Lucid COPS

Cognitive Profiling System

Teacher's Manual

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Lucid CoPS Teacher's Manual

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Contents

Figures

Tables

1. Introduction

1.1. What is CoPS?

CoPS (Cognitive Profiling System) is a fully computerised psychometric assessment system that has been standardised for use with children from 4 years 0 months to 8 years 11 months. It is designed to enable teachers, psychologists and other appropriately trained and qualified persons working in education or related professions to identify children's cognitive strengths and weaknesses. This information can assist in the:

- diagnosis of dyslexia (or specific learning difficulty)
- assessment of many other special educational needs
- identification of various developmental difficulties
- recognition of children's learning styles
- differentiation of educational provision for children with learning difficulties
- creation of individualised teaching and learning activities for all children in the age range

Although administration of CoPS is relatively straightforward, interpretation of the results produced by CoPS and implementation of appropriate educational provision, requires educational expertise and experience. Consequently, *CoPS is not suitable for use by persons without qualifications in education or psychology.*

CoPS should ideally be used for screening all children on school entry, or as soon as possible thereafter, i.e. at the age of four or five years. When used in this way, it can reveal many children who are likely to encounter significant difficulties in learning basic skills but who might otherwise have passed undetected at that stage. The problems experienced by such children may then be addressed swiftly and before these children have been discouraged by failure. However, CoPS can also be used for screening children aged six to eight years, or for assessment of any child within the age range who has encountered difficulties in learning. In such cases, CoPS can reveal underlying cognitive causes of learning difficulties, so that these may be taken into account when devising individual educational plans. In very exceptional circumstances, CoPS may be used with children outside the age range 4:0 to 8:11 (see Section 8.4 for further information).

The tests in CoPS are delivered in the form of games, which are stimulating, enjoyable and non-threatening for children. The game format helps to keep the child on task while maintaining their interest and motivation. It also contributes to greater accuracy and reliability of results.

CoPS provides *direct* assessment of the following areas of cognitive ability:

- visual/spatial sequential memory (spatial/temporal)
- visual/verbal sequential memory (symbolic)
- auditory/visual associative memory
- auditory/verbal sequential memory
- visual/verbal associative learning
- phonological awareness
- auditory (phoneme) discrimination
- colour discrimination

In addition, CoPS provides *indirect* assessment of:

- information processing speed
- motor processing speed

All these factors underpin learning processes and are especially important in the early stages of literacy development. CoPS was produced by Lucid Research Limited and utilised the scientific findings of a five-year

research project carried out in the Psychology Department of the University of Hull (see Singleton and Thomas, 1994b; Singleton, Thomas and Horne, 2000, Singleton, 2002). This project demonstrated the validity and effectiveness of the cognitive profiling approach in predicting children's difficulties in literacy and other areas of learning. Computerised assessment of the cognitive abilities listed above were shown to be significantly related to later development of reading, writing, spelling and numeracy skills.

The first prototype of CoPS was released early in 1996. The first of several Windows versions, with improved features, was first released in 1997. Swedish, Norwegian, Italian and Arabic editions were later released after collaborative projects.

Since 1996, CoPS has undergone many improvements and a full restandardisation. It has also become apparent over the years that CoPS is not just a system for identifying dyslexia. CoPS provides information about cognitive *strengths* as well as *weaknesses*. Hence, it is an appropriate tool for assessing the cognitive *individuality* of all children. The fundamental objective of CoPS is to use information from the child's cognitive profile in order to decide on teaching strategies and to shape learning activities which are individually appropriate. In other words — to *differentiate*, not only for dyslexic children but for all children. The intention is that by identifying strengths and weaknesses, and by starting early with the right educational input, any difficulties (or limitations) are not allowed to not develop into failures, while strengths can be built upon but not allowed to inhibit development of other skills. The educational implications of this approach have been developed further by Singleton (2002).

1.2. How CoPS was developed

1.2.1. Research background

The lack of general availability of facilities for identifying dyslexia, especially at an early age, has been a source of considerable frustration for teachers and psychologists for many years. The term *dyslexia* refers to a pattern of specific learning difficulties which occurs with some severity in approximately 4% of the population and which is generally of genetic origin. A further 6% of the population is estimated to have less severe dyslexic problems. The child with dyslexia is the one who experiences *unexpected* difficulties in acquiring literacy skills and possibly in some other aspects of learning also. Conventional approaches to the diagnosis of dyslexia make it very difficult to identify such children at an early age (Singleton, 1988). Many children with dyslexia are not identified until they are about 10 to 12 years of age, by which time they have experienced so much failure that their motivation and self-confidence will have been seriously eroded. The *Special Educational Needs and Disability Code of Practice: 0-25 years* (Department for Education, 2014) places on schools a legal duty to identify and address all special educational needs (including dyslexia) as early as possible in the child's school career.

There is now a well-established research literature documenting the principal underlying cognitive difficulties associated with the condition. These are in the areas of memory, sequential information processing, phonological awareness, and in some cases, visual-perceptual difficulties (Ellis and Large, 1987; Goswami and Bryant, 1990; Jorm et al., 1986; Pumfrey and Reason, 1991; Singleton, 1987, 1988; Singleton and Thomas, 1994a; Thomson, 1989; Snowling, 2000). The CoPS Project used this scientific knowledge of the cognitive precursors of dyslexic difficulties to formulate *objective* early identification procedures that could be used easily by teachers in the ordinary classroom. The precision, objectivity and flexibility of the computer made it an appropriate and cost-effective tool for assessing such cognitive abilities and deficits, as well as enabling the creation of tests in the form of 'games' which increases the child's motivation and interest in the task (Singleton, 1997b, 2001, 2003). The overall rationale for the CoPS Project was that early intervention with children identified as being at risk of dyslexia or literacy difficulties is not just desirable on educational grounds. It is also more cost effective than waiting until these children have experienced several years of failure and have lagged so far behind their peers that very expensive specialist remediation has to be provided on a withdrawal basis. The early intervention approach means that appropriately structured teaching can be provided in the ordinary classroom. This rationale is endorsed by the British Dyslexia Association (see Fawcett, Singleton and Peer, 1998).

1.2.2. The longitudinal study 1990–1995

The research that led to the development of CoPS was carried out in a 5-year longitudinal study that commenced in 1990. This study was conducted by Dr. Chris Singleton and Kevin Thomas of the Department of Psychology, University of Hull, UK, Although the initial motive was to create a computerised system for early identification of dyslexia, it swiftly became clear that the system that was emerging could have a *far greater* applicability than first envisaged. The outcome of this research is a general-purpose *tool* that has a very wide range of potential uses in education and elsewhere. Research work is only just beginning to explore the different ways in which CoPS might be used to advantage.

Twenty-seven computer tests were first created in order to assess various cognitive abilities, including visual, verbal, associative, sequential and spatial memory skills, also phonological awareness, auditory discrimination, visual processing capacity and other important linguistic and perceptual skills. A total of 400 children, aged 5 years, in 24 schools were administered these computer tasks, and their literacy, numeracy and intellectual development was followed up over the next four years, using a variety of standardised psychological measures. The follow-up data were then used to determine which of the computer tests were most effective predictors of dyslexia and other learning difficulties.

The aim of this research was to produce a user-friendly computer-based package of tests which will give early indication of many of the children who are at risk of dyslexia and other learning difficulties because of underlying cognitive deficits. Such children might not otherwise be spotted until very much later in their school careers. The tests yield a graphic profile of the child's cognitive strengths and weaknesses which may be printed out if desired and used in consultation with educational psychologists, learning support staff, and remedial and advisory teachers in formulating an individual learning programme. It is important to note, however, that this system does not necessarily involve labelling children as 'dyslexic' at the age of five years. Rather, the purpose of the tests is to identify children who *are likely to experience significant difficulty in acquiring literacy skills because of underlying cognitive deficits which are known to be associated with dyslexia.* Some of these children may well be giving cause for concern for other reasons (e.g. because they have a history of speech and language problems) but many of them would otherwise be liable to pass undetected for some time. The hope is that such children can be given appropriate teaching and support so that their cognitive difficulties do not significantly retard their literacy development (Singleton, 1996).

1.2.3. Results of the longitudinal study

The results of the longitudinal study showed that some of the computer tests gave a highly satisfactory prediction of children who later were found to be experiencing literacy difficulties and dyslexia. These computer tests produced data which were normally distributed, giving a good indication of the psychometric integrity of the tests. These computer tests also produced significant correlations with reading development, many of which had higher correlation coefficients than were found between intelligence (verbal and non-verbal) and reading development. Over 90% of children who subsequently were found to be experiencing significant literacy difficulties were successfully predicted by the computer tests alone on school entry, and the computer tests successfully discriminated dyslexia from other literacy difficulties in over 80% of cases. Since CoPS is designed to be used as a screening device it is important to specify the levels of false negatives and false positives; CoPS produced 16.7% false negatives and 2.3% false positives (Thomas et al, 1997). This compares very favourably with other screening devices (Singleton, 1997a).[1] Structural equation modelling provided confirmation of a statistical and conceptual distinction between verbal/auditory-related tasks and visual/perceptual tasks, thus enabling the identification of dyslexic sub-types, which is further facilitated by the examination of graphical profiles (Singleton, Thomas and Horne, 2000; Thomas et al, 1997). Various statistical techniques were used to determine which of the computer tests were most effective in predicting later difficulties (predictive validity), and eight of these were selected for the final software suite. For details of the statistical analyses carried out see Singleton, Thomas and Horne (2000) and the manual to the original (developmental) version of CoPS (Singleton, Thomas and Leedale, 1996).

[1] 'False negatives' and 'false positives' are the two types of classification error in screening. False negatives are cases where the screening device fails to identify a risk when a risk does in fact exist; false positives are cases where the screening device has identified a risk when a risk does *not* in fact exist.

1.3. Composition of the CoPS suite of tests

The composition of the final suite of tests in CoPS, following the statistical analysis described in the previous section, is shown in Table 1. To the eight tests giving the most useful prediction of later literacy difficulties and dyslexia, a ninth supplementary test (***Clown***) was added, in order to assess colour discrimination. The purpose of this was to determine cases where children may score low on either or both of the two visual memory tests ***Zoid's Friends*** and ***Toybox***, which depend on the child having competent colour discrimination (although not necessarily the ability to name colours). In such cases, if the child experiences colour discrimination difficulties then these, rather than memory limitations, could result in low scores. The final suite also featured a menu system, pupil registration, graphical report mode and facility for printout of results. All tests incorporate demonstration and/or practice items, and a choice of rewards ('end games') is available to the child at the conclusion of each test, which provides additional encouragement, interest and motivation for the child.

Table 1 – The nine tests in CoPS

Test name	***Cognitive skills being assessed***
Zoid's Friends	Visual/verbal sequential memory (colours)
Rabbits	Visual/spatial sequential memory (spatial / temporal position)
Toybox	Visual/verbal associative memory (shape and colour)
Zoid's Letters	Visual/verbal sequential memory (symbols)
Zoid's Letter Names	Auditory/visual associative memory (names and symbols)
Races	Auditory sequential memory (names)
Rhymes	Phonological awareness (rhyming and alliteration)
Wock	Auditory discrimination (phonemes)
Clown	Colour discrimination

1.4. Standardisation of CoPS

The CoPS tests have been standardised, so that teachers using the system would be able to establish where any given child fell on any of the cognitive components of the suite, in relation to the population norms. CoPS norms are based on a total sample of 1,107 children. A breakdown is given in Table 2.

Table 2 – Standardisation sample

Subsample details	***Age range***	***Number of children***
24 schools in Hull, East Yorkshire and North Lincolnshire	5 – 6 years	421
23 schools across England, Wales and Scotland	4 – 9 years	460
9 schools in Suffolk	5–6 years	110
3 schools in Cheltenham	4–5 years	116
Total		**1,107**

The standardisation procedure for CoPS and the documentation contained in this Manual conforms to psychometric principles and procedures laid down in the *Guidelines for the Development and Use of Computer-Based Assessments*, published by the British Psychological Society (BPS, 2002).

The norms for CoPS are incorporated into the software and enable results to be calculated immediately by the program, and displayed in either standard or centile scores. In addition, there are Z scores (standard deviation units) available. Since the CoPS program incorporates all the norms and automatically calculates results, it is not necessary for the teacher to consult norms tables (many teachers would regard that as a positive blessing!).

1.5. The advantages of CoPS for early screening and assessment

- Greater precision in presenting assessment tasks.
- Greater accuracy in measuring responses.
- Greater objectivity of assessment.
- It can be used much earlier than most conventional methods of assessment.
- It does not require a psychologist to do the assessment.
- It requires only minimal training of teachers or other personnel.
- Children enjoy it more the conventional assessment methods and so are motivated, which helps to ensure reliable results.
- It gives a detailed picture of a child's cognitive strengths and weaknesses, which can provide important indicators of sub-types of dyslexia, of a child's individual learning styles, and pointers for curriculum development and for differentiation within the classroom.
- It can utilise existing technology in schools so there is no extra expense for schools in purchasing special equipment.
- Once the software has been created and validated it is inexpensive and easy to reproduce for distribution to schools. The program can be used as many times as required without the recurrent expense of test booklets and other costly test materials.

1.6. Getting started with CoPS

Before installing CoPS please read the chapter which follows, noting that detailed operating guidance for the software itself can be found in the separate **CoPS Software Guide**.

1.6.1. CoPS Software Guide

The main purpose of the **CoPS Software Guide** accompanying this manual is to inform the teacher or administrator how to manage pupil information and results, how to view and print out reports and how to begin assessments. There is also technical information in the guide which would be useful for ITC personnel who intend to install and/or maintain the Lucid CoPS software. Both the **Software Guide** and the **Teacher's Manual** are accessible from the Lucid Research website at www.lucid-research.com/t/manuals.

Manuals and Guides may also be found on the CD or may be available as a link within the Lucid CoPS software.

1.6.2. Correct time, date and date format used by your computer

CoPS needs to calculate pupils' ages by using their date of birth and the computer's own system date. There are different formats to display dates used in different parts of the world; CoPS uses the British-type short date format *dd/mm/yy*. Therefore all dates of birth used for students are expected to be entered in this format. If your computer is normally set up to use the North American *mm/dd/yy* format then please change this format to *dd/mm/yy* (or *dd/mm/yyyy*) before using CoPS.

There is a version of Lucid CoPS available with American voiceovers and spellings, especially designed for US and Canadian users. American versions of other Lucid products are also available.

To check or modify your date format go to the Windows ® ***Control Panel*** and choose the ***Regional and Language options***. If the *Short Date* format is already shown as *dd/mm/yy* or *dd/mm/yyyy*, either of these settings is acceptable, otherwise your ITC support personnel will need to alter the format displayed.

1.6.3. Installing the software

Installation of CoPS is very straightforward. To install the software place the CoPS CD in the CD-Rom drive. On the Windows desktop select **Start** and then **Run** and enter the command line:

D:\SETUP

where D is your CD drive letter. A Setup menu will appear which includes an option to install the software onto your computer. Once installation starts follow the on-screen instructions. If more technical information is required in advance of attempting installation, please see the *Support* section of the Lucid website or email the Lucid technical support team at technical@lucid-research.com.

1.6.4. Running CoPS – Serial Number and Password

After installation you will be able to run the CoPS program either from an icon installed upon your computer's desktop or from the *Programs menu* accessible through the *Start* button. When you launch the program for the first time, you will be required to enter some user information, including the Serial Number.

Whenever you run CoPS you will need to enter your password. Your password is initially set to **lucid** (note that all the letters need to be in lower case). You can alter the password later should you wish. This and other software administration tasks are described in detail in the **CoPS Software Guide**.

1.6.5. Using the tests in CoPS

Before administering any test in CoPS, users should first read Chapters 2 and 3. Together, these provide detailed guidance on how to select CoPS tests and administer them. Assessing children with CoPS is straightforward but before you attempt to test any children you should first run through the complete suite of CoPS tests to familiarise yourself with it thoroughly. To do this you should register yourself as the 'child'. If you wish to exit any test and return to the *tests menu* before the end, then press F4. This quick exit from a test is also useful when demonstrating the program to other teachers or for use in training sessions. However, the F4 key should not be used when testing a child unless absolutely necessary.

1.6.6. Interpreting CoPS results

Before attempting to interpret CoPS results, and especially when drawing up an Education, Health and Care (EHC) plan or considering educational provision for any pupil in detail, teachers are strongly advised to consult the chapters in this manual dealing with interpretation of CoPS profiles (see Contents). Teachers who have already read these chapters and who are seeking speedy hints on interpretation of CoPS profiles may consult Section 4.4

1.6.7. Teaching activities

Chapter 10 gives details of teaching activities and resources that may be adopted in cases where CoPS results indicate a problem or potential problem in the child's learning. This is supplemented by further information and resources on the Lucid website (www.lucid-research.com), which is updated from time-to-time. In particular, educational software that is recommended in this manual may have been withdrawn from sale, superseded or augmented by new programs.

Use of CoPS does not imply any obligation to follow a particular line of teaching, and teachers, as professionals, will naturally wish to use their own judgement regarding what is, and is not, suitable for any given child. Nevertheless, it is strongly recommended that teachers read the teaching advice provided in this manual, as it is likely that they will find ideas and strategies that they had not previously considered. This is

especially likely if the teacher is not very experienced in working with children who have specific learning difficulties.

To keep up to date with software developments and other teaching resources, teachers should consult the Lucid website (www.lucid-research.com). In addition, the British Dyslexia Association publishes information on recommended software and teaching materials (www.bda-dyslexia.org.uk).

1.6.8. Troubleshooting

In the event that you encounter problems in running CoPS, please view the Help & Support page on the Lucid Research website www.lucid-research.com/t/Technical.htm . You can also ring the Technical Support line (see website for telephone and fax numbers) or email technical@lucid-research.com .

Updates to the latest version of CoPS can be downloaded at no cost from our Software Updates page at www.lucid-research.com/t/technical_Updates.htm .

2. Guidelines for test administration

2.1. The structure of the CoPS suite of tests

Before commencing testing with CoPS, it is important for teachers to have some appreciation of the whole suite of tests. From the original 27 cognitive tests that had been evaluated in research, eight core tests were selected to form the basis of CoPS. The main empirical factors governing selection were (a) statistical accuracy in predicting later literacy attainment, (b) general robustness[2] of the tests, and (c) their popularity with young children. The final selection of eight tests was also made in keeping with the theoretical principal of creating a balanced range of measures tapping different cognitive areas, so that the profile for any individual child should yield meaningful information on their relative strengths and weaknesses. A ninth test, ***Clown***, was subsequently added. This is a supplementary test and its purpose is explained later in this chapter.

The nine tests in the CoPS suite are listed in Table 3. It can be seen that the first four tests (***Zoid's Friends, Rabbits, Toybox*** and ***Zoid's Letters*****)** are predominantly 'visual' in their task requirements. However, children can (and many do) use *verbal* strategies for some of these 'visual' tests, e.g. saying the names of the colours to themselves *in* ***Zoid's Friends*** or ***Toybox***, or inventing 'names' such as 'bird' or 'table' for the symbols in ***Zoid's Letters***. The fifth test (***Zoid's Letter Names***) involves visual and verbal elements equally, whereas tests 6–8 (***Races, Rhymes*** and ***Wock***) are fundamentally verbal in their task requirements, even though they are presented in a visual manner.

Each test is preceded by verbal instructions delivered by the computer, followed by a practice phase in which the child is told by the computer how to play the 'game'. Although these procedures are usually sufficient to enable the child to understand the test requirements thoroughly, it is nevertheless worthwhile for the teacher to prepare the child for the task by explaining the scenario of the game, which is described in the following sections.

A choice of rewards ('end games') is available to the child at the conclusion of each test, which provides additional encouragement, interest and motivation for the child.

Table 3 – The nine tests in CoPS

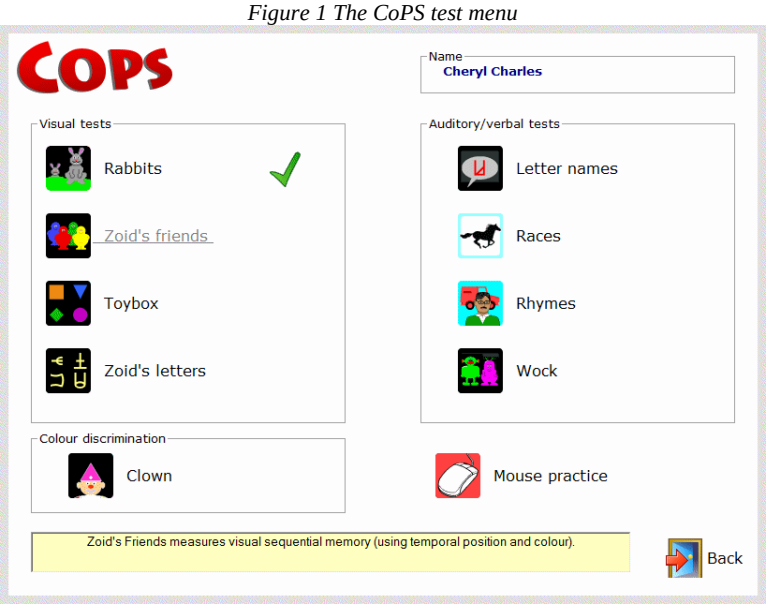
Test no.	Name	Cognitive skills being assessed
1	***Zoid's Friends***	Visual/verbal sequential memory (colours)
2	***Rabbits***	Visual/spatial sequential memory (spatial / temporal position)
3	***Toybox***	Visual/verbal associative memory (shape and colour)
4	***Zoid's Letters***	Visual/verbal sequential memory (symbols)
5	***Zoid's Letter Names***	Auditory/visual associative memory (names and symbols)
6	***Races***	Auditory sequential memory (names)
7	***Rhymes***	Phonological awareness (rhyming and alliteration)
8	***Wock***	Auditory discrimination (phonemes)
9	***Clown***	Colour discrimination

[2] The term robustness refers to overall test reliability and validity not being significantly compromised by usual administration anomalies and errors.

2.2. Software practicalities

This section provides a brief introduction to the test administration procedures. The tests are available through the *CoPS test menu* (See Figure 1) which is activated through **Assessments** (stand-alone edition) or by running the separate Tests Module (network edition). Ticks adjacent to the test buttons indicate those tests that have been completed by the *current* child. There is access to a mouse-practice game through the **Mouse practice** button.

Figure 1 The CoPS test menu



Each child should perform a test *only once*. However, further attempts at the same test are permitted, but this should only be carried out for valid reasons (see *2.4.6*). Re-testing can be effected by using the *Fine Tuning* option in the Administration Module – for details please see the **CoPS Software Guide**. Note that if a child completes a retest the previous results will be overwritten. Whenever a test is performed it should be under the supervision of a suitably experienced and qualified person.

It is sometimes useful to monitor a child's progress using CoPS. Every time a new CoPS profile is desired the child should have a new record created, otherwise his/her original data will be overwritten. It is recommended that a simple word or phrase be appended to the child's surname indicating that this is subsequent testing.

Tests have three stages: the practice (and demonstration) phase; the test phase; and the 'end game' phase. The practice phase is for children to familiarise themselves with the nature of the task and the mode of input or response. The test phase is where the data are being collected and it is important to adhere to the testing principles at this stage. A typical test takes from 3 to 8 minutes to complete with the average child. The end game is optional and is purely fun for the child (no information is being collected).

It is important that when using CoPS for testing a child, 'background running' applications such as virus scanners should be disabled as they can interfere with the timing of presentation of items in CoPS, affecting the validity and reliability of the results.

2.2.1. Mouse practice

The mouse practice activity may be freely played by the child and is designed to give practice in moving and clicking with a mouse. It is therefore desirable that a child who has no experience of using a mouse plays the game before attempting a CoPS test for the first time. The practice game may be played as many times as the teacher thinks is necessary. The results are not recorded.

2.2.2. Use of the function keys

2.2.2.1. Pausing a test (F2 key)

In real testing purposes this function is more likely to be used than a total abandonment. *It is not recommended that this function is used as standard practice during test administration and it should only be used when essential*. A record is kept of the number of times that the pause function was used. Activate this function by pressing the **F2** key. When activated the timers recording the response time (latency) are frozen and the accuracy/error scores are retained. When this key is pressed again it deactivates the pause function and the test proceeds by re-presenting the last test item shown. The timers and scores continue where they left off.

2.2.2.2. Repeating a test item (F3 key)

It is possible to repeat the presentation of an individual test item. The supervisor may need to do this when something interfered with the delivery of a particular test item. Such interference may have been the result of an extraneous noise, or other distraction, at the moment of item delivery. The key to activate this function is the **F3** key. *This facility should be used only where essential since its spurious or non-systematic use may affect the validity of the data collected*. The number of times it is used during each test is recorded.

2.2.2.3. Premature abandonment of a test (F4 key)

During testing a child may be failing badly, may lose interest totally or something unexpected may happen, like a fire alarm. It is possible to stop a test before the end. However this should only be used in extreme circumstances since ***all of the data for that partial attempt will be lost***. You can quit from a test prematurely by waiting until the mouse pointer is visible and then press the **F4** key. The child cannot restart the test where they left–off (a consequence of this would be to invalidate the results). It may be necessary for the child to attempt the test at a later date depending on the reason for premature abandonment. Premature exiting from a test is generally used for demonstration purposes rather than in real testing situations.

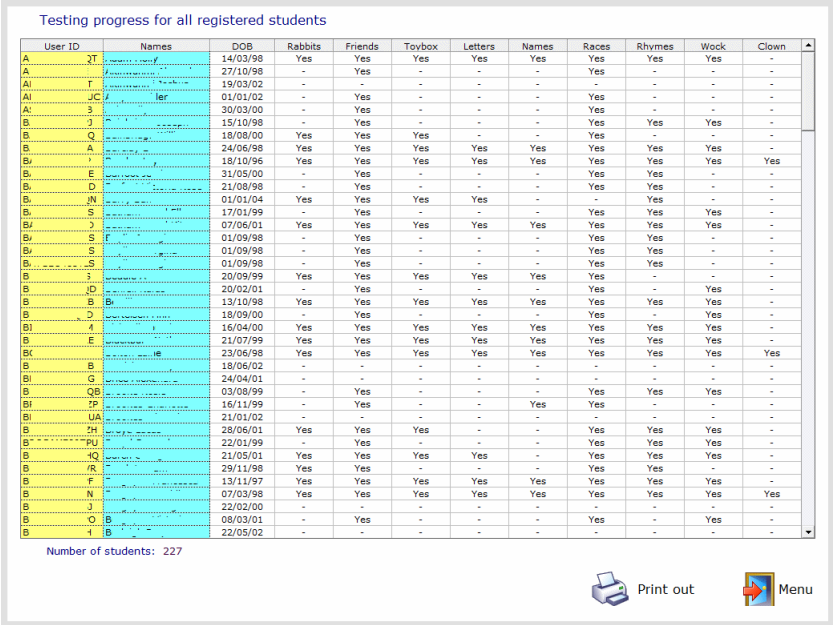
2.2.3. Recording of scores

All scores, items chosen and timings are saved automatically to database file upon completion of each test. The data saved also includes the date the test was completed and the number of times the repeat and pause keys were used.

2.2.4. Monitoring the testing progress of the class

There is an option to display the testing progress of all registered pupils on the CoPS database. Press the **Testing progress** button from the Reports and Administration menu to obtain the Testing Progress table. User IDs and names are shown down the table with the tests across the top. "Yes" indicates that the child has completed the test and a dash indicates that the test has not been completed (See Figure 2). Select **Print** to send the report to the default printer, if available.

Figure 2 Testing progress screen



(Note: User IDs and names in figure above have been obscured)

2.3. Guidelines for administering CoPS tests

Before commencing testing (and especially before the first test which is administered to any given child) and during any testing session, there are a number of things which the teacher should check and think about. These matters, which are explained in more detail below, are:

- Is the teacher familiar with the test being administered?
- Is the testing environment satisfactory?
- Is the equipment functioning correctly?
- Is the child prepared for the task?
- Which test(s) should be administered?
- In what order should the tests be administered?
- How many tests are going to be administered in a given session?
- Is the assessment being conducted fairly?
- How should prompts, encouragement and feedback be given?

2.3.1. Is the teacher familiar with the test being administered?

Teachers should be thoroughly familiar with each test before they attempt to administer it. The CoPS tests are extremely easy for any competent adult to deliver, but before administering the tests to a child, it is essential for users to become thoroughly familiar with them. *This includes any personnel who are going to administer the tests as well as the teacher who is going to be in overall responsibility for CoPS administration within the school.* The best way to do this is for users to register themselves as a 'child' and run through all the tests personally. When doing this, users should consult carefully the details of each test given in Chapter 3. This is especially important, for this chapter explains:

- the structure of each test
- how the child should be prepared for that test
- hints about administering that test.

2.3.2. Is the testing environment satisfactory?

The ideal testing environment is one that is reasonably quiet, with minimal distractions. However, CoPS was designed to use in the ordinary classroom, where distractions are often unavoidable. Visual and auditory distraction (both to the child being tested and to other children in the class) should be minimised. It is recommended that the computer and the child are positioned in such a way that the child is not looking directly at the rest of the class, nor should the rest of the class easily be able to see the monitor screen. The best position for this is usually in the corner of the room. To minimise auditory distraction, headphones are recommended (these are strongly recommended for **Wock**, unless the testing environment is very quiet). Two pairs of headphones will be required – one for the child and one for the supervisor – with a splitter (which can be purchased from most audio stores). Inexpensive lightweight headphones of the type used for portable audio equipment will be adequate *(but not the type that are inserted into the ear).*

The child should be sitting conformably at a suitable level in front of the computer screen (not too high or low in order to see the screen and use the mouse satisfactorily). It is not recommended that children attempt the tests standing up, as they are more likely to move about and alter the angle at which the screen is viewed – this can lead to failure to see everything that is happening on the monitor, and can also disrupt mouse control. The supervisor should check for reflections on the monitor from windows and lights that could impair the child's perception. To do this the supervisor should check by viewing the screen from the same position that the child will adopt.

It is not recommended that children attempt the tests when other children are standing or sitting in a position in which they can become involved in the task or act as a distraction. It will be hard for other children to inhibit their responses and their behaviour may influence the decisions of the child being tested.

2.3.3. Is the equipment functioning correctly?

The supervisor should check that (a) the monitor display is clear and its colours correct, (b) the sound system (speakers or headphones) is audible (not too loud or to soft, and without interference), and (c) the mouse is functioning correctly (the underside may need cleaning) and is positioned in front of the child on a suitable surface so that its movements are unimpeded. Note that in the four 'auditory' tests (***Zoid's Letter Names, Races, Rhymes*** and ***Wock***) sound quality will be rather more important than in the other tests.

2.3.4. Is the child prepared for the task?

It is important that the child *understands* the *nature* of the task, *how* to indicate responses to the computer using the mouse, and *when* to respond (essentially when the tests will allow them to respond). If the child is unfamiliar with the use of a computer mouse then it is advisable that he/she runs the mouse practice activities before commencing a test. It should be obvious that children should not be allowed to take the tests if they are unwell. In particular, colds are likely to affect the child's performance on ***Wock*** (although if the child regularly suffers from colds or glue ear it may be appropriate to assess the extent to which such problems are impairing auditory discrimination).

A story or scenario can be created for each test in order to make the task more interesting and enjoyable for the children. All verbal instructions delivered by the supervisor should be appropriate to the level of understanding of the child. If the child does not understand any instructions the supervisor may re–express them in a more suitable manner. For example, many young children may not fully understand what 'order' means. Here the tester may give examples of what is a correct order (and what is an incorrect order) to aid comprehension. Explaining and re-expressing the task requirements to the child may continue into the demonstration and practice stages of each test. This is particularly useful for any child who is experiencing problems in understanding the true nature of the task. It is often easier for the child to comprehend the task requirements by experience of the practice stages, than by more abstract oral explanation. There is no hard-and-fast rule regarding the scenario instructions and supervisors may wish to construct their own as long as the task requirements are conveyed in a suitably concise and consistent manner.

Once the test items commence, there should be no further aid given to the child. During the pause in-between test levels the tester may, if necessary, reiterate the task requirements to the child (as a reminder) and give general encouragement (see 2.3.9 Giving encouragement, prompts and feedback, page 21). If the tester believes that the child really does not understand the task, then it is permissible to pause the test by pressing the F2 key, and explaining the requirements of the test again. The test can be restarted by pressing F2 again.

This facility should be used only in exceptional circumstances, as habitual use with a child could invalidate the test results for that child. Note that the test item during which the F2 key was activated will normally be repeated before the remainder of the test continues.

2.3.5. Choosing which tests to administer

CoPS is a *suite* of tests – i.e. it comprises nine tests, each of which has different functions. Teachers can choose to give *all* or *some* of the tests. CoPS is a complex assessment package and a great deal of research and careful thought has gone into its creation – each and every test component is there for a specific purpose, and each test can give the teacher valuable information about the child. In order to obtain the maximum amount of information, and to maximise chances of identifying learning difficulties such as dyslexia, it is recommended that wherever possible *all* of the tests be administered (but *not all* in the same testing session). Younger children should not attempt more than two or three tests at any one sitting because they are liable to become mentally fatigued. Many teachers prefer to give younger children only one test at a time.

Consequently, teachers who have the time available are strongly recommended to administer all nine CoPS tests, thereby accessing the fullest information about the child. On average, this should take between 45 and 60 minutes to complete.

Although it is desirable to give the full suite of tests to each child, this it is not absolutely *essential.* If time is short, it is acceptable to administer a subset of the tests instead of the full suite, in which case the issue of choice of tests arises. In this situation, it is helpful to think of CoPS as a *kit of tools*, with the teacher choosing one or more of those tools for specific purposes. There are instances in which a teacher requires information about a child's abilities in a *particular cognitive domain*, such as phonological awareness or auditory discrimination. In such circumstances is perfectly acceptable for the teacher to carry out *only* those CoPS tests pertaining to this domain (in this case ***Rhymes*** for phonological awareness and ***Wock*** for auditory discrimination) rather than administering all the CoPS tests.

In order to make sensible choices about which tests to administer and which to leave out, teachers first need to understand what each of the tests is for. To accomplish this, teachers should read the chapters devoted to the interpretation of each test.

Whichever strategy teachers adopt for selecting CoPS tests for administration to any given child, it is strongly recommended that first they should familiarise themselves thoroughly with *all* the CoPS tests, how they are delivered and what cognitive abilities they measure. This will require trying out the tests as well as consulting the relevant sections of this manual. Only then can teachers make an informed professional decision about how best to use CoPS to meet their particular assessment needs.

2.3.6. Order in which tests are administered

The *order* in which CoPS tests are attempted is not particularly important. As teachers become more experienced with CoPS, they will find that they develop their own views about what tests are most useful to begin with, or to use in certain cases. However, it is generally *not* recommended that ***Rabbits*** be given as the first test (especially with younger children and those who do not have much experience in using the mouse) because of the high demands which that test places on visual scanning, concentration, attention and mouse control.

Some teachers like to use ***Clown*** as the first test, because it is quite simple for young children to understand and easy for them to do. However, a few younger children or those with poor mouse control may have some problems in ***Clown*** with controlling the mouse pointer accurately, because the patches of colour on the palette are quite small. In such cases ***Clown*** may actually serve a useful additional function of providing additional practice in mouse control (although there are other 'mouse practice' activities available in CoPS; see Section *2.2.1 Mouse practice, page 16*). Teachers can also use a touch screen if they wish.

Many teachers find that ***Zoid's Friends*** is a good test to begin with because it is relatively easy for the child to understand and does not demand very precise positioning of the mouse pointer.

2.3.7. Number of tests to be administered per session

It should be obvious that a satisfactory test result cannot be obtained if children are not attending to the tasks and attempting to do their best. However, the CoPS tests are mentally demanding and young children, especially, can easily become mentally fatigued after a few tests. The effort which they apply can diminish significantly, although they may still enjoy the activity. Consequently, even though children may express a desire to 'do some more games' it is recommended that not more than two tests are given to any one child in a continuous session. This may vary according to the concentration level of the child and other factors. The supervisor should use his or her discretion in these matters.

It is also preferable to spread administration of the whole suite of tests over several days. This avoids the situation where results may be grossly distorted because a child has an 'off day' through illness or some other idiosyncratic reason. Where any individual test result appears anomalous or unrepresentative the test may be re-administered after a suitable time period has elapsed.

2.3.8. Is the assessment being conducted fairly?

In order for the assessment to be 'fair' (i.e. to give a reasonably accurate representation of the child's abilities) is essential for the supervisor to ensure that during the test:

- the child is paying attention, is 'on task' and is not distracted
- the child does not become unduly fatigued
- there is no teaching or helping with the task during the test items (whether from the supervisor or other children)
- there is no 'cheating' — this may take the form of the child placing his or her hands on the computer screen to circumvent memory element of the test (e.g. in **Rabbits**).
- feedback from the supervisor is minimised and encouragement consistent
- repetition of test items (F3 key) is kept to a minimum — the repeat facility is specifically designed for occasions when the child has been *distracted* (e.g. by a sudden noise in the room or by coughing or sneezing themselves); it should not be used excessively or on a regular basis as this could invalidate results.

2.3.9. Giving encouragement, prompts and feedback

As much as possible, *the supervisor should avoid giving specific feedback to children during a test*, because this may influence their behaviour in an undesirable fashion. There is a risk of feedback differentially affecting children, so that some are encouraged and others discouraged. CoPS itself provides appropriate and limited feedback (i.e. 'well done', 'good'). Nevertheless, some children will try to elicit additional feedback from the supervisor about their performance. This may take the form of verbal and non-verbal behaviours. For example, the child may ask directly if they were correct. Many children will look for the supervisor's facial and bodily reactions to their responses. Some children may even try to evaluate the supervisor's reaction by observing the supervisor's reflection in the monitor screen. For these reasons it is usually preferable that the supervisor sits to the side and slightly behind the child to minimise any feedback to the children which may bias the results.

Rather than specific feedback, *general encouragement* should be given to the child. This encouragement should be referenced to task completion rather than task accuracy and ideally should be delivered equitably to all children. However, it is inevitable that some children will require more encouragement than others, and where this is the case the teacher should be mindful of the possibility of influencing results unduly. Differential encouragement between children is likely to have an influence on the results obtained and therefore should be avoided where possible. Some key phrases and general incentive prompts which may be used to aid the administration of the tests include: "well done"; "you were good at that game (or level), now try the next one"; "you will like this game"; "now concentrate on this"; "try hard"; "listen very carefully", "have go at these ones", "have a try", "just do your best".

Unless it is felt absolutely necessary, *prompting during the actual test items should be kept to a minimum.* For the most part any necessary prompting should occur during the pauses between test levels and

the tests themselves. However, these prompts and phrases must be used with careful consideration. It is very important that any prompting should not significantly affect the children's performances differentially. Ideally these prompts should be given to every child equally and are utilised as general encouragement in order to maintain concentration. They should not be related to children's specific accuracy performances, since this is likely to lead to children receiving differential encouragement due to the fact that some children will inevitably perform better than others. It is worth reminding the reader that CoPS is an assessment device rather than a teaching and learning tool so the nature and structure of feedback to children should be different.

However, there are occasions when prompting during the actual testing may be necessary in order to direct the child's attention and to ensure the child is on task. These prompts may take the form of cues to attend to the stimuli which is about to be presented. One test which is more likely to require cueing for some children is the ***Races*** test (see Section 3.7 RACES, page 38).

2.3.10. Keeping a Comments Record

It is recommended that the teacher makes a written record of the child's behaviour at each time of CoPS testing, particularly noting such factors as health, tiredness, attention, concentration, distractions, and general motivation. A template **Comments Sheet** is provided in the appendices of this manual (see page 101). This may be photocopied freely and used for recording any observations during testing. This record can then be referred to when interpreting the child's CoPS profile. The teacher should particularly be on the lookout for colds and coughs, which not only disturb concentration but which can also affect auditory discrimination and would show up as low scores on ***Wock*** and possibly other auditory/verbal tests as well. Sometimes a child may cough at a critical moment during a test and miss either the image that appears on the screen and/or the word that is spoken. Obviously in these circumstances testing should be discontinued until the child has recovered from the cold or cough, case of possible 'glue ear', in which auditory discrimination difficulties can be chronic or persistent, should be noted (for further information on auditory discrimination difficulties, see Section 10.2.

2.3.10.1. Suggestions regarding completion of the CoPS Comments Sheet

Testing Room: e.g. 'quiet room', 'classroom – noisy' (also mention any uncomfortable conditions)

Health: e.g. 'good', 'had bad cold', 'coughing' (also mention any other health factors)

Attention: e.g. 'good', 'fair', 'distracted', 'tired'

Other comments: e.g. 'over-confident', 'responded very quickly', 'nervous at first', 'did not understand instructions', 'could not hear computer properly', 'unconfident — kept asking "Is that right?"'

2.4. Special issues in assessment using CoPS

2.4.1. Children for whom English is an additional language

Assessment of any child who has limited proficiency in spoken English is always difficult. But there is evidence that CoPS is much better than conventional methods of assessment, because of its strongly visual format and minimal reliance on spoken instructions. The demonstration and practice items enable most children, even those with very little English, to understand the tasks, and where there is uncertainty a teacher or assistant who speaks the child's mother tongue can help with instructions. Administering the visual tests in CoPS (***Zoid's Friends, Toybox, Rabbits and Zoid's Letters***), as well as ***Clown*** and ***Zoid's Letter Names***, to children who have little or no English is quite straightforward, provided a teacher or classroom assistant can explain to the child in their own language what they have to do. The tasks will be essentially the same as for English-speaking children: only the instructions will be translated. Under most assessment circumstances, CoPS is perfectly adequate for testing children with limited English.

When CoPS is going to be used in another language altogether, certain tests — ***Races, Rhymes*** and ***Wock*** — require translation of words and alterations to items, e.g. the names of the animals in ***Races***, the rhyming words in **Rhymes** and the words and items in ***Wock*** (to ones which reflect auditory discrimination difficulties common in the language). Such changes are likely to alter the difficulty of the task. Furthermore, when any different language version has been created, it should be standardised on an appropriate sample of children who speak that language.

It might be assumed that similar problems will arise when assessing EAL children on these auditory-verbal tests of CoPS. However, the situation is not nearly as problematic as one might imagine. We have evidence from our own research with EAL children that many children from other language backgrounds who have only limited English can still do ***Rhymes*** and ***Wock*** perfectly satisfactorily. In fact, it turns out that amongst these children those with the least experience of English *do not* inevitably perform less well on ***Rhymes*** and ***Wock*** than those with more experience of English (in fact, they may be somewhat better because of their bilingual or multilingual experience). What is most important is that the pupils understand the tasks confronting them, and listen carefully to the items. Some bilingual children seem to have developed particular skills in noticing the sounds in language, and so can perform quite highly on ***Rhymes*** and ***Wock.***

Races, however, creates a special problem for children with limited experience of English (especially young children), and that is knowing the names of the animals. Details of all the animals that appear in Races is given in Section 3.7. If the teacher is unsure whether children know the names of all these animals, the most obvious solution is to familiarise all children with the animals. This can be accomplished efficiently and enjoyably in class or group activities, perhaps playing recognition games (e.g. bingo) using the pictures of the animals. Translation of the animal names into the child's mother tongue is not necessarily a solution, because the names of some animals (e.g. penguin, robin, kangaroo, hippopotamus, reindeer) might not exist (or be familiar) in their mother tongue. Even if straight translation of the names of the animals were to be possible, this would inevitably introduce an uncontrolled factor into the test, because in different languages the numbers of syllables in the animal names is likely to differ. (In ***Wock*** *and* ***Races*** syllable length has been controlled for and the tests have been standardised in this format.)

Above all, it is important that children who have limited English (for whatever reasons) are not left out of CoPS assessment. They will almost certainly feel disappointed and discriminated against if they are not allowed to participate. Case studies of four bilingual (EAL) children, together with their profiles on CoPS are discussed in Chapter 9. These show that it is possible to obtain extremely valuable information from CoPS assessment of such children.

For further information about multilingualism and dyslexia, the compendium edited by Peer and Reid (2000) is strongly recommended.

2.4.2. Children with co-ordination difficulties

Teachers often ask whether slowness or difficulty in using the mouse makes significant difference to a child's performance on CoPS. In general, the answer is no, because it is the accuracy scores derived from CoPS which are of paramount importance. Other than in ***Toybox***, the time scores only provide a check that the child has attempted the task in a reasonable time – e.g. not too fast – see Section *4.2.3 Time scores*, (page 53) for a discussion of how to interpret time scores. Even if a child is totally inexperienced with using a mouse and is consequently very slow, the accuracy scores would still be a valid measure of their performance. However, whenever the teacher suspects that a child may be inexperienced with the mouse or may have co-ordination difficulties, the mouse practice items should be used as much as required in order to give experience and build confidence. It has been found that the vast majority of children quickly get used to the mouse and noticeable improvement is seen after only one or two CoPS tests. Of course, a child may be slow on a CoPS test because they are finding it difficult – i.e. the cognitive load is high. (Sometimes, if the test is far too difficult the child may appear very quick – in such cases they cannot remember the items at all and so their responses are random.) In exceptional circumstances where a child's extreme inefficiency with the mouse is affecting their confidence (e.g. in cases of children with a physical disability), it is acceptable for the teacher to allow the child to point at the target on the screen and the teacher uses the mouse to click on that target. Alternatively, a touch screen which plugs into the mouse port may be used instead of the mouse. Note, however, that in this event the time norms may not be valid.

However, the distinction between children who are slow in using the mouse (perhaps because of inexperience) and those with more serious motor co-ordination difficulties may be tricky for the teacher. Children with motor co-ordination problems used to be called 'clumsy children' (Gubbay, 1975) but are now officially described as having 'Developmental Co-ordination Disorder' (DCD) (American Psychiatric Association, 1994). They are children who have some difficulty in performing skilled, purposive movements, which cannot be attributed to mental abnormality or physical deformity. In adults who have acquired such problems (typically due to stroke or head injury) the term 'apraxia' is normally used, 'praxis' being defined as the ability to manipulate and deal intelligently with objects in the environment (Ayres, 1985). Thus in children who have similar problems, the related term dyspraxia (or Developmental Dyspraxia) is also often used.

Developmental Dyspraxia covers a range of childhood disorders affecting the initiation, organisation and performance of action (Ayres, 1988; Fisher et al., 1991). However, there is no universal agreement amongst neuropsychologists and neurologists about the categorisation of such problems because dyspraxic children do not form a homogeneous group. Some seem to have problems more at the planning stage of skilled action, others more with the execution of actions. Furthermore, successful actions must usually be underpinned by a number of visual processes as well as motor ones and it may be the case that these visual processes are faulty as well as (or instead of) the motor ones (Lord and Hulme, 1987). Indeed, there appears to be some degree of overlap between children diagnosed with dyslexia and those with dyspraxic difficulties, although many dyslexic children exhibit excellent motor skills and coordination (see Thomson, 2001).

Assessment of dyspraxia can cover a very wide range of tasks, including manipulation of small objects, shape copying by drawing, imitating and repetition of actions and postures, ability to co-ordinate arms and legs together, throwing, catching, jumping and skipping. Both large and small muscles may be involved, as well as fast and slow actions. Well-known tests of motor co-ordination include the Test of Motor Impairment (Stott et al., 1984) and the Movement ABC (Henderson and Sugden, 1992). Scores are sometimes averaged to give a 'motor age' but this is not usually very useful, because it is possible for a child to have a co-ordination difficulty in one area and not another. Thus a limited range of tasks may fail to identify a real difficulty and an overall measure may be misleading (Anderson and Fairgrieve, 1996; Beardsworth and Harding, 1996).

For the above reasons, the incidence of DCD is difficult to establish with any certainty. Figures vary according to the procedures used to assess the children. Reviewing this, Hoare and Larkin (1991) conclude that it is safe to assume that about one child in 10 has co-ordination difficulties, although these will vary in severity. Studies generally report a higher incidence in boys than in girls (Piek and Edwards, 1997). Evidence provided by Knuckey and Gubbay (1983) suggests that some young children with observed DCD have a delay in maturation and will eventually 'grow out of it'. Labelling such children 'clumsy' at an early age may consequently be harmful. On the other hand, several recent studies indicate that long-term effects of DCD are common, including continuing motor difficulties as well as a variety of social, educational and emotional problems (see Piek and Edwards, 1997 for review). Because of this, many educationalists now believe that it is desirable to identify children with DCD as early as possible in their school lives, because it may affect their educational progress, and as such come within the heading 'Special Educational Needs'. The *Special Educational Needs and Disability Code of Practice: 0-25 years (2014)* states that schools should take all reasonable steps to identify and address such needs as early as possible in the child's school career.

CoPS has the potential to identify children with DCD because it contains a number of cognitive tests in which the speed at which the child performed the test as well as their cognitive accuracy on the test is recorded. However, time scores on CoPS comprise *two* interrelated factors: cognitive processing time (i.e. the time the child needed to think about the task) and motor processing time (i.e. the time the child needed to respond by moving the mouse and clicking on the appropriate part of the display). If a child has taken a long time to complete the task (and this will be shown by a centile score in the lower range) it could be because he or she is motorically slow, or cognitively slow, or both. Research is currently going on to determine what type of CoPS profiles and scores are obtained by children with DCD.

2.4.3. Children with Attention Deficit Hyperactivity Disorder (AD/HD)

'Attention Deficit Hyperactivity Disorder' (ADHD) is the medical term for children who, in the past, would have probably been called 'hyperactive'. The *Diagnostic and Statistical manual of Mental Disorders* – DSM IV (American Psychiatric Association, 1994) distinguishes three types of ADHD:

- the child with ADHD who is predominantly inattentive
- the child with ADHD who is predominantly hyperactive and impulsive
- the child with ADHD who is *both* inattentive *and* hyperactive/impulsive

The World Health Organisation[3] uses the term 'Hyperkinetic Disorder' to refer to type 3). It can be seen that the symptoms of ADHD do not just concern hyperactivity – i.e. restlessness, difficulty with sitting still, excessive movement or fidgeting. Rather, such children are equally, or even more, likely to have problems in sustaining attention on the task in hand, inhibiting impulsive responding, and generally in regulating and controlling behaviour. The causes of ADHD are uncertain, but the evidence for a biological basis is strong,

[3] *International Classification of Diseases*, 10th edition (ICD 10). World Health Organisation, 1990.

with pre-natal and birth complications being most frequently cited in the research literature. Evidence for ADHD being *due* to food allergies is rather weak, but there is some evidence that hypersensitivity to aspects of nutrition (e.g. sugars, food additives) can be a significant feature in individual cases of ADHD (Hinshaw, 1994). There is considerable national variation in the incidence of ADHD, which largely reflects differences in culture and diagnostic criteria. In the US, incidence is reported to be between 3–8% of children, while in the UK it is only about 0.5% (Barkley, 1990). Approximately 35% of children with diagnosed ADHD have delays in reading, spelling, writing, and/or mathematics. Obviously these learning problems could be the result of poor attention and concentration in the learning situation (i.e. an *indirect* effect of ADHD). In addition it has been suggested that children with ADHD have problems with working memory, which affects learning *directly*, because information is not stored properly nor is it retrieved fluently and reliably. Treatment for ADHD usually involves a combination of psychological methods (e.g. behaviour modification) and pharmacological methods (e.g. use of the drug *Ritalin*), but good educational management and committed parent involvement is crucial (Goldstein and Goldstein, 1990, 1992).

Use of CoPS as a diagnostic tool with children who have ADHD is relatively undeveloped at the present time, although there is some promise in this approach. ADHD children typically show *unevenness* or inconsistency in performance in many tasks. This will often show up on a CoPS graphical profile because if there are lapses of concentration this will affect scores. It should not be forgotten, however, that children with *other* types of learning problems (e.g. dyslexia) will *also* usually have uneven CoPS profiles. On the other hand, since CoPS measures *underlying* cognitive strengths and weaknesses, the results should be valid regardless of what *label* is given to the child. Indeed, the label – whether dyslexic, specific learning difficulty, autistic or hyperactive – should be irrelevant. So in theory, CoPS is appropriate for *all* children. In practice, we do not yet have sufficient data on children with ADHD to be sure about how to interpret their CoPS profiles, but we believe that the time scores will prove to be of greater significance for children with ADHD than for other groups.

2.4.4. Children with colour blindness or colour discrimination problems

Two of the CoPS tests – ***Zoid's Friends*** and ***Toybox*** (under 7 years version only) –specifically rely on colour perception for the child's response. Obviously if the child scores poorly on these tests it could be because of colour blindness or some other colour discrimination difficulty. Indeed, if the child is performing poorly on either of these two tests the computer will warn the teacher and suggest that the child should be given the supplementary test ***Clown*** in order to check for problems of colour discrimination. There are already a number of cases in which ***Clown*** has revealed a colour discrimination problem which was previously not known to the school. In the remaining tests in CoPS, although colour is employed, it is not central to the task, and colour blindness or colour discrimination difficulties should not affect performance. Interpreting the results obtained from ***Clown*** is discussed in some detail in Section *7.5 CLOWN* (page 75).

Teachers sometimes ask whether knowing the *names* of the colours helps children to complete ***Zoid's Friends*** and ***Toybox*.** However, whether they do or do not know colour names, these tests are still valid because they were found to be predictive of later literacy difficulties without reference to knowledge of colour names. Teaching the children colour names *specifically for the purposes* of attempting these tests is not recommended, because children who have only just acquired the names of the colours and not begun to use them fluently might be more liable to confusion. Some children clearly are using the labels for the colours as a *verbal strategy* in these tests, but this does not seem to be the case with all children – it appears to be possible to do these tests using only *visual strategies*.

2.4.5. Assessing children outside the age range for CoPS

CoPS is not recommended for use outside its specified age range. Any test which meets basic psychometric criteria (which CoPS does) must be standardised on a given population and this will determine the range of applicability of the test. CoPS is designed for use with children aged 4 years 0 months to 8 years 11 months. Use with children outside this range will mean that you have no proper standards against which you can compare the child's performance. This could result in inappropriate decisions being made – e.g. that a child is 'at risk' (or not 'at risk') when the evidence for this is unsound. Although some 3 year-olds can complete CoPS, at this age most children do not fully understand the requirements of all the tasks, so testing may be unreliable. Because the CoPS tests are generally too easy for older children, most children aged 9 or older will score at (or very close to) the 'ceiling' of the tests. Consequently, at this age the tests are not very good at discriminating children who have cognitive difficulties from those who do not. A few older children (or even

adults) do experience difficulties with some of the CoPS tests, but such results may be unreliable. More importantly, older children who may have cognitive problems are likely to remain undetected by the CoPS tests.

The preferred solution to assessment of children older that 8 years 11 months is to use **LASS 8-11** (age 8:0 – 11:11) or **LASS 11-15** (11:0 – 15:11). These products are available from Lucid Research.

As a general rule, if CoPS is used outside the specified age range, results should always be interpreted with extreme caution – see Section *8.4 Interpreting results of children who are* outside the CoPS norms range (page 81).

Under exceptional circumstances it is permissible to use CoPS outside the age range. For example, in the case of a very bright or advanced three-year-old or a child of nine or over with moderate or severe learning difficulties. In such cases, age equivalents would be the preferred form of scores for the teacher to consider. An age equivalent is defined as the chronological age range of children that would be expected to achieve a given raw score. Some teachers working in special education prefer to use age equivalents rather than centile scores, because age equivalents enable them to conceptualise the ability level of the child they are teaching, and so pitch the work at the correct level. For further information about using age equivalents see Section 4.2.4.

2.4.6. Re-testing with CoPS

Teachers often ask 'How soon can a child be re-tested with CoPS?' The answer depends on why re-testing is being considered. If the teacher has good reason to believe that a given result is not truly indicative of a child's ability because of some hindrance factor, then retesting can be as soon as is convenient. For example, this would be the case if a child had a cold and could not hear the words, was unwell and not able to concentrate, was excessively nervous, or because there were unexpected distractions in the room. Obviously efforts should be made to ensure that those hindrance factors have been resolved before re-testing. (Remember that re-testing will normally over-write the child's previous results – see Section *2.2.3 Recording of scores*.) If, on the other hand, the teacher wants to see if the child has improved as a result of some intervention — e.g. insertion of grommets as treatment for glue ear, or training in phonological awareness — then a sensible interval should be allowed before re-testing. In general, three months would be recommended as the minimum interval, but this could be less if the teacher had good reason for doing so. Repeated re-testing on CoPS is not advisable, because under those circumstances any ability test is likely to show spurious improvements in performance by virtue of a practice effect.

2.5. Problems of time-shortage for testing

2.5.1. Useful strategies for solving time-shortage problems

In cases where teachers wish to administer all the tests in the CoPS suite, but are prevented from doing so because of lack of time, it is recommended that they first explore ways of making more time available. Teachers should not *automatically* opt for delivery of less than the full suite of CoPS tests just because time is short. Useful strategies for solving time-shortage problems include:

- Ensuring that administration of CoPS is part of *school policy* and that appropriate staff time is *allocated* for it on the timetable, rather than expecting teachers somehow to *create* the time on top of their other responsibilities. Giving CoPS to children does take time, but all teachers in the school should accept that it is time well spent, because the information gained is valuable in their education.
- Encouraging staff to recognise that CoPS is a useful educational activity *in its own right*. The CoPS tests are mentally stimulating and involve use of concepts and skills which are vitally important in early learning (e.g. discrimination of colour, shape and sound, memorisation, understanding of ordinal position, visual and aural attention, awareness of rhyme and alliteration). Hence time spent by teachers and children on the CoPS tests has a wider educational value.
- Training non-teaching personnel to administer CoPS. Although it is essential that an experienced teacher carries out the interpretation of CoPS results, any suitable adult who understands the essentials of what the task involves can administer the tests. In particular, that they are *tests*, so the child needs to *understand*

what is required, but the tester is not permitted to coach the child or give hints to the answers. In many schools CoPS tests are being successfully and efficiently delivered by various non-teaching personnel, such as classroom assistants, parents, volunteers or school governors. However, it is not advisable to use older pupils to supervise testing.

- Registering all children in a block is more time-efficient than registering children singly at the time of testing. CoPS can import files from other databases so if the school already has the children registered on a management system, for example, this can be used instead of registering the children afresh.
- Giving all children in the class the same CoPS test, before moving on to another test. That way, the tester can get into a 'rhythm' and does not have to re-adjust to delivery of each different test.
- Organising activities in order to use available time most effectively. Using playtime or lunchtime can work in some cases. Amalgamating classes for some activities (e.g. story time) can free up one teacher who can use that time to administer CoPS.
- Operating an efficient 'queuing' system, so that the teacher does not have to waste time locating the next child and bringing that child to the computer for assessment. Often, older pupils can assist in this type of organisation, but it is *not* recommended that older pupils should assume responsibility for supervision of the assessments themselves.
- A shortened assessment procedure, called **Quick CoPS**, may be used. In this, the teacher administers four rather than eight CoPS tests, which are selected according to a set of rules. This procedure is described in the next section.

2.5.2. Quick CoPS

When teachers feel that there is insufficient time available to administer *all* of the CoPS tests and the solutions for overcoming this problem suggested in the last section are not appropriate, a shorter testing procedure, known as *Quick CoPS* may be adopted. In this procedure only *four* of the nine CoPS tests are used, *and the assessment will usually be completed in less than 30 minutes overall*. Obviously, a more complete picture of the child's abilities will be achieved by using all of the CoPS tests, but *Quick CoPS* is a satisfactory solution when circumstances prevent this.

Use of *Quick CoPS* requires the teacher to make decisions about which four CoPS tests to use. This will differ according to:

- the age of the child (to the nearest month)
- the nature of the child's difficulties (if known) and any other information about the child which the teacher possesses.

In order to decide which tests to employ, the teacher should refer to the *Quick CoPS* grid (see Table 4). This indicates which four CoPS tests should be used, *based solely on the age of the child* (shown by the four ticks ✓ in each column). However, when a teacher has relevant information about a child (e.g. information from medical records, from the child's pre-school, from parents, or from the child's performance in school) the *Quick CoPS* procedure can be made much more efficient by adding in that information on the grid. This is achieved by consulting the Relevant Factors Chart (see Table 5). The Relevant Factors Chart shows which CoPS tests should be given additional ticks on the grid, according to appropriate criteria listed a) to j) (e.g. if there is a history of difficulties in language and/or literacy in the child's family, then additional ticks should be given to ***Races, Rabbits*** and ***Rhymes***). Note that of the three tests indicated in each row of the Relevant Factors Chart, the one which is printed in **bold** is the most important.

2.5.2.1. Quick CoPS testing procedure

- If the assessor has *no relevant information* about the child, then deliver *Quick CoPS* according to the child's age (to the nearest month), administering the **four** tests which are ticked in the *Quick CoPS* grid (Table 4).
- If the assessor *has relevant information* about the child in any of the areas detailed below, then refer to the Relevant Factors Chart (Table 5) and where appropriate place additional ticks in the specified cells of the *Quick CoPS* grid. (A photocopy of the grid given in appendix *11.4*, page 102, should be used for

this purpose.) Then select the **four** tests which have the most ticks. In the case of ties making it difficult to decide which four to choose, the test printed in bold type in the Relevant Factors Chart should be given greater weight. Otherwise, the assessor should make their own decision to resolve ties.

Table 4 – The Quick CoPS Starting Grid

	Age of child				
Test	4:0 – 4:11	5:0 – 5:11	6:0 – 6:11	7:0 – 7:11	8:0 – 8:11
Zoid's Friends	✓	✓	✓		
Rabbits			✓	✓	✓
Toybox					✓
Zoid's Letters	✓			✓	
Zoid's Letter Names				✓	✓
Races		✓	✓	✓	✓
Rhymes	✓	✓	✓		
Wock	✓	✓			
Clown					

***Note**: Do not write on the above grid; a copy of the* **Quick CoPS Grid** *is provided in appendix 11.4; this may be freely photocopied and used for the purposes of deciding which CoPS tests to administer. When completed, the* **Quick CoPS Grid** *should be filed together with the child's results from CoPS testing and the CoPS comments sheet.*

2.5.2.2. The rationale behind Quick CoPS

The tests which have been pre-selected in *Quick CoPS* (i.e. those which are ticked for the various age groups on the *Quick CoPS* Starting Grid – see Table 4) have been chosen on the basis of their predictive validity, using data from the original CoPS research project (see Singleton, Thomas and Leedale, 1996). The criteria which appear in the first column of in the Relevant Factors Chart have been selected on the basis of evidence from research on the correlates of learning difficulties in general, and literacy difficulties/dyslexia in particular (Miles and Miles, 1999; Reid, 1998). The philosophy is that where teacher is aware of factors which could affect the child's learning, it will be most useful to concentrate on those CoPS tests which can confirm or disconfirm the teacher's suspicions. For example, if the teacher believes the child to have poor listening skills [item g) on the Relevant Factors Chart] then the CoPS tests which are selected should be ones which can give the teacher the most useful information on the significance of those apparently poor listening skills. These will be ***Zoid's Letter Names***, ***Wock,*** and ***Races***, because these are the tests which make the highest demands on the child's listening ability. If the child performs poorly on these tests, this suggests that the problems are pervasive, confirming the teacher's suspicions and supporting a case for intervention on this basis.' If, on the other hand, the child performs at an average level – or even well – on these tests, this suggests that the child's suspected poor listening skills are not pervasive – and may even be transitory. The latter finding may also indicate that the child's listening skills are good in some situations (e.g. 1 to 1 with the teacher) but poor in others (e.g. in a group situation). Either way, the results *help the teacher to clarify the nature and extent of the child's difficulties.*

Table 5 – Quick CoPS Relevant Factors Chart

If the child satisfies the following criteria:	**Add an additional tick on the Quick CoPS Grid in the following cells:**
a Family history of dyslexia and/or literacy difficulties	**Races**, Rabbits, Rhymes
b Early speech and/or language problems	**Rhymes**, Wock, Races
c Glue ear and/or hearing difficulties	**Wock**, Rhymes, Zoid's Letter Names
d Poor reading skills (oral and/or silent reading)	**Rhymes**, Races, Rabbits
e Poor writing and/or spelling skills	**Zoid's Letters**, Zoid's Letter Names,
f Poor maths and/or number skills	**Toybox**, Rabbits, Zoid's Letters
g Poor listening skills	**Zoid's Letter Names**, Wock, Races
h Poor attention and/or concentration	**Rabbits**, Toybox, Races
i Known or suspected co-ordination difficulties	**Rabbits**, Clown, Zoid's Letters
j Known or suspected visual difficulties	**Clown,** Rabbits, Zoid's Letters

2.5.2.3. Quick CoPS – an example in practice

Emily is 6 years 5 months. She is making little progress in reading (particularly picking up phonics) and her teacher believes she also has poor attention and concentration. The teacher filled in the Quick CoPS grid as shown in Figure 3 (page 30).

It can be seen that on this basis, *Quick CoPS* indicates that Emily should be assessed with ***Races*** and ***Rabbits*** (both receive 3 ticks), ***Rhymes*** (2 ticks) and *either* ***Zoid's Friends*** *or* ***Toybox*** (both 1 tick). Both of the latter tests would be suitable under these circumstances. Both measure fluency of verbal labelling, while ***Toybox*** is sensitive to lapses in attention and concentration and ***Zoid's Friends*** is more sensitive to weaknesses in sequential memory. If the teacher is unable to decide then it is perfectly acceptable to administer both these test (although then the administration time will take a little longer).

In Emily's case, the teacher decided to administer ***Races***, ***Rabbits***, ***Rhymes*** and ***Zoid's Friends***. The results are shown in Table 6. In order to understand these results, users who have not yet read the chapters on test interpretation may need to consult the relevant portions of those chapters before proceeding.

Table 6 – Results for Emily Pearson (age 6:5) using Quick CoPS (centile scores)

Test	**Races**	**Rabbits**	**Rhymes**	**Zoid's Friends**
Accuracy score	**7**	**37**	**13**	**62**
Time score	**32**	**68**	**45**	**88**

It is clear that Emily is having problems with ***Races*** (centile 7) and ***Rhymes*** (centile 13), whereas her performances on ***Rabbits*** and ***Zoid's Friends*** are both satisfactory (centiles 37 and 62, respectively). All the time scores are satisfactory. This suggests that Emily's suspected problems of attention and concentration do not give cause for great concern. She has managed to cope quite well with ***Rabbits***, a test that demands close attention and maintenance of good concentration. Her result on ***Zoid's Friends*** suggests she does not have problems of verbal labelling and visual sequencing. However, the ***Races*** and ***Rhymes*** results suggest

underlying difficulties of phonological processing and auditory memory, which are 'classic' symptoms of dyslexia. In fact, after the assessment, Emily's teacher talked to her parents and they revealed that one of Emily's cousins had been diagnosed as dyslexic the previous year, a finding which further supports the conclusion that Emily seems to be experiencing difficulties of a dyslexic nature.

Figure 3 Quick CoPS Grid for Emily Pearson (age 6:5)

The Quick CoPS Grid

Child' Name: Emily Pearson ..... **Date of birth** 17.4.91

Age at time of testing: 6 years 5 months

Class: Miss Evans

Relevant factors used: **a) b) c) (d) e) f) g) (h) i) j)**
(please circle)

Other information:

.....

	Age of child				
TEST	4:0 – 4:11	5:0 –5:11	6:0 – 6:11	7:0 – 7:11	8:0 – 8:11
Zoid's Friends	✓	✓	✓		
Rabbits			✓✓✓	✓	✓
Toybox			✓		✓
Zoid's Letters	✓			✓	
Zoid's Letter Names				✓	✓
Races		✓	✓✓✓	✓	✓
Rhymes	✓	✓	✓✓		
Wock	✓	✓			
Clown					

This form may be freely copied. The four tests selected for administration should be ringed in the first column.

NOTES: .....

.....

.....

.....

3. Test administration procedures for each test

3.1. Introduction

Table 7 provides summary details of the various test levels delivered to each child. Until the teacher is familiar with each CoPS test it is recommended to interpret this table in combination with the individual test descriptions provided later in this chapter. Note that children under 7 years old receive different test levels (and sometimes different test items) from those children aged 7 years and above. In the table the first number before an x represents the number of task presentations and the number after the x indicates the task level (difficulty). For example, **Zoid's Friends** *(children under 7 years old)* has one practice item followed by 5 presentations of remembering 2 colours (5x2), 5 presentations of remembering 3 colours (5x3), and 5 presentations of remembering 4 colours (5x4); total number items = 16. **Zoid's Friends** *(children aged 7 years and over)* has one practice item followed by 2 presentations of remembering 2 colours (2x2), 2 presentations of remembering 3 colours (2x3), 3 presentations of remembering 4 colours (3x4), 4 presentations of remembering 5 colours (4x5), and 4 presentations of remembering 6 colours (4x 6); total number items = 16.

All tests are preceded by a practice phase, and some provide a demonstration also. The practice item(s) will be repeated if the child gets them wrong. The teacher should help the child to understand the requirements of the test by explaining the scenarios of each test to the child. These scenarios are described in the following sections.

3.2. ZOID'S FRIENDS

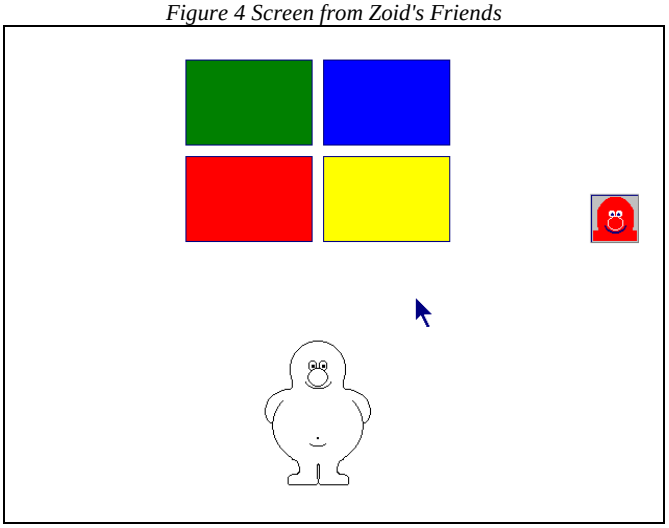
This is a test of visual sequential memory using temporal position and colour. During the test items the child is presented with a coloured character (one of Zoid's friends), which disappears and another coloured friend appears in its place. The task is to remember the colours of each friend as they appear and then replicate the presented colours in the *same order* by selecting the colours from a set of four presented at the end of the test item (See Figure 4). The child may change his or her mind by simply clicking on the colour filled friend he/she wishes to change. Once the child is happy with his/her selection he/she must press the 'Zoid' button to continue. The tester must ensure, as far as possible, that the child understands the full task requirements. Special attention must be given to ensuring that the child tries to replicate the *order* of colour presentation and not simply the colours shown in any order. The test begins with a practice.

Table 7 – Summary details of the CoPS tests

TEST	**For children under 7 years**			**For children 7 years and over**		
	Number of levels	**Test details**	**Total number of test items**	**Number of levels**	**Test details**	**Total number of test items**
Zoid's Friends	4	Practice x1 5x2, 5x3, 5x4	16	5	Practice x1 2x2, 2x3, 3x4, 4x5, 4x6	16
Toybox	3	[colours] Demo x1 Practice x1 Test – 90 secs.	varies	3	[patterns] Demo x1 Practice x1 Test – 90 secs.	varies
Rabbits	5	Demo x1 Practice x1 1x2, 6x3, 3x4	12	7	Demo x1 Practice x1 2x2, 2x3, 4x4, 3x5, 2x6	15

TEST	For children under 7 years			For children 7 years and over		
Zoid's Letters	3	Practice x2 5x2, 5x3	12	5	Practice x2 2x2, 4x3, 4x4, 2x5	14
Zoid's Letter Names	3	Practice x1 4x2, 4x3	10	4	Practice x1 4x2, 4x3, 4x4	13
Races	3	Practice x1 4x 3, 3x 4	8	4	Practice x1 2x3, 4x4, 3x5	10
Rhymes/ alliteration	2	Practice x2 8 rhymes	10	4	Practice x2 4 rhymes, Practice x2 8 alliterations	16
Wock	2	Practice x1 15 items	16	2	Practice x1 25 items	26
Clown	2	Demo x1 6 areas to paint	7	2	Demo x1 6 areas to paint	7

Figure 4 Screen from Zoid's Friends



The test items presented to children younger than 7 years old are different from the items presented to children of 7 years and above.

If a child fails to match any colour on the practice level a warning is given to the teacher advising that the child's colour discrimination ability should be checked using the ***Clown*** test, which can ascertain whether or not the child can adequately discriminate the colours used in CoPS.

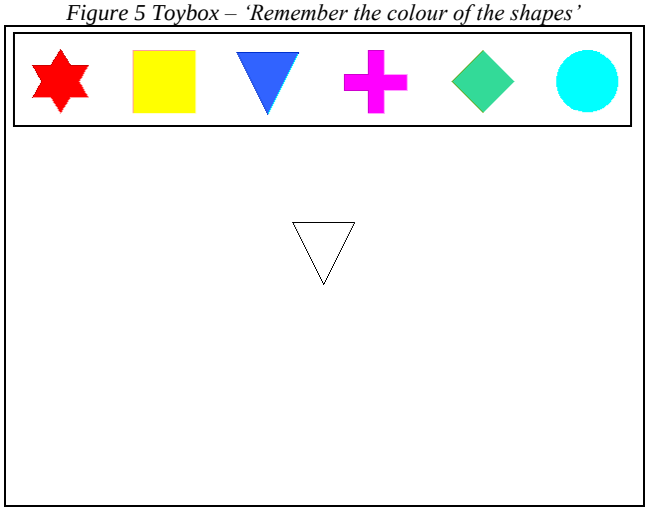
3.3. TOYBOX

This is a test of visual associative memory, based on either a shape-colour association (children aged 4-6) or a shape-pattern association (children aged 7-8). An array of shapes either coloured or patterned appears at the top of the screen. The shape-colour or shape-pattern relationship is consistent within a test but is not consistent across different children, i.e. it varies from child to child, so that the outcome of the test cannot be affected by children communicating between tests (e.g. one child saying to another 'the star is red'). An empty shape appears in the middle of the screen and then as the array at the top disappears, a new array of colours or patterns undifferentiated by shape appears at the bottom. The child is required to click on the colour or pattern that is associated with the shape in the middle of the screen. The order of shapes at the top of the screen and

the order of colours or patterns at the bottom is the screen is randomised for reach item if the test, so that a child cannot associate a colour or pattern with a particular spatial position.

The scenario for children younger than 7 years old is that the computer has some 'toys', which are shapes (see Figure 5). Sometimes the computer 'forgets' which colour each shape should be. It wants the child to remember which colour goes with each shape and when the computer 'forgets' the colour the child has to 'tell' the computer which one it is by choosing the correct colour from the array of different colours that appears at the bottom of the screen. For children 7 years and over the scenario is that the computer shows various shapes, which have different patterns inside (See Figure 6). The child has to remember the patterns inside each shape, and demonstrate this by clicking on the correct pattern from the array of different patterns that appears at the bottom of the screen.

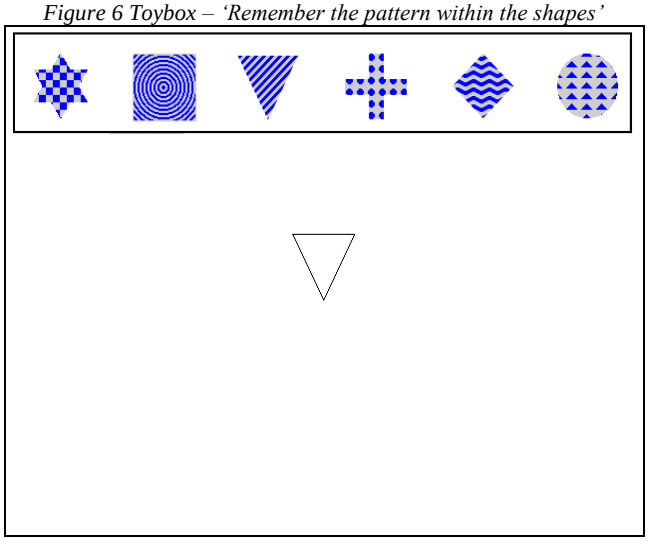
Figure 5 Toybox – 'Remember the colour of the shapes'



In all cases the child has a practice phase in which the requirement is to correctly match 6 shapes with their correct colours (or patterns). A maximum of 20 attempts in total are permitted and the time the child takes to do this is recorded, which provides the time data for this test. In the test phase the child is given 90 seconds to match as many shapes as possible with their correct colours (or patterns), which provides the accuracy data for this test.

If a child makes three or more colour mismatches in the practice or achieves a success rate of less than 75% in the main test a warning is given to the teacher advising that the child's colour discrimination ability should be checked using the ***Clown*** test, which will ascertain whether or not the child can adequately discriminate the colours used in CoPS.

Figure 6 Toybox – 'Remember the pattern within the shapes'

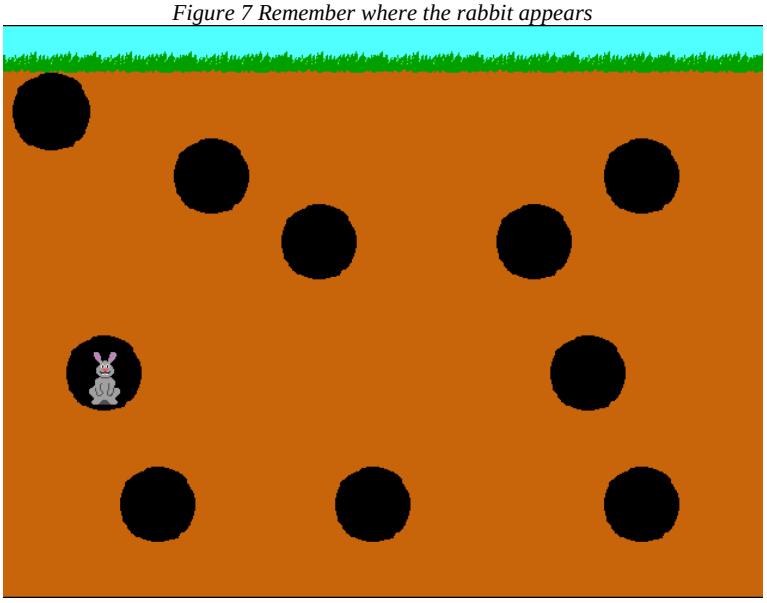


3.4. RABBITS

This is a test of visual sequential memory based on temporal and spatial position. The test administrator should explain to the child that the picture on the screen (see Figure 7) is where some rabbits live, and the holes are the homes of the rabbits. There is one friendly rabbit who likes to visit many friends. The child has to remember where the rabbit goes, i.e. which friends the rabbit visits in the order in which s/he visited them. The child demonstrates his/her recall by clicking on the holes in the correct sequence. A demonstration is given first, followed by a practice phase before the test phase.

The test items presented to children younger than 7 years old are different from the items presented to children of 7 years and above (see Table 7).

Figure 7 Remember where the rabbit appears

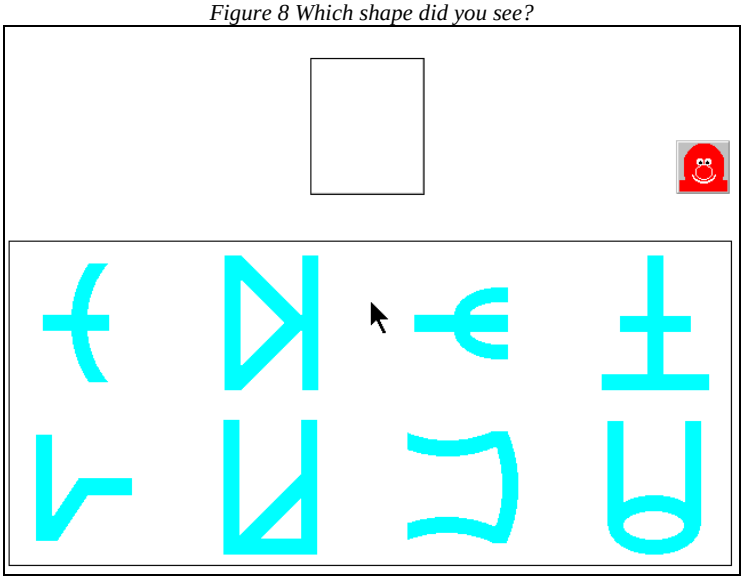


3.5. ZOID'S LETTERS

This is a test of visual sequential memory based on symbol sequence. The scenario is that the character 'Zoid' has a special language and he/she wants to see if we (humans) can remember his/her letters. Zoid will show the child some of his/her letters and the child has to remember them in sequence. The child demonstrates by choosing the correct ones from the full set of Zoid's letters. Once the child has chosen the symbol(s) they have to confirm their selection by clicking on the Zoid button (see Figure 8). The child may change their selection by clicking on the shape which they wish to change and it will be removed. They must then re-select their new choice.

The teacher should ensure that the child knows that the correct order of shape/symbol presentation must be replicated, not simply to remember the shapes shown and replicate them in any order. The test phase is preceded by a practice phase. Throughout the test, target stimuli are randomly selected from the complete array of eight symbols shown Figure 8). The test items presented to children younger than 7 years old are different from the items presented to children of 7 years and above (see Table 7).

Figure 8 Which shape did you see?



3.6. ZOID'S LETTER NAMES

This is a test of visual-verbal associative memory in which the child has to remember the 'name' that is given to each 'symbol' in the test. The scenario is that Zoid has some 'letters' and these letters have 'names'. Zoid wants to see if the child can remember the names of the letters. The computer shows two of Zoid's letters and tells the child the name of each. The computer then asks the child to show it one of Zoid's letters, by clicking on the symbol that was associated with the name spoken (See Figure 9). Care must be taken to ensure that the child listens carefully and is concentrating on the task. It is not expected that the child, or adult, will recognise the symbol name since it is a non-word. This is part of the test design and is obviously much less dependent on the familiarity with words or the vocabulary experience of the child than it would be if real names were used in the test. There is a practice phase followed by a test phase.

The test items presented to children younger than 7 years old are different from the items presented to children of 7 years and above (see Figure 10 and Figure 11).

Figure 9 Which one is called Baf?

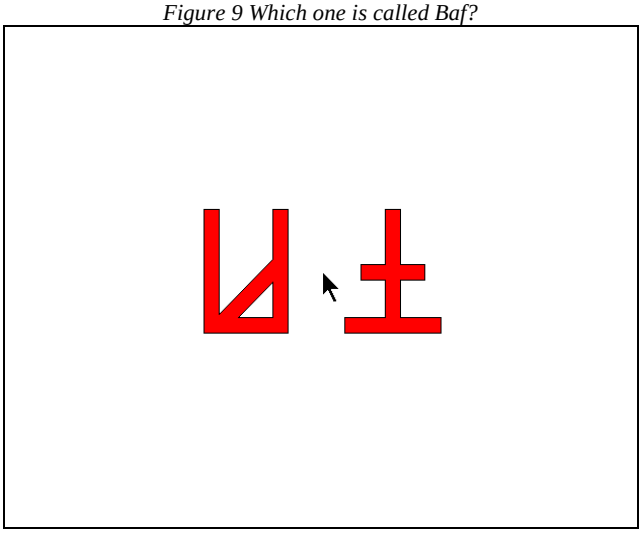


Figure 10 Stimuli for Zoid's Letter Names — children under 7 years old

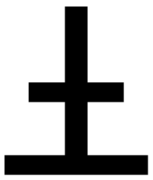
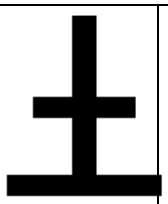
Stimuli for Zoid's Letter Names — children under 7 years old			
1	 BAF	 GOW	
2	 FID	 PUZ	
3	 HUK	 DEP	
4	 JAT	 KEB	
5	 LIG	 DUT	
6	 TUD	 VON	 HEF
7	 REZ	 NOF	 TAV
8	 GOV	 LUT	 TUL
9	 VIT	 ZIM	 NAZ

Figure 11 Stimuli for Zoid's Letter Names — children 7 years and over

Stimuli for Zoid's Letter Names — children 7 years and over				
1	 BAF	 GOW		
2	 FID	 PUZ		
3	 HUK	 DEP		
4	 REEN	 VIT		
5	 GLATE	 NAZ		
6	 TUD	 VON	 HEF	
7	 REZ	 NOF	 TAV	

Stimuli for Zoid's Letter Names — children 7 years and over				
8	 GOV	 LUT	 TUL	
9	 PUND	 FRUG	 BRIN	
10	 VIT	 NAZ	 ZIM	 REEN
11	 JAT	 KEB	 GLATE	 FRUG
12	 LIG	 ROOPE	 DUT	 WUD
13	 POG	 PUND	 HEEN	 HURN

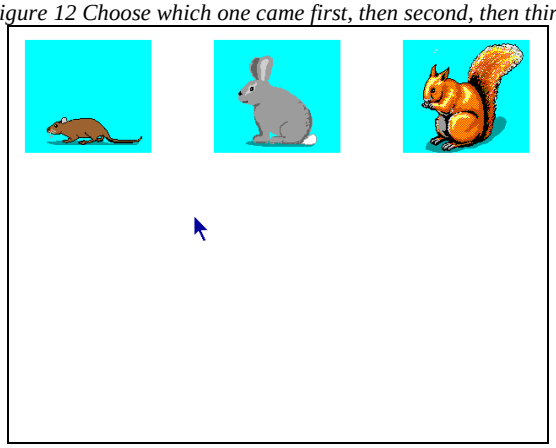
3.7. RACES

This is a test of auditory/verbal sequential memory using animal names. The scenario is that some animals are going to have races together. The child sees an animated clip of animals racing within a cloud of dust but cannot tell by looking which one comes first, second or third. To find out the finishing order of the animals (i.e. to find out which animal came first, which one came second, and which one came third) the child has to listen to the computer. The computer tells the child the order by saying the animal names one after the other. The child is required to remember the animal names *in the same order* that the computer says. S/he then demonstrates their recall by clicking on the pictures of the animals in order that they finished the race (See Figure 12). It is important to ensure that the child does not attempt to predetermine the finishing order based on

the pictorial representations (the order they appear on screen), nor on the assumed superiority of one animal over another (e.g. believing that a lion will necessarily beat a tiger).

The test starts with three animals and progresses up to four animals [children under seven] or five animals [children seven and older] (see Table 8 and Table 9). The number of syllables and other difficulty factors have been controlled in each item at a given level.

Figure 12 Choose which one came first, then second, then third



Particular care must be taken with this test to ensure that the child knows they must remember the spoken animal names and reproduce them in the correct order. Young children may not fully understand terms such as 'order', 'first', 'second', 'third', or 'fourth', so re–expression of the task requirements may aid comprehension. In addition, providing examples for the child will aid understanding (ensure that the animals chosen are not the same as those in the test). *Cueing* the child to listen to the specific moment of the memory element will also help. This may take the form of waiting until the computer says its *cueing* prompt of *"the order the animals finished in was"*. At this point the tester may reinforce this cue with their own, for example they may simply point to the computer screen or say a phrase such as "remember these", "listen carefully", "listen now", "listen". Again, the practice level allows the child to make mistakes and have subsequent attempts before the test begins and the supervisor may reinforce the task requirements during this process.

Table 8 – Races items for children under 7 years

Item number	Animals racing
(Practice)	elephant, hippopotamus.
1.	fox, dog, cat
2.	goat, sheep, donkey
3.	rabbit, squirrel, mouse
4.	panda, tiger, monkey
5.	spider, ant, crab, frog
6.	duck, hen, penguin, robin
7.	horse, camel, reindeer, lion

Table 9 – Races items for children over 7 years

Item number	Animals racing
(Practice)	elephant, hippopotamus.
1.	cat, fox, goat,
2.	rabbit, squirrel, mouse
3.	frog, ant, crab, spider
4.	duck, hen, penguin, robin
5.	horse, camel, reindeer, lion

Item number	Animals racing
6.	rhinoceros, panda, donkey, monkey
7.	earwig, beetle, scorpion, snake, lizard
8.	seagull, pigeon, eagle, parrot, blackbird
9.	kangaroo, buffalo, giraffe, zebra, tiger

3.8. RHYMES

This is a test of phonological awareness, involving detection of rhyme (in the case of children aged 4–6 years) and rhyme and alliteration (in the case of children 7 years and over). The test items presented to children younger than 7 years old are different from the items presented to children of 7 years and above (see Table 10 and Table 11).

The scenario presented to children younger than 7 years old is that the computer will display some pictures which have names. Some of the names rhyme ('sound the same at the end'. If the child already knows what rhymes are, you can quickly progress to testing. If the child does not know what a rhyme is then the tester may provide examples of rhymes, but should be careful to ensure that any rhymes which occur in the test are **not** included in this demonstration. The supervisor may emphasise the rhyming end sounds during the CoPS demonstration and practice phases. After no more than a few examples testing should commence, whereupon the child should not be given the benefit of any repetition or emphasis from the tester.

For children 7 years and older a similar scenario can be used for the first part of this test, after modification to ensure it is age appropriate. However the second half of the test for the older children includes items which alliterate rather than rhyme. Instructions should be modified for these different test items. Such instructions may be in the form of: 'Now try something different. Instead of words sounding the same at the end, they will sound the same at the beginning. Listen very carefully' (see *Figure 14*).

It is possible that the supervisor may feel that the child will not be very successful at this test even after they have explained the task personally. Do not worry about this and proceed with testing as normal. This is not a problem since the test has been shown to be valid and reliable adhering to these test principles. Simply try to encourage the child to complete the test in the best way they can.

Note that each of the rhyming and alliterative items include a semantic distracter (see *Figure 13*). This is a picture which has some meaningful link to the 'to be rhymed with' item but its name does not rhyme. So in the example given in the figure the semantic distracter to the 'boat–coat' rhyme is 'boat-river'. If the child cannot rhyme with confidence then he/she may tend to select the semantic distracter. This type of error will be identified in the **Data Table** of the test results.

Figure 13 An example of a rhyming test item (boat–coat)

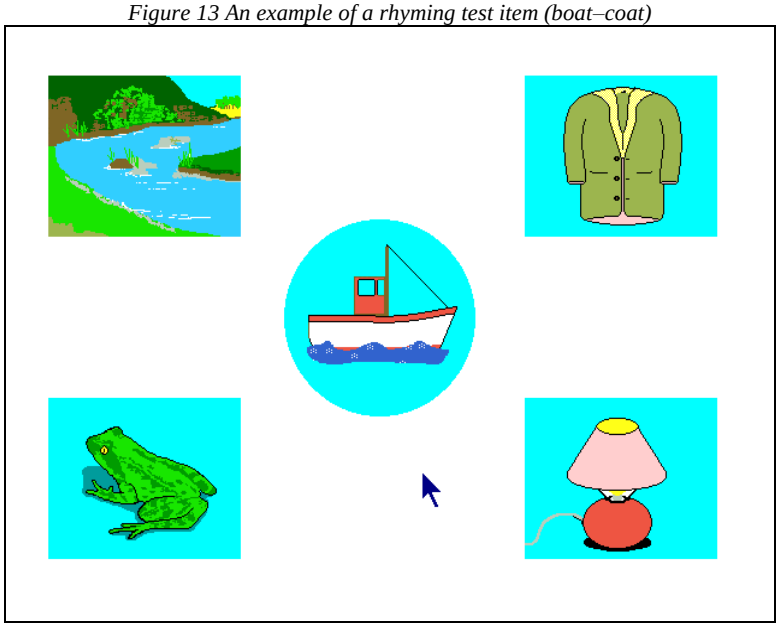


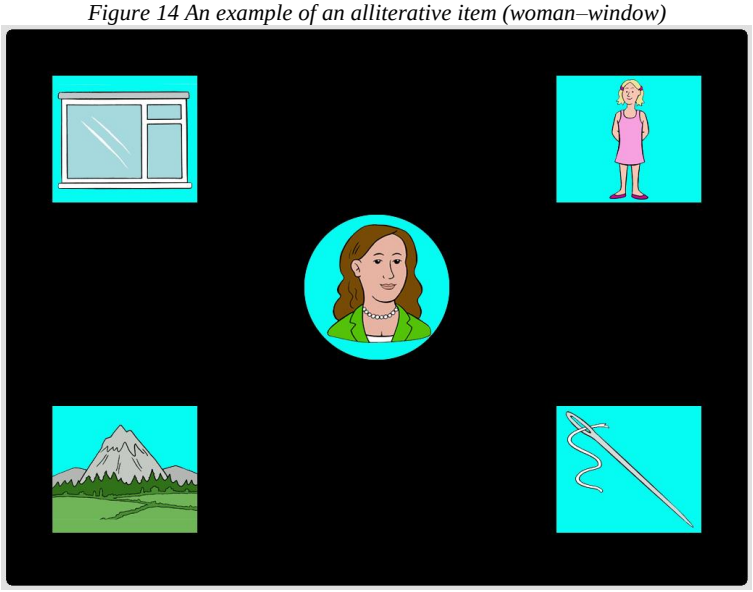
Table 10 – Composition of Rhymes test for children under 7 years

Item Number	Target word	Alternatives (choose the one which rhymes with the target)
(Practice)	van	bike, **man**, sun, book
(Practice)	hen	**pen**, door, chair, egg
1.	hat	dog, cup, **bat**, glove
2.	king	tree, **ring**, zip, queen
3.	dish	cake, spoon, **fish**, bird
4.	mouse	**house**, cat, drawer, chair
5.	boat	river, **coat**, frog, lamp
6.	parrot	feather, **carrot**, table, gate
7.	sock	flower, lorry, **clock**, boot
8.	flag	**bag**, plane, girl, castle

Table 11 – Composition of Rhymes / Alliteration test for children 7 years and over

Item Number	Target word	Alternatives (choose the one which rhymes with the target)
Rhymes (Practice)	van	bike, **man**, sun, fish
(Practice)	hen	**pen**, door, chair, egg
1.	boat	river, **coat**, frog, lamp
2.	parrot	feather, **carrot**, table, gate
3.	sock	flower, lorry, **clock**, boot
4.	flag	**bag**, plane, girl, castle
Alliterations (Practice)	ball	**book**, goal, drum, tap
(Practice)	dog	**door**, cat, goat, umbrella
5.	teapot	**table**, cup, pond, lamp
6.	sun	boot, zip, torch, **sock**
7.	fox	bowl, crab, shirt, **fish**
8.	bottle	glass, apple, knife, **balloon**
9.	leaf	**ladder**, flower, boat, candle
10.	tractor	**tree**, car, rattle, bucket
11.	woman	**window**, girl, mountain, needle
12.	hand	**house**, gloves, nail, dance

Figure 14 An example of an alliterative item (woman–window)



3.9. WOCK

This is a test of phonological discrimination. The scenario is that some of Zoid's friends are trying to learn our language. The computer shows a picture and says its name. Then Zoid's friends will try to say the word, one after the other. The child has to listen very carefully and decide which of Zoid's friends says the word properly (correctly). The child tells the computer which one said the word correctly by clicking on that friend (see Figure 15)

Care must be taken to ensure that the child listens very carefully to the spoken words. This process can easily be disrupted by excessive or sudden noise, so care must be taken to minimise this type of influence. If it is clear that the child missed the presented word then it can be repeated (press F3 key). The practice level provides the child the opportunity to become familiar with the task before the test begins.

The test items presented to children as shown in Table 12. Children younger than 7 years old receive items 1–16, while children of 7 years and above received items 1–26. The first item is a practice item. The use of the Phonetic Alphabet has been avoided in this table as not all teachers may know this. This does not create problems as far as consonants are concerned but it does make it difficult to represent vowel sounds, and for these some approximations have been necessary in the table. Where teachers are unsure about the exact nature of any particular discrimination, they should refer to the correct and incorrect words for that item, which should make it clear.

Figure 15 The duck–buck discrimination item

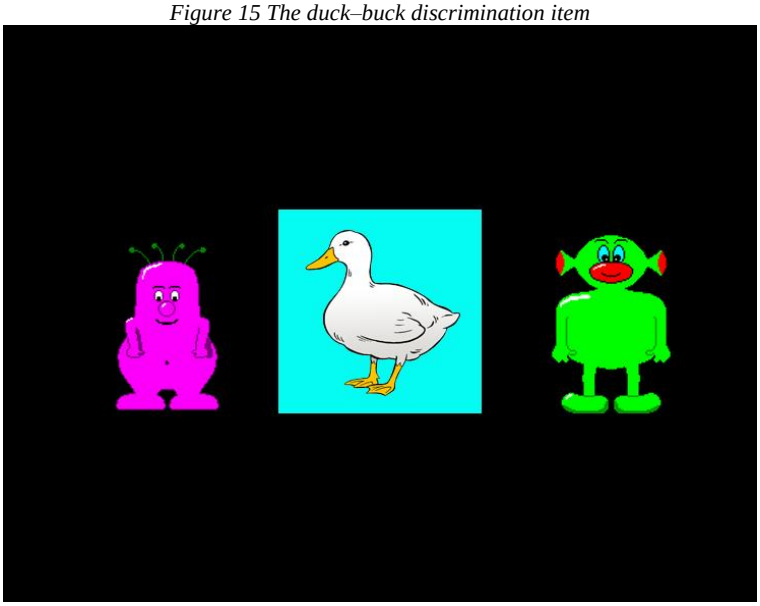


Table 12 – The phonological discriminations in Wock

Item number	Discrimination	Position	Correct word	Incorrect word
1. (practice)	p/t	initial	pen	ten
2.	d/b	initial	duck	buck
3.	s/sh	initial	sun	shun
4.	t/p	initial	tool	pool
5.	sh/ss	final	brush	bruss
6.	v/f	initial	van	fan
7.	p/b	initial	peg	beg
8.	i/e	medial	fish	fesh
9.	r/w	initial	rock	wock
10.	c/t	initial	cart	tart
11.	t/p	final	pot	pop
12.	a/h	initial	ant	hant
13.	o/u	medial	lock	luck
14.	j/ch	initial	jam	cham
15.	t/k	final	hat	hack
16.	g/b	initial	goat	boat
17.	fr/fl	initial	frog	flog
18.	o/ow	medial	pond	pound
19.	p/k	final	rope	roke
20.	d/dr	initial	door	draw
21.	u/o	medial	wood	wod
22.	n/ng	final	bin	bing
23.	a/ey	medial	can	cane
24.	o/u	medial	sock	suck
25.	b/br	initial	ball	brawl
26.	ch/j	initial	cheese	jeeze

3.10. CLOWN

The ninth test (***Clown***) was added to CoPS in order to identify children with poor colour discrimination or colour 'blindness'. This addition was not made because colour discrimination is a predictor of literacy attainment, but because performance on two CoPS tests **(*Zoid's Friends*** and ***Toybox***) may be affected by poor colour discrimination. About 7.5% of males and less than 1% of females are colour blind, which reflects a sex-linked recessive inheritance. The colour discriminations tested in ***Clown*** are:

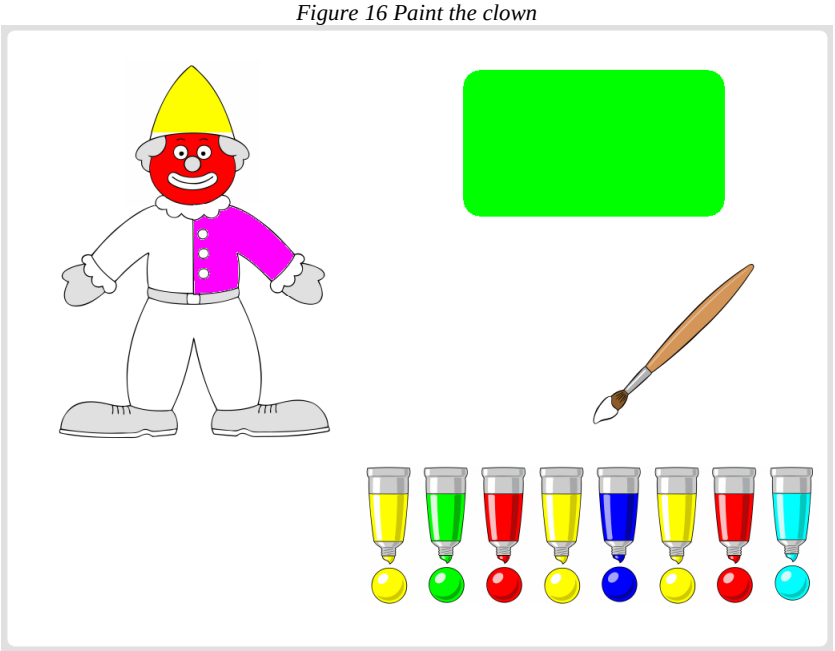
- Yellow
- Red
- Purple
- Green
- Light Blue
- Dark blue

These are the colours used in ***Toybox*** and ***Zoid's Friends***. Of these colours, the most likely confusion in a child who is colour blind will be when trying to distinguish red and green.

The task is to paint the clown with the colours indicated by the flashing outline, by clicking on the appropriate coloured paint tube in the row at the bottom of the screen - the range of colours in this display changes each time. The observant teacher will see that the ***Clown*** test devotes a number of items to ascertain the child's abilities to discriminate these particular colours. The results of the ***Clown*** test do not form part of the cognitive profile. ***Clown*** may be regarded as a supplementary test (rather than a core test). In cases where children have scored low on either ***Zoid's Friends*** and/or ***Toybox, Clown*** should be administered; otherwise it

is optional. CoPS will flag up a warning if this threshold has been reached in either of these tests and the child has not attempted the ***Clown*** test. However, because ***Clown*** is a very easy test for most children to do, many teachers use it as an introduction to the CoPS tests, especially for younger children in the age range.

Figure 16 Paint the clown



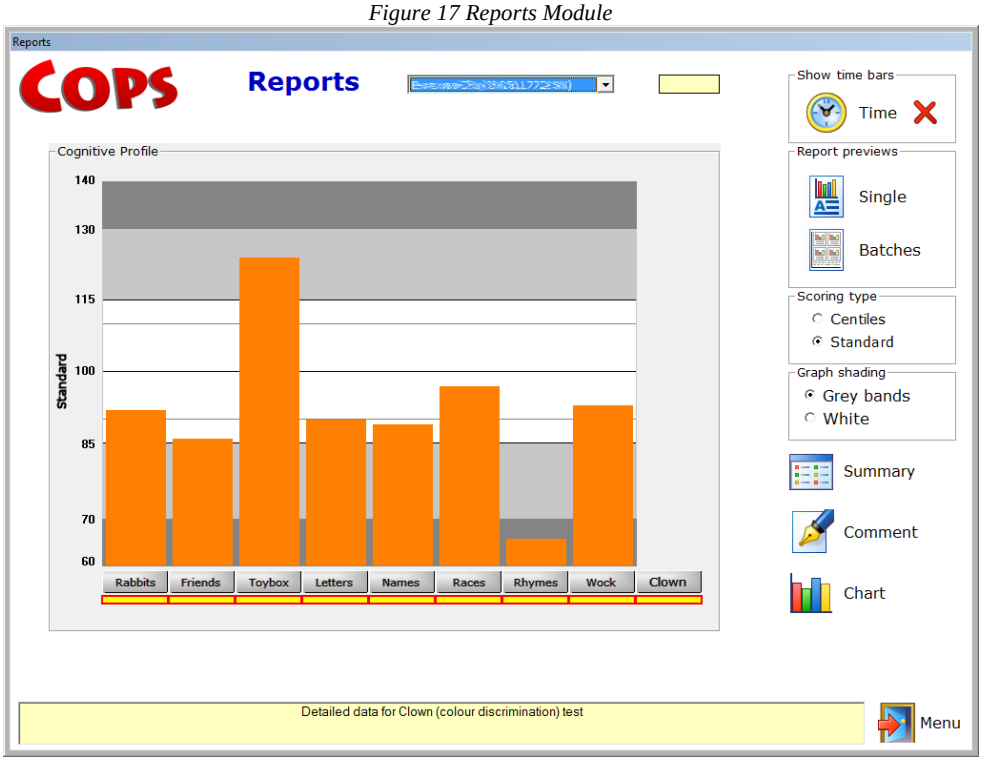
4. Interpreting CoPS profiles: a general overview

4.1. The Reports Module

Reports are calculated in real time, i.e. at the time of access or viewing, so that if any information has changed it will be incorporated in the current displays. Results are calculated using raw data stored in the central database. This data is loaded, scored and cross-referenced with national norms tables before being displayed.

You enter the *Reports Module* by clicking the **Reports and Administration** button from the *Main menu* or by launching the separate Admin module if you are using the CoPS network version. A typical screen is shown in Figure 17. There are several buttons and icons available for selection and their purpose will be described below.

Figure 17 Reports Module



4.1.1. Displaying a child's profile

Figure 18 Select pupil

Select the appropriate child from the pull down **Select pupil** button (Figure 18). Press the down arrow button and a list of registered pupils will be displayed.

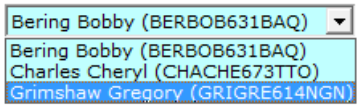
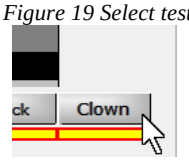


Figure 19 Select tests

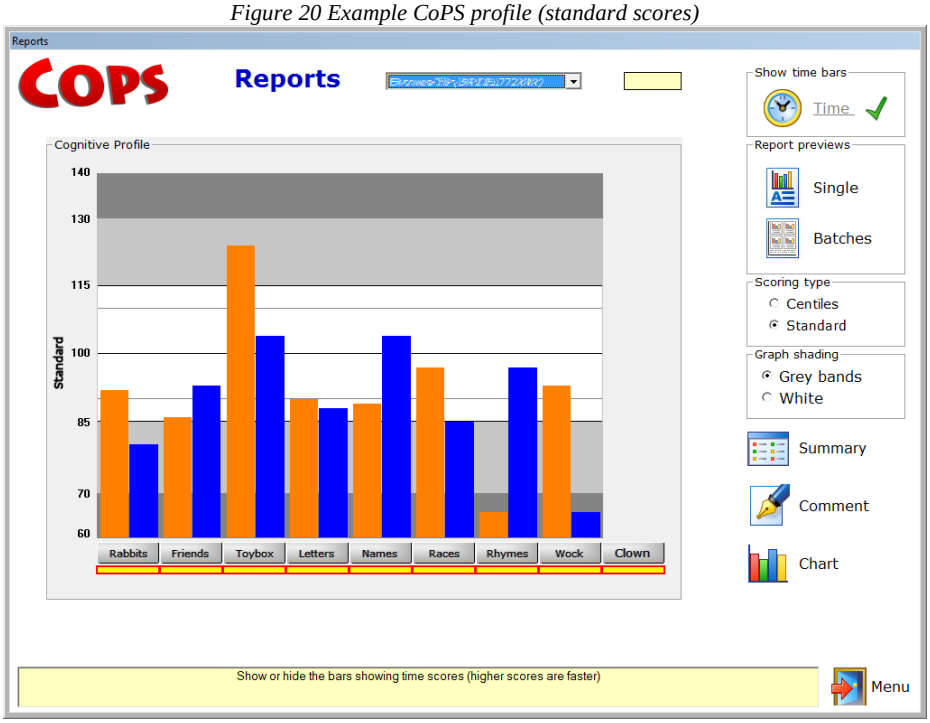
If the pupil has completed the Clown test you can view his/her performance by clicking on the Clown button as shown in Figure 19. A table will then be displayed showing if any errors had been made by the child with the Clown test.



When you have finished considering results from Clown test you can view the main cognitive profile from the Report Generator main page (see Figure 20). The red bars (left hand bar of the pair) indicate the child's overall accuracy for the whole test. The blue bars (right hand bar of the pair) indicate the child's

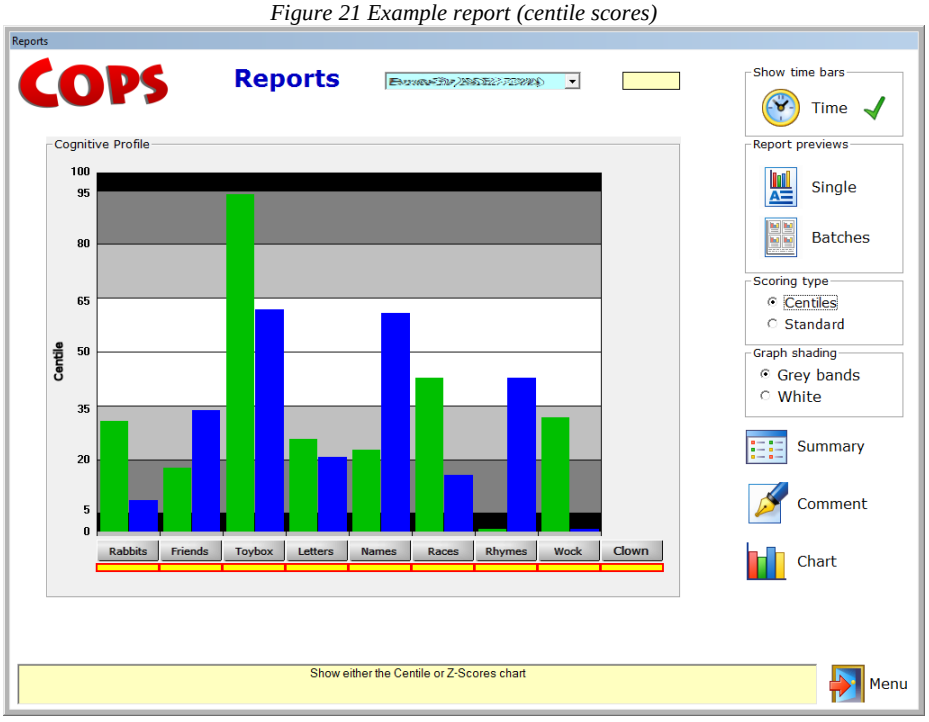
overall time to complete the test. The accuracy data can be displayed alone (without the time data). Some teachers may find considering the accuracy data alone in the first instance easier to interpret. By pressing the **Time** button (see Figure 20) the accuracy data can be viewed in isolation, however it is recommended that the time data always be considered when interpreting the results in totality.

Figure 20 Example CoPS profile (standard scores)



The appearance of the graphical profile can be altered by selecting **White** in the *Graph shading* panel. This will make the bars more readable, especially when printing out reports (See Figure 21).

Figure 21 Example report (centile scores)

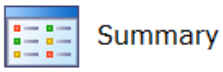


4.1.2. Comment

The **Comment** button is available to allow the teacher to add a specific paragraph to each child's Report when printed out. This can be used as valuable additional information for the school, teacher or parents about that particular child in addition to his or her CoPS results. The comment may have between 16 and

20 lines of text depending upon the software version. The comments can be viewed in the Report preview screen (select **Single**). Comments are not displayed in the multiple (batch) reports.

4.1.3. Charts and scores



Performance of each test can be viewed in a variety of ways. Test totals are indicated in the *Summary Data table* (select **Summary** option shown on the left), the *Data tables*, or the *Graphical Profile*. The most frequently used will be through the *Graphical Profile* as seen in Figure 20. The profile can be viewed in either centile or standard scores. The *Graphical profile* automatically charts the individual child's performance against those of the norm referenced group, based on the child's age in the following bands: 4:0 – 4:11; 5:0 – 5:11; 6:0 – 6:11; 7:0 – 7:11; and 8:0 – 8:11.

4.1.3.1. Centile scores

These can be viewed by selecting the option 'Centiles' in the Scoring type panel on the right of the bar chart. The individual's score is shown with reference to the population norms in centile units.

Centile (or percentile) values range from 1 to 99. A centile score of 63 means the child's score lay at the point where 63% of the population scored less, and 37% scored more.

A centile *time* score of 99 means the child performed at a speed where 99% of the population were slower and only 1% were faster. ***Be careful not to misinterpret the time data*.**

4.1.3.2. Standard Scores

These can be viewed by selecting the option 'Standard' in the Scoring type panel on the right of the bar chart. The individual's score is shown with reference to the population norms in standard scores.

Standard scores have a mean (average) of 100 and a standard deviation of 15. This means, for example, that a score of 85 is one standard deviation below the mean for the population, and a score of 130 is two standard deviations above the mean for the population.

4.1.3.3. Z-Scores

These are no longer available in bar chart form, but are shown in tabular form on single page reports and by selecting 'Summary' to the right of the bar chart. The z-scores are converted directly from the centile scores maintaining a normal distribution. These charts may be of greatest interest to a trained psychologist or others familiar with working with standard deviation units.

Z scores have a mean (average) of 0 and a standard deviation of 1. This means, for example, that a score of -1.0 is one standard deviation below the mean for the population, and a score of +2.0 is two standard deviations above the mean for the population.

4.1.3.4. Missing scores

If bars are missing from any of the tests represented on the chart then the child did not attempt or did not *complete* that test.

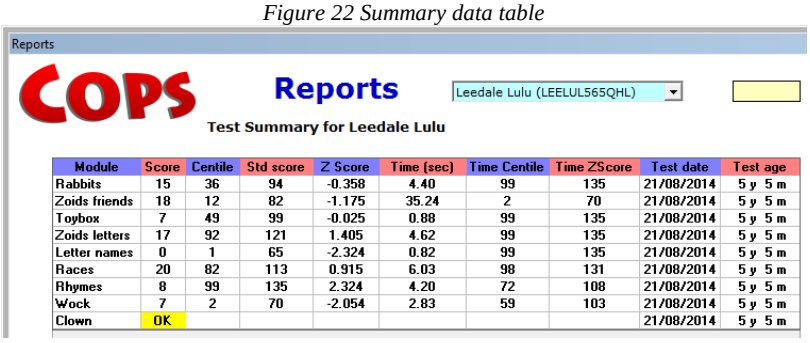
4.1.4. Data tables

Tables are split into the Summary table and the individual Test tables.

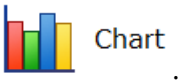
4.1.4.1. Summary table

This is viewed by pressing the **Summary** button and will show the total scores obtained in each test in raw scores, centiles, standard scores and z-scores as well as the date the test was completed and the child's age on that date (See Figure 22).

Figure 22 Summary data table



Module	Score	Centile	Std score	Z Score	Time (sec)	Time Centile	Time ZScore	Test date	Test age
Rabbits	15	36	94	-0.358	4.40	99	135	21/08/2014	5 y 5 m
Zoids friends	18	12	82	-1.175	35.24	2	70	21/08/2014	5 y 5 m
Toybox	7	49	99	-0.025	0.88	99	135	21/08/2014	5 y 5 m
Zoids letters	17	92	121	1.405	4.62	99	135	21/08/2014	5 y 5 m
Letter names	0	1	65	-2.324	0.82	99	135	21/08/2014	5 y 5 m
Races	20	82	113	0.915	6.03	98	131	21/08/2014	5 y 5 m
Rhymes	8	99	135	2.324	4.20	72	108	21/08/2014	5 y 5 m
Wock	7	2	70	-2.054	2.83	59	103	21/08/2014	5 y 5 m
Clown	OK							21/08/2014	5 y 5 m

To return to the graphical profile press this button 

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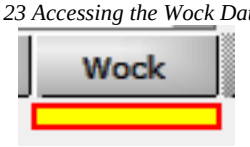
4.1.4.2. Test tables

These provide a much more detailed analysis of the child's responses. Individual responses to each item are recorded and can be viewed in the *Data tables*. These are accessed by clicking on the test name button at the bottom of the bar as shown on the *Graphical profile*. For example, to view the Data table for *Wock* click on the grey button marked 'Wock' from the Graphical profile screen (see Figure 23).

Figure 23 Accessing the Wock Data table



An example Data table of *Wock* is shown in Figure 24. The column widths may be altered by hovering the mouse pointer over the gap between two grey column headers, waiting for the mouse pointer to change from a cross to a double cursor, then clicking and dragging the column to the desired width.

Figure 24 Wock Data table

Test data for Wock

Test level	Target alien	Target pos	Distracter	Target word	Word chosen	Time	Correct
1	Green	Left	buck	duck	duck	1.05	1
2	Purple	Left	shun	sun	sun	0.75	1
3	Purple	Right	pool	tool	pool	1.13	0
4	Green	Right	bruss	brush	brush	1.27	1
5	Purple	Left	fan	van	van	0.80	1
6	Green	Right	beg	peg	peg	1.30	1
7	Green	Left	fesh	fish	fish	1.23	1
8	Green	Right	wock	rock	rock	1.32	1
9	Purple	Left	tart	cart	cart	3.32	1
10	Purple	Right	pop	pot	pot	4.21	1
11	Green	Right	hant	ant	ant	6.77	1
12	Green	Left	luck	lock	lock	6.17	1
13	Purple	Right	cham	jam	jam	3.81	1
14	Green	Left	hak	hat	hak	3.40	0
15	Purple	Left	boat	goat	goat	0.91	1
					Child's total	37.44	13
					Child's avge	2.50	
	Paused: 0				Popul'n mean	3.11	14
	Repeated: 0				Popul'n SD	1.18	1

Accuracy scores, items chosen, correct items and timings are shown as well as population means and standard deviations. A data table is available for each of the nine tests completed and each of these can be printed out. To return to the graphical profile, click the **Chart** button.

4.1.5. Printing

Profiles and data tables seen in the *Report Generator* can be printed out by selecting the button **Single**. If the graphical profile is on display the CoPS Print Preview Page will be shown (Figure 25).

The Print Preview screen shows the report exactly as it will be printed as an A4 sheet. There are Zoom buttons to enlarge the report window. The *Preferences* panel has tick boxes which can be cleared to remove components from the report. The button called **Copy** can be selected to copy the entire report to the Windows clipboard as a Windows Metafile, which may then be pasted into other applications such as word processors or spreadsheets.

By selecting the **Batches** button, the profiles of up to 8 pupils per page can be previewed and printed out. Printing out batches of profiles saves a great deal of time and allows inspection of the profiles of entire classes (Figure 26).

To create a batch report (which may contain multiple pages) select the students whose graphical profiles you wish to include by highlighting them on the *Batch list* panel (Figure 26). Then click on *Create batch report* to complete the process. You can use the *Group Filter* drop-down list to show only students within a particular group.

The panel entitled *Student label* has options to show either the name of the student or his/her CoPS ID above the graphical profile. The panel *Background* allows you to change the background on the profiles, using either grey bands or plain white.

The *Copy* option copies the page on display to the clipboard. The *Print* option will allow all or any of the pages (whether displayed or not) to be printed out

Figure 25 Print Preview page

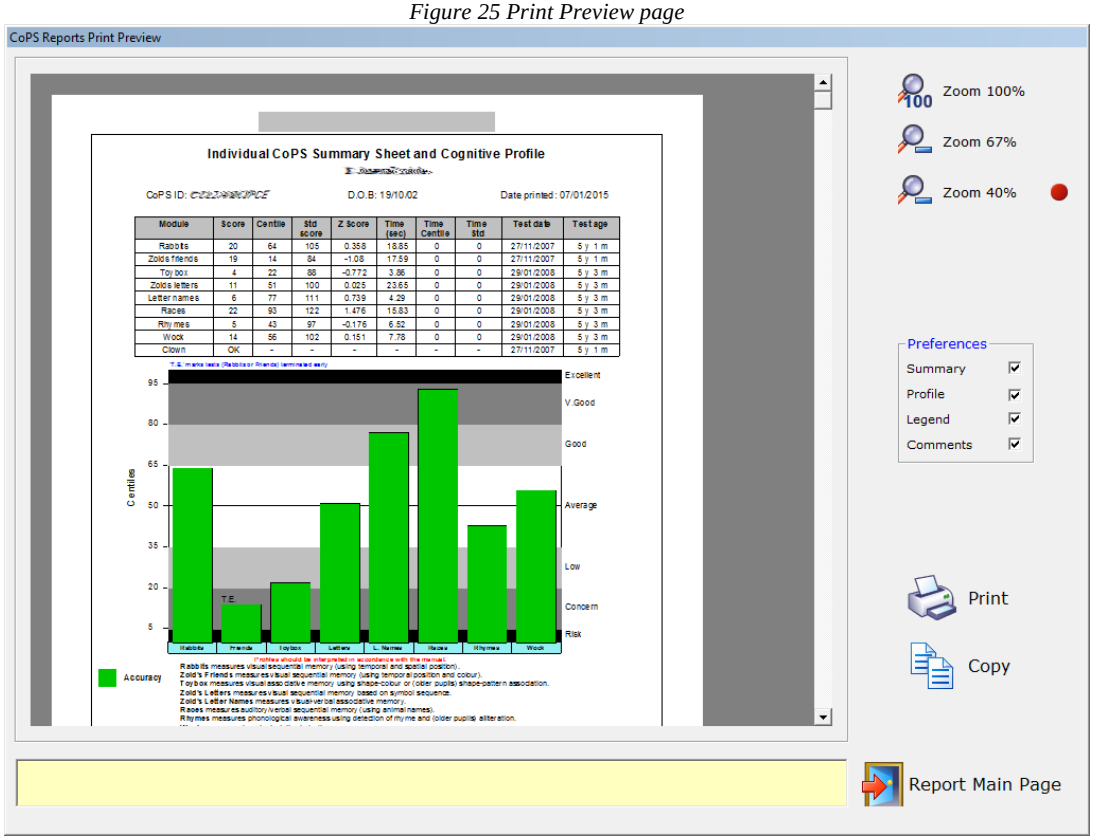
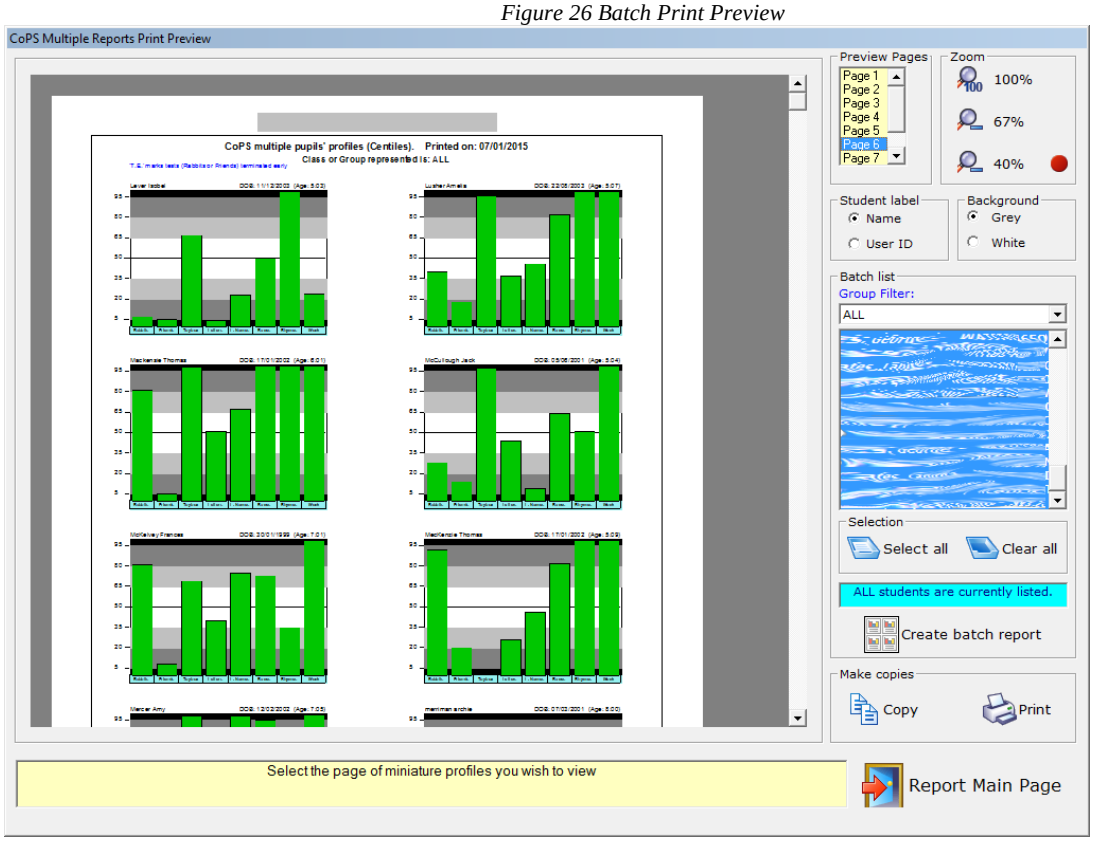


Figure 26 Batch Print Preview



It is the responsibility of the person administering CoPS to store and maintain records relating to the use of this system and we strongly recommend that you print out all reports (graphical profiles and all the tables) that are or may be necessary for all of your possible present and future requirements. This recommendation is in addition to maintaining sufficient archiving and backup copies.

4.1.6. Copying CoPS reports screens to another application

CoPS *Raw Data tables* can be copied to other applications such as word processors, spreadsheets etc. First, select the portion of the table to copy by clicking and holding down the mouse button on the first cell of the selection, dragging the mouse pointer to the last cell of the selection to be copied. With the selection highlighted, press the **Ctrl** and **C** keys together to copy this selection. Start the other Windows application (e.g. word processor) and go to the place where you wish to "paste" the selection. Press the **Ctrl** and **V** keys together to paste the selection. This facility can be very helpful when composing and compiling the reports and records that are required as part of your record keeping responsibilities.

Individual and batch reports can be copied with a single mouse click to the clipboard as a *Windows Metafile* which can then be pasted as a single object into an application such as a word processor.

4.2. Understanding CoPS scores

For each CoPS test, results are calculated by the program and are shown both for *accuracy* (red or orange bars on the Profile) and *time* (blue bars on the profile). Of these, *accuracy* is usually the most important indicator. CoPS results for both accuracy and time on each individual test are available in four forms:

- Raw scores
- Standard scores
- Centiles
- Z-scores (see Section 4.1.3.3)

Raw scores are accessed via the on-screen *Data tables* for each CoPS test, which also show the means and standard deviations for the population norms of each test. For an explanation of how to access Data tables, see Section 1.6.1. A *Summary Table* shows mean scores for all tests taken. Centile and standard scores are shown in graphical form as bar charts on-screen and both these and the data tables can be printed out if desired. The *Graphical profile* automatically charts the individual child's performance against those of the norm referenced group, which is based on the child's age in the following bands: 4:0 – 4:11; 5:0 – 5:11; 6:0 – 6:11; 7:0 – 7:11; 8:0 – 8:11.

Of the four types of scores, standard scores will generally be most useful for teachers, although educational and clinical psychologists may prefer to work with z-scores (for more information on z-scores see Section 4.1.3.3). Standard scores are increasingly used in assessments (such as CoPS) which use national norms; any student's performance in a test can be compared with those of the other pupils of the same age range. The mean standard score is 100 with a standard deviation of 15. Sixty-eight percent of pupils will lie within the range of plus or minus one standard deviation (85 to 115 standard score).

A centile score (sometimes referred to as a 'percentile score') should not be confused with percent correct. It reflects a child's ability on any given test on a scale of 1 to 99 in comparison with other children in the reference group (i.e. the norm group or the same age group). Hence the average child will obtain centile scores in the middle range (e.g. in the range 35 – 65), whilst an above-average child will have centile scores higher than this, and the below-average child will have centile scores lower than this. For example, a child with a centile score of 5 will be just inside the bottom 5% of children for that particular ability, and a child with a centile score of 95 will be just inside the top 5% of children for that particular ability.

4.2.1. Accuracy scores

How low must a CoPS individual test result be before the teacher should be concerned about the child's performance? Put another way: what is the critical cut-off point or threshold that can be used when deciding whether or not a given child is 'at risk'? Unfortunately, this is not a question that can be answered in a straightforward fashion, because much depends on other factors. These include: (a) the particular CoPS test under consideration (some tests are more highly predictive of later literacy difficulties than others), (b) whether the results of other individual CoPS tests confirm or disconfirm the result being examined, (c) the age of the child being tested, and (d) the school's or LEA's own SEN criteria or thresholds.

Conventional SEN thresholds are: below 20th centile (i.e. the '1 child in 5' category) and below the 5th centile (the '1 in 20' category). Approximate equivalent standard (SS) scores are: below SS 85 and below SS

70 (i.e. one and two standard deviations below the mean, respectively), which are widely used as an SEN threshold. Note, however, that SS85 is strictly equivalent to centile 17 and SS70 is strictly equivalent to centile 3.

Teachers need to use their own judgement about such thresholds. Not only should teachers endeavour to take other relevant factors into account in addition to CoPS results, but also they will be able to facilitate the development of their own judgement about CoPS profiles by following up the progress of children who have been screened using CoPS, over as long a period as possible, and seeing how they develop in relation to their original CoPS profile. (Of course, the effects of any teaching or training must also be taken into account.)

4.2.1.1. The Threshold of Concern

A good rule of thumb is to regard as a matter of *concern* any individual CoPS test result which falls **below the 20th centile or standard score 85** (i.e. near or below *one* standard deviation below the mean). This is a fairly conventional cut-off point in identifying special needs or moderate educational weaknesses. In this Manual it will be referred to as the '**Threshold of Concern**' (about 1 child in 5). A child who falls below this threshold should be *considered* for intervention of some kind, depending on other factors (see below). Sometimes a weakness is identified which can be remedied by appropriate training. In some cases the problem is more pervasive and requires a differentiated approach to teaching in basic skills. Where there is strong confirmation (e.g. a *number of related tests* at or below the 20th centile or SS85) then the assessor can be convinced that concern is appropriate.

4.2.1.2. The Threshold of Risk

On the other hand, where a child is scoring **below the 5th centile or standard score 70** on any particular test (near or below *two* standard deviations below the mean), this generally indicates a serious difficulty and should always be treated as diagnostically significant. Usually this will be a strong indication that a child is at risk of later literacy and/or numeracy difficulties. In this Manual this will be referred to as the '**Threshold of Risk**' (about 1 child in 20). Remediation by way of training will often be required as well as a differentiated approach to basic skills teaching. Again, where there is strong confirmation (e.g. a *number of related tests* at or below the 5th centile or SS70) then the assessor can be even more confident about the diagnosis.

4.2.2. Differences between tests

Some CoPS tests are more highly predictive of later literacy difficulties than others. For example, ***Races*** and ***Rhymes*** (given at age 5 years) are the CoPS tests which most consistently show the best correlation with literacy at 6 years 6 months and 8 years[4]. This exactly what would be expected, given the research on cognitive predictors carried out by Ellis and Large (1987), Jorm *et al*. (1986), and many other researchers. After ***Races*** and ***Rhymes***, ***Wock*** shows the next highest correlation, but higher at 6 years 6 months than at 8 years, which suggests that the importance of auditory discrimination in reading development (although still significant) decreases somewhat during that period. However, although this is probably true of readers in general, auditory discrimination remains and important factor for the poorer readers and most of those who are dyslexic. The next highest correlations are produced by ***Zoid's Friends*** and ***Rabbits,*** with ***Zoid's Letters*** having a higher correlation at 6 years 6 months than at 8 years. Again, this latter finding suggests that for most readers simple sequential memory for letter shapes as a componential factor in reading declines in importance over that period, although it will still remain significant for the poorer readers and many dyslexic children. The associative (as opposed to sequential) memory tasks (***Toybox*** and ***Zoid's Letter Names*****)** showed the lowest (although still statistically significant) correlation with later reading ability, but in the Windows version these tests have been redesigned in order to improve predictive validity. Differential predictive efficacy is probably due to quite different factors operating. ***Toybox*** is quite easy for most children in the 4 to 8 year old range, whereas ***Zoid's Letter Names*** is much more difficult. In fact, many dyslexic adults cannot do ***Zoid's Letter Names*** very well. Of course, the results have been standardised to permit comparison between different tests and with the population of children of that age. Nevertheless, it was important to include these two tests in the CoPS suite because otherwise there would not have been any measures of *associative* memory for the teacher to rely on. Particularly in the case of a child who has difficulties with *sequential memory* — i.e. keeping those

[4] Correlation is a measure of the extent to which scores obtained by an individual on one variable (e.g. a CoPS test) can predict scores on another variable (e.g. reading) either at the same time or at some later date.

letters and sounds in the right order — it is important for the teacher to know whether *associative memory* is intact. If the child's scores on ***Toybox*** and/or ***Zoid's Letter Names*** are satisfactory, then at least the teacher knows that the child should be able to cope with the memorisation of basic associations (e.g. between letters and sounds). Another reason for including ***Toybox*** in the final CoPS suite is that has a high correlation with later *numeracy skills*.

4.2.3. Time scores

Time scores are shown on-screen by the blue bars on the graphical profile and these can be turned on and off by clicking on the **Time** toggle button. A high time score is one in which the child completes the test more quickly than average and is shown in centile terms by blue bars extending into the upper portion of the bar chart. The 95th centile and above will comprise the fastest 5% of children, and the 5th centile and below will comprise the slowest 5% of children. The equivalent Standard scores are 125 and 75 respectively.

Time results can be useful to the teacher in a number of ways. Broadly, the teacher should look at:

- **the overall pattern of time results**
- **time scores for individual tests**

4.2.3.1. The overall pattern of time results

The overall pattern of time results from all the tests for an individual child can tell the teacher whether the child is generally *fast, average* or *slow* at carrying out the CoPS tests. However, time results inevitably show wide variability between children (this is indicated by the relatively large *standard deviations* in the data tables) and when interpreting CoPS, time scores are not nearly as important as accuracy scores. Children with *attention deficit hyperactivity disorder* (ADHD) tend to be relatively fast and children with *developmental co-ordination disorder* (sometimes called 'clumsy' children) tend to be rather slow. However, data are still being collected on this, so fast or slow times on CoPS tests should not be used diagnostically at the present time. Fast times, when associated with low accuracy, may indicate AD/HD, *but not necessarily*. Whenever there is a significant negative correlation between time and accuracy (i.e. fast times being linked with low accuracy, and slow or average times being linked with average or high accuracy), the data should be regarded as suspicious. In such circumstances it is likely that the child has been rushing some of the tasks, or perhaps responding impulsively. A *negative correlation* between time and accuracy on CoPS, therefore, may suggest ADHD. Research on this topic is in progress, but until we have more information, CoPS should obviously be used with caution for the assessment of such children.

All centile and standard scores for times are shown relative to the norms. However, it might be assumed that younger children in the age group will inevitably show slower *raw* scores for time and those somewhat older will show faster *raw* scores for time. Our research data suggests that whilst, in general, younger children do tend to be slower, *this is not always the case* and, more importantly, the standard deviations tend to be comparatively larger, indicating greater variability in the scores of the younger group. Younger children certainly *can be slow* because of poor mouse control, but also they can sometimes produce relatively fast times. This tends to be due to boredom, fatigue, or impulsivity, or sometimes because the child has perceived that the task level has become too difficult and has consequently ceased to make the necessary effort. Older children are often relatively quick, but sometimes they take rather longer because they are being more careful and thoughtful in their responses. In all these cases it is recommended that the teacher should record any observations about the child's rate of responding on the **Comments Sheet** (see Appendix, page 101), which may then be referred to when interpreting the cognitive profile.

Of course, a fair number of children will have had little or no experience of using a mouse, and that is bound to result in slow times, especially at first. For this reason, *mouse practice* should always be given the first time a child is being tested, and at the start of subsequent testing sessions if the teacher feels that this is necessary. On those rare occasions where a child has completed all, or most, of the CoPS tests in one session (this not generally recommended, however) it has usually been found that children's mouse control at the end of the session is noticeably better than at the start of the session.

4.2.3.2. Time scores for individual tests

Observation of time scores for individual tests usually enables the teacher to check whether the child has approached the task carefully enough for the accuracy score to be relied upon. Conscientious use of the **Comments Sheet** when testing will also help the teacher to resolve cases where it appears that the child was unwell, inattentive, distracted, or poorly motivated. Obviously, if a child has a number of low accuracy scores coupled with high time scores for those same tests, it strongly suggests that the child has simply been doing the test too quickly. If he or she slowed down to a more reasonable rate then the accuracy score might then be within the average range. If the teacher suspects that this is what has happened, then it would be a legitimate reason for repeating the test(s) in question. On the other hand, if the child has a high time score coupled with an average or above-average accuracy score for that particular test, then the teacher has no cause for worry.

It is important to appreciate that different children can all achieve similarly fast times, but for quite different reasons. Correspondingly, different children can all achieve fairly slow times, but for equally different reasons. Time scores can sometimes reflect personality factors. Some children are by temperament slow, meticulous and careful, others are fast, impetuous and careless. Some children are slow and still fail to achieve high accuracy, and a few are surprisingly fast but achieve high accuracy throughout. Teachers will hopefully be able to bring to the process of interpretation some awareness of these temperamental factors in their pupils.

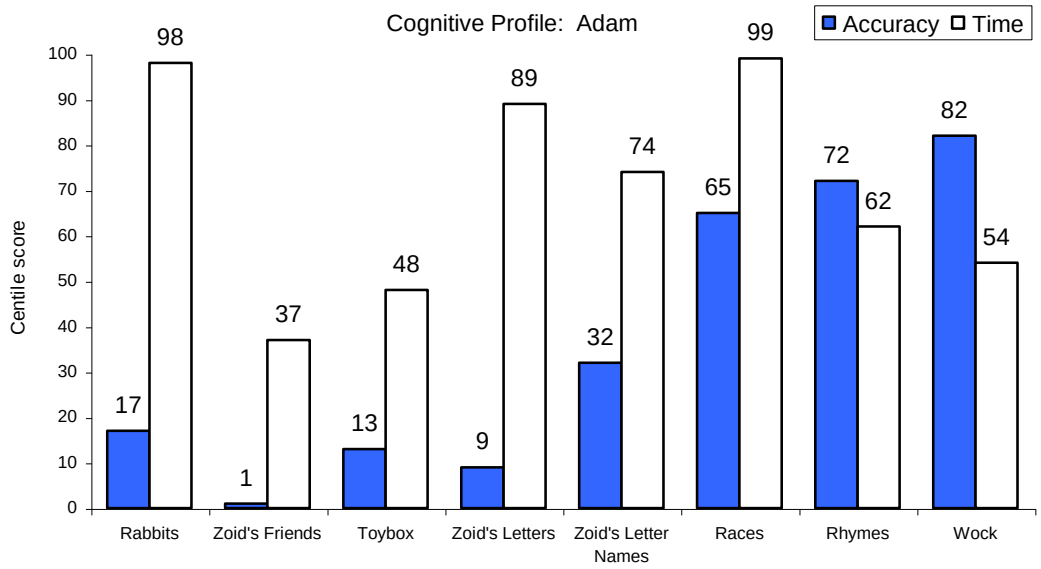
Speed can even change within a test. For example, sometimes a child who has previously been careful and thoughtful in their responses will start responding very quickly in the latter stages of a test. This usually happens if the test level has become too difficult for them (e.g. the latter levels of ***Zoid's Friends***). This becomes apparent if you examine the data table for the test, which will show whether the child has been making errors throughout the test or mainly in the later stages. Under the latter circumstances, the accuracy scores may still be regarded as valid, even though time scores may be rather high. However, it can also happen if the child has simply become fatigued because they have been asked to do too many tests in a single session. Obviously in this case the test would have to be repeated on another occasion when the child was fresh.

4.2.3.3. Case studies showing fast response times

Occasionally, however, a child who is consistently a fast responder shows some low accuracy scores. In such a case, even though there is a big discrepancy between the time scores (high) and the accuracy scores (low), the accuracy scores may still be relied upon, especially if there is good confirmation from other CoPS tests.

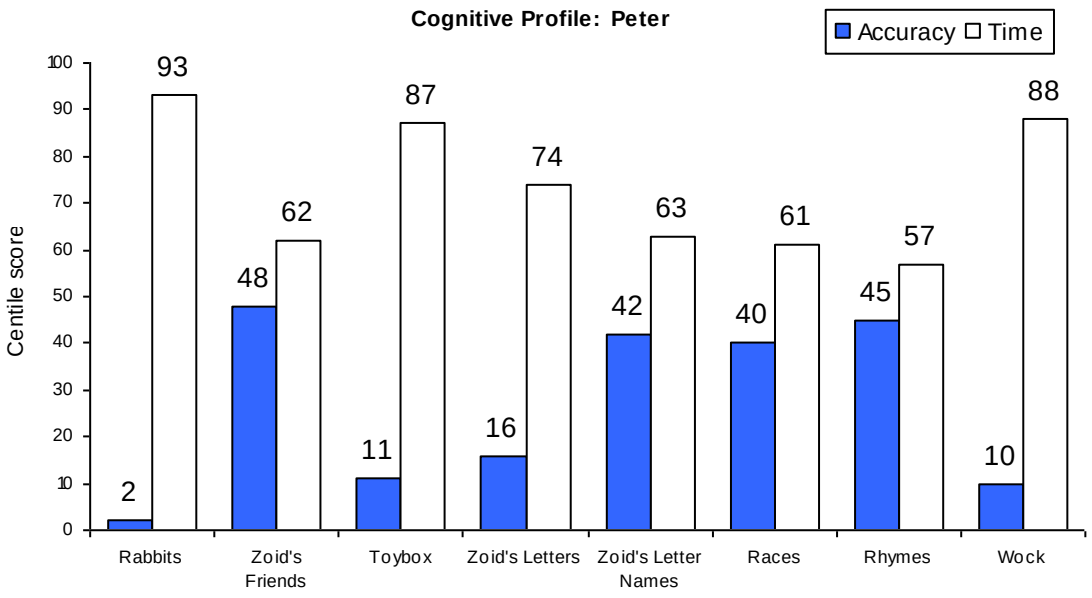
An example of this is given in Figure 27, which shows CoPS centile scores for Adam, who is nearly six. He displayed consistently poor accuracy scores for the visual tests, but average or above-average scores for the auditory/verbal tests. All time scores were high. Even though he was quite bright (WISC-III Full Scale IQ 123) and despite being in school for about eighteen months, he was making abysmal progress in reading and writing. Although he tried very hard, he could not remember letter shapes or visual word patterns very well. His father once commented, "Adam learns with his ears". However, he had slight hyperactive tendencies and was orally extremely fluent, so his teacher had assumed that he just needed to settle down and concentrate better and then he would begin to learn without any special or individualised teaching. In fact, CoPS indicated that he was *visually dyslexic* (a diagnosis later confirmed in full psychological assessment) and only when he received appropriate teaching using a structured phonic approach, did he begin to make significant improvement. In Adam's case, although he did obtain scores on some tests which showed a large discrepancy between accuracy and time, high time scores were *normal* for him and so did not diminish the validity of his accuracy scores.

Figure 27 Case study—Adam



Consider, on the other hand, CoPS centile scores for Peter, which are shown in Figure 28. In Peter's profile we notice that the normal process of interpretation is confounded by a high negative correlation between speed and accuracy, where tasks that have low accuracy scores have been attempted far too quickly. By contrast, those test which have average accuracy scores have been attempted at rates within the average range. This inconsistency is also apparent if one attempts to interpret Peter's profile of accuracy scores. Thus, auditory discrimination (***Wock***) appears poor, but nevertheless Peter has still managed an average performance on ***Rhymes***, ***Races*** and ***Zoid's Letter Names***, all of which demand good auditory discrimination and listening skills, which is clearly contradictory. Similarly, ***Rabbits*** gives a very poor score, suggesting visual sequential memory problems, but ***Zoid's Friends*** is satisfactory, which appears to contradict this view (although it must be acknowledged that ***Rabbits*** and ***Zoid's Friends*** do assess somewhat different aspects of visual sequential memory, so it is not necessarily an inconsistent finding). However, some young children, especially if they have attempted computer games of older siblings, erroneously assume that the only approach to all computer games is to 'shoot everything in sight as quickly as possible'. They tend to point and click without really thinking about what they are doing. The recommendation with Peter would therefore be to re-test, explaining to him that he must *think* about the tasks carefully and must *not* rush them.

Figure 28 Case study—Peter



4.2.4. Age equivalents

Although as a general rule, CoPS should not be used outside the age range for which it is normed (4:0 to 8:11), there are exceptional circumstances when it is permissible to do so. For example, in the case of a very bright or advanced three-year-old or a child of nine or over with moderate or severe learning difficulties. Here, the norms may not be particularly helpful because they would be comparing the child with (in the first example) four-year-olds, and (in the second example) eight-year-olds. In such cases, age equivalents can often provide the teacher with more useful information. In fact, some teachers in special education prefer to work with age equivalents rather than centiles or standard scores, because it enables them to conceptualise the ability level of the child they are teaching, and so pitch the work at the correct level. An age equivalent is defined as the chronological age range of children that would be expected to achieve a given raw score.

Age equivalents are designed to be used only in exceptional circumstances such as those illustrated above and should not be used routinely in cases where centile or standard score norms are applicable, because age equivalents give only a very rough approximation of the child's ability. Nor should CoPS be used routinely above the age of 7 years 11 months because there is an assessment suite designed specifically for, and standardised for use with, this older age group, i.e. **LASS 8-11** (for further information visit our website www.lucid-research.com).

Tables of age equivalents for CoPS accuracy scores have been provided in the Appendix, which teachers may consult if they wish — see Section 11.5. Note that age equivalents are given only for CoPS accuracy scores; the construction of the CoPS tests, with different levels, varying numbers of items and different difficulties related to chronological age, means that age equivalents for time scores would not be helpful.

4.3. General issues in interpretation

4.3.1. Adopting a 'problem solving' approach

Interpretation of CoPS Cognitive Profiles requires some thought. CoPS is a complex instrument and a careful, problem-solving approach is necessary. Teachers should resist the temptation to seek instant answers but instead should get used to considering a number of essential issues before reaching a conclusion. At first this approach may seem unfamiliar and a little slow, but with experience the task becomes quicker and easier. It is important not to lose sight of the fact that the interpretation (particularly in the case of the 'at risk' child) is likely to have a *significant effect* on the child's education, and such decisions should not be made lightly or hurriedly.

In trials carried with CoPS, many teachers reported that they found the task of interpretation a challenge at first, but with practice they soon became quite confident and were more adept at using the system as a basis for making decisions about the most appropriate teaching for individual children. Teachers should therefore take heart from these experiences and persevere with the new strategy which CoPS provides them. A brief guide to interpretation is given in Section 4.4. This may be used as a starting point for interpretation but will not give sufficient information to enable a proper interpretation to be carried out.

In this Section, unless otherwise specified, the terms 'scores' or 'results' should be taken to mean measures of the *accuracy* of the child's performance. The red or orange bars on the graphical profile show accuracy. In addition, however, CoPS gives the teacher information on the times (i.e. information processing speed or rate) of all the child's responses, which are shown by the *blue* bars on the graphical profile. The interpretation of time scores is explained later on in this Chapter 4.2.3.

Consistent with sound educational practice in general, and with the *Special Educational Needs and Disability Code of Practice: 0-25 year.* (2014) in particular, teachers should not regard assessment as a single event, but rather as a continuing process. CoPS results should be considered together with other information about the child, including formal data from sources such as SATs and the Foundation Stage Profile, and informal observations made by the teacher. Strategies for intervention should not be regarded as set in stone, but should be flexible and responsive to a child's progress (or lack of progress). When reviewing a child's progress or Individual Education Plan it may be helpful to reassess the child using CoPS, or, if the child is between 8 and 11 years by this time, **LASS 8-11** (see Section 1.1).

4.3.2. Identifying dyslexia

4.3.2.1. What is dyslexia?

It is not possible here to give a detailed account of the nature of dyslexia. Readers are recommended to consult any one of a number of reputable texts, including Miles (1993), Miles and Miles (1999); Reid (1998), Snowling (2000) and Thomson (1993). The genetic and neurological bases of dyslexia are now well established and reflected in most current definitions of the condition. For example, the International Dyslexia Association (formerly the Orton Dyslexia Society) published the following definition of dyslexia:

> *"Dyslexia is a neurologically-based, often familial disorder which interferes with the acquisition of language. Varying the degrees of severity, it is manifested by difficulties in receptive and expressive language, including phonological processing, in reading, writing, spelling, handwriting and sometimes arithmetic. Dyslexia is not the result of lack of motivation, sensory impairment, inadequate instructional or environmental opportunities, but may occur together with these conditions. Although dyslexia is life-long, individuals with dyslexia frequently respond successfully to timely and appropriate intervention"* (Orton Dyslexia Society, 1994).

However, not all authorities agree that we have sufficient evidence to produce a convincing definition of dyslexia that incorporates aetiology (as in the one given above). In 1999 a Working Party of the British Psychological Society's Division of Educational and Child Psychology produced a report designed to help psychologists deal with the problems of how to assess children with dyslexia (BPS, 1999). This group reviewed — albeit inconclusively — research findings and theories in the field, and decided to produce a 'working definition' that was free of aetiological and theoretical assumptions:

> *"Dyslexia is evident when accurate and fluent word reading and/or spelling develops very incompletely or with great difficulty. This focuses on literacy learning at the 'word level' and implies that the problem is severe and persistent despite appropriate learning opportunities. It provides the basis for a staged process of assessment through teaching."* (BPS, 1999, p. 8).

Although the intentions of the BPS Working Party appear to have been to produce recommendations that had a close fit with the 1994 SEN Code of Practice — which, on the face of it, seems commendable — as far as *early* identification of dyslexia is concerned, arguably they represent a retrogressive step. On the basis of the approach advocated in the BPS report, before identifying a child as having dyslexia, it first has to be shown that the child is struggling to a great extent in literacy and that, despite additional input, difficulties have persisted. Early identification would therefore seem to be ruled out because diagnosis is *predicated on failure*, a regrettable return to the position that applied to special educational needs legislation and practice in the 1980s and which the *1993 Education Act* sought to do away with. The rationale behind CoPS is the identification of cognitive precursors of dyslexia and other problems in the development of literacy and numeracy, which the teacher can use (together with other information about the child) to formulate flexible intervention strategies with which to tackle the problems before they precipitate outright failure (see Singleton, 2002, 2003). This is entirely consistent with the *Special Educational Needs and Disability Code of Practice: 0-25 years, 2014*, which stresses the importance of early identification of special educational needs.

4.3.2.2. Characteristics of dyslexia

Dyslexia is a variable condition and not all people with dyslexia will display the same range of difficulties or characteristics. Nevertheless, the following characteristics have been widely noted in connection with dyslexia.

- A marked inefficiency in the *working or short-term memory system*, which is regarded by many experts in the field as the fundamental underlying difficulty experienced by people with dyslexia (e.g. Beech, 1997; McLoughlin, Fitzgibbon and Young 1993; Rack, 1997; Thomson, 2001). Memory difficulties may result in problems of retaining the meaning of text (especially when reading at speed), failure to marshal learned facts effectively in examinations, disjointed written work or an omission of words and phrases in written examinations, because pupils have lost track of what they are trying to express.
- Inadequate *phonological processing abilities*, which affects the acquisition of phonic skills in reading and spelling so that unfamiliar words are frequently misread, which may in turn affect comprehension. Not only has it been clearly established that phonological processing difficulties are seen in the majority

of children with dyslexia (e.g. Snowling, 2000), but research has also indicated that this occurs in many adults with dyslexia (see Beaton, McDougall and Singleton, 1997a).

- *Difficulties with motor skills or coordination.* Nicolson and Fawcett (1990, 1994) have noted that people with dyslexia can show a particular difficulty in *automatising skills*. Examples of failure to automatise skills in the pupil situation might be the inability to listen with understanding while taking adequate notes, or the inability to concentrate on both the spelling and the content of written work. *Dyspraxia* is the generic term used to cover a heterogeneous range of disorders affecting the initiation, organisation and performance of action (Ayres, 1985; Fisher et al, 1991; Ripley et al, 1997). In childhood it is sometimes referred to as developmental coordination disorder. Pupils with dyspraxic difficulties are likely to have problems with handwriting, especially for when writing for lengthy periods or under conditions of time pressure. It should be noted that by no means all pupils with dyslexia will necessarily have dyspraxic difficulties.
- A range of problems connected with *visual processing*, which can affect reading generally, but especially when dealing with large amounts of text. Such problems can include *binocular instability* and susceptibility to *visual stress* (see Evans, 1997, 2001; Evans, Drasdo and Richards, 1996; Stein, Talcott and Witton, 2001; Wilkins, 1991, 1995, 2003). *Visual discomfort* is a generic term for the effects of hypersensitivity to the irritating effect of strong visual contrast or rapid flicker (e.g. where parallel lines of text create the appearance of a black-and-white grating or consciously or subconsciously perceived flicker of fluorescent lighting or some computer monitors). Movement and colour illusions can be perceived, or the text may appear unstable or obscured. Reading for any length of time may cause headaches and eyestrain, and so can be done only in short bursts, which can disrupt the comprehension process. In some medical conditions (e.g. epilepsy and migraine) susceptibility to visual discomfort is generally more extreme than is usually seen in cases of dyslexia (Wilkins, 1995). It should be noted, however, that although there appears to be a statistical association between dyslexia and visual discomfort, *not all* persons with dyslexia are highly susceptible to visual discomfort and *not all* persons who suffer from visual discomfort will necessarily exhibit the typical characteristics of dyslexia outlined above. There is evidence that use of coloured overlays or filters (e.g. by use of acetate sheets or tinted lenses) can be beneficial in alleviating the symptoms of visual discomfort in a fair proportion of cases (Irlen, 1991; Wilkins et al, 1994, 2001; Whiteley and Smith, 2001).

4.3.2.3. Theories of dyslexia

The term 'specific learning difficulty' (which for a generation or more has been preferred by many educational psychologists to the term 'dyslexia') means little more than a discrepancy between ability and attainment. The principal difference between 'dyslexia' and 'specific learning difficulty' is that dyslexia presupposes the existence of certain cognitive deficits which are believed to underpin the condition. Such cognitive deficits (e.g. in phonological processing, memory, visual processing, or motor co-ordination) are believed to be either inherited or due to neurological anomalies which have arisen before (or during) birth or in early childhood.

There are several theories of dyslexia, which space precludes a detailed discussion of here. There is little disagreement that the condition is a neurological one, and that it has genetic causes in most cases (see Fisher and Smith, 2001). However, the exact neurological and cognitive mechanisms are still the subject of widespread research and theoretical debate (see Frith, 1997). The predominant theory is that dyslexia is due to a fundamental deficiency in the processing of phonological information — this is usually referred to as the Phonological Deficit Theory (Rack, 1994; Rack, Snowling and Olson, 1992; Snowling, 1995). This theory is supported by a wealth of research evidence (for review see Snowling, 2000) but is complicated by it does not explain *all* the phenomena associated with the condition (see previous section). The 'Double Deficit' Theory (see Wolf and O'Brien, 2001) proposes that in addition to phonological deficits, dyslexic individuals have inherent problems in processing information at speed, which interferes with many cognitive activities, including reading and writing. Prominent alternative theories include the Magnocellular Deficit Theory (see Stein, Talcott and Witton, 2001), the Cerebellar Deficit Theory (see Fawcett and Nicolson, 2001), both of which have less evidence in support, but which address particular aspects of the condition that demand further research. Of course, it may turn out that there are distinct subtypes of dyslexia, for which different causal theories may be applicable (see Stanovich, Siegel and Gottardo, 1997).

4.3.2.4. CoPS profiles and dyslexia

The chapters that follow show how CoPS profiles can be used very effectively to identify dyslexia in most cases. Although the composition of the CoPS tests was determined by statistical analysis of longitudinal research data (see section 1.2), it can be seen that CoPS nevertheless seems to fit the phonological deficit model more closely than it fits the alternative models of dyslexia. Hence it should be expected that CoPS will be at its most effective in identifying children with the 'classic' form of dyslexia — which includes by far the majority of the group — characterised by cognitive difficulties that most notably affect the mapping graphemes onto phonemes. But CoPS is actually rather broader in its scope that first might meet the eye. Since it includes a number of key visual memory measures, CoPS is also adept at picking up 'atypical' cases of dyslexia where, instead of phonological deficits predominating, instead, the chief problem concerns visual memory. (Note, however, that CoPS it will not necessarily pick up children with other types of visual processing difficulties —such as susceptibility to visual stress — for which children may need to be referred to an eye clinic for further investigation; see Wilkins, 2003). Finally, a valuable advantage of including the separately normed time scores in CoPS is that speed of processing (and to some extent motor coordination) factors can also be taken into account. Thus in various ways CoPS encompasses a wide range of psychological correlates of dyslexia which have theoretical support from different camps. As an all-round screening and assessment tool, therefore, it has substantial theoretical validity as well as excellent predictive validity, the latter having been established in the original longitudinal study.

4.3.3. Must children be labeled?

Labels for different special educational needs (especially the label "dyslexia") have not been universally popular. However, labels are not always undesirable. Although all SEN children are individuals, there are broad categories that can be useful in teaching, and the history of SEN legislation reveals significant shifts in educational opinion on the matter. The *1981 Education Act*, which had encouraged a non-labelling approach to SEN, was superseded by the *1993 Education Act*, and the *Code of Practice for the Identification and Assessment of Special Educational Needs* (1994), recognised labelling of SEN categories, including the category 'Specific Learning Difficulties (Dyslexia)'. This development was an acknowledgement of the fact that SEN labels are often necessary to ensure that the child receives the right sort of support in learning.

The 2001 *SEN Code of Practice,* which superseded the 1994 version, again moved away from use of labels and focused instead on areas of need and their impact on learning, a trend continued in the most recent legislation (*Special educational needs and disability code of practice: 0-25 years*; 2014). However, the current *Code of Practice* recognises labels such as 'Specific learning difficulties (SpLD)' as applying to a range of conditions such as dyslexia, dyscalculia and dyspraxia that can affect one or more specific aspects of learning [Section 6.31].

On the other hand, there is still a need for differentiation of teaching and learning activities within a single category. This is particularly true of the category 'dyslexia' (or Specific Learning Difficulty), in which some children may be affected more in the *auditory/verbal* domain, others in the *visual/perceptual* domain, and a few in *both* domains or who may have *motor difficulties*. Hence, dyslexic children may exhibit a variety of difficulties and dyslexia has been described as a variable syndrome (Singleton, 1987). Nevertheless, dyslexia is a condition that can usually be helped tremendously by the right type of teaching, even though dyslexic children cannot all be taught in exactly the same way (Thomson, 1989; Augur, 1990; Thomson and Watkins, 1990; Miles, 1992; Pollock and Waller, 1994; Reid, 1998).

On the other hand, many teachers are justifiably worried that labelling a child — especially at an early age — is dangerous, and can become a 'self-fulfilling prophecy'. Fortunately, the CoPS approach does *not* demand that young children be labelled — instead it promotes the awareness of children's individual learning abilities and encourages taking these into account when teaching. Since the CoPS graphical profile indicates a child's cognitive *strengths* as well as *limitations*, it gives the teacher important insights into their learning styles. In turn, this provides essential pointers for curriculum development, for differentiation within the classroom, and for more appropriate teaching techniques. Hence it is not necessary to use labels such as 'dyslexic' when describing a child assessed with CoPS, even though parents may press for such labels.

The term 'dyslexia' may be reserved for those children who show a significant discrepancy between ability and attainment that is known to be caused by particular cognitive limitations. However, the principal aim of early screening using CoPS is to identify children who are at risk in order to *prevent that discrepancy developing*, by teaching the child in a more appropriate way from the start. By identifying cognitive strengths

and weaknesses it is easier for the teacher to differentiate and structure the child's learning experience in order to maximise success and avoid failure. The intention is that children who in the present system would be likely to fail and may subsequently attract the label "dyslexic", never reach that stage. It is usually satisfactory to explain to the parents that the screening or assessment using CoPS reveals the cognitive (or learning) strengths and weaknesses of all children. If CoPS has shown some weaknesses in certain areas for a given child the parents may be informed that the school will be addressing those weaknesses with appropriate teaching. If parents press the question "Is my child dyslexic?" it would be fair to point out that the question cannot usually be given a satisfactory answer until such time as the child has had a proper opportunity to learn to read and write. The child *may* turn out to be dyslexic but the school's intentions, rather than waiting and seeing whether the child *fails*, should be to try to ensure that he or she is taught in the most suitable way from the beginning. Of course, where CoPS is being used as an assessment device for diagnosis of older children who are already failing in literacy, explanations necessarily have to be more complex and the label 'dyslexic' becomes more appropriate and may even be unavoidable. This, in itself, demonstrates an advantage of using CoPS as a *screening system* on school entry. Used in this way, teachers are alerted to risks *before* those risk factors lead to failure.

4.3.4. Screening or assessment?

CoPS can be used both for routine screening of children who have no known difficulties in literacy and/or numeracy. It can also be used equally well to assess children who are known to have difficulties in literacy and/or numeracy or who are suspected of having dyslexia (e.g. because of a family history of the condition or because the child has experienced problems in language development such as pronunciation difficulties). The former approach has the benefit of possibly identifying children who are at risk of dyslexia that the teacher was totally unaware of. In such cases low-key early intervention can make a remarkable difference to the child's development, and prevent many agonies that would have been likely to have occurred later. But this approach can also be time-consuming (although see the section on addressing problems of time for testing with CoPS — Section 2.5), and for that reason many schools prefer to adopt the latter approach of using CoPS as an assessment tool.

Whichever of these two approaches is adopted, the processes of interpretation of CoPS results are essentially the same. However, as explained in section 4.3.3, CoPS is not a test that necessarily gives a label to a child ('dyslexia'), so it is not a screening test in the conventional sense of the term. Rather, CoPS is a diagnostic suite of assessment tests that can also be used for screening. The reasons for this are not only that CoPS doesn't classify or label children, but also to do with the way the tests have been constructed and developed. Each test in CoPS has been separately validated and standardised and can be used in its own right to assess the cognitive skills involved in the test. With a few exceptions, the scores on CoPS tests are distributed in a 'normal' (Guassian or bell-shaped) distribution, which gives them certain statistical properties. When tests are used for screening, what is critical is not that they have a normal distribution of scores, but rather that they can accurately discriminate between those who do and who do not possess the target characteristic (in this case, dyslexia). Inaccuracy in screening is reflected in misclassifications, either 'false negatives' (e. g. cases where the test has inaccurately classified a child as not having dyslexia when actually they do) and 'false positives' (e. g. cases where the test has inaccurately classified a child as having dyslexia when in reality they do not); see Singleton (1997a) for discussion of educational screening. Singleton, Thomas and Horne (2000) reported a study in which the screening accuracy of CoPS was evaluated in comparison with various other measures. CoPS had an exceptionally low level of false negatives and false positives and performed better than all the alternative measures under consideration. This finding has been used to develop another program, **Lucid Rapid Dyslexia Screening**, which gives an automatic interpretation of results in terms of probability of dyslexia. Results from Lucid Rapid can be exported into CoPS, so the two products can be used together effectively both to screen and then to follow up with a full diagnostic assessment where this is necessary for developing teaching strategies. For further information about **Lucid Rapid** see the Lucid website www.lucid-research.com

4.3.5. Which test to start with when interpreting a profile?

When interpreting CoPS results, it has generally been found most useful to start from the right-hand side of the profile — i.e. with the tests assessing basic auditory and verbal processing skills — and then to progress left across the profile, considering the various memory tests in turn.

4.3.6. Essential factors to take into account

4.3.6.1. Not one test but several

When considering CoPS results, it is important to bear in mind that it is not one test which is being interpreted, but the performance of a child on a number of related tests. This is bound to be a more complex matter than single test interpretation. Hence the normative information (about how a child is performing relative to other children of that age) must be considered together with the ipsative information (about how that child is performing in certain cognitive areas relative to that same child's performance in other cognitive areas). The pattern or profile of cognitive strengths and weaknesses is crucial.

4.3.6.2. Things that the computer cannot know

The computer is not all-seeing, all-knowing — nor is it infallible. For example, the computer cannot be aware of the demeanour and state of the child at the time of testing. Most children find the CoPS tests interesting and show a high level of involvement in the tasks. In such cases the teacher can have confidence in the results produced. Occasionally, however, a few children do not show such interest or engagement and in these cases the results must be interpreted with more caution. Where a child produces a number of low scores a simple first precaution in the interpretative process is to note the date and time when those tests were carried out. If it turns out that those tests were all carried out on the same day or in the same testing session, then there is cause for suspicion that some other, non-cognitive factors, are involved. It may be that the child was unwell on that day, or anxious, or simply wanted to be doing what the rest of the class were doing at that time (e.g. at playtime). Or it may be that the adult who is supervising the child was impatient to finish and the child sensed this. Time (as opposed to accuracy) scores can often indicate if a child was not approaching the tasks with the right amount of application or concentration. Young children can easily become fatigued or bored with a task, and for this reason it is recommended that children should normally only attempt two or three CoPS tests during a given session. Low accuracy scores with corresponding high time scores usually suggests that the child was tired, or bored, or not concentrating properly, found the task too difficult, or for some reason was over-eager to finish. The implications of time scores are discussed in Section 4.2.3.

4.3.6.3. Cognitive ability <u>not</u> attainment

It is important to remember that the performance being interpreted with CoPS is based on tests of *cognitive ability* rather than *attainment*. Teachers are most familiar with tests of attainment, such as reading, spelling, and mathematics. Assessment of cognitive abilities, however, requires a broader interpretative approach. Although cognitive abilities *underlie* attainment, other factors are obviously involved in the determination of attainment, such as the child's motivation and opportunities for learning. (Note that here we are referring to *general motivation* in the educational context, not motivation to carry out the CoPS tests.) CoPS tests provide a very good prediction of later attainment, but cannot provide an *infallible* prediction because of the intervention of these other factors. Of course, motivation is itself affected by attainment. Children lose interest in activities in which they are failing, and often develop strategies to avoid being exposed to further failure (especially if that failure is public). Consequently, if (for example) two children exhibited identical 'at risk' CoPS profiles, the one with the poorer motivation would be regarded as being at greatest risk (other things being equal). CoPS cannot measure motivation, but it is important for the teacher to take that factor into account.

4.4. Brief pointers for interpretation of results

Table 13 gives some brief pointers for interpretation of results. However, this is only intended as a very general introduction to the interpretation process. Teachers are strongly recommended to consult the relevant chapters on interpretation before drawing final conclusions about a child and formulating teaching plans.

Table 13 – Brief interpretation guide to CoPS

TEST NAME	**COGNITIVE SKILLS MEASURED**	**SIMPLIFIED INDICATIONS FOR ACTION** In the case of children with low (less than 20th centile) or very low (less than 5th centile) scores in individual tests (except ***Clown***).

TEST NAME	COGNITIVE SKILLS MEASURED	SIMPLIFIED INDICATIONS FOR ACTION In the case of children with low (less than 20th centile) or very low (less than 5th centile) scores in individual tests (except ***Clown***).
Wock	Phoneme discrimination	Could be *temporary* or *non-temporary* problem. Refer for hearing assessment — possible glue ear. Auditory discrimination training will be necessary, even after treatment. Other auditory/verbal CoPS tests will be affected — these may need to be re-assessed after treatment. Child will find phonics work difficult (confusions in letter-sound relationships and problems in blending) and may develop an over-reliance on visual strategies in reading — careful structuring and monitoring of phonics activities required. Learning activities should be differentiated to allow for auditory discrimination problems.
Rhymes	Phonological awareness (rhyming)	Check whether there are *general* auditory problems. Phonological awareness training needed — most children respond well to this, but the dyslexic child may have more persistent problems. Without phonological awareness training, the child will find phonics work difficult and may develop an over-reliance on visual strategies in reading.
Zoid's Letter Names	Auditory/ verbal *associative* memory (symbols and names)	Compare with the results of ***Races*** and with ***Toybox*** — has the child got a general *associative* memory difficulty or a general auditory/verbal memory difficulty? Check auditory discrimination skills (***Wock***) and phonological awareness (***Rhymes***). Child is likely to have difficulty with basic phonics (especially letter-sound association) which can lead to early discouragement and frustration. Starting with whole-word ('look and say') methods not inappropriate but difficulties could be encountered. Spelling and writing also likely to be a problem. Early start to structured phonics work is recommended with ample practice (overlearning). Multisensory approach is best, building on any visual and kinaesthetic strengths. Auditory/verbal memory training should be helpful.
Races	Auditory/ verbal *sequential* memory (names)	Compare with the results of the other sequential memory tests — has the child got a general sequential memory difficulty, or just auditory/verbal sequential memory problems? Check auditory discrimination skills (***Wock***) and phonological awareness (***Rhymes***). Child will find phonics work difficult and may develop an over-reliance on visual strategies in reading. Careful structuring and monitoring of phonics activities required, with ample practice (overlearning). Multisensory phonics work is recommended, building on any visual and kinaesthetic strengths. Auditory/verbal memory training should be helpful.

TEST NAME	COGNITIVE SKILLS	SIMPLIFIED INDICATIONS FOR ACTION
Rabbits	Visual *sequential* memory (spatial/ temporal)	Should be compared with the results of the other visual memory tests and with ***Races.*** Has the child got a general *sequential* memory difficulty, a general *visual* memory difficulty or only *visual sequential memory* problems? ***Rabbits*** is the most difficult test for the child to encode verbally so it provides a purer measure of *visual* memory skills. The child will have difficulty with visual whole word ('look and say') methods which can lead to early discouragement and frustration. Spelling and writing also likely to be a problem. Visual *sequential* memory training useful. Early start to structured phonics work recommended with ample practice (overlearning). Multisensory approach is best, building on any auditory and kinaesthetic strengths.
Zoid's Friends	Visual *sequential* memory and verbal encoding (colours)	Should be compared with the results of the other visual memory tests. This test can be done non-verbally, but most children try to encode the colours *verbally*, so it can help to identify the child who has difficulty in applying verbal labels and holding them in working memory. Child will have difficulty with visual whole word ('look and say') methods which can lead to early discouragement and frustration. Spelling and writing likely to be a problem. Potential slow reader. Visual *sequential* memory training useful. Early start to structured phonics work recommended with ample practice (overlearning). Multisensory approach is best, building on any auditory and kinaesthetic strengths.
Toybox	Visual *associative* memory and verbal encoding (colour/ shape)	Should be compared with the results of the other visual memory tests and with ***Zoid's Letter Names.*** Has the child got a general *associative* memory difficulty, a general *visual* memory difficulty or only *visual associative memory* problems? Child will have difficulty with visual whole word ('look and say') methods, which can lead to early discouragement and frustration. Spelling and writing likely to be a problem. Visual *associative* memory training useful. Early start to structured phonics work recommended with ample practice (overlearning). Multisensory approach is best, building on any auditory and kinaesthetic strengths.
Zoid's Letters	Visual *sequential* memory and verbal encoding (symbols)	Should be compared with the results of the other visual memory tests (as with ***Rabbits*** and ***Zoid's Friends***). Child will have difficulty with visual whole word ('look and say') methods which can lead to early discouragement and frustration. Letter recognition and recall will be hard. Visual *sequential* memory training useful. Spelling and writing likely to be a problem. Early start to structured phonics work recommended with ample practice (overlearning). Multisensory approach is best, building on any auditory and kinaesthetic strengths.
Clown	Colour discrimination	A criterion referenced test without norms. Refer to the data table for details of colours the child is has difficulty with. Child can be referred via GP to child development unit or hospital eye clinic for full assessment of colour blindness. Learning activities should be differentiated to allow for colour discrimination problems. Note that performance on ***Toybox*** and ***Zoid's Friends*** will probably be affected.

5. Interpreting results of the phonological tests

5.1. Introduction

The phonological tests are:

- WOCK — assesses phonological discrimination
- RHYMES — assesses phonological awareness

Both of these skills are vitally important for good literacy development, especially for the acquisition of phonic skills, i.e. mapping of letters (graphemes) on to sounds (phonemes).

5.2. WOCK

Wock assesses *phonological discrimination.* This ability is very important for acquisition of effective phonic skills and for many aspects of learning which depend on oral communication, including ordinary classroom activities. In literacy development, children first have to be able to hear and discriminate the fine differences between speech sounds in order to learn the relationships between those sounds and the letters of the alphabet. The brain learns to discriminate those speech sounds by experience and exposure to good models of speech in the early years.

In the CoPS research project, ***Wock*** correlated significantly with later literacy skills, listening skills and development of ability in phonics. It may therefore be concluded not only that it is a valid indicator but also a good predictor. ***Wock*** given at age 5 correlated with all phonics aspects of the *Middle Infant Screening Test* (MIST) given at age 6:6 with a significance level of 0.01 level or better, and the correlation with the *Word Recognition and Phonics Skills Test* (WRaPS) given at age 8 was 0.73 ($p<0.01$) and with the *Edinburgh Reading Test* at age 8 was 0.44 ($p<0.01$). Stepwise regression analyses showed that ***Wock***, together with ***Rhymes***, were among the best predictor variables. For further information on the statistical evidence see Singleton, Thomas and Leedale (1996) and Singleton, Thomas and Horne (2000).

5.2.1. Causes of poor performance on Wock

Poor performance on ***Wock*** can result from:

(a) Temporary factors:

- The child having a cold or ear infection at the time of testing
- Inattentiveness during testing
- Classroom distractions at the time of testing
- Being assessed in a noisy environment

Obviously if the poor performance is attributable to temporary factors then the solution is to re-test the child at an appropriate time.

(b) Non-temporary factors:

- Congenital or acquired hearing impairment
- Lack of experience of the relevant auditory discriminations
- Glue ear
- Difficulty in processing information at the phoneme level

5.2.1.1. Congenital or acquired hearing impairment

Congenital or acquired hearing impairment can be *conductive* and/or *sensory*. In conductive impairment something impedes the movement of acoustic energy through the outer or middle ear (e.g. a malformation of the ear structure, or build-up of wax). In sensory impairment there is damage to the parts of the hearing mechanism involved in analysing sounds (e.g. through prolonged exposure to loud noise, or neural abnormalities of the auditory system due to maternal *Rubella). Conductive* impairments are often fluctuating and can often be rectified by treatment, whereas *sensory* losses are permanent although a hearing aid can help in many cases. Children with good auditory sensitivity for low sound frequencies but who have high-frequency loss are often detected late in childhood. This is because in a one-to-one situation or relatively quiet environment they may appear to hear satisfactorily, but in a noisy environment or typical classroom, many sounds are not heard properly, particularly weak high-frequency consonants (e.g. s, sh, f, th, v).

5.2.1.2. Lack of experience with English

Phonological discrimination difficulties can also arise in cases where children have had to rely on an inadequate or distorted model of English speech in the home. Children from home backgrounds where English is not spoken or spoken with a foreign accent may not have had the opportunity to learn certain speech sound discriminations that are important in English. It is important to note that under the *1996 Education Act* a child must not be regarded as having a *learning difficulty* solely because the language of the home is different from the language in which he or she is taught. Nevertheless, it is important for the teacher to have information on the phonological discrimination skills of children from such home backgrounds, because this pertains critically to the teaching of phonics in English. However, it should not be assumed that all children for whom English is an additional language (EAL) will perform poorly on ***Wock***. Studies of EAL and bilingual children have shown that in many cases they have heightened awareness of speech sounds and may perform very well on ***Wock***. For further information see Chapter 9.

5.2.1.3. Glue ear (Otitis media)

Glue ear (*Otitis media)* is a group of conditions in which there is fluid in the middle ear, often caused by colds or other infections, and which result in conductive hearing loss and, sometimes, earache. It is common in children up to the age of 6 years, but declines steadily in incidence thereafter. It should be suspected in any child who is frequently inattentive, often says "What?" when asked a question, or who persistently turns up the volume on the television to a level which other viewers find excessive. Children who suffer from glue ear will not have had good models because the sounds they have heard will have been distorted. The effects on phonological discrimination increase with the severity of the glue ear and the length of time for which it has persisted without effective treatment. Chronic glue ear before the age of three tends to delay speech development in a more pervasive manner. However, although the fundamentals of speech and language are already largely established prior to the age of three, there nevertheless seems to be a period from about 3 years to 7 years of age during which the process of learning to make fine phonological discriminations continues to be quite critical. Consequently, glue ear during this time tends to have more subtle but rather long-lasting effects on language and literacy development, even though no *gross* effects on speech production or reception may be apparent. Some persons with dyslexia have discovered to their amazement well into adulthood that certain words which they had always believed were spoken and spelled identically (homonyms) were, in fact, quite different (e.g. *exclaimed* and *explained*).

Of course, by no means all children who suffer, or have suffered, from glue ear show dyslexic-type difficulties in memory and other areas of cognition. However, there is a statistical association between glue ear and dyslexia, as there is between dyslexia and disorders of the immune system such as asthma, eczema and allergies, and so there may be a causal overlap between all these conditions (Galaburda, 1993). Hence teachers need to be alerted to the *possibility* of glue ear in any child showing dyslexic difficulties and *vice versa.*

5.2.1.4. Difficulty in processing information at the phoneme level

The predominant theory of dyslexia focuses on the child's difficulty in processing phonological information (for review see Snowling, 2000). There is some evidence that this type of difficulty can also affect speech perception (e.g. Hurford and Sanders; 1990; Manis et al, 1997; McBride-Chang, 1996). This is not altogether

surprising, because when we perceive speech we have to store the stream of information in short-term memory in the form of a phonological code while we process it. In the ***Wock*** test, children have to hold two very similar words in short-term memory and then decide which one is the same as the target word, which is also held in short-term storage. It can be seen that if the child experiences an inherent difficulty in generating phonological codes or in phonological information processing (i.e. is dyslexic), this is liable to affect phonological discrimination tasks, such as ***Wock***.

5.2.2. Treatment for auditory discrimination difficulties

Children who have auditory discrimination difficulties or who show signs of glue ear should always be referred for medical examination if this has not already been done. Medical treatment (e.g. antibiotics to treat infections) or surgical interventions (e.g. draining excess fluid from the middle ear or fitting grommets to facilitate fluid drainage) may result in varying degrees of improvement. Unfortunately, a few children, even with treatment, continue to suffer from intermittent glue ear until adolescence or beyond. In general, however, the problems of glue ear tend to decline (or become less noticeable) as the child gets older. There appear to be various reasons for this — the child develops better resistance to infection, the Eustachian tube that drains the middle ear grows and may be less prone to blockage, or the child develops strategies to compensate for the hearing loss. However, even if the child's hearing is subsequently found to be satisfactory (i.e. pronounced 'normal' following audiometric assessment) it is essential that teachers realise that the child *may still experience significant difficulties in discriminating some speech sounds when acquiring phonic skills in reading.* This is because the brain has not had the opportunity to learn those discriminations during the 'critical' period. It is the function of ***Wock*** to detect such difficulties.

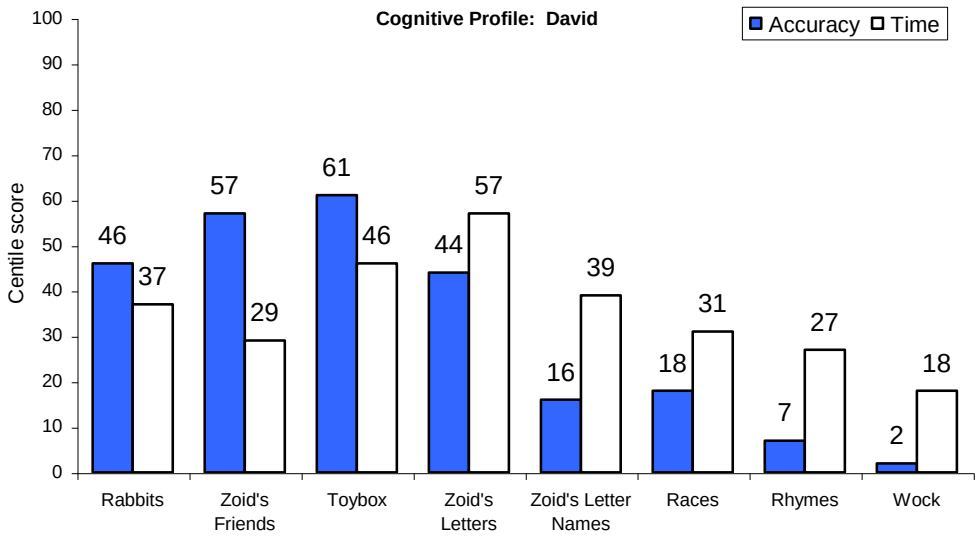
There are many classroom (and home) activities that can be used to develop auditory discrimination, and many of these are also good for promoting phonological awareness. These are described in Chapter 10.

5.2.3. Case study — phoneme discrimination difficulties

An illustration of a case with auditory discrimination difficulties is shown in Figure 29. David's phonological awareness (***Rhymes***) and auditory discrimination (***Wock***) skills are very weak, and this also seems to be affecting auditory/verbal memory to some extent (***Zoid's Letter Names*** and ***Races***). The recommendations would be (a) referral for hearing assessment (possible glue ear), and (b) an early introduction of regular training in both phonological awareness and auditory discrimination. It would be useful to assess the whole class to see if training could be done on a small group or even whole-class basis, to save time. In reading development it would be a mistake just to concentrate on utilising his visual strengths, because he will then encounter major difficulties later on. Instead, a well-structured multisensory phonic approach would help to avoid auditory confusions, although great care must be taken to ensure that David hears letter sounds and words clearly. If David receives treatment for glue ear, then the CoPS auditory/verbal tests should all be repeated at a suitable interval, because it will be necessary to establish whether his low scores on ***Races, Zoid's Letter Names*** and ***Rhymes*** were simply due to his auditory problems or whether they signal other underlying cognitive problems.

Of course, children with auditory discrimination weaknesses will also suffer other impediments to effective learning. In a typical busy classroom they often will not hear, or may misunderstand, the teacher's instructions, and so may carry out the wrong task or waste time waiting for instructions that have already been given. In group work, they often will not hear the speech of other children properly, and so may fail to follow group discussion, which can result in them being implicitly or explicitly excluded from real collaboration. The learning opportunities of these children will consequently be reduced. It is the teacher's job to ensure, as far as possible, that the child with auditory discrimination weaknesses, is not significantly handicapped by these factors. For further discussion of these issues see Webster and Ellwood (1985).

Figure 29 Case study—David



5.3. RHYMES

Rhymes assesses *phonological awareness*. The phonological system is the part of language that is concerned with the ways in which *sound patterns* are used to communicate. As children learn to talk they develop increasingly sophisticated cognitive representations for phonological aspects of speech. They become aware that words can be *segmented* into syllables (e.g. that 'wigwam' is composed of 'wig' and 'wam'), and that different words can contain similar elements (i.e. similar *onsets* like **w**-ig and **w**-am, or similar *rimes* like w-**ig** and p-**ig**). The importance of this phonological awareness for early literacy development has been very well demonstrated in research carried out all over the world in the past twenty years (for reviews see Snowling, 1995; Goswami, 1994; Goswami and Bryant, 1990; Rack, 1994; Goswami, 1999, 2001; Savage, 2001). Phonological awareness is often assessed by means of an 'oddity task' in which the child has to pick out the one which is different from of list of similar sounding words, e.g. *'mop, hop, tap, lop'; 'ham, tap, had, hat'* (Bradley and Bryant, 1983. Bradley, 1980). Many teachers and researchers have observed that the oddity test is difficult to give, especially with very young children. Children tend to forget the items and may fail for reasons other than poor phonological awareness. The CoPS ***Rhymes*** Test does not suffer from this limitation, because it incorporates pictures which help the child to remember the items.

Dyslexic children are known generally to have poor phonological skills (Rack, Snowling and Olson, 1992; Holligan and Johnston, 1988). In the *phonological deficit model of dyslexia* (Hulme and Snowling, 1991; Snowling, 1995) it has been hypothesised that the status of children's underlying phonological representations determines the ease with which they learn to read, and that the poorly developed phonological representations of dyslexic children are the fundamental cause of their literacy difficulties. In the CoPS research ***Rhymes*** was found to be a highly significant predictor of later literacy skill. ***Rhymes*** (given at age 5) correlations with literacy skills were 0.54 (*BAS Word Reading* at 6:6), 0.58 (*Macmillan Individual Reading Analysis* (MIRA) at 6:6), 0.52 (*Edinburgh Reading Test* at 8:0), 0.45 (*Word Recognition and Phonics Skills Test (*WRaPS) at 8:0), and 0.50 (*BAS Spelling* at 8:0). All except WRaPS ($p<0.05$) were significant at the 0.01 level or better. ***Rhymes*** also correlated with all phonics aspects of the *Middle Infant Screening Test* (MIST) given at age 6:6, and were significant at the 0.01 level or better. Stepwise regression analyses showed that ***Rhymes***, together with ***Wock***, were among the best predictor variables. For further information on the statistical evidence see Singleton, Thomas and Leedale (1996) and Singleton, Thomas and Horne (2000).

Although the CoPS phonological awareness test (***Rhymes***) involves *rhyming* this should not be taken to mean that other aspects of phonological awareness (such as alliteration and syllable segmentation) are not important for early literacy development. The CoPS research version included an alliteration test as well as a rhymes test, but when predicting from CoPS given at age 5 to literacy skills at age 8 years ***Rhymes*** proved to be a better predictor than alliteration, so rhyming items were preferred for the original CoPS suite for DOS and Acorn. In the Windows version, the original 2 practice and 8 test rhyming items have been retained for children aged under 7 years (see Table 10), but for children aged 7 years and over, the rhyming component has been reduced to 4 items and a further 8 alliteration items have been added (see Table 11). This makes the test

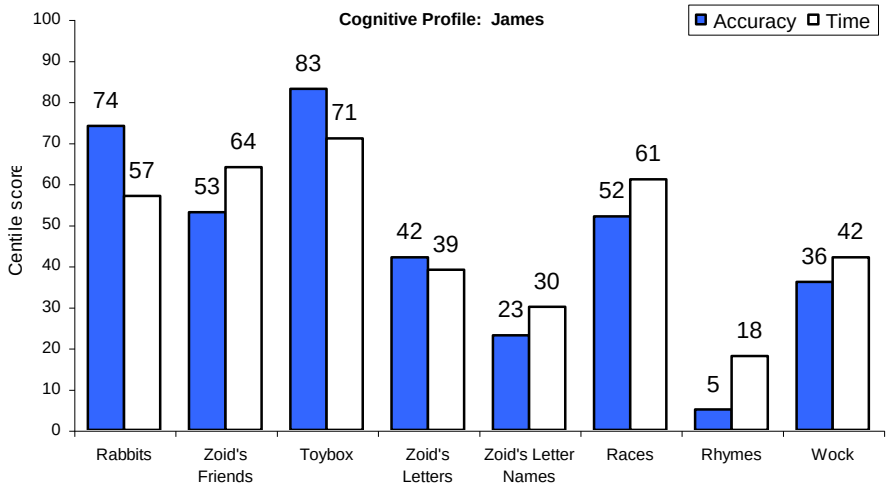
more sensitive for children in the older age group. However, it is important to stress that when the teacher is addressing the development or facilitation of the language and literacy skills of young children *all* possible aspects of phonological awareness should be taken into account, including rhyming, alliteration and other skills (e.g. syllable segmentation, deletion and elision).

5.3.1. Case study — poor phonological awareness

The CoPS profile of James, aged 5, shows good or reasonably satisfactory scores in all areas except ***Rhymes***, which is on the 5th centile (see Figure 30). His visual memory skills are fairly strong. Further investigation by his teacher showed that he had no idea about rhyming or alliteration or syllable segmentation at all. He could not generate any rhymes and did not recognise common nursery rhymes. Although his auditory discrimination skills were not all that strong, he was nevertheless generally able to detect when two words were identical and often– but not always – noticed when two words were not identical. It is likely that some auditory discrimination weakness has also affected James's performance on ***Zoid's Letter Names,*** which demands quite close auditory attention. However, he seemed totally unable to determine *similarities* between syllables within sounds. It was if he could not analyse words into constituent parts but heard them only as 'whole sounds'. Or perhaps he did analyse words into sounds but somehow could not avoid focusing on the points of difference between them, oblivious of any similarities. For example, James maintained that 'peg' and 'beg' were just different — he could not appreciate that they ended with the same sound. Nor was it the case that he was focusing on the onset of the words, because he could not appreciate that 'peg' and 'pet' began with similar sounds, either.

Although James's poor phonological awareness could be due to dyslexia, in the absence of evidence of other cognitive difficulties, it is most likely that it is due to lack of appropriate language experience in the pre-school period. He was a very shy, quiet child who had been upset by the noise and boisterousness of the play group and so his mother had withdrawn him and he seems to have spent most of his pre-school years at home on his own. He had very good constructional skills, which his mother said was developed through many hours of playing with Lego by himself.

Figure 30 Case study—James



James's good visual memory will probably mean that he has no problems with whole-word methods of reading, and his average score for ***Races*** does not indicate a serious auditory/verbal memory difficulty. Nevertheless, he will tend to struggle with phonics, and may even avoid any analytical approach to reading, which is likely to create problems later in his schooling. He could even manage to get by on purely visual strategies in reading but will almost certainly have difficulties with writing and spelling. Phonological awareness and auditory discrimination training at this stage will give James a much better basis for literacy development, enable him to benefit from phonics teaching and help to prevent literacy difficulties later on. At the same time, an assured start can be made in 'look-and-say' which should give James encouragement to tackle the complexities of phonics as soon as he is judged to be ready for this. If desired, ***Rhymes*** and ***Wock*** (and ***Zoid's Letter Names*** as well if the teacher wishes) can be re-administered in a few months to ascertain whether James has made the progress necessary to begin phonics teaching with confidence.

Strategies for teaching the child with poor phonological awareness may be found in Chapter 10.

6. Interpreting results of the auditory-verbal memory tests

6.1. Introduction

The auditory-verbal memory tests in CoPS are:

- ***Zoid's Letter Names*** — assesses the child's ability to associate visual symbols with verbal labels
- ***Races*** — assesses auditory sequential short-term memory

Both of these skills in short-term (working) memory are critical for literacy development, especially for the acquisition of phonic skills, i.e. mapping of letters (graphemes) on to sounds (phonemes), and for the storage of phonological codes in short-term memory during word recognition and processing of text. There is also a well-established connection between reading and memory (for reviews, see Baddeley, 1986; Beech, 1997; Brady, 1986; Jorm, 1983; Wagner and Torgesen, 1987). The predominant view in the research literature is that phonological processes underpin the development of a phonological recoding strategy in reading, and that working memory plays a significant role in this strategy, enabling constituent sounds and/or phonological codes to be held in short-term store until these can be recognised as a word and its meaning accessed in long-term memory (e.g. Gathercole and Baddeley, 1993a; Wagner et al, 1993).

6.2. RACES

Races is a *sequential* memory test (i.e. in which items have to be remembered in the correct order). It correlates significantly with those sub-test of WISC-III which are widely used as diagnostic indicators of dyslexia, namely Arithmetic, Coding, Information and Digit Span (ACID profile). (Thomson, 1989). Correlations of ***Races*** given at age 5 with WISC-III^{UK} given at 8 years were: Arithmetic 0.49, Coding 0.47, Information 0.58, Digit Span 0.36. All were significant at the 0.05 level or better. It also correlates significantly with later literacy development. The correlation of ***Races*** given at age 5 with *BAS Word Reading* at 6:6 was 0.50, with *Macmillan Individual Reading Analysis* (MIRA) at 6:6 was 0.58, with *Edinburgh Reading Test* at 8:0 was 0.52, and with *BAS Spelling* at 8:0 was 0.53. All were significant at the 0.01 level or better. For further information on the statistical evidence see Singleton, Thomas and Leedale (1996) and Singleton, Thomas and Horne (2000).

6.3. ZOID'S LETTER NAMES

Zoid's Letter Names is an *associative* memory test, which simulates the situation of a child learning to associate letters and their names. Early letter name knowledge and speed of naming are both good predictors of later literacy development (Rack, 1994; Snowling, 1995). Although good letter name knowledge at an early age is probably due in part to some children being taught letter names at home or in the pre-school, those children with competent verbal/auditory memory skills will have an advantage in these aspects of learning over those children with memory weaknesses. For this reason, ***Races*** and ***Zoid's Letter Names*** are both important tests although of the two, ***Races*** is the better predictor of later literacy skills. ***Zoid's Letter Names*** is quite a difficult test for younger children and demands considerable concentration (as well as good listening skills). It is probably a better measure for older children (7–8 year-olds) than it is for younger ones, but until more data is available, conclusions on this matter must remain tentative. Nevertheless, ***Zoid's Letter Names*** correlated significantly with later phonic skills. The correlation of ***Zoid's Letter Names*** given at age 5 with all phonics aspects of the *Middle Infant Screening Test* (MIST) given at age 6:6 were significant at the 0.05 level or better. For further information on the statistical evidence see Singleton, Thomas and Leedale (1996) and Singleton, Thomas and Horne (2000).

6.4. The nature and causes of auditory/verbal memory difficulties

Short term auditory/verbal memory is sometimes called *'working memory'* because it is the system which we use when we have to hold information for a brief period of time while we process it. Working memory is a limited-capacity system, and unless rehearsed or transferred to longer-term storage, information in working memory is only retained for a few seconds (Baddeley, 1986). For example, in order to understand what a person is saying to us we have to hold their words in working memory until they get to the end of a sentence (or equivalent break), then we can process those words for their meaning. We cannot process each individual word for meaning as we hear it because by themselves words do not convey sufficient meaning. Furthermore, words heard later in an utterance can substantially alter the meaning of words heard earlier (e.g. "The man opened the magazine — then he carefully extracted the remaining bullets it contained"). Other examples of working memory include trying to hold a telephone number in mind while we dial it, and carrying out mental arithmetic.

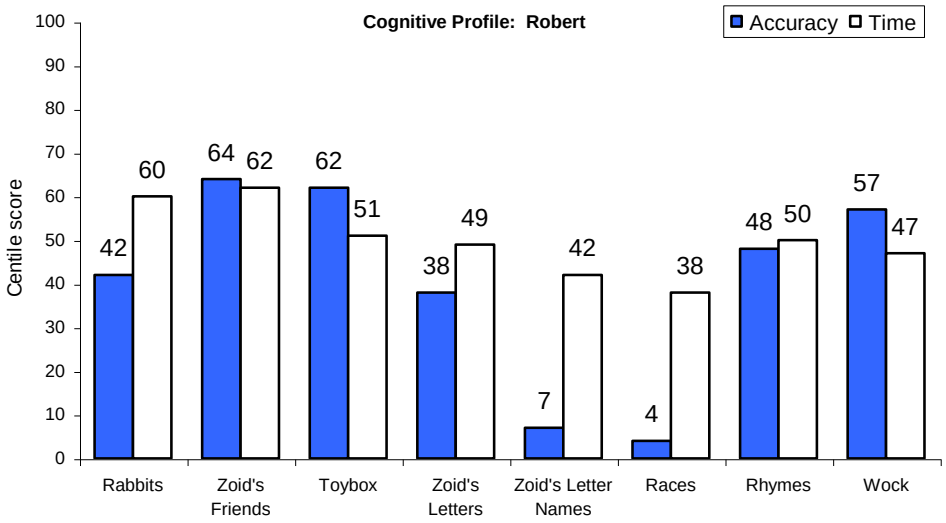
The relevance of auditory/verbal working memory to literacy skills should be obvious — in the same way that it is necessary to hold spoken words in memory in conversation, the child must hold *letters and syllables* in memory when decoding words. This is very important in the development of phonic skills. The majority of dyslexic children have problems in this area of cognitive processing (Thomson, 1989). Awaida and Beech (1995) found that phonological memory at age 5 predicted non-word reading (i.e. phonics skills) at 6 years. When reading continuous text for meaning the child must also hold *words* in memory until the end of the phrase or sentence. Poor working memory will thus affect reading comprehension. Of course, *visual* memory skills will be involved in much of this cognitive activity, especially for beginning readers who have not progressed to phonics, and also for more competent readers whose capacity for rapid visual recognition of words steadily increases with age. Nevertheless, auditory/verbal working memory remains a significant factor in reading development and in writing as well. Children with weaknesses in auditory/verbal working memory also tend have difficulty in *monitoring* their written output, and are inclined to miss letters, syllables and/or words out when they are writing. (For reviews of research on the connections between verbal memory and reading see Baddeley, 1986; Brady, 1986; Jorm; 1983; Wagner and Torgeson, 1987.)

More recently, further research has suggested a very close connection between auditory memory span and articulation (speech) rate (Avons and Hanna, 1995; McDougall and Hulme, 1994). It could well be that articulation rate is an index of the efficiency with which phonological representations of words can be located in memory and activated (i.e. spoken). In turn, this could be closely related to how quickly cognitive representations of words being read can be located in the orthographic and semantic lexicons and activated (i.e. recognised and understood). The three lexicons (phonological, orthographic and semantic) are all believed to be closely related (Rayner and Polatsek, 1989). The fact that ***Races*** was a significant predictor of later literacy skills (despite not involving the child in any speech) suggests that sequential processes in auditory/verbal working memory are nevertheless important in reading, independently of articulation rate.

6.4.1. Case study — auditory/verbal working memory difficulties

Inspection of Robert's cognitive profile (see Figure 31) suggests that he does not have any major problems in visual information processing. His phonological awareness (***Rhymes***) and auditory discrimination skills (***Wock***) are also satisfactory. On the other hand, he has major difficulties in auditory/verbal working memory, both associative (***Zoid's Letter Names***) and sequential (***Races***). Consequently, Robert would be expected to have problems in acquiring effective phonic skills, but may make satisfactory progress in the early stages of reading, where the emphasis tends to be on building up simple visual word recognition skills. For this reason, it would be easy to overlook Robert's problems and assume that because a good early start has been made that everything else will follow automatically. In fact, Robert would probably learn to rely almost exclusively on visual strategies in reading and he could be as old as 9 or 10 before his real problems really become noticeable, by which time so much learning opportunity has been wasted. The recommendations would be for a fairly early introduction of well-structured multisensory phonic approach to literacy learning with ample practice to compensate for his memory weakness, but using his strong visual channel to maintain confidence in his skills. He will almost certainly have problems in writing and spelling, especially with regular words and new or uncommon words. Word processing activities (especially with a talking word processor) would be a great help.

Figure 31 Case study—Robert



7. Interpreting results of the visual memory tests

7.1. Introduction

The visual memory tests in CoPS are:

- ***Zoid's Friends*** — assesses visual/verbal sequential memory (colours)
- ***Rabbits*** — assesses visual/spatial sequential memory (spatial / temporal position)
- ***Toybox*** — assesses visual/verbal associative memory (shape and colour)
- ***Zoid's Letters*** — assesses visual/verbal sequential memory (symbols)

These four tests of visual memory will be considered together, because the teacher needs to compare them when interpreting CoPS results. Visual memory is an essential component of literacy development, especially in rapid word recognition (particularly of irregular words for which a phonic strategy would not be appropriate), in fast processing of text, and also in spelling (again, particularly where irregular words are concerned).

7.2. Visual memory and literacy development

Models of reading acquisition suggest that visual memory is particularly important in the earliest stages of learning to read, usually referred to as the pre-alphabetic or logographic phase (e.g. Ehri, 1995; Frith, 1985). Conclusions reported by Passenger, Stuart and Terrell (2000) from their study of 80 preliterate children during their first year of formal schooling lend some support for this view. Stuart, Masterson and Dixon (2000) also found that visual memory influences the acquisition of sight vocabulary in children aged 5 who displayed poor graphophonic skills (i.e. those who had not yet acquired the ability to segment words on the basis of their sounds and who displayed little or no knowledge of sound-to-letter mappings). For children with good graphophonic skills, however, no association between visual memory and word learning was found. In the CoPS study, the correlations between scores on ***Zoid's Letters*** and single word reading (in the region of 0.28) were clearly not of the order reported by Stuart, Masterson and Dixon. Nevertheless, the results were statistically significant. It should also be borne in mind that in the Stuart, Masterson and Dixon study, the children had to learn to recognise words that were unfamiliar to them (e.g. leopard, haddock, canoe), whereas in the present study, the children were assessed on words that they had already acquired, and no distinction was made between children with good or poor graphophonic skills.

There is also evidence that poor readers have a bias towards visual encoding of words. Johnston and Anderson (1998) reported that poor readers showed a preference for using pictorial rather than verbal information, which they suggest may arise from previous difficulties in learning to attach verbal labels to visual stimuli. Ellis, McDougall and Monk (1996) reported that dyslexics aged 10 years were significantly faster on some visual processing tasks (e.g. picture categorisation) than other groups, including reading age (RA) controls. On word recognition tasks in which the words are paired with either visually similar cues or phonological similar cues, poor readers are known to perform *better* than reading age controls on the visually similar cue items but not on the phonological similar cue items (Holligan and Johnston, 1988; Rack, 1987). In other words, they display a less pronounced phonological similarity effect and a more pronounced visual similarity effect (Katz, 1986; Mann and Liberman, 1984).

Palmer (2000) used the *Corsi Blocks* test to measure visuospatial span in three groups of 14 year-old students: dyslexics, RA controls, and chronological age (CA) controls with normal reading ability. The *Corsi Blocks* test comprises a set of nine blocks fixed to a base in a predetermined pattern. The test administrator touches the blocks in a set sequence and the testee is required to recall that sequence by touching the same blocks in the same order. This has a direct parallel with the *Rabbits* test in the *CoPS* suite. Palmer found that the dyslexic group significantly outperformed the RA controls on this test. The results also suggested that while all participants showed evidence of using phonological coding to remember pictures, only those in the dyslexic group used visual coding.

Another study by Palmer (2000) provides further evidence that it is useful for teachers to know about children's visual memory skills. In this experiment, it was found that children who maintained a visual representation of words alongside a phonological representation after age 7, were significantly worse readers than those for whom the ability to switch strategies by inhibiting the visual representation had fully developed. Children with good visual memory but poor auditory verbal memory would not only be expected to find acquisition of an effective phonological decoding strategy in reading rather difficult, but also be inclined to rely for an longer period on visual strategies. This approach is liable to run into trouble as the child's education progresses and the number of new words with which the child is confronted steadily increases.

7.3. RABBITS, ZOID'S FRIENDS, TOYBOX and ZOID'S LETTERS

Before attempting an interpretation of results from any of these individual tests it is advisable for the teacher first to look for confirmation from the other memory tests. Obviously, where there is strong confirmation (e.g. a number of related tests at or below the *threshold of concern* —20th centile) then the teacher can be much more confident about the diagnosis. If only one test result is below the 20th centile (particularly in one of the memory tests, which require a very high degree of concentration) when all others are average or above average for that child, this may simply be a chance result, and rarely indicates a real weakness. If in doubt, the teacher would be wise to re-test the child on that particular test. On the other hand, one test result below the *threshold of risk* (5th centile) is more likely to indicate a real and significant difficulty.

7.4. The nature and causes of visual memory difficulties

Toybox assesses visual *associative* memory, whereas the other four visual tests assess *sequential* memory. There is one other associative memory test in CoPS — ***Zoid's Letter Names***, which is an auditory/verbal test. The results of this should also be compared with those from ***Toybox***. The other three visual tests (***Rabbits, Zoid's Friends,*** and ***Zoid's Letters)*** are all *sequential* memory tests. There is one other sequential memory test in CoPS — ***Races***, which is an auditory/verbal test. The results of this should also be compared with those from ***Rabbits, Zoid's Friends,*** and ***Zoid's Letters***. Hence, the teacher should ask which of the following is the case:

- the child has general *associative* memory difficulties (visual as well as verbal)
- the child has general *sequential* memory difficulties (visual as well as verbal)
- the child has general visual memory difficulties
- the child has *specific* difficulties in visual *associative* memory
- the child has specific difficulties in visual sequential memory
- the child has a combination of some the above difficulties

Selection of appropriate teaching and training activities will depend to a large extent on the answers to this question, as well as on the severity of the difficulties. The more extensive and the more severe the memory problems, the more difficult they will be to remediate. Nevertheless, memory remediation activities should always be attempted.

However, there are other important differences between the various memory tests of which the teacher should be aware. ***Toybox*** and ***Zoid's Friends*** are both tests where verbal encoding (of colour names) helps the child considerably. It is always important to rule out colour discrimination difficulties in cases of children with a low performance on ***Toybox*** and ***Zoid's Friends***. Hence when children do score low on those tests, if ***Clown*** has not already been administered to the child, then it should always be given as a precaution, before attempting to interpret the results of ***Toybox*** and ***Zoid's Friends***.

Psychologists often argue that there is no such thing as a 'pure' test of visual memory, uncontaminated by verbal encoding, because most human beings will usually try to use verbal encoding strategies to assist memory. (Of course, one could try to prevent this by asking the individual to recite something at the same as they attempted to remember visual items, although this would make the task rather artificial and possibly uncontrolled — perhaps appropriate in the psychology laboratory, but not to be recommended as part of a

psychometric test.) So ***Toybox*** and ***Zoid's Friends*** can help to identify the child who has difficulty in applying verbal labels and holding them in working memory. The result from ***Toybox*** and ***Zoid's Friends*** can indicate the child who is likely to have difficulty with visual whole word ('look and say') methods, which can lead to early discouragement and frustration. Such a child is potentially a rather slow reader because the associative linkages are not so easily forged and the child may have to decode words that should have become familiar and recognised 'by sight'. Spelling is also likely to be a problem and (especially in the early stages of writing) the child will probably have difficulties in remembering the letters that he/she needs to use. By contrast, ***Rabbits*** is the most difficult of the CoPS tests for the child to encode verbally — so it provides a 'purer' measure of *visual* memory skills. It requires the child to remember spatial positions as well as temporal sequences.

In the CoPS research project all four tests were found to have significant correlations with later literacy development. Example correlations (from CoPS tests given at age 5 to literacy measures at age 8:0) for ***Rabbits*** were 0.40 *(Neale Analysis of Reading)*, 0.39 *(Edinburgh Reading Test)* and 0.32 *(BAS Spelling)*; for ***Zoid's Friends*** were 0.36 *(Edinburgh Reading Test)* and 0.36 *(BAS Spelling)*; for ***Toybox*** 0.33 *(BAS Spelling)* and 0.32 *(Word Recognition and Phonics Skills Test)*; for ***Zoid's Letters*** 0.36 *(Neale Analysis of Reading*) and 0.43 *(BAS Spelling)*. All are significant at the 0.05 level or better.

The importance of working memory in reading has already been discussed above. Although working memory is typically conceptualised as being a phonological system subserving speech, a visual equivalent known as the 'visuo-spatial scratch pad' has been hypothesised (Baddeley, 1996). This is believed to enable us to keep small amounts of visual information in short-term memory. Such a system is important in developing visual strategies in reading, especially those used by beginning readers ('look and say'). It is also essential in rapid retrieval of visual whole-word representations from the mental lexicon by older and more fluent readers when reading text, and in retrieving visual sequences of letters in the correct order when spelling.

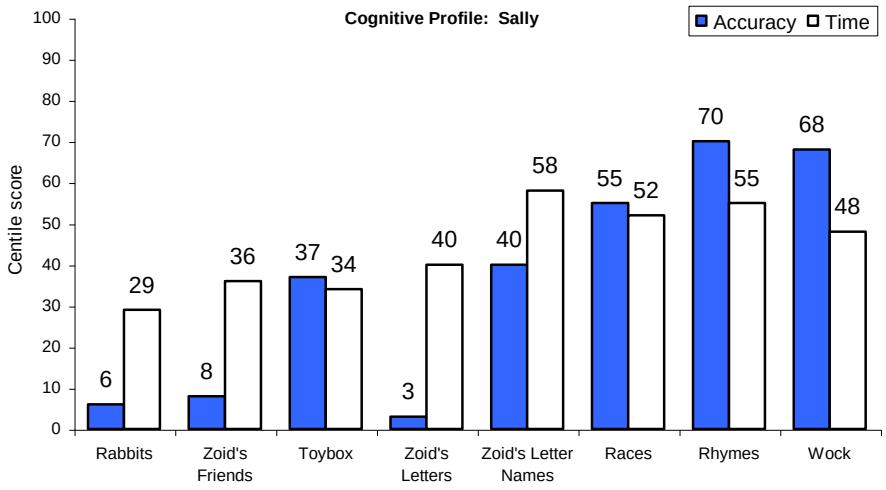
Some teachers and psychologists assume that problems with short-term memory are entirely verbal rather than visual. However, research suggests otherwise. Awaida and Beech (1995) found that ability to remember letter-like forms (similar to those in ***Zoid's Letters*** and ***Zoid's Letter Name***s) at four years of age correlated with reading skills one year later. There is a substantial literature on subtypes of dyslexia, in which visual deficits predominate (Thomson, 1989; Pumfrey and Reason, 1991). Some tests for dyslexia incorporate visual memory tests, e.g. *The Aston Index* (Newton and Thomson, 1982) and the *Coding* sub-test of WISC-III^{UK} ,which is one of the key elements of the A–C–I–D profile that is often used as an indicator of dyslexic difficulties (Thomson, 1989). In the CoPS project, WISC Coding given at age 8:0 correlated 0.36 ($p<0.05$) with ***Rabbits*** administered at age 5. Fein, Davenport, Yingling and Galin (1988) found that visual memory is a factor which may be separated from verbal memory in some cases of dyslexia. Finally, there are a variety of other research themes focusing on more physiological aspects of 'visual dyslexia', including work on visual discomfort (e.g. Wilkins, 1991); atypical eye movements in reading (e.g. Pavlidis, 1985); ocular dominance (e.g. Stein, 1991, 1994); and defects in the transient visual system (e.g. Lovegrove, 1991,1993, 1994). However, perhaps with the exception of visual discomfort (sometimes referred to as the 'Irlen syndrome', after Irlen; 1991) the evidence on some of these physiological issues at the present time seems to be equivocal and more research is required before they can be of practical value in diagnosis and education (Stanley, 1994).

7.4.1. Case studies

7.4.1.1. Sally — visual sequential memory difficulties

Sally shows no problems of auditory/verbal information processing; in fact, her phonological awareness (***Rhymes***) and auditory discrimination (***Wock***) are both quite good (see Figure 32). But she has clear weaknesses in visual sequential memory (***Rabbit, Zoid's Friends*** and ***Zoid's Letters*****)**. Her associative memory is reasonably satisfactory (***Toybox*** and ***Zoid's Letter Names***). Sally would be expected to have problems in the very early stages of reading, where the emphasis tends to be on building up simple visual word recognition skills. Confusion of letter order (e.g. "was" vs. "saw") is likely. Since her associative and verbal memory are satisfactory and she has good phonological awareness and auditory discrimination skills, a phonically-based approach to reading is indicated from the beginning with, ideally, a multisensory strategy. If conventional 'look-and -say' approach is adopted, early difficulties would be expected, leading to loss of confidence and erosion of motivation. Later difficulties must also be anticipated and catered for — e.g. expected problems in spelling (especially irregular words) and in rapid word recognition and text processing.

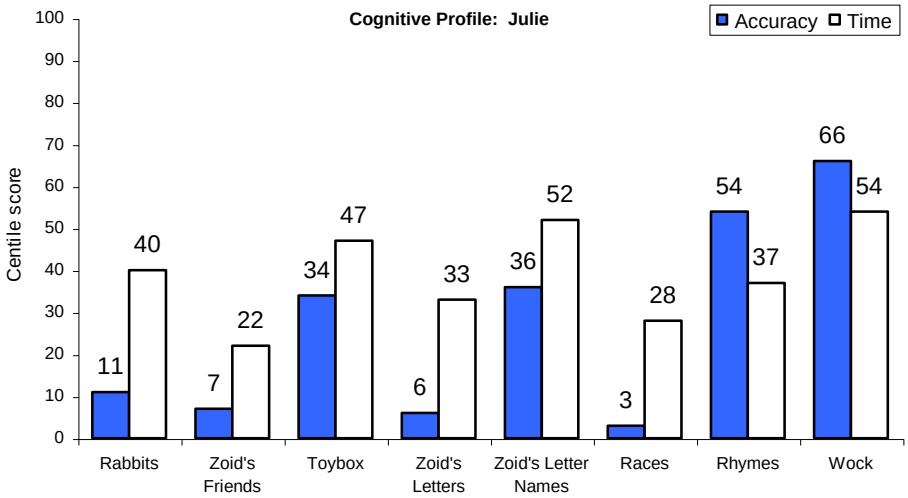
Figure 32 Case study—Sally



7.4.1.2. Julie — general sequencing difficulties

Julie's problems (see Figure 33) are with sequencing, in both auditory and visual modes (note results for ***Rabbit, Zoid's Friends, Zoid's Letters*** and ***Races***). There is a weakness in associative memory, too (see ***Toybox*** and ***Zoid's Letter Names***), but note that phonological awareness (***Rhymes***) and auditory discrimination (***Wock***) skills are quite competent. Julie would be expected to have problems not only in acquiring effective phonic skills, but also have some difficulties in the early stages of reading, where the emphasis tends to be on building up simple visual word recognition skills. She would have particular problems in spelling and writing, with sequencing errors being common. The recommendations would be that a highly structured multisensory phonic approach to literacy learning would be essential with ample practice to compensate for memory weakness. Structured learning software which facilitates practice of both auditory and visual sequencing in reading and writing would be especially useful, and regular word processing activities (especially with a talking word processor) would be a great help.

Figure 33 Case study—Julie



7.5. CLOWN

Clown is a test of colour discrimination. At present this is a criterion referenced test without norms, although data will be collected for standardisation during 1996. A child who is having difficulties on ***Clown*** will probably have colour discrimination problems (but not necessarily so — see below), and *may* be colour blind, but as yet there are no data against which ***Clown*** can be validated as test of *colour blindness*, so teachers must not jump to conclusions. The teacher should refer to the data table for details of which colours the child is experiencing difficulty with. The child can be referred via the GP to a child development unit or hospital eye clinic for full assessment for colour blindness.

The main function of ***Clown*** was to rule out colour discrimination difficulties in cases of children with a low performance on ***Toybox*** and ***Zoid's Friends***. Hence when children *do* score low on those tests, if ***Clown*** has not already been administered to the child, then it should always be given as a precaution, before attempting to interpret the results of ***Toybox*** and ***Zoid's Friends***. The ***Clown*** test need not be given if the teacher is confident that the child's colour discrimination is satisfactory. On the other hand, many teachers find ***Clown*** is a good introduction to the suite of tests because most children find it very easy but enjoyable nonetheless. However, teachers should be aware of the problems of the child with poor mouse control — see below.

The colour discriminations tested in ***Clown*** are:

- Yellow
- Red
- Purple
- Green
- Light Blue
- Dark blue

These are the colours used in ***Toybox*** and ***Zoid's Friends***. Of these colours, the most likely confusion in a child who is colour blind will be when trying to distinguish red and green. About 7.5% of males and less than 1% of females are colour blind, which reflects a sex-linked recessive inheritance.

7.5.1. Interpreting results of the Clown test

The ***Clown*** test requires six items (separate colour discriminations) to paint the clown fully. These are the six colours given in the list above**.** The test allows a *maximum* of four attempts at each item. On the fourth attempt the colour chosen is accepted, regardless of whether or not it is the correct colour. When the teacher inspects the data table for the test, the number of attempts which the child made at each colour can be determined. *One error on any colour should not necessarily be regarded as significant, because this could result from carelessness or poor mouse control. However, if a child has two or more errors on a given colour then this should be regarded as suspicious.*

Teachers should be aware that some younger children or pupils with poor mouse control may obtain spuriously low scores on ***Clown*** because they are not pointing the mouse pointer directly on the correct colour on the palette. If this is suspected it is acceptable for the teacher to take over the mouse and ask the child to point at the colour that they want to select and say '*That one'*. (Be careful that the child points *distinctly*; do not assume they are choosing a colour just because their finger lingers in its vicinity for a moment — they may be looking for cues from you.) If a teacher wants to make sure about any suspected colour discrimination problem, then ***Clown*** can be repeated with that child on another occasion.

Where the results of ***Clown*** shows that the child has colour discrimination difficulties, the results of ***Toybox*** and ***Zoid's Friends*** may not be valid. It depends on the nature and extent of the colour problem. Teachers will have to inspect the data tables and use their own judgement.

8. Interpreting complex CoPS profiles

8.1. Low overall profile

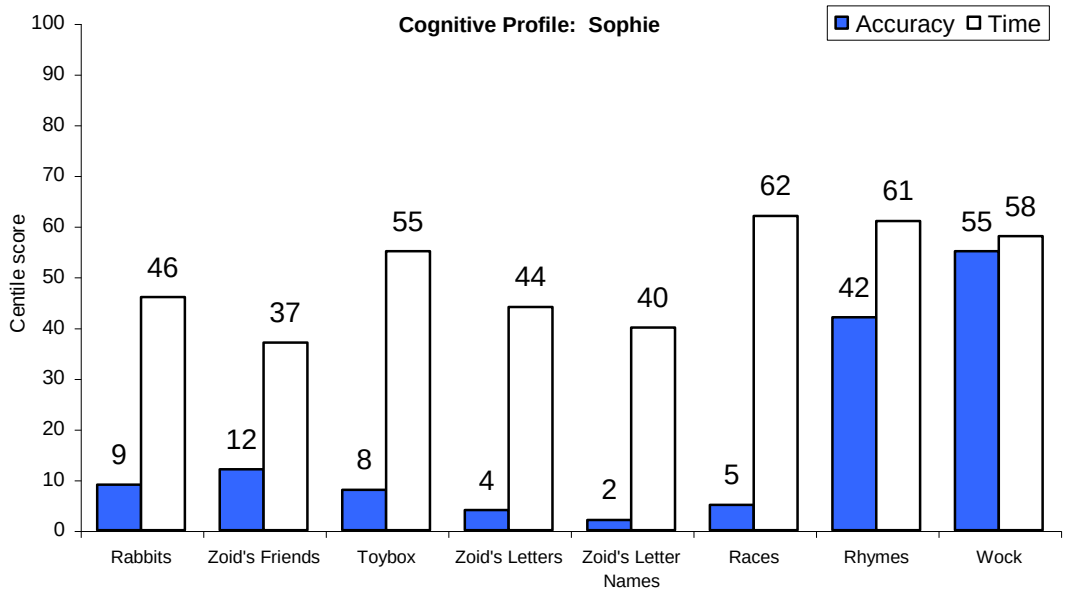
At the present time CoPS does not provide a completely satisfactory distinction between the child with a *specific* learning difficulty (dyslexia) which is very severe, and the child with more general *moderate* learning difficulties. In theory, both types of child *could* produce similar profiles on CoPS — i.e. fairly low scores across most or all of the CoPS tests. Although this dilemma rarely occurs in practice, teachers are usually able to distinguish the two because the child with moderate learning difficulties is commonly found to be 'slow' in other aspects of learning and in many classroom activities. Their language comprehension may be poor, their thinking and reasoning skills weak, and they may also be poorly co-ordinated. (Hyperactive children will tend to have fast times and low accuracy.) On the other hand, the dyslexic child will generally be an 'unexpected' discovery by the teacher — i.e. in classroom activities, reasoning, oral fluency, etc., seemed at least average, if not above average. If the teacher wants to be sure, then an independent check on the child's intellectual skills can be carried out, for example, using a test such as the *British Picture Vocabulary Scales—Second Edition* (Dunn et al, 1982). If still in doubt, the child can be referred to an Educational Psychologist for full assessment.

However, it should not be assumed that CoPS has no value in cases of children with moderate learning difficulties. CoPS is a useful tool to identify these children's relative strengths so that teaching can be more effectively differentiated for them, and training activities more precisely targeted.

8.1.1. Case study

Sophie has general memory difficulties, with low performance on all except the phonological awareness (***Rhymes***) and auditory discrimination (***Wock)*** tests (see Figure 34). She is unlikely to have moderate learning difficulties because those two tests show reasonable scores, but the teacher might wish to check Sophie's intelligence level with a suitable conventional test. Sophie's profile is typical of the more severe case of dyslexia, and consequently she would be expected to have difficulties both in the early stages of reading, where the emphasis tends to be on building up simple visual word recognition, and also later in acquiring phonic skills. She will tend to experience problems in reading as well as in spelling and writing. A highly structured multisensory phonic approach to literacy learning would be essential for Sophie, with ample practice to compensate for these memory weaknesses. Structured learning software to give lots of practice in both auditory and visual memory components of reading and spelling would be very helpful, and regular word processing activities (especially with a talking word processor) would also be beneficial. Later on, difficulties in rapid word recognition and more advanced text processing should be anticipated because the speed of lexical access (word finding) is a limiting factor here and this is dependent on both auditory and visual memory. She will need help to develop good higher-order reading skills (skimming and scanning) otherwise she will always be a slow laborious reader and this will handicap her at Key Stages 3 and 4 and above.

Figure 34 Case study—Sophie



8.2. High overall profile

At the present time, data on the relationship between high CoPS profiles and high general ability has yet to be analysed, and further research is also necessary. CoPS (particularly with the addition of the new tests for verbal and non-verbal reasoning) could be useful in identifying exceptionally bright (or even 'gifted') children.

Such children sometimes have learning problems because they find the work they are given in school too easy and they swiftly become bored. They can become lazy or careless because they are accustomed to tasks being effortless. They may become naughty or start to disrupt the work of other children in order to create some excitement in their school lives. Very bright children also have special educational needs, and these should be addressed as early as possible. Teachers should try to ensure that very bright children are provided with educational stimulation and challenge appropriate to their abilities, and that special talents are encouraged.

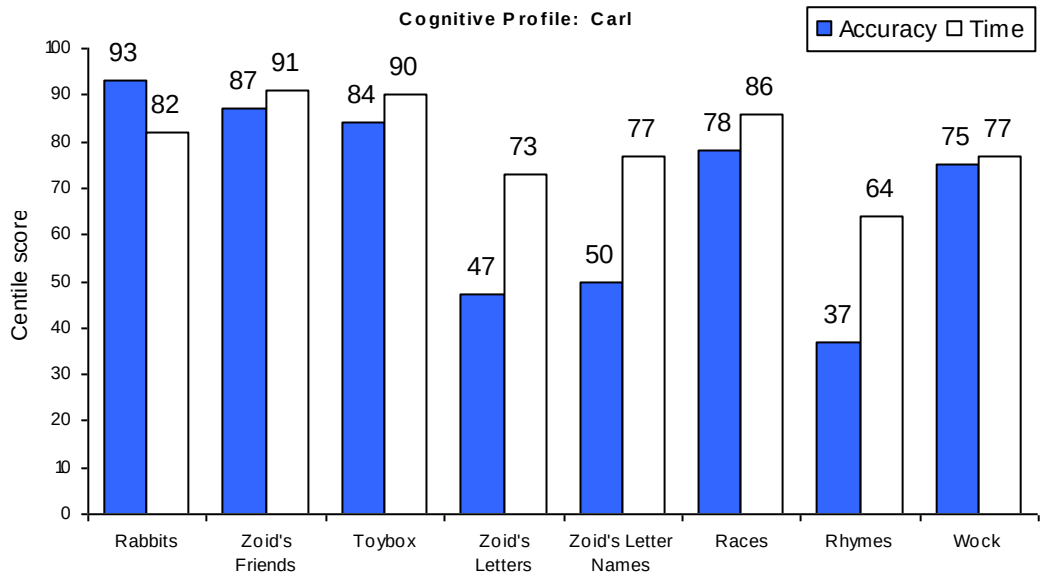
On the other hand, a few exceptionally bright children have relative difficulties which may be hidden and which can cause learning problems.

8.2.1. Case study

Carl's profile (see Figure 35) shows that most test scores are in the upper range of the chart, particularly in the visual tests, with results for accuracy above the 75th centile on all except three tests. Those three tests have scores in the centile range 37 to 50, which would not normally give the teacher any cause for concern. Indeed, at first sight, Carl's whole profile would not worry most teachers. On the other hand, Carl *could* be a very bright (or even 'gifted') child, and the teacher should try to check this. If Carl *is* bright, then he may have some difficulties for which he is able to compensate at this stage of education, but which may cause him problems later on. In other words, there may be a *hidden* difficulty. Teachers should try to consider the *relative* scores on the profile as well as investigating whether score fall below the thresholds for concern or risk.

Actually, Carl's WISC IQ score was later found to be 127, which although not exceptionally high is nevertheless in the top 5% of children in intellectual terms. However, his phonological awareness (***Rhymes***) is *relatively* low for a child who seems so adept at the other tests. One would have expected a child with all these other high scores and with very good auditory discrimination to have encountered no difficulty whatsoever with rhymes and obtained a perfect or near-perfect score. For some reason Carl did not, and the teacher should try to look into that. In Carl's case, it appears that home background factors were the most likely cause of his somewhat weak phonological awareness — the home was bilingual and there were some aspects of the English language which he had not had opportunities to discover.

Figure 35 Case study—Carl



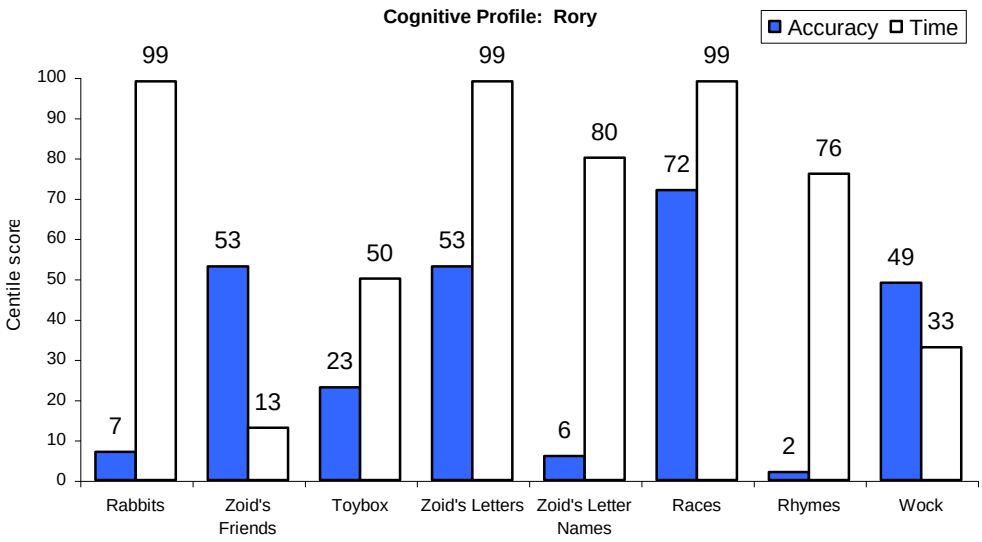
8.3. Other complex profiles

Many CoPS profiles display a complex pattern of 'highs' and 'lows' and at first sight appear quite puzzling. When tackling such profiles it is particularly important to bear in mind any extraneous factors which might have affected the child's performance. Examine the data to see on what days and times different tests were done. Motivation, ill-heath (actual or imminent), and impatience are often causes of a pupil under-performing. Or the child may simply have 'got the wrong end of the stick' (e.g. assuming that they have to do a test as quickly as possible when in fact it is accuracy which is most important). If the teacher is not confident about any particular result, then the safest course of action is to repeat the test(s) in question.

8.3.1. Case study – Rory

Rory's profile (see Figure 36), apart from the very low ***Rhymes*** result (suggesting poor phonological awareness), is rather difficult to interpret. Rory is aged 6 years 7 months. It might easily be assumed that his poor scores are the result of having attempted those particular tests too quickly. However, the results of Races and ***Zoid's Letters*** do not confirm this view, for the accuracy scores obtained on these test are average/good, despite time scores at the 99th centile. His results do not suggest an overall memory problem (***Races, Zoid's Friends*** and ***Zoid's Letters*** all being satisfactory), not do they suggest a sequencing problem (***Zoid's Friends*** and ***Zoid's Letters*** being satisfactory). Nevertheless, he was struggling in literacy work, despite being a fairly bright boy. He had developed a reasonable sight vocabulary, but could seem to remember the letter-sound relationships in phonics.

Figure 36 Case study—Rory

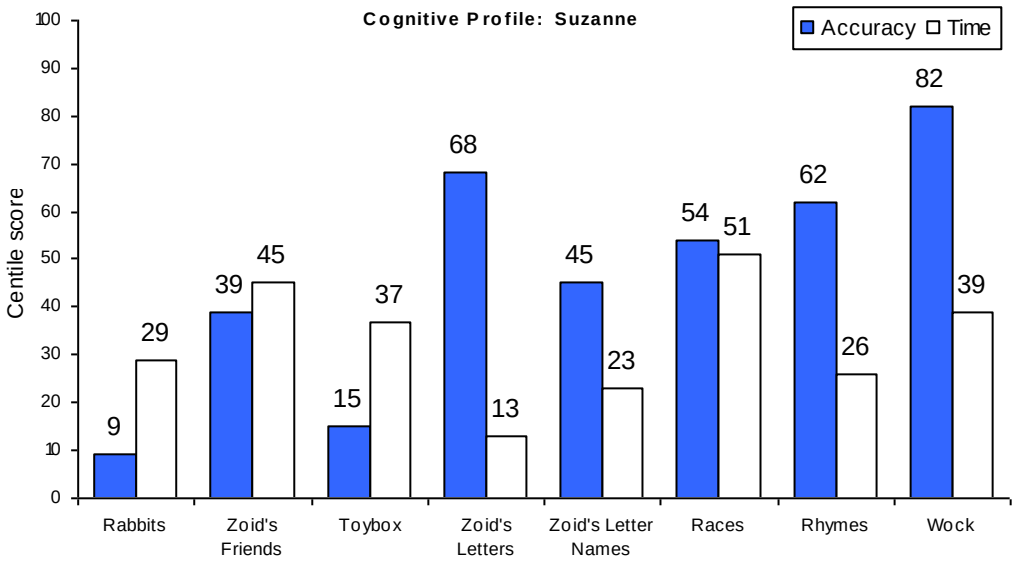


It turned out that on the day when he was attempting ***Rabbits***, the school was visited by a touring drama workshop, which created great excitement amongst the pupils. Rory had been under the impression that he would not be chosen to participate if he did not hurry up and finish the CoPS tests, hence the poor result. When this test was repeated another day, he scored at the 57th centile, which is average. However, a repeat of ***Zoid's Letter Names*** did not result in significant improvement (his score at the second attempt was at the 14th centile). However, it then became more obvious that he did seem to have a weakness in associative memory (***Toybox*** and ***Zoid's Letter Names***) — a 'pattern' had emerged. His teachers and his parents began to do regular memory work with him (as well as rhyming activities) and his ability to remember letter-sound relationships began to show some improvement.

8.3.2. Case study – Suzanne

The profile of Suzanne, aged 4 years 10 months, is also puzzling (see Figure 37). It is obvious that she is not impulsive — in all probability she is fairly careful as her time scores tend to be a little below the average, on the whole. And it is clear that she has strengths in auditory/verbal skills. But the results on the visual/perceptual side are not particularly consistent. Although her ***Rabbits*** score is low, her problem does not seem to be with visual sequencing as the results of ***Zoid's Letters*** and ***Zoid's Friends*** are average/good. She does not appear to have a problem with using verbal labels to aid visual memory (***Zoid's Friends*** result is satisfactory). Only the ***Toybox*** and ***Rabbits*** results give cause for concern, and it is difficult to see what these have in common which might help us explain the profile. It subsequently turned out that the explanation for her difficulties on ***Toybox*** and ***Rabbits*** was a visual difficulty. She was found to be suffering from a form of amblyopia ('lazy eye') in which the image from one eye was significantly out of focus. She thus was relying on the visual information from one eye. When she could focus her 'good' eye on a stationary target (or a sequence of stationary targets), she was able to cope quite well. However, but she found it very difficult to track a moving target accurately, to locate transient images in the visual field or to scan a row of images quickly. Thus she was experiencing problems on ***Rabbits*** (because the rabbit had usually moved on before she had located and registered its position) and ***Toybox***, where she had to scan the row of shapes rapidly to find the one with the same colour as the target.

Figure 37 Case study—Suzanne



The main strategy for interpreting complex CoPS profiles (or those that appear complex) is therefore to examine all possible reasons for any apparent area(s) of weakness, considering extraneous factors, and re-testing were necessary to check a result.

8.4. Interpreting results of children who are outside the CoPS norms range

CoPS is normed for use with children in the age range 4 years 0 months to 8 years 11 months. Over the age of 8:11, CoPS raw scores will not be normally distributed as many children will achieve a maximum or near-maximum performance (in statistical jargon this is sometimes referred to as a *'ceiling effect'*). Similarly, below 4:0, most children will obtain very low scores on the CoPS tests which will create a bunching of scores at the lower end of the distribution (sometimes called a '*floor effect'*). When ceiling and floor effects occur in any test, it is not a good discriminator between children with differing abilities. Most children younger than 4 years are not developmentally mature enough to cope with the requirements of CoPS and so it is not recommended for use below 4 years.

The norms for CoPS *only extend to 8:11*, so it can *only* be used *psychometrically* (i.e. to compare a given child's performance with that of other children of the same age) up to that age. However, over this age range it can have a certain limited value if used *clinically* (i.e. to identify children with particular difficulties), or *ipsatively* (i.e. to compare a given child's performance on one test with the same child's performance on another). When employed in this way with older individuals, it should always be used with *extreme caution*, and then only by experienced professionals who fully appreciate the limits within which they are working. Many older individuals with significant cognitive problems (e.g. dyslexia) are likely to experience difficulties on some CoPS tests (e.g. a 12 year old with a history of glue ear will tend to struggle with ***Wock***; and even many adult dyslexics with severe memory difficulties find tests like ***Zoid's Letter Names*** very hard indeed). Nevertheless, this is not *necessarily* the case. When used with older individuals, absence of any indications of difficulty on CoPS tests must *never* be taken as evidence that there *are no* underlying difficulties because the tests may just not be sensitive enough. In any case, older persons typically develop strategies by which they can compensate for any cognitive limitations, and these can have a masking effect, preventing any limitations from showing up in assessments.

Under exceptional circumstances, age equivalent scores can be used when assessing children outside the norm range: see Sections 2.4.5 and 4.2.4.

The preferred solution to assessment of children older than 8 years 11 months is to use **LASS 8-11** (age 8:0 – 11:11) or **LASS 11-15** (11:0 – 15:11). For more information visit our website (www.lucid-research.com).

9. Interpreting profiles of children who have limited English

9.1. Introduction

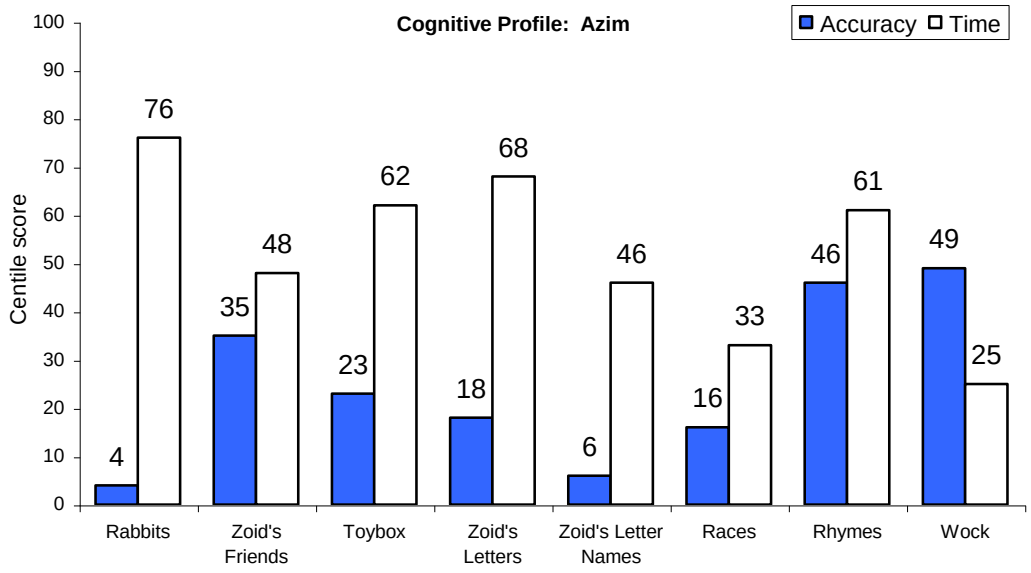
Assessment of any child who has limited proficiency in spoken English is always difficult. The approach to CoPS assessment of such children has already been discussed in Section *2.4.1*. This section shows CoPS profiles of four quite different children for whom English is an additional language (EAL). All four attend one school in Birmingham, and the language of their homes is Punjabi. Their skills in English were rated by their teachers using the Bilingual Check List. On this check list the teacher rates the child on four aspects of *proficiency* in English, four aspects of *degree of use* of English, and one rating for *motivation* to learn and use English. Each of the nine components is assigned a rating of between 0 and 4. Mean scores of less than 3.0 may be considered as indicating limited English overall, while mean scores of 3.0 or more may be considered as indicating satisfactory English overall.

9.2. Case studies

9.2.1. Azim

Figure 38 shows the CoPS profile of Azim, aged 6:3, who had a rather poor check list score of 1.88. His limited knowledge of verbal concepts in English is shown by his BPVS[5] standard score of 49, which is very low (less than 1st centile). His teachers are quite rightly worried about him (he is, in fact, on the school's SEN register), but his scores on ***Wock*** and ***Rhymes*** are quite satisfactory (in the vicinity of the 50th centile). However, his other CoPS results suggest that he has fairly serious memory difficulties, which could lie behind his poor progress in English and in other aspects of the curriculum.

Figure 38 Case study—Azim (Age 6 years 3 months)



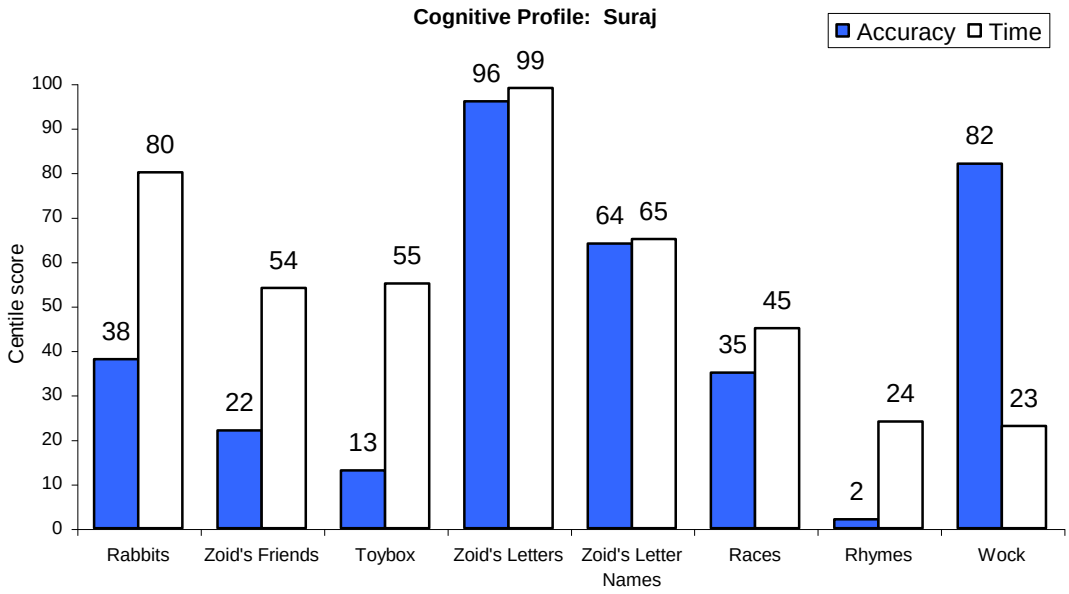
[Bilingual Check List mean score: 1.88. BPVS standard score: 49]

[5] *British Picture Vocabulary Test–Second Edition* (Dunn et al., 1982). Standard scores have a mean of 100 and a standard deviation of 15 (i.e. about 17% of children will have standard scores less than 85 and only about 3% less than 70).

9.2.2. Suraj

Figure 39 shows results for Suraj, aged 5:10. Like Azim, his English is rather poor (mean check list score 1.33 and BPVS standard score 76). Suraj has good scores for ***Wock*** (82nd centile) and ***Zoid's Letters*** (96th centile), and both ***Zoid's Letter Names*** (54th centile) and ***Rabbits*** (38th centile) are satisfactory; the latter three results suggesting competent visual memory skills. What is noticeable in his case are the poor scores for ***Zoid's Friends*** and ***Toybox*** (22nd and 13th centiles, respectively), which suggest difficulties with verbal encoding — specifically, in the use of colour labels.[6] Finally, the ***Rhymes*** score is very low (2nd centile), indicating poor phonological awareness. The recommendations for Suraj are, essentially, continue with intensive language work, concentrating on phonological awareness and verbal encoding of experience. His prognosis appears rather better than that of Azim, who seems to have more serious underlying memory difficulties.

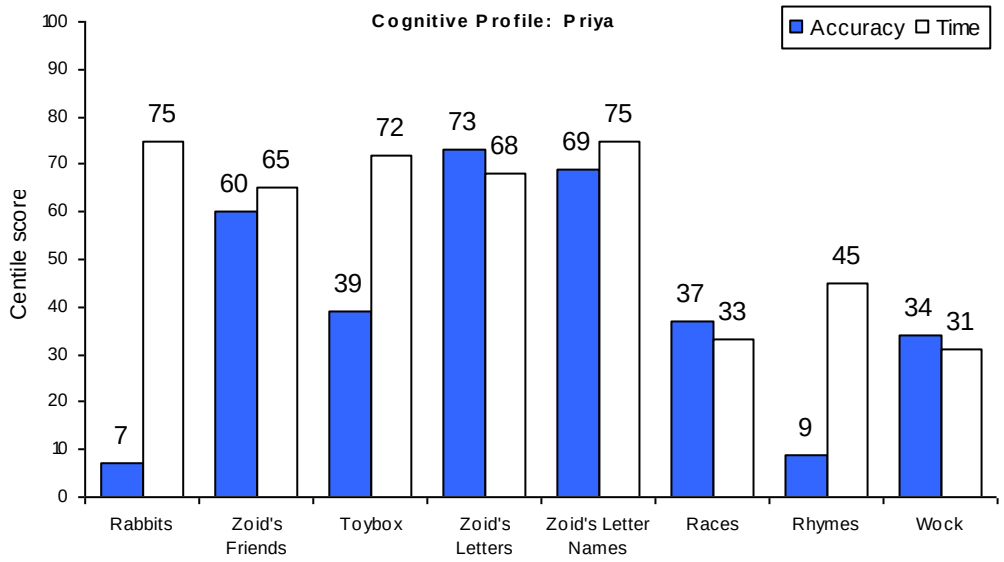
Figure 39 Case study—Suraj (Age: 5 years 10 months)



[Bilingual Check List mean score: 1.33. BPVS standard score: 76]

9.2.3. Priya

Figure 40 Case study—Priya (Age: 5 years 11 month)



[Bilingual Check List mean score: 3.56. BPVS standard score: 88]

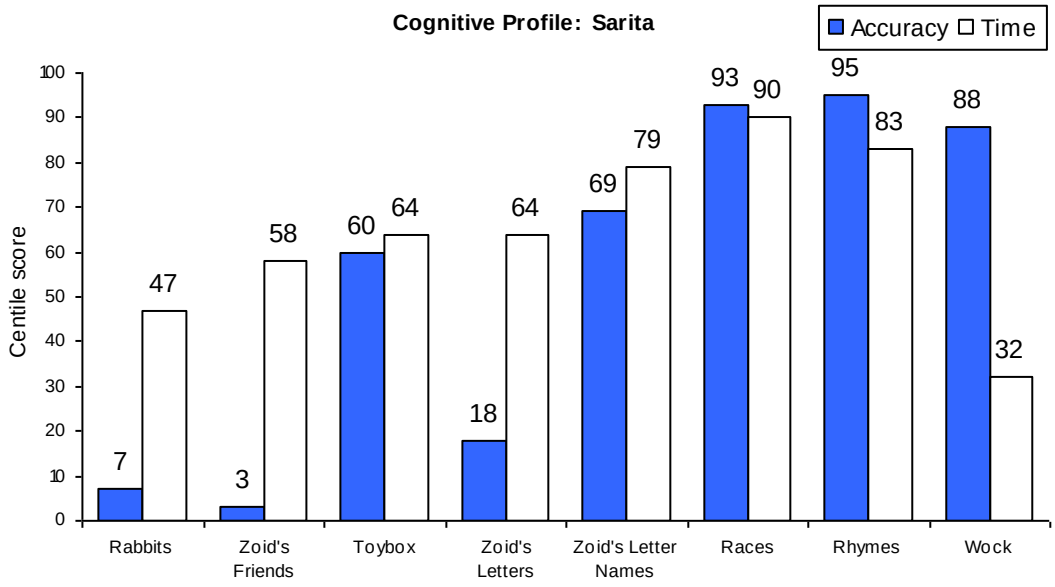
[6] ***Clown*** performance was satisfactory, so these results were not due to colour discrimination problems.

Figure 40 shows results for Priya, aged 5:11. Her English proficiency and usage is quite good (check list score 3.56), although her understanding of verbal concepts in English is still somewhat limited (BPVS standard score 88; centile 22). In general, her profile indicates that she is not seriously at risk: apart from ***Rabbits*** (which she may have attempted too quickly)[7] her scores on the memory tests in CoPS are average or good. Auditory discrimination is also satisfactory (***Wock***), although phonological awareness is still limited (***Rhymes*** centile 9). Priya needs time spent on rhyming and other phonological activities to give her a better start in literacy learning, but otherwise she gives no serious cause for concern.

9.2.4. Sarita

Figure 41 shows CoPS results for Sarita, who has a fairly low standard of spoken English (Check List mean score 2.11) but whose English conceptual knowledge is average (BPVS standard score 94). She was also having great difficulties in early literacy work. There was a difference of opinion about this girl amongst her teachers. Some felt that she displayed 'typical' EAL problems, and simply needed more time to become fluent in English. Others felt that her case was more complex, that there were some other factors which were hindering her learning, which at that stage was mainly whole-word activities with flash cards. The CoPS results shows that her auditory/verbal skills are good — but she does have some significant problems with visual sequential memory, and these are likely to hinder her ability to cope with a whole-word approach. Equipped with this knowledge, her teachers were able to change tack and give her literacy work which utilises her good auditory/verbal skills, rather than concentrating on a visual approach, and she is now making better progress.

Figure 41 Case study—Sarita (Age: 5 years 8 months)



[Bilingual Check List mean score: 2.11. BPVS standard score: 94]

[7] This could be repeated if desired, in order to check.

10. Recommendations on teaching

10.1. Approaches to teaching

CoPS results should always be considered in relation to two fundamental educational strategies:

- **Remediation of cognitive weaknesses**
- **Differentiated teaching in basic skills**

Cognitive abilities that are especially important for early literacy generally improve with the right type of practice. Where CoPS reveals limitation in these skills, the teacher knows where and with which pupils to give remediation. However, the objective of CoPS is *not just the identification of specific cognitive weaknesses so that these can be given training.* An equally important function of CoPS is to give the teacher insights into the child's pattern of cognitive strengths and weaknesses. This enables the teacher to make the literacy and basic skills learning programme for the child more *individualised* and more *efficacious*. It is important to stress that the two approaches (cognitive remediation and differentiated teaching) should be *complementary* and not *contradictory*. In other words, *both* strategies should be considered and will usually be implemented *together*. The best overall approach is one which attempts to remedy weaknesses whilst at the same time building on strengths. For further discussion of the research underlying this approach and how it can be applied in the classroom, see Singleton (2002, 2003).

Throughout this chapter, teachers will find recommendations regarding software and other resources. These materials were available at the time of printing, and addresses of suppliers are given in the Appendix, section 11.2. In the course of time these materials may become unavailable, while new materials are likely to become come on to the market. Teachers should consult the Lucid website (www.lucid-research.com) for up-to-date information about current software and resources. Teaching strategies and suggested software for children with dyslexia and other literacy difficulties have been reviewed by Crivelli (2001), Keates (2000), Stansfield (2000), and Kaufman and Whiting (2002). Teachers will find many additional suggestions in these highly recommended books. For further suggestions on suitable software see the British Dyslexia Association website (www.bda-dyslexia.org.uk) which is updated on a regular basis.

10.1.1. Remediation of cognitive weaknesses

The approach here is to use the CoPS tests to identify cognitive weaknesses and then for the teacher to address these directly with suitable training activities. However, some cognitive weaknesses respond better to direct remediation than others, especially with young children. Poor phonological awareness (***Rhymes***) and auditory discrimination weaknesses (***Wock***), for example, generally respond better to training than do memory difficulties.

Training can be carried out individually or in group work, in the classroom or at home. Examples of training activities are given later in this Section. It is important that progress is properly monitored to ensure that the techniques being used are effective. As far as possible, it is better to use measures or techniques other than CoPS for this purpose. Although CoPS can be used for monitoring progress, care must be taken not to over-test the child. Any test will show a practice effect with repeated testing and the apparent improvement in test performance may not always give a true reflection of the more generalised cognitive improvement that is being sought

However, it is important to stress that remediation of cognitive weaknesses should generally be used *in conjunction with* differentiated literacy teaching. Cognitive remediation is unlikely to be a successful strategy *by itself* unless the weaknesses are very minor and/or can be treated swiftly in a manner which has already been proven to be effective. For example, in the case of a child from an impoverished language background, who has scored low on ***Rhymes*** (phonological awareness) but has a satisfactory performance on all the other CoPS tests. Phonological training using rhyming, alliterative and syllable segmentation activities have a very good chance of success with such a child, provided the help can be provided early enough and intensively enough (Bryant and Bradley, 1985; Goswami and Bryant, 1990). However, it must always be borne in mind that whilst cognitive remediation is being carried out, the child is still likely to be involved in early literacy work in the classroom. If that literacy work is not differentiated for the child in a manner which takes account

of their cognitive strengths and weaknesses, they are likely to experience failure and frustration which will be a barrier to learning. They will quickly perceive that their progress is not as good as that of other children and this will affect motivation. There is good evidence, however, that phonological training is most effective when combined with structured teaching of reading (Hatcher, Hulme and Ellis, 1994).

10.1.2. Differentiated teaching in basic skills

The approach here is to use CoPS to identify the child's cognitive strengths as well as limitations, and for the teacher then to use this information to design a literacy learning programme which is differentiated for that particular child, taking those strengths and limitations into account. The aim is to give the teacher the type of information that enables the creation of a more appropriately differentiated learning scheme for the child. By recognising difficulties which the child is likely to encounter, the teacher is in a better position to structure the child's learning experiences in such a way that success is maximised and failure is minimised. Examples of this approach are given later in this Section.

It can be appreciated, therefore, that CoPS is *not* just a device for diagnosing dyslexia. It can be used as a form of early screening on school entry, to identify all children's cognitive strengths and weaknesses, and to shape learning schemes more appropriately. Alternatively, CoPS can be used later in school to assess children who are experiencing problems in reading, writing or maths, to help uncover the causes of the difficulty. However, this latter approach is perhaps not as desirable as using CoPS to screen all children, because it will not enable the teacher to identify at an early age — and before they have begun to fail — those children whose difficulty is *unexpected* (which is the case with most dyslexic children).

10.2. Phonological discrimination problems

10.2.1. Phonological discrimination training

The responsiveness of phonological discrimination difficulties to training largely depends on their severity. The severity of such weaknesses is affected by the degree and duration of the child's hearing difficulty or impoverished experience, and the effectiveness of any medical interventions which have been carried out (e.g. fitting of grommets in cases of glue ear). It is generally easier to improve phonological discrimination of four- or five-year olds than of six- or seven-year olds, because the older children will usually have had a longer duration of disturbance in hearing or inadequate language experience, which has deprived the brain of the opportunity to learn the fine differences between speech sounds.

A teacher wishing to carry out training work with a child who is scoring low on ***Wock*** would be well advised first to consult the data table for ***Wock*** for that child in order to identify the particular difficulties which the child was experiencing. An individual programme of remediation can then be created. The phonological discriminations in ***Wock*** are shown in Table 12.

The first item of ***Wock*** (pen/ten) is relatively easy and is intended to be so, because it is a practice item. In pen/ten the p/t discrimination is in the *initial* position, whereas the p/t discrimination in the *final* position (No. 11: pot/pop) is much more difficult, as is the discrimination between the unvoiced 'p' and its voiced equivalent 'b', even in the initial position (no. 7: peg/beg). Of course, there are many more relevant discriminations for the child to know than have been included in the ***Wock*** test. In the original research version of ***Wock*** 30 different discriminations were tested in two parallel forms of the test, but these were narrowed down to the 16 items in the original DOS and Acorn version of ***Wock*** (the first item being a practice). This was carried out not only in the interests of speed of administration of the test, and to avoid the child becoming bored, but also item analysis was conducted to identify which individual items were the best predictors of later literacy difficulty. Only the most predictive items were retained in ***Wock***, so that as a test it is as effective as possible. This also explains why ***Wock*** is predominantly a test of auditory discrimination in initial position (as opposed to medial and final positions). In the research version of ***Wock*** this was not the case — the test was more evenly balanced between initial, medial and final position discriminations. However, medial and final discriminations are generally more difficult than initial discriminations. Hence a large proportion of young children (including many of those who will not turn out to have literacy difficulties) will fail on medial and final discrimination items, and those items will not statistically distinguish children at risk from those not at risk. Medial and final discriminations are better for assessment of somewhat older children. Consequently, in the Windows version, the original 15 test discriminations have been retained for children under 7 years, while

children 7 years and over have those same 15 items, followed by a further 10 more difficult discriminations, of which most are in medial and final positions, and those that are in initial position involve discrimination of 'awkward' consonant blends (e.g. d/dr, b/br, fr/fl). Occasionally, however, a 6 year-old child with satisfactory phonological discrimination skills may make one or two errors (perhaps out of carelessness), which will reduce the centile score significantly and it will then appear that his/her phonological discrimination skills are less satisfactory. These larger centile jumps are a direct function of the normative data (most children this age do not make these errors and therefore larger centile point jumps occur with changing accuracy scores). In addition at this age the program gives only 15 test items and not the full 25 items, so the child does not have the opportunity to attempt further items. If the teacher suspects that this may have occurred and wishes to administer all 25 items, a solution is to register the child under another name using a false date of birth which will make the child appear 7 years of age, and rerun the test, thus ensuring that all 25 items are delivered. Although the centile score obtained by this method will be based on the norms for 7 year-olds, it will provide the teacher with an approximate check on whether the child's phonological discrimination is below the expected level or whether the previous result was a test design artefact.

Inspection of the ***Wock*** data table will give the teacher information on which particular phonological discriminations the child was experiencing difficulties. Obviously, these will need to be targeted in any training activities. However, that does *not* mean that when carrying out phonological discrimination training work with a child, the teacher should concentrate solely on those particular phonological discriminations that the child found problematic. Nor, indeed, should the teacher necessarily be restricted to the set of phonological discriminations contained within ***Wock***. As previously explained, ***Wock*** contains those items which were found to be most highly correlated with later literacy development for the *group* of children in the research project. These may be thought of as a general indicator of phonological discrimination difficulty, but other discriminations not included in ***Wock*** *may* be equally important in the literacy development of the *individual* child. Consequently, when ***Wock*** has indicated that a child has a non-temporary difficulty with any phonological discriminations, the teacher should (a) investigate which items of ***Wock*** caused the child problems, and (b) try to investigate which other aspects of phonological discrimination the child might be finding difficult, and work on these as well. For further information see Smith and Bloor (1985); Webster and Ellwood (1985); and Webster and McConnell (1987). The games and activities for phonological discrimination training described below can also be used by the teacher for this type of investigation.

- **'I spy'** — either conventionally (alliterative) or *'Rhyming I Spy'.*
- **Word families** — i.e. putting words in to families based on different sound components (e.g. *made, paid, glade; flower, flan, flock; trip, grit, crab; tan, fat, sad).*
- **Spot the difference** — can the child detect the difference between similar sounding words (e.g. *town–down, pat–pad, fag–sag, shot–shop*)? By inserting some identical pairs in the game (e.g. *show–show*) you can play an individual or group game which encourages careful listening. If possible children should try to *identify* the difference as well as detect it. This can be tape-recorded in advance, which circumvents the problem of children lip-reading the teacher (alternatively, blindfolds can be worn or the children can face away from the teacher).
- **Computer programs**. - there are a computer programs that provide training in sound and speech recognition and discrimination. We recommend Earobics (www.earobics.com).

10.2.1.1. Teaching the child with phonological discrimination difficulties

As far as the development of literacy is concerned, the principal problem for the child with phonological discrimination difficulties —whatever their cause— is developing phonic skills. Phonological discrimination training will help, but at the same time the teacher should appreciate that the child will still require very careful teaching in phonics. If the child also has good visual memory skills, then there may be an inclination to rely predominantly or even exclusively on visual strategies in reading which may give an erroneous impression that the child is reading well. Neglect of the problem at this stage will only exacerbate difficulties that will have to be addressed later in schooling. A well-structured multisensory teaching approach is recommended, with care being taken to ensure that the child is hearing the sounds properly. The child will also require plenty of additional practice in phonics activities to counteract the child's tendency to be confused by similar sounds. For further information on teaching phonics see Section 10.4.2, page 90.

Children with phonological discrimination problems may also experience difficulties hearing instructions given by the teacher. Noisy classroom environments will exacerbate this problem. If a child has not heard or

understood instructions s/he may carry out the wrong task, daydream, or interfere with the work of other children, perhaps in the attempt to discover what they should be doing. The teacher should therefore seat the child as close to the front of the class as possible, making sure to check that the child has heard and understood instructions, and monitor the child regularly to ensure that they remain on-task. Snowling and Stackhouse (1996) provide a useful compendium of recommendations on teaching dyslexic children with speech and language difficulties.

10.3. Poor phonological awareness

The evidence that training in phonological skills facilitates literacy development is extremely strong (for reviews see Bryant and Bradley, 1985; Goswami and Bryant, 1990; and Rack, 1994). However, auditory discrimination may also require training, so firstly the teacher should check the child's auditory discrimination abilities and take appropriate action (see under ***Wock***, above). Lundberg, Frost and Peterson (1988) showed that relatively short daily sessions of phonological activities (15–20 minutes) carried out with kindergarten children resulted in improved phonological skills and significant gains in reading and spelling (compared with a control group) through at least to their second year of schooling. In this particular study, activities progressed from simple listening and rhyming games, to segmentation of sentences into words, words into syllables and, finally, syllables into phonemes. In the Cumbria study, Hatcher, Hulme, and Ellis (1994) found that integrated sound-categorisation and letter-knowledge training produced the largest improvements in reading and spelling of a group of seven-year-olds who were failing in reading.

Phonological awareness can be developed by a variety of methods. For example:

- **Rhyming** and **alliteration** —suitable techniques range from simple rhyming songs and games to more structured activities involving making books with rhyming or alliterative themes, playing rhyming snap or 'odd-one-out' games with pictures and objects; using plastic letters to discover and create rhyming word families
- **Deletion** of the first sound (e.g. '*near–ear'*) or of the last sound (e.g. *'party–part'*), or of whole syllables (e.g. saying '*alligator'* without the '*all'*)
- **Elision** of the middle sound (e.g. snail–sail) or syllable ('*alligator'* without the '*ga'*).
- **Correspondence** — e.g. tapping out the number of syllables in a word.

Many of these activities are very suitable for playing at home, so parental involvement is strongly encouraged. Many phonological discrimination activities are also useful for phonological training. For ideas on phonological awareness activities see Goswami and Bryant (1990); Layton and Upton (1993); Layton, Deeney, Tall and Upton (1996); Buckley, James and Kerr (1994); James, Kerr and Tyler (1994); Yopp (1992). *Sound Linkage* (Hatcher; 1994) is based on the Cumbria project on phonological awareness (Hatcher, Hulme and Ellis, 1994) and includes materials for testing and training. Snowling and Stackhouse (1996) provide a useful compendium of recommendations on teaching dyslexic children with speech and language difficulties.

For computer-based activities for practising phonological skills we recommend looking at these websites jollylearning.co.uk, letterland.com and sherston.com**.**

In general, children respond well to phonological training activities and skills swiftly improve. However, some dyslexic children may have more persistent difficulties that will require particularly careful literacy teaching. In such cases, a well-structured multisensory approach incorporating plenty of practice in phonic skills (over-learning) is recommended. Examples of suitable schemes are given later in section 10.4.2. Without phonological awareness training, many children with such weaknesses are liable to develop an over-reliance on visual (whole word) and contextual strategies in reading (especially if they are bright). They can easily 'slip through the net', only to re-appear as a child who is failing in reading and spelling later in the primary school.

10.4. Poor auditory/verbal working memory

When interpreting results from ***Races*** and ***Zoid's Letter Names***, comparison should be made with the other memory tests in CoPS as well as the other auditory verbal tests. The teacher should ask which of the following is the case?

- the child has general *associative* memory difficulties (visual as well as verbal)

- the child has general *sequential* memory difficulties (visual as well as verbal)
- the child has general auditory/verbal memory difficulties
- the child has *specific* difficulties in auditory/verbal *associative* memory
- the child has *specific* difficulties in auditory/verbal *sequential* memory
- the child has general auditory/verbal processing difficulties
- the child has a combination of some the above difficulties

Selection of appropriate teaching and training activities will depend to a large extent on the answers to this question, as well as on the severity of the difficulties. The more extensive and the more severe the memory problems, the more difficult they will be to remediate. Nevertheless, memory remediation activities should always be considered. It is tempting to suggest that because a child has auditory/verbal processing difficulties of some kind then the solution is to teach the child to use only visual strategies for reading instead of teaching phonic decoding skills. However, this is an inadequate solution which will result in the child having greater difficulties later on (see further discussion of this below).

10.4.1. Auditory/verbal memory training activities

It is commonly found that memory limitations are more difficult to improve by direct training, especially with younger children, than are weaknesses in either phonological awareness or auditory discrimination. On the other hand, older children can respond well to *metacognitive* approaches to memory improvement, i.e. techniques designed to promote understanding of their own memory limitations and to develop appropriate compensatory strategies (see Buzan, 1986). However, that does not mean that memory training is not worthwhile with young children. Indeed, it may well be the case that with improved training techniques, remediation of memory weaknesses could turn out to be a much more promising approach in the future. The emphasis should be on variety and on stretching the child steadily with each training session. The tasks should not be too easy for the child (which would be boring) nor much too difficult (which would be discouraging), but just give the right amount of *challenge* to motivate the child to maximum effort. Use of prizes, star charts for improvement, etc., should all be used if these will help motivation. Activities can usually be carried out at home as well as in school. Competition between children can be motivating for some children, but it can also be discouraging for the child with severe difficulties, because they will easily perceive and be embarrassed by the discrepancy between their performance and that of other children.

Auditory/verbal training activities include:

- **I went to the supermarket** — teacher says to the child sentences of increasing length and complexity and the child has to repeat these back verbatim (e.g. *"I went to the supermarket and bought three tins of beans, one loaf of bread, a carton of milk, a packet of sweets, two bars of chocolate...."* etc.)
- **Find the changed (or missing) word** — teacher says sequence of words to the child (e.g. *dog, cat, fish, monkey, spider*) and then repeats it changing one (or missing one out altogether), either slightly or more obviously (e.g. *dog, cat, fox, monkey, spider*) and the child has to identify the change.
- **What's their job?** — Teacher says to the child a list of name-occupation associations (e.g. *"Mr Pearce the painter, Mrs Jolly the grocer, Miss Fish the hairdresser, Mr Brown the electrician"*) and then asks for recall of one (e.g. *"Who was the grocer?"* or *"What is Mr Brown's job?"*). Occupational stereotypes can be avoided if desired.
- **Word repetition** — teacher says sequences of unrelated words to the child (e.g. *hat, mouse, box, cup, ladder, tree, biscuit, car, fork, carpet*) and the child has to repeat them in the correct order. The length of the list can be gradually extended. If the words are semantically related it is more difficult, and if they are phonologically related (e.g. *fish, film, fog, fun, phone, finger*) it is more difficult still.
- **Phoneme repetition** — as word repetition, but with phonemes (*"oo, v, s, er, d"*). Note that phonologically similar lists will be much more difficult (e.g. *"p, b, k, d, t"*)
- **Letter name repetition** — as word repetition, but with letter names.

- **Digit repetition** — as word repetition, but with digits. About one per second is maximum difficult for short sequences. Slightly faster or slower rates are both easier for ordinary individuals to remember, but dyslexics tend to find a slower sequence harder (because their rehearsal processes in working memory are deficient).

Good computer software for developing auditory/verbal memory includes: ***Leaps and Bounds*** (inclusive technology); ***Mastering Memory*** (CALSC) and ***Memory Booster*** (Lucid Research).

10.4.2. Teaching phonics

For the reasons explained above, the child who displays major difficulties in *auditory/verbal* memory is likely to have problems in acquiring effective phonic skills. Nevertheless, this type of child may make satisfactory progress in the *early* stages of reading—where the emphasis tends to be on building up simple visual word recognition skills—if visual memory skills are quite good. Because of this, it is very easy to overlook this child's problems and assume that because an apparently satisfactory early start has been made, everything else will follow automatically. In fact, this child would probably learn to rely almost exclusively on visual strategies in reading. It could be as late as nine or ten years of age before the underlying problems become noticeable, by which time so much learning opportunity has been wasted. Many dyslexics have a pattern of development like this. The recommendations here would be for an early introduction of a highly-structured *multisensory phonic approach* to literacy learning. This should not only provide ample practice to compensate for memory weakness, but should in this case also make use of the child's strong visual skills in order to reinforce learning and help to maintain confidence.

Examples of well-structured phonics schemes suitable for younger children with dyslexic difficulties include:

- *Alpha to Omega* (Hornsby and Shear, 1975) †
- *Spelling Made Easy* (Brand, 1988) †
- *The Bangor Teaching System* (Miles, 1989)
- *The Hickey Multisensory Language Course* (Augur and Briggs, 1992)
- *The Star Track Reading Scheme* (Beadle and Hampshire, 1995) †
- *The Phonics Handbook* (Lloyd, 1992) †
- *Toe by Toe* (Cowling and Cowling, 1993)

Books marked † also have worksheets.

Good computer software for practising phonic skills includes: **Wordshark 5** (White Space); **abc-CD V2** and **Rhyme and Analogy** (Sherston); **Clicker Phonics** (Cricksoft); **Gamz** (gamzuk.com), **Catch-Up** (CatchUp).

Use of a talking word processor is beneficial because it gives the child auditory feedback and encourages them to pay attention to the phonic components of words when writing. For example: **WriteOnline** (Cricksoft), **Write:Outloud 6** (Inclusive Technology), **WordRead** (Claro Software), **Read&Write** (TextHelp).

A generic structured learning scheme such as **AcceleRead AcceleWrite** (dyslexic.com) can be used with any good talking word processor (Miles, 1994). Further information on techniques for teaching the dyslexic child can be found in Augur (1995); Cooke (1992); Crombie (1992); Hornsby (1982); Pollock and Waller (1994); Reid (1998); Thomson and Watkins (1990).

10.5. Visual memory difficulties

It is widely acknowledged that the *predominant* problems found in dyslexic children are phonological rather than visual (Pumfrey and Reason, 1991; Snowling and Thomson, 1994). Indeed, dyslexic individuals often have excellent visual skills (West, 1991). Nevertheless, teachers and educational psychologists are not infrequently confronted by cases of young children who appear to have inordinate difficulties in remembering various types of information presented visually. The case study Adam (see Figure 27 earlier in this Section) is

one such child. (Remember that his father commented: *"Adam learns with his ears"*.) Such cases are undoubtedly less common than those of children with phonological difficulties[8]. However, they do form a very important group because these are the pupils who are likely to fall at the very first hurdle with which they are confronted in literacy — i.e. whole-word, 'look and say' reading activities, often presented on flash cards. Of course, some teachers would presume that the child who cannot remember flash cards (however bright, orally fluent and well-motivated) is simply not *ready* for reading. On the other hand, if the child cannot begin reading in the most conventional way the most obvious solution is not to ignore the child's problems, but to find the way which is most appropriate for the child to learn.

In cases where the child is experiencing difficulty with visual whole word ('look and say') methods because of visual memory problems this can lead to early discouragement and frustration which can easily affect the whole of the child's educational activities. The child can swiftly become a reluctant learner. Spelling and writing are also likely to be a struggle. Visual memory training would be beneficial, but the main solution would be to make a much earlier start to structured phonics work, with ample practice (over-learning) to compensate for memory weaknesses. A multisensory approach is strongly recommended, building on any auditory and kinaesthetic strengths. A list of suitable phonics programmes and associated activities was given earlier in this Section (see *Teaching Phonics*).

10.5.1. Visual memory training activities

- **Find the missing part** — create pictures of everyday things with parts of the pictures missing (e.g. doll with one arm, table with only three legs) and ask the child to identify what is missing. To do this the child has to recall visual images of the relevant objects.
- **What's wrong here** — use pictures of everyday things with parts of the pictures wrong (e.g. house with the door halfway up the wall; person with feet pointing backwards instead of forwards) and ask the child to identify what is wrong. To do this the child has to recall visual images of the relevant objects.
- **Kim's game** — an array of familiar objects on a tray (or picture of an array of objects). The child scans this for two minutes (or whatever period of time is appropriate) and then has to remember as many as possible.
- **Symbols** — show child a sequence of symbols, letters or shapes of increasing length, and then jumble them up and the child has to rearrange them in the correct order. Remember that this can become more of a verbal task than a visual task — if you want to practice *visual* skills then it is best to have stimuli which are not easily verbally coded, like the ones in ***Zoid's Letters.***[9]
- **Who lives here?** — Make a set of pictures of people (these may be cut from magazines) and a set of houses of different colours, or different appearance in some way. The people are matched with the houses, and then jumbled up. The child has to rearrange them in the correct relationship. If the people are given names then the task becomes more verbal.
- **Pelmanism** — remembering matching pairs of cards from a set, when cards are individually turned over and then turned back. The child has to remember where the other one of the pair is, and if both are located these are removed from the set, and so on.
- **Card games** — e.g. Snap, Happy Families.

Good computer software for developing visual memory skills includes: Memory Booster (Lucid Research); Mastering Memory (CALSC); Shiny Learning.

10.6. Colour discrimination difficulties

Colour vision deficiencies are important because they can be a contributory factor in learning difficulties. Although they are not treatable, teachers and parents can help children adjust to this condition. Learning

[8] A variety of research studies has estimated the incidence at between about 10% and 20% of dyslexic children have mainly visual processing difficulties (Thomson, 1989).

[9] But the *exact* symbols from ***Zoid's Letters*** should *not* be used otherwise this test will not be suitable for monitoring the child's progress.

activities in the classroom must be adapted to allow for any colour vision problems detected in the child. In rare cases, dyslexic children can suffer from *colour anomia* — i.e. a neurological deficit which affects the extent and speed with which they are able to name colours. About 10% of dyslexic children have been reported to have this difficulty, which appears to be connected with visual and verbal memory in some way (Mattocks and Hynd, 1986).

11. Appendices

11.1. References

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11.2. Addresses

Please carry out an appropriate web search for up-to-date resources and address changes. Books and other printed publications recommended in this manual can be obtained from SEN Marketing. Most of the software recommended in this manual can be obtained from REM. iANSYST also supply some of the recommended software. Both companies have very useful websites.

In cases of difficulty obtaining software, please contact the publisher direct or ask the British Dyslexia Association (BDA) for advice. The BDA has information on software and publications on its website and also publishes a magazine ('Dyslexia Contact') three times a year, which contains reviews of software and publications.

The publications '*Guidelines for the Development and Use of Computer-Based Assessments'* and *'Dyslexia, Literacy and Psychological Assessment'* are available from The British Psychological Society

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British Psychological Society www.bps.org.uk

iANSYST www.dyslexic.com

Inclusive Technology www.inclusive.co.uk

REM www.r-e-m.co.uk

SEMERC http://www.semerc.com

SEN Marketing www.senbooks.co.uk

Dyslexia Action http://www.dyslexiaaction.org.uk/

11.3. CoPS COMMENTS SHEET

Name of child ..... Date of Birth .....

Class ..... Supervisor .....

School or Centre .....

Test	Date	Testing room	Health	Attention	Other comments	Initials of tester
Zoid's Friends						
Rabbits						
Toybox						
Zoid's Letters						
Zoid's Letter Names						
Races						
Rhymes						
Wock						
Clown						

General comments .....

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This sheet may be freely photocopied for use in conjunction with CoPS testing.

11.4. The Quick CoPS Grid

Child' Name: ..... **Date of birth:** ……..

Age at time of testing: …….. years ……. months

Class:

Relevant factors used: **a)** **b)** **c)** **d)** **e)** **f)** **g)** **h)** **i)** **j)**
(please circle)

Other information:

.....

	Age of child				
TEST	4:0 – 4:11	5:0 –5:11	6:0 – 6:11	7:0 – 7:11	8:0 – 8:11
Zoid's Friends	✓	✓	✓		
Rabbits			✓	✓	✓
Toybox					✓
Zoid's Letters	✓			✓	
Zoid's Letter Names				✓	✓
Races		✓	✓	✓	✓
Rhymes	✓	✓	✓		
Wock	✓	✓			
Clown					

This form may be freely copied. The four tests selected for administration should be ringed in the first column.

NOTES: .....

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11.5. Tables of age equivalents

An age equivalent is defined as the chronological age range of children that would be expected to achieve a given raw score. Age equivalents are designed to be used only in exceptional circumstances, e.g. for pupils in special education where centile norms are not always helpful. Age equivalents should not be used routinely in cases where centile norms are applicable, because age equivalents give only a very rough approximation of the child's ability. For explanation of this issue, please see Section 2.4.5.

To calculate an age equivalent for any CoPS accuracy score, first find the child's raw score for any of the CoPS tests by consulting the relevant data tables in the Report Generator (for an explanation of how to do this see Section 4.1.4). Next, locate the corresponding score (or score range) in the body of Table 14 or Table 15, given below. The age equivalent for that score is given in the left-hand column of the table on the same row as the child's accuracy score.

Note that for most of the CoPS tests age equivalents in 6 month age bands can be calculated (see Table 14), but for certain tests (***Zoid's Letter Names, Rhymes*** and ***Wock***) age equivalents in 12 month age bands have been given instead (see Table 15). This difference is a consequence of complying with teacher's requirements that the time taken to administer CoPS tests should be kept to a minimum, whilst preserving validity and reliability of the results. In the case of ***Zoid's Letter Names, Rhymes*** and ***Wock*** it was possible to reduce the number of items whilst retaining the psychometric integrity of the tests. In the case of the other CoPS tests, it turned out that rather more items were needed. Thus ***Zoid's Letter Names, Rhymes*** and ***Wock*** have a reduced score range and, correspondingly, age equivalents can only be calculated in a fairly broad range.

Note that age equivalents are given only for CoPS accuracy scores; the construction of the CoPS tests, with different levels and difficulties related to chronological age, means that age equivalents for time scores would not be helpful.

Example

Thomas, chronological age 9 years 3 months, has moderate learning difficulties. He has raw scores of 20 on Rabbits and 3 on Rhymes. His teacher wishes to know his approximate developmental age level for these abilities. Referring to Table 14, it can seen that on ***Rabbits*** (visual sequential memory) his score places him at the 6:0 – 6:5 age level. Referring to Table 15, it can seen that on ***Rhymes*** (phonological awareness) Thomas's score places him on the 4:0 – 4:11 level. This suggests that he ought to be able to cope with a visual look-and-say approach to word recognition, but probably needs more phonological input before he is likely to be able to cope with learning phonics. Naturally the teacher will want to check Thomas's other CoPS results before reaching any firm conclusions, and she may also wish to assess him using **LASS Junior**, which covers the age range 8:0 to 11:11 (for further information on **LASS** visit the website www.lucid-research.com).

Table 14 – Age equivalents for accuracy scores from Zoid's Friends, Rabbits, Toybox, Zoid's Letters and Races.

Age equivalent range	Zoid's Friends	Rabbits	Toybox	Zoid's Letters	Races
< 4y 0m	0 – 10	0 – 4	0 – 1	0 – 5	0 – 6
4y 0m – 4y 5m	11 – 16	5 – 12	2 – 3	6 – 8	7 – 10
4y 6m – 4y 11m	17 – 23	13 – 14	4	9	11 – 12
5y 0m – 5y 5m	24 – 27	15 – 17	5	10	13 – 14
5y 6m – 5y 11m	28 – 29	18 – 19	6	11	15 – 16
6y 0m – 6y 5m	30 – 31	20 – 21	7	12	17 – 19
6y 6m – 6y 11m	32 – 36	22 – 25	8	13	20 – 22
7y 0m – 7y 5m	37 – 43	26 – 30	9	14 – 15	23 – 25
7y 6m – 7 y 11m	44 – 46	31 – 35	10	16	26
8y 0m – 8y 5m	47 – 49	36 – 39	11 – 12	17	27
8y 6m – 8y 11m	50 – 56	40 – 42	13 – 16	18 – 25	28 – 31
> 8 y 11m +	57 – 66	43	17 +	26 – 42	32 – 37

Table 15 – Age equivalents for accuracy scores from Zoid's Letter Names, Rhymes and Wock.

Age equivalent range	Zoid's Letter Names	Rhymes	Wock
< 4y 0m	0 – 3	0 – 1	0 – 10
4y 0m – 4y 11m	4	2 – 3	11 – 13
5y 0m – 5y 11m	5	4 – 6	14
6y 0m – 6y 11m	6	7 – 8	15
7y 0m – 7 y 11m	7	9 – 10	16 – 23
8y 0m – 8y 11m	8 – 9	11	24 – 25
> 8 y 11m +	10 – 12	12	26

12.Index