WiltonLogic

Tests of Executive Function

Product Vision

A portfolio of objective computerized assessments for measuring critical components of executive function which are sensitive to psychological state and treatment interventions.

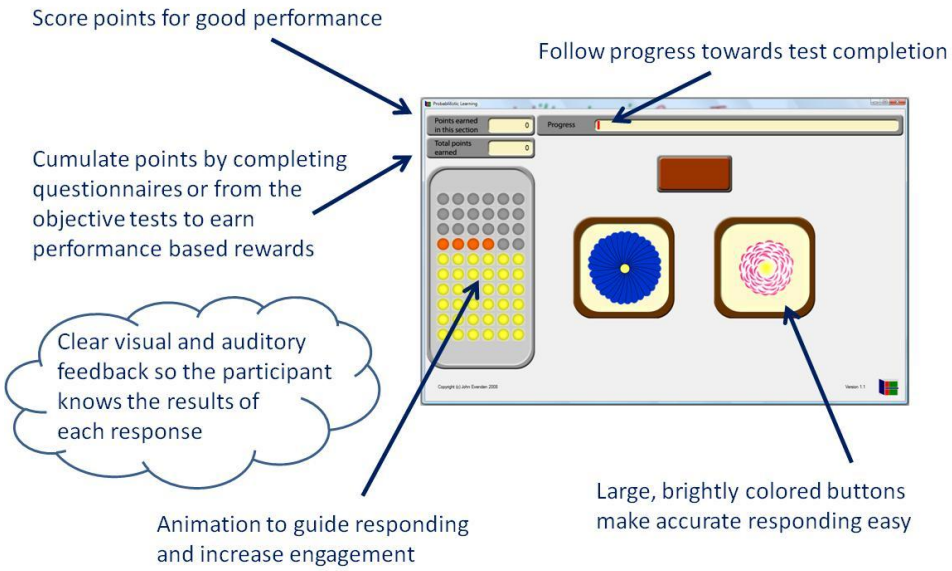
Product Characteristics

- No verbal test material, to maximize cross-cultural validity.
- Primary input via touch screen, for ease of use by participants unused to computers, although mouse input can also be used if preferred.
- Short test times, to allow for assessment of a broad range of psychological constructs.
- Flexible selection of tests and questionnaires to construct the optimal test battery.
- Test administration by lay personnel using simple, instruction scripts and test examples
- Whenever possible, use translational procedures to facilitate application of preclinical findings from animal studies to human behavior.
- Questionnaire administration using visual analog or multi-choice Likert scales integrated into test battery

Product Highlights

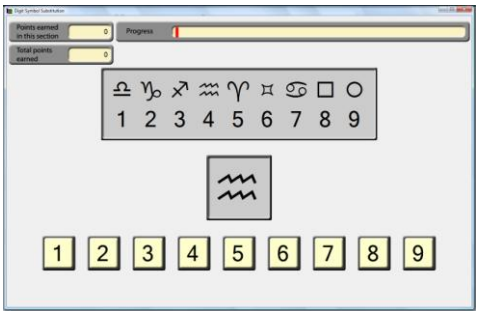
General Principals

WiltonLogic has adopted some of the principals of game design in the construction of the psychological tests. Some of the key features are illustrated here:



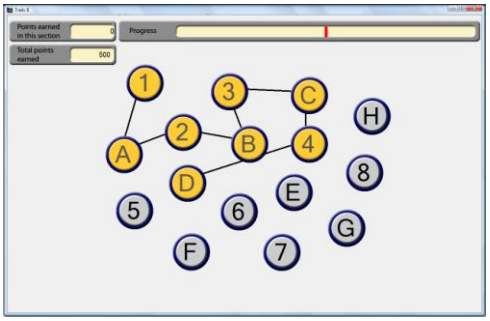
Rule Following

Digit-Symbol Substitution



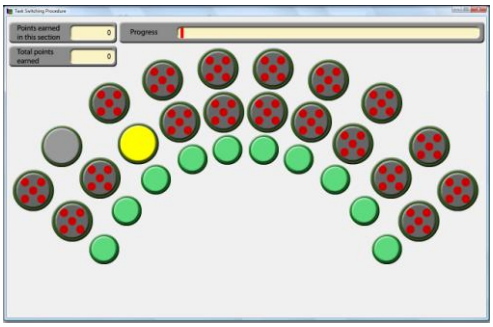
The simplest form of rules following is to be given a set of information and a set of instructions as to how to use it. The Digit-Symbol Substitution test is a widely used method for assessing the ability of subjects to follow a simple rule, and to do so as quickly and accurately as possible. In the WiltonLogic version, the subject is shown a set of digit-symbol pairs in the upper part of the screen. Symbols from the list are shown one at a time in the center of the screen, and the participant has to touch the button with corresponding number at the bottom of the screen. As in the traditional paper-and-pencil version, the goal is to complete as many matches as possible in 90 seconds.

Trails A and B



The next level of complication in rules following concerns the ability to switch between rules. This has long been tested using the variations of the Trails A and B tests. In the Trails A test there is only one rule to follow: join the numbers in ascending order. In the WiltonLogic version, this is done by touch the circles in ascending numerical order. In the Trails B test, shown in the picture, a second rule is added. In this test both numbers and letters are shown. The participant is asked to alternate between the two sets of symbols, touching first a number and then a letter. The numbers should be touched in ascending order, and the letters in alphabetical order, so 1..A..2..B..etc. This requires the participant to switch rule after every touch. The mental cost of switching can be calculated by comparing the time taken to complete the sequence of numbers alone with the time taken to complete the alternating sequence.

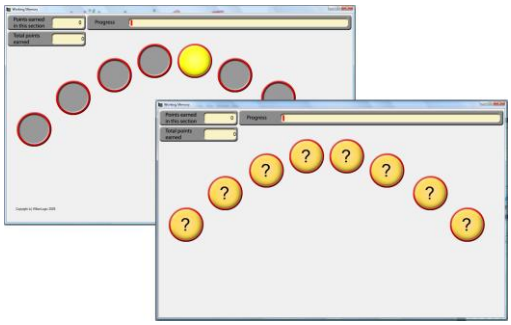
Task Switching



Flexibility in rule following is one of the most important aspects of executive function. In the task switching test, the ability to switch rule in a dynamic manner can be examined. The subject is asked to touch the green buttons in response to one of two rules signaled by the design shown in the majority of the target buttons (the "context"). One rule tells the subject whether to touch the green button corresponding to the grey or yellow target, and the second tells the subject whether to touch the button corresponding to the target in the inner or outer layer of the display. Once the subjects have practiced the rules, which rule applies on any given can be changed dynamically by changing the context, either in a regular manner such as alternation, or in a randomized manner. The warning time can also be altered by using a neutral background color, and showing the context at varying intervals before the targets appear. By comparing the time needed to make a correct choice under the different conditions, a measure of the participant's ability to switch rules in a flexible manner can be obtained

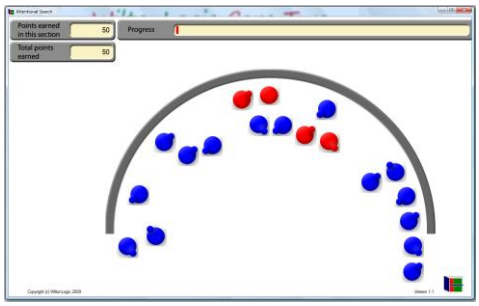
Cognitive Function

Working Memory



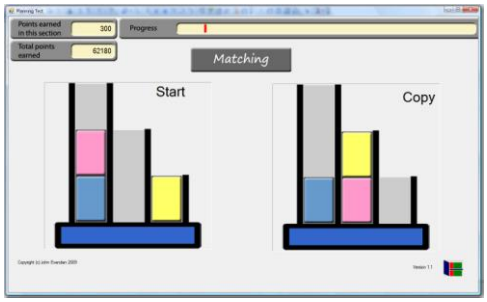
Working memory can be assessed by using the discrete trial spatial n-back task, a modification of the standard task to make it suitable for translational research. A sequence of locations is illuminated during the learning phase. This is followed by a recall phase in which the participants may be asked to indicate the last (1-back), penultimate (2-back) or third to last (3-back) location in the sequence. The length of the sequence is varied so that the occurrence of the recall phase is unpredictable. The test can start with a set of trials of the simplest 1-back level, and difficulty increased by successively increasing the memory burden using the 2-back and 3-back tasks.

Attentional Control



Many facets of attention are important for executive function. WiltonLogic has included a test of attentional control. The task itself is simple: search through the array and reach out and touch the red circle. The search is made more difficult by two classes of irrelevant stimuli: blue shapes, which are irrelevant to the search, and red shapes which are potentially relevant, and need to be checked. Participants with poor attentional control will be distracted by the irrelevant stimuli, and the degree of this interference can be assessed by varying the proportions of blue and red shapes.

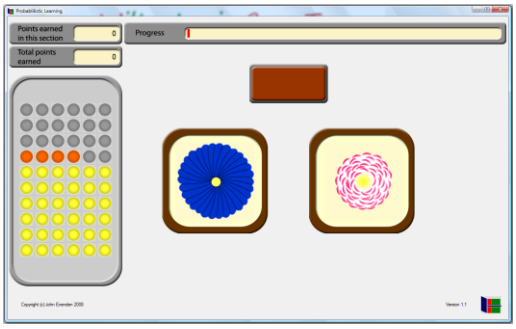
Planning



To test planning ability, WiltonLogic has adapted the classic Tower of Hanoi test. In this procedure two arrangements of three blocks are shown. The subject has to move the blocks in the left hand arrangement to match the blocks in the right hand arrangement. The blocks can only be moved one step at a time. In the example shown, two moves are needed to complete the problem. By mapping out all the possible problems, WiltonLogic has devised five problem sets containing equal numbers of 2, 3 and 4 move problems. A control for motor performance can be obtained by asking the participant to move the blocks one at a time, prompted by changes in the computer display. Participants with poor planning ability will take more time in identifying the correct solution, and make more errors in moving the blocks.

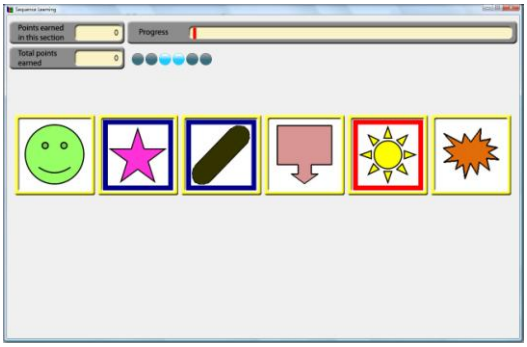
Learning

Reinforcement Learning



The use of feedback to guide learning can be assessed by a reinforcement learning procedure. The participants must identify which of the two targets is correct using auditory feedback, and show their learning by completing a sequence of six consecutive choices of that option. Learning is made more difficult by the presentation of false feedback – correct choices receive negative feedback and vice versa. In the easiest version, this incorrect feedback occurs on only 15% of occasions, but task difficulty can be increased by using a greater degree of false information (25-35%). Once the participants have learned the correct choice, the contingencies are reversed, and they must use the change in feedback to adjust their behavior. Each task must be completed within a maximum of 60 choices, indicated by the color-coded display on the left-hand side of the display.

Response Sequence Learning



The second learning task included in WiltonLogic's current portfolio is one involving response sequence learning. In this task the participants must learn to touch three of the six pictures in the correct order. To ensure the subject focus on the pictures, the order is rearranged after each choice. Once the first sequence has been learned, a second is presented using new pictures. The third and final sequence is built from the same picture set as the second, to measure interference from previous learning. Participants with poor learning skills will make more errors in learning the sequences.

Data Storage

Data are appended to an ASCII file labeled with the participant identifier on completion of each test. These files can easily be clipped and pasted into data analysis programs.

Recommended Equipment

WiltonLogic recommends the use of HP tablet computers, current model Jan 2009, HP TouchSmart tx2z series. These computers have a touch screen, and a convertible design with a twisting hinge that lets the screen to swivel to display mode so that the test participant does not have to reach across the keyboard.

Contact Information

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