

TECHNICAL SPECIFICATIONS

Hardware Specifications

Stimulus materials are presented using DOS or Windows computers. The program requires at least an 80286 microprocessor running at 6MHz. Computers based on the Intel 8086 and 8088 microprocessors will run too slowly to be able to accurately time the stimulus materials.

The program requires a standard IBM CGA, EGA, VGA, or SVGA or 100% compatible color display. Non-standard liquid crystal displays and plasma displays such as those used in laptop computers will not function correctly, nor will Passive Matrix displays used in color laptops. Active Matrix color displays will work correctly.

The stimulus materials developed for this program will appear correctly using CGA, EGA, VGA or Active Matrix LCD color displays. Normative data were collected using 14" EGA and VGA monitors. There were no significant differences in reaction time or signal detection parameters as a function of the type of monitor used.

The program requires at least the speed of an 80286 microprocessor, but automatically adjusts for changes in clock speed to provide uniform timing.

The timing circuits have a minimum resolution of 0.70 msec for timing of the materials displayed on the screen, and a minimum resolution of 1.34 msec for detecting keypress responses from the subject. Interrupt timing introduces a maximum 27 msec timing error. All timing errors can be positive or negative and average out to 0 over repeated trials.

The hardware that controls the color monitor rewrites the screen image sixty times per second which means that there is a potential timing error of up to 34 msec during which the stimulus image is written on the screen (17 msec) and subsequently erased from the screen (another 17 msec). The CALCAP checks the position of the electron scanning gun prior to writing to the screen, thus reducing actual error variance to 1-2 msec.

Compatibility Issues

The CalCAP is a DOS program that runs correctly on a single-speed computer running DOS or Windows. Since the CalCAP requires exclusive use of your microprocessor and your screen, it runs within a virtual machine if you are using Windows Vista, Windows 7 or a later operating system.

The CalCAP is incompatible with laptop computers that automatically adjust their clock speed, though you may be able to permanently set your clock speed through the laptop BIOS or SpeedSwitchXP Software (<http://www.diefer.de/speedswitchxp/index.html>).

Software Timing

The timing accuracy of the CALCAP software is limited primarily by the hardware considerations detailed above. In addition to these hardware limitations, the following rules are used for computation of reaction times:

For simple reaction time measures, mean reaction time is computed by dropping the best and worst trials (or the two best and two worst trials if there are over 10 trials), and then averaging the remaining trials. The maximum reaction time is computed as the upper limit defined by the Program Drivers (1.5 seconds in the Standard, Abbreviated and CPT program drivers).

For choice reaction time measures, mean reaction time is computed by dropping the two best and two worst trials and then averaging the remaining trials. The maximum reaction time is equal to the sum of the minimum inter-stimulus interval and the stimulus duration, minus half of the speed at which the computer writes information on the screen [$ISI.MIN + \text{stimulus duration} - (\text{screen.write.speed} / 2)$]. As described under hardware considerations above, screen.write.speed is usually 34 msec. Thus, if the minimum inter-stimulus interval (ISI.MIN) is equal to 800 msec, stimulus duration is equal to 200 msec, and screen writing speed = 34 msec, then

maximum possible reaction time = $800 + 200 - (34/2) = 983$.

Program Driver History

Standard Version. ECTL0291.RT is a modification of standard version (CTRL0191.RT) that increases the number of Simple RT trials from 6 to 12. Available beginning in February 1991. Designed to be used at all installations for commercial sales. A special version called ECRM0291.RT includes Task 11 (Recognition Memory). Recognition Memory was dropped from the MACS study in 9/89 to reduce the overall length of the test battery and because it did not appear particularly sensitive to HIV-specific cognitive deficits.

CPT Version. CPT0191.RT is the Continuous Performance Test version of the CALCAP program first developed in Spring 1989. Adapted and extended in Fall 1990 to allow 3 iterations of the standard CPT protocol.

Abbreviated Version. MACS0191.RT is a modification of standard version requiring less time (approx. 7-10 minutes) and VGA monitors. Available beginning in February 1991. Designed to be used at all MACS centers beginning in April 1991. Renamed ART0292.RT in February 1992.

Original Version. CTRL0191.RT is the original version used to develop norms in the MACS (based on AT-compatible computers). Takes approx. 20-25 minutes & requires CGA or EGA monitors. Simple RT tasks consist of 6 actual trials. Used primarily in the MACS study in Los Angeles from April 1987 through March 1991. (Last distributed on 1/31/91). A special version called CTRM0191.RT includes Task 11 (Recognition Memory). Recognition Memory was dropped from the MACS study in 9/89 to reduce the overall length of the test battery and because it did not appear particularly sensitive to HIV-specific cognitive deficits.