The 22 tests in the CANTAB® battery may be divided into the following main types of task:

- screening tests
- visual memory tests
- executive function, working memory and planning tests
- attention tests
- semantic/verbal memory tests
- decision-making and response control tests

These are described below.

### Screening tests

#### Motor Screening (MOT)

The motor screening test is common to all of the CANTAB batteries, and should be given at the beginning of a test session. A series of crosses is shown in different locations on the screen. After a demonstration of the correct way to point using the forefinger of the dominant hand, the subjects must point to the crosses in turn.

This motor screening test has two purposes:

- to act as a training procedure to ensure that the subjects can point accurately
- to provide measures of both speed and accuracy that provide an index of the subjects’ motor skill

#### Big/Little Circle (BLC)

A series of pairs of circles, one large and one small, are presented to the subject. The subject is instructed first to point to the smaller of the two circles, and then, after 20 trials to point to the larger circle.

This visual discrimination test is designed to train a subject to:

- follow an explicit instructional rule
- reverse a rule

### Visual memory tests

#### Delayed Matching to Sample (DMS)

This is a test of perceptual matching, immediate and delayed visual memory, in a four-choice simultaneous and delayed recognition memory paradigm.

The subjects are shown a complex visual pattern (the sample) and then, after a brief delay, four patterns. In some trials the sample and the choice
patterns are shown simultaneously, whereas in others a delay (of 0, 4 or 12 seconds) is introduced between covering the sample pattern and showing the choice patterns.

**Paired Associates Learning (PAL)**

This test is a form of delayed response procedure, which tests two different aspects of the ability to form visuo-spatial associations:

- the number of patterns placed correctly on the first presentation of each trial gives an index of ‘list memory’
- the number of repeat, reminder presentations needed for the subject to learn all the associations provides a measure of ‘list learning’

Six boxes are displayed on the screen. All are opened in a randomised order. One or more of them will contain a pattern. The subject is required to remember patterns associated with different locations on the screen, and during the test phase, as each pattern is presented, point to the appropriate location. The test starts at a very simple level and gradually increases in difficulty.

**Pattern Recognition Memory (PRM)**

This is a test of visual pattern recognition memory in a 2-choice forced discrimination paradigm.

A sequence of visual patterns is presented in the centre of the screen. These patterns are designed so that they cannot easily be given verbal labels. In the recognition phase, the subjects are required to choose between a pattern they have already seen and a novel pattern.

**Spatial Recognition Memory (SRM)**

This is a test of spatial recognition memory in a 2-choice forced discrimination paradigm.

A white square is displayed in sequence in five different places on the screen. In the recognition phase the subjects see a series of five pairs of squares, one of which is in a place previously seen in the presentation phase, and one of which is a distracter. The five squares are shown in reverse order.

**Executive function, working memory and planning**

**Intra/Extradimensional shift (IED)**

This test examines a subject’s ability to attend to the specific attributes of compound stimuli, and to shift that attention when required.

Two artificial dimensions are used in the test; colour-filled shapes and white lines. Simple stimuli are made up of just one of these dimensions, whereas compound stimuli are made up of both, namely white lines overlying colour-filled shapes. Subjects progress through the test by satisfying a set criterion of learning at each stage (6 consecutive correct responses). If at any stage the subject fails to reach this criterion after 50 trials, the test ends.
One Touch Stockings of Cambridge (OTS)
OTS is a spatial planning test variant based upon the ‘Tower of London’ test and on the CANTAB Stockings of Cambridge test, and gives a measure of frontal lobe functioning.

The subject is shown two displays containing three coloured balls. The displays are presented in such a way that they can easily be perceived as stacks of coloured balls held in stockings or socks suspended from a beam. There is a row of boxes containing numbers at the bottom of the screen, from one upwards.

The test administrator first demonstrates to the subject how to use the balls in the lower display to copy the pattern shown in the upper display. The balls may be moved one at a time by touching the required ball, then touching the position to which it should be moved.

The subject is shown one demonstration problem, then must solve three further problems. These problems increase in complexity, from one move to four moves.

Next the subject is shown more problems, and must work out how many moves the solutions require in their heads, then touch the appropriate box at the bottom of the screen to indicate the number of moves required.

Stockings of Cambridge (SOC)
This is a test of spatial planning based upon the ‘Tower of London’ test. The subject is shown two displays containing three coloured balls. The displays can easily be perceived as stacks of coloured balls held in stockings or socks suspended from a beam. This arrangement assists subjects to come to grips with some of the rules of the problems which involve 3-D concepts, and to fit in with the verbal instructions. The subject must use the balls in the lower display to copy the pattern shown in the upper one.

Spatial Span (SSP)
This test gives a measure of the subject’s spatial memory span. A set of white squares is shown on the screen. Some of the squares change in colour, one by one, in a variable sequence. At the end of each sequence a tone indicates that the subject should touch each of the boxes coloured by the computer in the same order as they were originally presented. The number of squares ranges from 2 to 9 squares.

Spatial Working Memory (SWM)
This is a test of the subject’s ability to retain spatial information and to manipulate remembered items in working memory. It is a self-ordered task, which also assesses heuristic strategy.

A trial begins with a number of coloured squares (boxes) being shown on the screen. The overall aim is that the subject should find a blue ‘counter’ in each of the boxes and use them to fill up an empty column on the right hand side of the screen. The subject must touch each box in turn until one opens with a blue ‘counter’ inside (a search). Returning to an empty box already sampled on this search is an error.
Attention

Choice Reaction Time (CRT)
This 2-choice reaction time test has stimulus and response uncertainty, with two possible stimuli (left and right) and two possible outcomes (left and right press pad buttons). The subject must press the left hand button on the press pad if the stimulus is displayed on the left hand side of the screen, and the right hand button on the press pad if the stimulus is displayed on the right hand side of the screen.

Matching to Sample Visual Search (MTS)
MTS is a speed/accuracy trade-off task, testing the subject’s ability to match visual samples and measuring their reaction and movement time.
An abstract pattern composed of four coloured elements is presented in the middle of the screen. After a brief delay, a varying number of similar patterns is shown in a circle of boxes around the edge of the screen. Only one of these matches the pattern in the centre of the screen and the subject must indicate which it is by touching it. The number of patterns in the circle may be 1, 2, 4 or 8, and the incorrect patterns are composed of juggled elements of the sample pattern or juggled distracter elements.

Reaction Time (RTI)
This task has three purposes:

◆ to train the subject in the skills related to holding down the press pad and touching the screen
◆ to provide a screen for the ability to acquire and perform this motor skill
◆ to acts as a simple single and multiple choice reaction time task

The subject must touch the screen when a yellow dot is displayed. For the multiple choice reaction time test, the dot may be shown in one of five locations.

Rapid Visual Information Processing (RVP)
This is a test of visual sustained attention with a small working memory component.
A white box is displayed in the centre of the computer screen, inside which digits, from 2 to 9, are displayed in a pseudo-random order, at the rate of 100 digits per minute. The subject must detect consecutive odd or even sequences of digits (for example, 2-4-6) and respond by pressing the touch pad.

Simple Reaction Time (SRT)
This is a test which measures simple reaction time – through delivery of a known stimulus to a known location to elicit a known response. The only uncertainty is with regard to when the stimulus will occur, by having a variable interval between the trial response and the onset of the stimulus for the next trial.
The stimulus is a simple white square on the screen.
Semantic/verbal memory tests

Graded Naming Test (GNT)
The test consists of thirty black and white line drawings, ordered with increasing difficulty. Reduced efficiency in retrieving the name of an object can be the first and only indication of impaired language functioning. This test assesses object-naming ability, but is in addition graded in difficulty to allow for individual differences. This means that it may be able to detect any word-finding difficulty even in those with an extensive naming vocabulary.

Verbal Recognition Memory (VRM)
The VRM test assesses immediate and delayed memory of verbal information under free recall and forced choice recognition conditions. The subject is shown a list of 12 words and then asked to produce as many of the words as possible immediately following the presentation, recognise the words they have seen before from a list containing the original words and distracters, and finally, following a delay, recognise the words they have seen before from another list of words containing the original list and new distracters.

Decision-making and response control tests

Affective Go/No-go (AGN)
The Affective Go/No-go (AGN) test assesses information processing biases and inhibitory control for positive and negative stimuli.

A series of words is rapidly presented in the centre of the screen. These words are positive, negative or neutral valence.

The subject is given a target valence and is asked to press the press pad when they see a word that matches this valence.

Cambridge Gambling Task (CGT)
The Cambridge Gambling Task was developed to assess decision-making and risk-taking behaviour outside a learning context. The subject is presented with a row of ten boxes across the top of the screen, some of which are red and some of which are blue. At the bottom of the screen are rectangles containing the words ‘Red’ and ‘Blue’. The subject must guess whether a yellow token is hidden in a red box or a blue box.

In the gambling stages, subjects start with a number of points, displayed on the screen, and can select a proportion of these points (5%, 25%, 50%, 75% or 95%), displayed in either rising or falling order, in a second box on the screen, to gamble on their confidence in this judgement. A stake box on the screen displays the current amount of the bet.
**Information Sampling Task (IST)**

IST is a task designed to measure pre-decisional processing, where the subject gathers and evaluates information prior to making a decision. Inadequate reflection means that decisions will be made on the basis of less evidence, and, therefore will reduce the accuracy of the eventual decision.

The subject is presented with a 5x5 array of grey boxes on the screen, and two larger coloured panels below these boxes. The subject is instructed that they are playing a game for points, which they can win by making a correct decision about which colour is in the majority under the grey boxes. They must touch the grey boxes in the array, one at a time, which open up to reveal one of two colours. Once a box has been touched, it remains open. When the subject has made their decision about which colour is in the majority, they must touch the panel of that colour at the bottom of the screen to indicate their choice.

There are two conditions – the fixed win condition, in which the subject is awarded 100 points for a correct decision regardless of the number of boxes opened, and the decreasing win condition, in which the number of points that can be won for a correct decision starts at 250 and decreases by 10 points for every box touched. In either condition an incorrect decision costs 100 points.

**Stop Signal Task (SST)**

SST is a classic stop signal response inhibition test, which uses interleaved staircase functions to generate an estimate of stop signal reaction time.

This test gives a measure of an individual’s ability to inhibit a response.

The task screen for SST shows a white ring, displayed to alert the subject, and then a visual stimulus displayed within the ring after a fixed 500ms delay, consisting of an arrow pointing to the left or to the right.

The test consists of two parts. In the first part, the subject is introduced to the press pad, and told to press the left hand button when they see an arrow pointing to the left, and the right hand button when they see an arrow pointing to the right. There is one block of 16 trials for the subject to practice this.

In the second part, the subject is told to continue pressing the buttons on the press pad when they see the arrows, as before, but, if they hear an auditory signal (a beep), they should not press the button. There are five assessed blocks, each of 64 trials.