# RNIB Centre for Accessible Information (CAI)

# Literature review

# Assessing the ability of blind and partially sighted people: are psychometric tests fair?

**Published by:**

RNIB Centre for Accessible Information (CAI), 58-72 John Bright Street, Birmingham, B1 1BN, UK

**Commissioned by:**

As publisher

**Authors:**

Stuart Atkins\*

\*For correspondence:

Tel: 0121 665 4211

Email: stuart.atkins@rnib.org.uk

**Date:** 08 February 2012

**Document reference:** CAI-LR5 [02-2012]

**Sensitivity:** Internal and full public access

**Copyright:** RNIB 2012

**Citation guidance:** Atkins, S. (2012). Assessing the ability of blind and partially sighted people: are psychometric tests fair? RNIB Centre for Accessible Information, Birmingham.

**Acknowledgements:**

Rory Cobb, Sue Keil, Sarah Home, Sarah Morley Wilkins

# Assessing the ability of blind and partially sighted people: are psychometric tests fair?

## RNIB Centre for Accessible Information (CAI)

Prepared by:

Stuart Atkins (Research Officer, CAI)

Stuart.atkins@rnib.org.uk

0121 665 4211

FINAL report

© RNIB 08 November 2012

### Table of contents

[Executive summary 4](file:///C:\Users\rhedley\Downloads\psychometric_testing_report%20(1).doc#_Toc316480829)

[Introduction 6](file:///C:\Users\rhedley\Downloads\psychometric_testing_report%20(1).doc#_Toc316480830)

[1. Psychometric tests developed for sighted people 7](file:///C:\Users\rhedley\Downloads\psychometric_testing_report%20(1).doc#_Toc316480831)

[1.1 Using tests developed for sighted people with blind and partially sighted people 8](file:///C:\Users\rhedley\Downloads\psychometric_testing_report%20(1).doc#_Toc316480832)

[1.1.1 Visual interpretation of pictures 8](file:///C:\Users\rhedley\Downloads\psychometric_testing_report%20(1).doc#_Toc316480833)

[1.1.2 Reading speed and comprehension 10](file:///C:\Users\rhedley\Downloads\psychometric_testing_report%20(1).doc#_Toc316480834)

[1.1.3 Skills being assessed 13](file:///C:\Users\rhedley\Downloads\psychometric_testing_report%20(1).doc#_Toc316480835)

[1.1.4 Scores used in selection 15](file:///C:\Users\rhedley\Downloads\psychometric_testing_report%20(1).doc#_Toc316480836)

[2. Psychometric tests developed for blind or partially sighted people 18](file:///C:\Users\rhedley\Downloads\psychometric_testing_report%20(1).doc#_Toc316480837)

[3. The use of technology in assessments 21](file:///C:\Users\rhedley\Downloads\psychometric_testing_report%20(1).doc#_Toc316480838)

[Conclusion 23](file:///C:\Users\rhedley\Downloads\psychometric_testing_report%20(1).doc#_Toc316480839)

[Recommendations 25](file:///C:\Users\rhedley\Downloads\psychometric_testing_report%20(1).doc#_Toc316480840)

[References 26](file:///C:\Users\rhedley\Downloads\psychometric_testing_report%20(1).doc#_Toc316480841)

# Executive summary

Psychometric or standardised tests are assessments that measure knowledge, abilities, attitudes and personality traits. They are used in education and recruitment and can consist of written, online or oral tests. Blind and partially sighted individuals are potentially disadvantaged by the use of these tests.

Tests developed for sighted individuals are not always appropriate to use with blind and partially sighted people. Non-verbal tests often use pictures and images which are inaccessible to blind and partially sighted people. Haptic (touch based) representations can be used to administer these questions, but logistical and administrative issues often make them an unsuitable alternative. While non-verbal aspects of tests are often inaccessible, verbal aspects of tests, such as the Wechsler Adult Intelligence Scale (WAIS-III), can often be successfully used with blind and partially sighted people.

Research shows that blind and partially sighted people on average read at a slower rate than sighted people, therefore blind and partially sighted people are often given a time extension when taking tests. However, the difference in reading speed will vary from person to person, depending on sight condition, format of text and experience of reading in given format. Therefore standard time extensions for tests are not appropriate, and may give some individuals an advantage and others a disadvantage depending on their sight problem.

It is debatable whether blind and partially sighted people's level of reading comprehension is on average lower than that of sighted people. Some research suggests comprehension is at a comparable level, other research suggests blind and partially sighted people have reduced comprehension due to their sight loss. The gap in reading comprehension between blind and partially sighted people and sighted people is likely to be greater for children than for adults. As speed and comprehension are linked, timed tests can mean a blind or partially sighted person may need to sacrifice some comprehension in order to complete the task more quickly.

Psychometric tests are often used to test innate ability, but the skills being assessed for a blind or partially sighted person may differ from the skills being assessed for a sighted person. For example, sighted people can use visual cues when looking for patterns, but blind or partially sighted people may need to rely on short term memory in order to answer the same question.

Psychometric tests can be used individually to assess a person's progress or learning needs, or collectively to compare an individual's results against others. Scores on psychometric tests are often used in recruitment and selection for employment, school, college or university places. Due to the problems faced by blind and partially sighted people when completing these tests they may be disadvantaged in selection processes that use psychometric tests. Tests taken under non-standard conditions (i.e. where extra time to complete the test has been given) are not always deemed to be comparable by test providers as scores cannot be validated. This can also cause problems if tests are being used in a selection process.

A range of psychometric tests have been developed for blind and partially sighted people, but few of these tests were developed in the UK. Tests developed for blind and partially sighted people are useful on an individual basis to assess a person's academic progress or understand learning needs. However, due to a lack of validation they are not useful for comparing performance against others.

The advancements in the use of technology (such as computers and tablets) in administering tests could potentially provide more accessible options for blind and partially sighted candidates. An individual's access technology could potentially be used so that they are able to complete the test in their desired format. Research has also been conducted that found that tablet devices (such as the iPad) could be used with diagrams, potentially meaning non-verbal tests could be accessed in this way. The use of technology to administer and complete tests is more likely in employment recruitment than in education settings, due to the potential issues of cost and logistics of large numbers of people completing tests simultaneously.

# Introduction

Psychometric or standardised tests are assessments developed by psychologists to measure knowledge, abilities, attitudes and personality traits. They are used in education; to measure progress and to predict attainment; and in employment recruitment; to ascertain suitability for a role. Psychometric tests are also sometimes used to measure an individual's IQ. Tests can consist of written, online or oral tests. Blind and partially sighted individuals are potentially disadvantaged by the use of these tests.

RNIB is often approached by teachers and parents concerned about the use of standardised/psychometric testing in education and whether these tests can be suitably adapted or are relevant to blind and partially sighted children. This led to the initial question "what do we know about the use of psychometric testing with blind and partially sighted people?"

This literature review was commissioned to establish relevant literature and research about how psychometric tests can be adapted and are used with people with sight loss. The scope of the project included standardised tests in both education and employment. The literature review was conducted between November 2011 and January 2012.

The findings from the literature review are split into three sections:

1. The first section looks at tests developed for sighted people and used with blind and partially sighted people. It highlights why these tests are used, some of the adaptations that are made to the tests, and some of the issues faced by blind and partially sighted users when accessing these tests.
2. The second section looks at tests developed for and standardised on blind and partially sighted people. Where applicable, the strengths and weaknesses of the tests are discussed, and research looking at their usage summarised.
3. The final section summarises research looking at the potential for using computerised tests as a way of making tests accessible to all.

# 1. Psychometric tests developed for sighted people

There are a range of psychometric tests developed for sighted people that are also used with blind and partially sighted people. In the UK, examples of psychometric tests used in schools include the Cognitive Ability Test (CAT) and the Neale Analysis of Reading Ability (NARA). Assessment companies such as SHL, Kenexa and Psytech produce psychometric tests that are used as part of recruitment processes in the workplace. Specific psychometric tests must be passed in certain professions, such as in medicine (the UKCAT), in teaching (the QTS) and in law (the LNAT). Online aptitude tests are also used in graduate recruitment. In the USA the Wechsler Intelligence Test for Children (WISC-III), Wechsler Adult Intelligence Scale (WAIS-III) and Woodcock-Johnson Psychoeducational Battery, Revised (W-JR) are standard tests which are used with blind and partially sighted children **(Miller and Skillman, 2003)**.

There are a range of reasons why tests developed for the sighted population are used with blind or partially sighted learners. **Miller and Skillman (2003)** suggest the reason tests such as the Wechsler scales are widely used with children who are blind or partially sighted is because of their flexibility, familiarity, availability, favourable psychometrics and cost effectiveness. Another reason put forward for using tests developed for sighted users is the lack of psychometric tests designed for, and standardised on, visually impaired people **(Tobin, 1994)**. Using the same test with sighted, blind and partially sighted children also allows educators to compare results both in the class and against a baseline of normalised scores **(Douglas et al, 2002).**

However, professionals have expressed concerns with using tests developed for sighted users with blind or partially sighted people **(Tobin, 1994, Tobin and Hill, 2011)**, and RNIB recommends that where a child has a significant visual impairment alternative evidence of their ability should be sought, based on their classroom performance **(RNIB, 2011)**.

## 1.1 Using tests developed for sighted people with blind and partially sighted people

Many of the barriers faced by blind or partially sighted people in accessing psychometric tests developed for sighted users are familiar, including:

* Difficulty in accessing text in the size the test is administered in
* Difficulty in accessing passages to re-read
* Inaccessible layout

These barriers are also an issue in other examinations, but for these the level of disadvantage can be reduced by altering the layout and text size, or converting to audio, which will not generally affect the content of the test. Many of the more commonly used tests are available in accessible formats, including large print and braille, which can make these tests accessible to some blind and partially sighted individuals.

However, additional problems arise for psychometric testing:

* Non-verbal reasoning tests often rely on visual interpretation of pictures
* Skills that are being assessed by psychometric tests are not always the same for blind users as they are for sighted users
* Results of psychometric tests are being used for selection in jobs and grammar school places, potentially disadvantaging candidates who cannot access them.

The following sections explore in more detail some of the problems faced by blind and partially sighted individuals when accessing psychometric assessments designed for the sighted population.

### 1.1.1 Visual interpretation of pictures

Psychometric tests, particularly the non-verbal reasoning element, often contain questions which are biased towards visual imagery, visual memory and visual search, disadvantaging individuals with sight loss **(Tobin and Hill, 2011).** In non-verbal reasoning assessments this could be a diagram, or set of pictures, on which questions are based. This is clearly inaccessible to individuals who are blind or have very low vision, but a decrease in performance has also been observed with even modest reductions in vision **(Groenveld and Jan, 1992, Cited Miller et al. 2007)**.

For image-based tests to be accessible to blind and partially sighted people alterations are required. One suggestion is to replace visual elements with text descriptions which can be administered in the candidate's chosen format (large print, braille or audio) **(Baron and Ham, 2000)**. Altering the test in this way is likely to affect its validity, meaning that comparison with sighted test takers would no longer be possible.

An alternative may be to display images as tactile graphics or as a haptic test. **Baron and Ham, (2000)** discuss the possibility of using Thermoform and Minolta as forms of tactile media but explain that where the picture is abstract (i.e. in non-verbal reasoning tests) the task of understanding the image can be extremely difficult even to experienced tactile users. They suggest that tests of this nature should not be translated to tactile format as they do not transcribe well. Another issue with using tactile images relates to an individual's experience and skill at using tactile images. Even well-produced material will be of little benefit if users do not know how to use them **(Cryer and Gunn 2008).**

Another approach is to use adapted haptic tests as a way of assessing cognitive ability. **Miller et al, (2007)** used three dimensional matrices, constructed as an analogue to the visual matrix tests, such as Ravens Progressive Matrices. The matrix consisted of a board with 9 perpendicular dowels inserted. The dowels were evenly spaced in three rows of three dowels. The dowels were used to stack different sizes and shapes of beads in vertical and horizontal configurations. Participants were then asked to solve puzzles based on the haptic patterns created by the beads on the dowels.

Using the matrix, blind participants undertook a range of tasks based on those in the Cognitive Test for the Blind (CTB) and the WAIS-III. The researchers found their model - referred to as 3-DHM (three dimensional haptic matrices) - produced scores which were valid indicators of non-verbal cognitive ability, although through predominantly haptic spatial reasoning ability rather than general non-verbal ability.

While results were positive, and to an extent comparable with the norm tests they were based on, it is difficult to see how this type of test could work in practice (in schools or the workplace) as it would require additional equipment and alternative administration. Whilst the use of tactile or haptic representation may allow the use of the same questions there would still be issues around validity. The replacement of visual understanding with understanding via touch means the sense used has changed, and therefore the way of processing information is different.

A further option is to remove the visual elements of the test when used with blind or partially sighted individuals. However, by removing parts of a test, blind and partially sighted individuals are not being given the opportunity to demonstrate their skills in the same way as their sighted peers. This also means that in schools educational psychologists and other staff are presented with an incomplete picture when assessing the future learning needs of a student with a visual impairment.

### 1.1.2 Reading speed and comprehension

A range of studies have been conducted to investigate the difference in reading speed between sighted and blind and partially sighted individuals. While studies agree that blind and partially sighted people generally read more slowly, and therefore require extra time in exams, the amount of extra time allowed is widely debated.

Some suggested time extensions include:

* 2 times longer for large print and 3 times longer for braille (secondary age learners) **Mohammed & Omar (2011)**
* 1.5 to 2 times longer for primary age learners with low vision **(Gompel, van Bon, and Schreuder, 2004)**
* 1.5 times longer for all learners with a visual impairment (school age) **(Spungin, 2002)**
* 0.5 times longer for experienced adult braille readers **(Wetzel and Knowlton, 2000)**
* A little less than 2 times longer for large print and more than 2 times longer for braille learners (school age) **(Packer, 1989)**
* 1.5 times longer for large print and 2.5 times longer for braille **(Morris, 1974)** **(Cited Allman, 2006).**

Even within different reading formats the extra time required for reading may differ. **Kamei-Hannan (2008)** used computerised tests with partially sighted students and found that as magnification increased the time spent on the test also increased. Another factor affecting speed will include when a person first experienced sight loss and their experience of using large print, assistive technology or braille. **Tobin (1994)** explains that students who began reading print, but converted to braille as their sight deteriorated, may be progressing satisfactorily but their reading speed and accuracy may be lagging behind their comprehension. **Gonzalez Garcia (2004)** also found that statistically, people who learn to read using braille, read faster than people who began reading print but converted to braille later in life.

Most countries have policies in place for how much additional time should be allowed for blind or partially sighted students when sitting exams. Often the time is the same as for students with other disabilities, and is either measured as a percentage of additional time or as a set amount of time **(Pepper, 2007).** Allowing the same additional time for all students with sight loss means some students with lower level sight loss may have an advantage over their sighted peers, whereas others with greater degeneration in their vision may still be at a disadvantage. Ideally the extra allotted time would be directly linked to an individual's reading speed, rather than "a one size fits all" approach **(Mohammed and Omar, 2011).** Many professionals suggest that exams should not be timed when used with blind or partially sighted learners.

Research conducted by **Douglas et al, (2002)** aimed to establish standard reading ages for pupils with sight loss. Using the Neale Analysis of Reading Ability (NARA), 476 pupils with sight loss read unmodified passages from the NARA, using low vision aids if they wished. Their reading speed, accuracy and comprehension were recorded. The researchers found that average reading speed, accuracy and comprehension for pupils with sight loss all lagged behind their sighted peers. It also found that the lag increased with age, for example, the reading speed of a partially sighted pupil is 10 months behind their sighted peers at age 9, but 30 months behind at age 14.

It is likely that accessibility of test materials has some negative impact upon test performance. As font size decreases tests become more difficult for blind and partially sighted learners and tests for older learners tend to be presented in smaller print size than tests for younger learners. But Douglas et al argue that previous research by **Long et al, (2002) (cited in Douglas et al, (200))** found that performance by children with a visual impairment didn't improve when text size was enlarged. In contrast **Aitken et al, (2000)** found that font type and text size did make a difference, and at larger sizes students read more quickly and with greater accuracy. Aitken et al support the use of Helvetica 24 for the purpose of printing materials for exams.

Based on the findings from their research, Douglas et al were able to construct a NARA reading age conversion table for partially sighted individuals. By administering the test in its original format test administrators can use the raw score to look up the average reading age for a student with sight loss. The NARA has also been produced in braille by the University of Birmingham.

When a person reads they use two types of process: a micro process, concerned with decoding the information; and a macro process, understanding the meaning **(Gonzalez Garcia, 2004)**. Speed of reading will rely on the micro process, whereas comprehension relies on the macro process. Whilst it is generally agreed that blind and partially sighted learners who use large print or braille will typically have a slower reading speed than their sighted peers, whether there is also a deficit in comprehension is less clear. As noted earlier **Douglas et al, (2002)** found that visual impairment had an effect on comprehension as well as speed and accuracy, whereas **Mohammed and Omar (2011)** found a reduced reading speed for blind and partially sighted users, but no significant difference in comprehension when compared to sighted peers. **Gonzalez Garcia (2004)** found no evidence that people who learn to read using braille have better comprehension than people who began reading print but converted to braille later in life. There was also no significant connection between how experienced an individual was in using braille and their level of comprehension.

Some research suggests that comprehension scores for blind and partially sighted adults and sighted adults are more likely to be comparable than blind and partially sighted children and sighted children. **Vander-Kolk, (1982)** used the verbal subtest of the Wechsler Intelligence Scale (WAIS) to determine whether there was a difference in performance between subgroups of adults who were blind or partially sighted and to draw comparison with sighted peers. He found that verbal IQ scores for the blind or partially sighted were slightly higher than the sighted sample used to norm the WAIS. Whilst performance varied between subgroups for the different subtests none were significant and blind or partially sighted people generally obtained very similar scores to sighted people.

Vander-Kolk did find that use of vision, even partial vision was an advantage in calculating maths problems. He also recognised that results may be different for children, as previous studies that have found a difference in performance were conducted with children as their subjects. This may be due to a developmental lag in childhood, but over time this lag is corrected.

Vander-Kolk is not the only person to recommend the Wechsler Adult Intelligence Scale. **Reid, (1997)** sees a major advantage in the fact the test requires no adaption to be used with blind or partially sighted users, enabling easy administration by psychologists, even those with little experience of working with blind or partially sighted people. However, the author recognises its limitations; whilst a reliable measure of verbal intelligence it fails to measure non-verbal skills and therefore it is of limited use in assessing general intellectual functioning.

**Mohammed and Omar, (2011)** did point out that reading speed and comprehension are linked. In their study students with visual impairments took twice as long to read printed material as sighted students and braille readers took three times as long to read braille. Comprehension was at a similar level across the groups. The authors noted that when there is no time limit students can take longer to read information and comprehend it, but a trade off may be required between speed and comprehension in timed tests.

### 1.1.3 Skills being assessed

Due to the fact that the majority of psychometric tests have been standardised on a sighted population it is difficult to know whether the skills required to complete the tests are comparable between blind and sighted individuals. Educators suggest atypical development in cognitive, sensory, motor, and emotional development will affect the validity of standardised test scores **(Baker et al, 1995, Swallow, 1981, Warren 1984, cited in Kamei-Hannan, 2007).**

If a psychometric test is being used to measure an individual's development and understand their learning style the same assumptions cannot be made for sighted and blind children based on these results alone. While **Tobin (1994)** suggests that results should be interpreted with care, he also sees some merits in using tests standardised on a sighted population. He goes on to suggest that in the hands of an experienced psychologist results can be interpreted to provide some valuable information, including specific areas and aspects of learning where there may be an educational disadvantage **(Tobin and Hill, 2011).**

One disadvantage to a congenitally blind individual is a lack of visual learning in their early life. **Tobin (1994**) explains how congenitally blind individuals may be shut off from certain experiences that sighted children would have. Sighted children learn an enormous amount informally because of visual experiences, but less is known about how congenitally blind children develop concepts of objects and events. Age of onset of blindness could have an invisible affect on a child's performance on aptitude tests, particularly if unfamiliar or abstract objects are displayed or described.

In their research using the 3-DHM (described above) **Miller et al, (2007)** found that visual experience related to performance on the test. Although the sample size was small, participants who described items visually, and had become visually impaired more recently, completed haptic tasks more quickly and accurately than those who had been visually impaired for longer.

The skill being assessed for a blind individual and a sighted individual can also differ in certain tests. For example **Baron and Ham (2000)** converted a literacy test into braille for use with blind participants. The test was based on a community newspaper and contained a large amount of reference material. The braille version took up multiple sheets so an index was provided to help candidates find appropriate articles to refer back to in order to answer questions. They argue that this turned a basic literacy test into a test of competence in using braille. **Douglas et al, (2002)** also note how referring back to text to answer comprehension questions can be difficult for learners with sight loss. Their research found that children who did refer back had difficulty scanning the text to identify answers. Scanning takes up more time for learners with sight loss (an issue in timed tests) and some individuals may give up and rely on memory instead.

Depending on the sense being used the way of processing the information will differ. **Danks and End (1997) (cited Gonzalez Garcia 2004)**, point out that listening and reading are not homogenous processes that work in the same way, therefore comprehension of such information could be affected by the way information is accessed. The same is also true of active touch. Blind or partially sighted individuals may have to use short term memory more than sighted individuals when completing tests. Research from **Nolan and Kederis (1969) (cited Gonzalez Garcia 2004)** suggests braille reading is performed by the sequential recovery of information, letter by letter, which makes it quite different to reading by sight, where visual fixation contains groups of letters or even words. Therefore a braille reader will have to use short term memory until a sufficient volume of letters has been identified to form a whole word. Experienced contracted (grade 2) braille readers will be less affected by this, but a slower reading speed could have a similar effect because words need to be held in short term memory until enough have been read to form sentences or passages that can then be comprehended.

This need to store information in short term memory will also affect blind or partially sighted users in psychometric tests where a sequence of abstract letters, symbols or numbers are presented and the link between the them has to be identified. A similar problem will arise in these sorts of tests if they are administered through audio format, as no visual reference will be available.

However, the process or skills being used to complete the task are not necessarily an issue. For example, if a psychometric test is being used to assess whether a candidate can do a job the process being used is not the issue, but whether they achieve a satisfactory score. As long as the format is accessible the test results remain valid.

### 1.1.4 Scores used in selection

Scores obtained in psychometric tests can be used in many ways, including:

* Individually, to plan future learning/training based on strengths and areas for development
* Collectively, to compare performance amongst peers.

When tests are being used in selection for school, college or university places, or in recruitment, the barriers mentioned above can disadvantage blind and partially sighted individuals.

Psychometric tests are now commonly used as part of assessment centres and recruitment processes by employers. 35 per cent of employers use some form of psychometric/aptitude or personality questionnaires during recruitment, with many other employers using other forms of tests **(Chartered Institute of Personnel and Development, 2011)**. Organisations such as SHL, PSL and GTIOS produce psychometric tests for employers and some employers will produce their own tailored tests.

As psychometric tests vary from organisation to organisation it is difficult to ensure that all tests are accessible to all blind and partially sighted applicants. However, a range of guidance exists **(Baron and Ham (2000), Baron (2006), Clark and Baron (2000), Hackston, (2009))** to help employers and candidates in preparing and taking psychometric tests. The general advice is for employers to contact candidates and ask what adjustments they require to make tests accessible. RNIB has also produced guidance for schools in making exam papers work for learners with sight problems **(Cobb and Webb, 2010)**, although these do not cover the types of questions usually associated with psychometric tests**.**

**The Special Educational Needs and Disability Act (2001)** and **Equality Act (2010)** require responsible bodies to take reasonable steps to ensure that disabled pupils are not placed at a substantial disadvantage when taking tests. The National Foundation for Educational Research (NFER) provides important guidelines on their website on special arrangements for psychometric tests used for 11+ selection. The guidelines state that "the provision of special arrangements should be based on the on-going support that individual pupils normally receive and therefore, wherever possible, the test conditions should mirror those in which the pupil normally works…In certain circumstances, it may be decided that a test is wholly inappropriate for a particular pupil."

In conclusion NFER recommends that "all results must be interpreted in the light of the specific circumstances of individual pupils and a professional judgment made" **(NFER, 2011).**

UK employment equality law also makes discrimination in hiring a person unlawful and helps to ensure all reasonable adjustments are made in the recruitment process, which would also cover psychometric tests **(Equality Act 2010).** Even if it is impossible to make all parts of psychometric tests accessible, they often make up a small percentage of the overall score during the selection process for a job, allowing a blind or partially sighted candidate other opportunities to demonstrate their skills to prospective employers.

However, some schools (for example grammar schools) will use performance on psychometric tests as their primary selection method. Blind and partially sighted learners are disadvantaged in the selection process where tests are inaccessible and they are unable to demonstrate their skills in other ways.

Even if the test can be successfully converted into an accessible format, or acceptable adjustments are made, issues with discrimination can still arise. When tests are produced they undergo a validation process. Tests are standardised on a large group of people, who are taking the test under set conditions. This process allows exam boards to be confident that results attained by test takers are valid and comparable. However, when alternative arrangements are made for a blind or partially sighted student, by the school or the exam board, the test is no longer deemed to have been taken under standard conditions by the exam board. This means that a student given additional time, or taking a test converted into audio or braille, will be taking the test under non-standard conditions and the test administrator cannot validate the results.

In some countries tests taken under non-standard conditions are "flagged", meaning that it is noted on the certificate that the test was not taken under standard conditions. **LaBarre, (1994)** explains how this creates discriminatory standards for blind and partially sighted people in standardised testing; if a test is flagged it can lead to schools, colleges or universities assuming that scores are not comparable with sighted peers' scores. Since 2003 in the USA it has not been permissible for the SAT taken at the end of high school to be flagged as taken under special conditions. In some countries, including Singapore and Finland this flagging still takes place. For the tests NFER produce, including a range of 11+ assessments, they recommend that special testing arrangements should be noted alongside the test score and taken into account in any borderline decision. They recommend this because it is not possible to establish that special arrangements perfectly compensate for the disadvantage.

# 2. Psychometric tests developed for blind or partially sighted people

A range of psychometric tests have been developed for use with people who are blind or partially sighted. Some tests have been developed based on tests for sighted people, although some were designed specifically for blind and partially sighted people. Some examples of both are listed below:

**The Blind Learning Aptitude Test (BLAT) (United States)** - This test uses raised line symbols similar to braille. There are various behavioural tasks and the main theme is differentiating between symbols and making deductions. Many of the tasks are adaptations of items on the Culture Fair Intelligence Test, and Raven's Progressive Matrices. Although designed and standardised in the United States the test has also been used in England, Wales and India (**Mason, H.L., and Skukla, S.R, 1992).**

The test is designed for children of all school grades. **Newland (1979 (cited Baker et al, 1995))** found that correlation between performance on the BLAT and performance on subsections of the Stanford Achievement Test were highest for tasks such as comprehension of paragraphs and arithmetic reasoning. Areas which require more memorisation, such as spelling were less highly correlated with the BLAT. **Baker et al, (1995)** found the relationship between performance on the BLAT and comprehension scores on a separate reading test was stronger than the relationship between performance on the BLAT and braille reading speed. There is also a significant relationship between performance on the WISC-R and performance on the BLAT.

There have been some issues with the testing materials such as durability and structure. However, the test can be helpful in discovering strengths and weaknesses and can be a useful complement to other tests of intelligence. Qualitative feedback can also be provided by observing a child performing the tasks.

**Cognitive Test for the Blind (CTB) (United States)** - The CTB assesses cognitive functions including measures of abstract reasoning, auditory language functions, memory and spatial abilities. It contains verbal and non-visual performance sections. It is used with both children and adults.

The verbal sub-tests include auditory analysis, immediate digit recall, language comprehension and memory, letter number learning and vocabulary. Research has found a reasonable correlation to the verbal section of the Wechsler Adult Intelligence Scale-Revised (WAIS-R), and found it is a valid assessment of intellectual functioning for persons with visual impairment or blindness **(Nelson et al, 2002). Miller and Skillman, (2003)** found that the test is not as widely used as tests developed for sighted people (such as the WISC-III), but that satisfaction among assessors is high.

The non-visual performance sub-tests include haptic category learning, haptic category memory, haptic memory recognition, pattern recall and spatial analysis.

The CTB is an integral component of the Comprehensive Vocational Evaluation System (CVES). The CVES includes an assessment of three major constructs of behaviour: verbal-spatial-cognitive, sensory-motor, and emotional-coping.

**The Intelligence Test for Visually Impaired Children (Holland)** was developed by the Bartimeus Centre in 1989 and consists of both verbal and tactile performance subtests. It is published in Dutch, German and English. The test was standardised on the entire Dutch speaking, braille reading population of Holland and Belgium (156 children). To date, no studies have been conducted with English speaking children.

**Williams Intelligence Test for VI Children (UK)** - The only specialist IQ test standardised in the UK. Developed in 1956 it measures verbal intelligence and gives out a single intelligence score, although in principal an educational psychologist could draw up a profile based on the processes within the test. Scores on the test have improved over time and **Tobin and Hill (2011)** suggestthis should be noted by educational advisors. Tobin and Hill also found test-retest reliability. They say that whilst it doesn't incorporate all the conceptual, evolutionary developments of modern tests it is still useful for teachers and educational psychologists who assess the ability and educational needs of blind and partially sighted children. However due to the developments over the last 50 years Tobin and Hill suggest a new standardised intelligence test should be developed to include developments in the concept of cognition and intelligence.

**The Interim Hayes-Binet intelligence scale (United States)** was published in 1942, and uses items in the Stanford-Binet intelligence scale that do not require the use of vision. The scales created for both children and adults show high correlations with measures of academic achievement.

**The Perkins-Binet (United States)**, considered a successor to the Interim Hayes-Binet, contained both verbal IQ and performance IQ items. It was first published in 1980 and standardised on blind and partially sighted children. One study found mean IQ scores from the Perkins-Binet are significantly different to IQ scores from the WISC-R verbal scale. The test is also said to have low correlation with the Wide Range Achievement Test (WRAT) and lacks reliability **(Gutterman et al, 1985).** Due to this and confusing test items it has now been withdrawn from the market.

There are a range of haptic tests that have been developed for blind and partially sighted people. The D48 Test (UK) **(Gough and Domino, 1963)** utilised tactile dominoes, items that are already familiar to many people with sight loss. Gough and Domino found that scores on the D48 correlated well with scores on the Wechsler Verbal Scale. Unfortunately the test was very difficult and stressful for most people and Domino recognised its usefulness was limited.

The Tactual Progressive Matrices is another test which correlated well with the Wechsler Verbal Scale **(Dauterman et al, 1967) (cited Reid, 1997)**. Like a number of haptic tests it was based on the Ravens Standard Progressive Matrices and used balsa wood and sandpaper to reproduce test items. This test was discontinued due to high costs prohibiting it being produced on a large scale. Recently the 3-DHM (United States) **(Miller et al, 2007)** (described earlier) was also designed based on the Ravens Progressive Matrices.

**Ballesteros et al, (2005)** (Spain) produced a haptic test to assess blind and partially sighted children's abilities in processing perceptual information. The test used raised lines, raised dots and 3D objects (both familiar and unfamiliar) to form a range of subtests. By comparing results for blind, partially sighted and sighted children they found the tests to be valid and reliability was also high. However, the issues of using haptic tests (mentioned earlier) remain. That said these forms of psychometric tests may still be useful to educational psychologists, even if they are not comparable to tests taken by sighted people.

Whilst a collection of psychometric tests have been developed for blind and partially sighted people standardisation is often an issue. The low incidence of blindness, particularly among children, and the geographical spread mean accessing a large sample for standardisation can be difficult **(Hull and Mason, 1993).** Many of the studies mentioned above were conducted with small samples. There is also little reported evidence on how widely the various tests developed for blind and partially sighted people are used, and the preferred tests within education settings in the UK or other countries. This could potentially be an area for further work.

# 3. The use of technology in assessments

A number of studies have considered how technology can be used in the administration of assessments for blind and partially sighted people. A range of countries, including Sweden, Australia and Canada appear to have computer-based examinations available. In contrast the use of computer based exams in England and Wales has been cautious to date **(Douglas et al, 2009).** The details of how these exams worked in practice are less clear from the work conducted by Douglas et al, but other research has explored how the process of using technology could work in practice.

**Papadopoulos and Goudiras (2004)** looked at alternative ways of testing University students, although the methods are potentially useable at other stages of education. The system it proposes uses a computer with screen-reading software. Teachers can set multiple choice or open-ended questions and the individual completes the test online, navigating the test using key strokes. This system is based on a teacher setting questions, not an exam board. In terms of psychometric testing, while the method may be an improvement (or at least an alternative), pictorial questions, such as the non-verbal reasoning examples described above, would still be difficult to display.

**Landau et al, (2003)** think there is the potential for tactile images and computer aided assistive technology to be combined and used in maths tests (and potentially non-verbal aspects of psychometric tests). Using a Talking Tactile Tablet (TTT), questions from an American state 10th grade maths test were converted into tactile overlays which interacted with the TTT. Blind and partially sighted users could explore the graphical items tactually, and then press the tablet for more information on the item via audio. A pilot study involving a small sample explored the feasibility and impact of using the TTT as a test accommodation for blind and visually impaired students.

Results were highly positive, when participants used the TTT performance appeared to be better than if they used their preferred current option. Performance also closely matched the average performance on the test (normed on a sighted population) whereas performance by participants using their preferred access option was below the average.

Because the sample was small, and the research didn't try to establish whether the test was giving an advantage that would also be realised by sighted individuals, more research would be needed to validate the findings. However with the recent adoption of tablet devices (such as the iPad) there is potential to further investigate the possibility of a combined tactile and computerised test.

A computer-based approach to psychometric tests, particularly in a recruitment situation, may be useful. Tests administered in this way could allow each individual to use their own access technology or computer settings. It would be more difficult to implement in an education setting though. The cost of equipment, ensuring all students are accessing the test at the same time, the disruption caused by technical problems and students' screens being viewable by other students (if delivered in a traditional exam setting) are some of the financial, logistical and administrative issues that would need to be overcome.

A study looking at the use of assistive technology and performance on the Woodcock-Johnson Tests of Academic Achievement: III found that level of sight loss and use of access technology had little relationship to performance on the tests **(Freeland et al, 2010).** Each participant took two separate tests as part of a longitudinal study. The researchers found that blind participants who had used access technology in only one of the two tests performed less well than those who had not used access technology in either test.

Freeland et al, conclude that access technology for young people with visual impairment is not as effective as was previously thought. Whilst this may be true of their research, and even true for exam settings, there were a number of variables that were not built into the research. This includes the variables of age of onset of blindness, or experience of using access technology. In addition 'Low Vision' was a single variable, so the level of remaining vision was not considered. Finally the term 'access technology' is ambiguous. Freeland et al conclude that future research should define 'access technology' to fully examine the impact of access technology on academic performance.

# Conclusion

A range of literature and research exists on the subject of psychometric testing for blind and partially sighted people. It is clear that there are issues associated with blind and partially sighted people taking psychometric tests, and that there is no obvious solution to many of the issues identified.

The research suggests non-verbal aspects of tests are more problematic than verbal aspects. For verbal aspects of psychometric tests the average performance of blind and partially sighted people is at a similar level to sighted people, particularly amongst adults. This suggests that as long as the source material can be administered in an accessible way there are fewer concerns in using the tests with blind and partially sighted people.

However some parts of psychometric tests could be more difficult for blind and partially sighted people as they may be required to use different skills to sighted people. For example, blind and partially sighted people may need to use short term memory more than sighted people as they cannot rely on visual cues. It is difficult to know how this will affect performance, particularly as blind and partially sighted people will be used to using different approaches and skills for tasks that sighted people would use visual cues.

Non-verbal aspects of tests are more problematic for blind and partially sighted people. Because images and diagrams are often used in these tests they are not fully accessible and research shows a decrease in performance with even modest reductions in vision. However, it is possible that if the test materials are enlarged some of these tests would be accessible to some people with sight loss.

A range of adaptations to non-verbal aspects of psychometric tests have been trialled, particularly using haptic models, and some have been shown to be a reliable measure of cognitive ability. However the introduction of haptic alternatives on a large scale is unlikely due to the requirement for different equipment, alternative administration and a lack of comparability to other standardised tests.

Allowing extra time is common when administering tests for blind or partially sighted people. The amount of additional time that should be allowed is less clear, and realistically a one size fits all adjustment is going to leave some people at an advantage and some at a disadvantage depending on their level of sight loss and their experience in using the administered format. The ideal would be an extra time allowance to suit each individual, so they are neither disadvantaged or gain an advantage over sighted people due to the extra time allowance. Alternatively using an untimed test would mean each individual could take as much time as they needed on the test. This may however cause logistical problems for administrators.

Once tests or the administration process are altered in any way, test providers argue that the test results can no longer be validated, and results are therefore no longer comparable against people who take the tests under standard conditions. This can potentially mean scores obtained by blind or partially sighted people may not be seen as reliable by schools, colleges, universities and employers. This is an issue that needs to be addressed if blind and partially sighted people are to achieve the same level and range of opportunities as their sighted peers.

It is important to strive to achieve the same level of opportunity for blind and partially sighted people as for sighted people, but **Elliott (1999)** suggests the opportunity to take the psychometric test is not the issue, but the opportunity to demonstrate ones abilities is. Because of the disadvantage faced by blind and partially sighted people when taking psychometric tests **Elliott** argues that they should make the choice of not taking these tests when they are the gateway to a graduate scheme. Elliot suggests the candidate deals directly with admissions and offers an alternative way that the college can assess their suitability for the course (for example via classroom performance or interview).

# Recommendations

## Recommendation 1

This report provides the basis for further discussion between academics in visual impairment education and psychology, test providers, the Department for Education and others as appropriate about whether there is a need for:

1. Further research into the use of cognitive ability tests with different population of blind and partially sighted children and adults.
2. Tests standardised on a blind and partially sighted population.
3. A review of the way psychometric tests are presented, including the text size used and the time allowance for completing the test, in order to increase the accessibility of the test when in its standard format.

## Recommendation 2

Further guidance to be developed for schools, local authorities, parents and test candidates on making psychometric tests accessible to blind and partially sighted people. The guidance should take account of the specific situations the tests are being used in and the outcomes that are being sought. The following points should also be taken into consideration:

* Tests are not always inaccessible, evidence could be collected in each case to decide whether a person is able to take the test. If it is felt to be appropriate the results of the test could be compared with classroom performance to see if it is an accurate reflection of ability. If the test isn't taken, or the test is not felt to accurately reflect classroom performance, alternative measures could be used
* Results of psychometric tests should not be used in isolation to make decisions
* The body administering the test must be clear what is being tested and the reason for the test
* Don't assume performance on the test is always reflecting ability, talk to an educational psychologist if in doubt.

# References

Aitken, S., Ravenscroft, J., and Buultjens, M. (2000). The assessment of reading performance by visually impaired adolescents with modified print. RNIB.

Allman, C. (2006). Accessible Tests Department - Position Paper: Use of Extended Time. <http://www.aph.org/tests/xtime.html>.

Baker, C.P., Koenig, A.J., and Sowell, V.M. (1995). Relationship of the Blind Learning Aptitude Test to braille reading skills. Journal of Visual Impairment and Blindness, 89 (5), 440-447.

Ballesteros, S., Bardisa, D., Millar, S., and Reales, J.M. (2005). The haptic test battery: A new instrument to test tactual abilities in blind and visually impaired and sighted children. British Journal of Visual Impairment, 23 (1), 11-24.

Baron, H., and Ham, L. (2000). Psychometric testing and visual impairment: Research report on testing visually impaired individuals. Employment Service and RNIB.

Baron, H. (2006). Visual impairment and psychometric testing: Practical advice for test users managing the testing of people who have sight disabilities. The British Psychological Society.

Chartered Institute of Personnel and Development. (2011). Recruitment, retention and turnover 2009. Chartered Institute of Personnel and Development.

Clark, R., and Baron, H. (2000). Guidelines for testing people with disabilities. SHL.

Cobb, R., and Webb, V. (2010). Well prepared: making exam papers work for learners with sight problems. RNIB.

Cryer, H., and Gunn, D. (2008). Exploring tactile graphics: Which strategies work? RNIB

Danks, J.H., and End, L.J. (1987). Processing strategies for reading and listening, in R. Horowitz and S.J. Samuels (eds) Comprehending Oral and Written Language. London: Academic Press.

Dauterman, W.L., Shapiro, B., and Suinn, R. (1967). Performance tests of intelligence for the blind reviewed. International Journal of Education of the Blind, 17, 8-16.

Douglas, G., Grimley, M., Hill, E., Long, R., and Tobin, M. (2002). The use of the NARA for assessing the reading ability of children with low vision. British Journal of Visual Impairment, 20 (2), 68-75.

Douglas, G., McCall, S., and Pavey, S. (2009). Summary report on international systems of exam access for visually impaired pupils. University of Birmingham and CALL Scotland.

Elliott, P. (1999). What's round and mean?: Standardized testing and blind students. Speech delivered at Mid-Winter Conference of the National Association of Blind Students.

Equality Act (2010). C. 15

Freeland, A.L., Wall Emerson, R., Curtis, A.B., and Fogarty, K. (2010). Exploring the relationship between access technology and standardized test scores for youths with visual impairments: Secondary analysis of the national longitudinal transition study 2. Journal of Visual Impairment and Blindness, 104 (3), 170-182.

Gompel, M., van Bon, W. H. J., and Schreuder, R. (2004). Reading by Children with Low Vision. Journal of Visual Impairment and Blindness, 98 (2), 77-89.

Gonzalez Garcia, L. (2004). Assessment of text reading comprehension by Spanish-speaking blind persons. British Journal of Visual Impairment, 22 (1), 4-12.

Gough, H.G., and Domino, G. (1963). The D48 Test as a measure of general ability among grade school children. Journal of Consulting Psychology, 27, 344-349.

Groenveld, M., and Jan, J. (1992). Intelligence profiles of low vision and blind children. Journal of Visual Impairment and Blindness, 86, 68-71.

Gutterman, J.E., Ward, M., and Genshaft, J. (1985). Correlations of scores of low vision children on the Perkins-Binet Tests of Intelligence for the Blind, the WISC-R and the WRAT. Journal of Visual Impairment and Blindness, 79, 55-58

Hackston, J. (2009). Guidelines for the use of psychometric assessment with disabled people. OPP.

Hill, E., Long, R., Douglas, G., Tobin, M., and Grimley, M. (2005). Neale analysis of reading ability for readers with low vision. University of Birmingham.

Hull, T., and Mason, H. (1993). Issues in standardizing psychometric tests for children who are blind. Journal of Visual Impairment and Blindness, 87 (5), 149-150

Hull, T., and Mason, H. (1995). A tactile version of the speed of information processing test for the blind - a revision and improvement. British Journal of Visual Impairment, 13 (1), 33-36.

Kamei-Hannan, C. (2007). Exploring assessment processes in specialized schools for students who are visually impaired. Journal of Visual Impairment and Blindness, 101 (2), 69-79.

Kamei-Hannan, C. (2008). Examining the accessibility of a computerized adapted test using assistive technology. Journal of Visual Impairment and Blindness, 102 (5), 261-271.

LaBarre, S. (1994). Discriminatory standards for the blind in standardized testing. Future Reflections, 13 (2).

Landau, S., Russell, M., Gourgey, K., Erin, J., and Cowan, J. (2003). Use of the talking tactile tablet in mathematics testing. Journal of Visual Impairment and Blindness, 97 (2), 85-96.

Long, R., Douglas, G., Hill, E., and Cross. (2002). Choosing font size when testing reading - bigger isn't necessarily better. Unpublished

Mason, H.L., and Skukla, S.R. (1992). The Use of the Blind Learning Aptitude Test in England and Wales, India and the USA. British Journal of Visual Impairment, 10 (3), 95-99

Miller, J.C., and Skillman, G.D. (2003). Assessors' satisfaction with measures of cognitive ability applied to persons with visual impairments. Journal of Visual Impairment and Blindness, 97 (12), 769-774.

Miller, J.C., Skillman, G.D., Benedetto, J.M., Holtz, A.M., Nassif, C.L., and Weber, A.D. (2007). A three-dimensional haptic matrix test of nonverbal reasoning. Journal of Visual Impairment and Blindness, 101 (9), 557-570.

Mohammed, Z., and Omar, R. (2011). Comparison of reading performance between visually impaired and normally sighted students in Malaysia. British Journal of Visual Impairment, 29 (3), 196-207.

Morris, J. E. (1974). The 1973 Stanford Achievement Test Series as adapted for use by the visually handicapped. Education of the Visually Handicapped, 6 (2), 33-46.

Nelson, P.A., Dial, J.G., and Joyce, A. (2002). Validation of the cognitive test for the blind as an assessment of intellectual functioning. Rehabilitation Psychology, 47 (2), 184-193.

Newland, T.E. (1979). The Blind Learning Aptitude Test. Journal of Visual Impairment and Blindness, 73, 134-139.

NFER. (2011). 11+ selection tests. NFER, <http://www.nfer.ac.uk/research/assessment/eleven-plus/eleven-plus_home.cfm>

Nolan, C.Y., and Kederis, A.J.C. (1969) Perceptual factors in braille word recognition. New York: American Foundation for the Blind.

Packer, J. (1989). How much extra time do visually impaired people need to take examinations: The case of the SAT. Journal of Visual Impairment and Blindness, 83 (7), 358-360.

Papadopoulos, K.S., and Goudiras, D.B. (2004). Visually-impaired students and university examinations. British Journal of Visual Impairment, 22 (2), 66-70.

Pepper, D. (2007). Assessment for disabled students: An international comparison. Qualifications and Curriculum Authority.

Reid, J.M.V. (1997). Standardized ability testing for vocational rehabilitation in visually impaired adults: A literature review. Journal of Visual Impairment and Blindness, 19 (6), 546-554.

RNIB (2011) RNIB Position statement on cognitive ability and selection tests. RNIB.

Special Educational Needs and Disability Act (2001). c. 10

Spungin, S.J. (Ed.). (2002). When you have a visually impaired student in your classroom: A guide for teachers. New York: AFB Press.

Swallow, R.M. (1981). Fifty assessment instruments commonly used with blind and partially seeing individuals. Journal of Visual Impairment and Blindness, 75 (2), 65-72

Tobin, M.J (1994). Assessing visually handicapped people: An introduction to test procedures. David Fulton Publishers.

Tobin, M.J., and Hill, E.W. (2011). Issues in the educational. psychological assessment of visually impaired children: Test-retest reliability of the Williams Intelligence Test for Children with Defective Vision. British Journal of Visual Impairment, 29 (3), 208-214.

Vander Kolk, C.J. (1982). A comparison of intelligence test score patterns between visually impaired subgroups and the sighted. Rehabilitation Psychology, 27 (2), 115-120.

Wetzel, R., and Knowlton, M. (2000). A comparison of print and braille reading rates on three reading tasks. Journal of Visual Impairment and Blindness, 94 (3).

Warren, D.H. (1984). Blindness and early childhood development (rev. ed.). New York: American Foundation for the Blind.

A copy of the NARA conversion table is available from <http://www.birmingham.ac.uk/Documents/college-social-sciences/education/victar/neale-analysis-reading-ability.pdf>.

### About RNIB’s research

RNIB is a leading source of information on sight loss and the issues affecting blind and partially sighted people. Our Research and Knowledge Hub contains key information and statistics about blind and partially sighted people including our Sight Loss Data Tool, which provides information about sight loss at a local level throughout the UK. You’ll also find research reports on a range of topics including employment, education, technology, accessibility and more. Visit our Knowledge and Research Hub at: **rnib.org.uk/research**