilitating or preventing travel by dyslexic people, and provided an essential first step towards understanding the complex needs of this group from traveller information provision. However, further research will be necessary in order to advance understanding in this area. Research examining the influence (or otherwise) of improved information provision upon the travel behaviour of people with dyslexia, would be useful in testing the results of the focus groups and in further developing best practice guidance in the provision of information to facilitate travel for this group. By examining the co-existence of dyslexia and travel information provision in-situ, perhaps through an ethnography study, a deeper understanding of the movement and behaviour of dyslexic people and the informational and emotional setting within which these travellers find themselves would emerge, as well as the circumstances in which reported barriers can be overcome.

[4] The recommendations provided are based only upon the views of the authors and research participants, and do not necessarily represent those of dyslexic people outside of the sample studied. Further research is needed in order to clarify the credibility of the recommendations and explain any contradictions.

A new sample of dyslexic people should be incorporated into further research. The views of immobile dyslexics with the ability/desire to travel and dyslexics living in rural areas would be valuable, as would the views of dyslexics who fall outside of the age range previously studied, that is [potential] travellers younger than 18 and over the age of 60. To clarify the value of qualitative evaluations and conclude that the challenges faced by dyslexic travellers are unique and felt more frequently and severely than non-dyslexics needs to be verified by incorporating non-dyslexic control sample data. Only then can the conclusion of specificity be derived. A comparative analysis with other similar use cases would be equally useful. For example, comparing and contrasting the results with the elderly and other disabilities.

Focus groups do not aim to establish facts that can be statistically verified or generalised, but aim to advance theoretical and contextual understanding by means of qualitative empirical findings. However, this means that the findings are only representative of the sample being studied and not necessarily typical of the entire population from which the participants have been recruited (Edmunds, 1999). A quantitative follow-up study involving a larger sample size would address these concerns and provide valuable support data for this research.

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