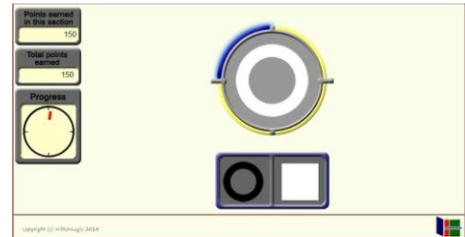




## Module 5: Executive Function

### New for 2013 - Task Switching (MTS)

This procedure is based on a series of publications by S Monsell, and is designed to look at the costs of switching from one cognitive task to the other. On each trial one of four shapes are shown in the central location – a white ring, a black ring, a white square and a black square. The tasks set for the test participant are to classify these shapes according to form (ring/square) or color (black/white). To do this the test participant should click or touch on one of the two shapes shown in the lower display. Each of the choice shapes share one property with the target shape (either form or color). The task to be done is signaled by the position and color of the highlighted segment of the frame surrounding target shape. If the highlight is in the upper half of the frame, and colored blue, then the rule “classify according to form” is to be used, and if it is in the lower half and colored pink, then the rule “classify according to color” is to be used. The unique advantage of this type of display is that it allows alternating presentation of the two tasks in a easily predictable manner by rotating the highlighted area around the display in a clockwise manner, alternating repeat task examples with switches between tasks.



As currently formatted the test participant is led through a brief training procedure, consisting of sections when each of the two component tasks is presented alone (the highlight remaining in either the lower or upper half of the display), and a section when the frequency of alternations between the tasks increases until the final double-alternation procedure is introduced. The critical data in this test are the number of errors and the reaction time for each combination – color repeat, switch to form, form repeat and switch to color.

### Block Planning Test (BPL)

The BPL is an analog to the widely used Tower of London (Shallice, 1982) and “Socks of Cambridge” (Morris et al, 1988, originally devised by John Evenden) tests, both based in turn on the mathematical puzzle, the “Tower of Hanoi”. All of these tests pose similar problems to the participants. In the BPL, they must move objects in the right hand display one position at a time until they form the pattern shown in the left hand display. The number of moves required varies from problem to problem. The simplest practice problems involve only one move, and the number is progressively increased from 2 to 6. In the example 4 moves will be required to complete the second pattern. The yellow block has been clicked to activate it. To assist in making the correct moves, the arrows indicate which locations are valid for the activated block. Clicking on the desired location will place the block. Once a problem is completed, and



the participant has received confirmatory feedback, a button appears giving access to the next problem. The data recorded are the time from presentation of the problem until the first block activation (problem planning time), the time to move the first block, and thereafter the successive times to select and move the remaining blocks to complete the problem. All moves are recorded, and if the participant makes an error, this is also recorded, and a lower number of points are awarded.

### **Reversal Learning Test (REVL)**

This test is designed to measure learning and cognitive flexibility. It consists of 6 problems of ascending difficulty. At the start of each problem three pictures are shown on the screen. In the first problem the first picture clicked on by the test participant is designated as correct, but the selection is not shown to the test participant. Clicking on this picture results in positive feedback in the form of a ding, whereas clicking on either of the other pictures results in negative feedback in the form of a buzzer. The location of the pictures on the screen is shuffled after each response. Once the participant has clicked on the “correct” picture a predetermined number of times in a row (the counter is reset if the participant clicks on one of the other pictures), the computer chooses at random one of the other two pictures to be correct. Further clicking on the originally correct picture now results in the buzzer, negative feedback. The participant should switch to clicking on the newly designated correct picture until the end of the problem. There is only one switch per problem, and the number of consecutive repeated clicks required to trigger the switch and complete the problem varies from problem to problem, but averages 7 clicks in a row. The second problem is similar to the first, with the exception that the first picture clicked on by the participant is designated as incorrect, and one of the other two pictures is designated as correct. The test participants are not informed of these selection rules.



In the third problem the reliability of the feedback is reduced. In this problem, 15% of clicks on the correct picture will result in the buzzer, and 15% of clicks on either of the incorrect pictures will result in the ding. The test participant should continue clicking on the picture giving the highest proportion of positive feedback until the switch is made. After this point, clicking the formerly correct picture will result in 85% negative feedback, whereas clicking on whichever of the other two pictures is now designated as correct will result in 85% positive feedback. In the third problem, the first picture clicked on by the test participant is designated at the start as correct. In the fourth problem, the first picture clicked on at the start is designated as incorrect, and one of the other two pictures is the correct one. For the fifth and sixth problems, the same contingencies apply, except that now the likelihood of erroneous feedback is 30% versus 70% correct feedback. To protect test participants who do not learn the rule, there is a cut-off, a maximum number of clicks which can be made before the problem is terminated. This maximum is increased as the problems get more difficult. Performance feedback to the test participant is provided by deducting points from the maximum attainable for each problem for each click made. This maximum is increased with problem difficulty. There is also cut off for the minimum number of points so that every participant gets some positive outcome, however many errors they make.

The key measure in this test is the number of click responses required to identify the initial correct picture, the number of errors made on the initial correct picture after the switch has been made, and the number of click responses required to identify the new correct picture and complete the problem.