

Note: this document may not describe the most recent version of the test available in the TestMyBrain Cognitive Science Toolkit. We will be updating our documentation over the next several months, at which point this message will be removed.

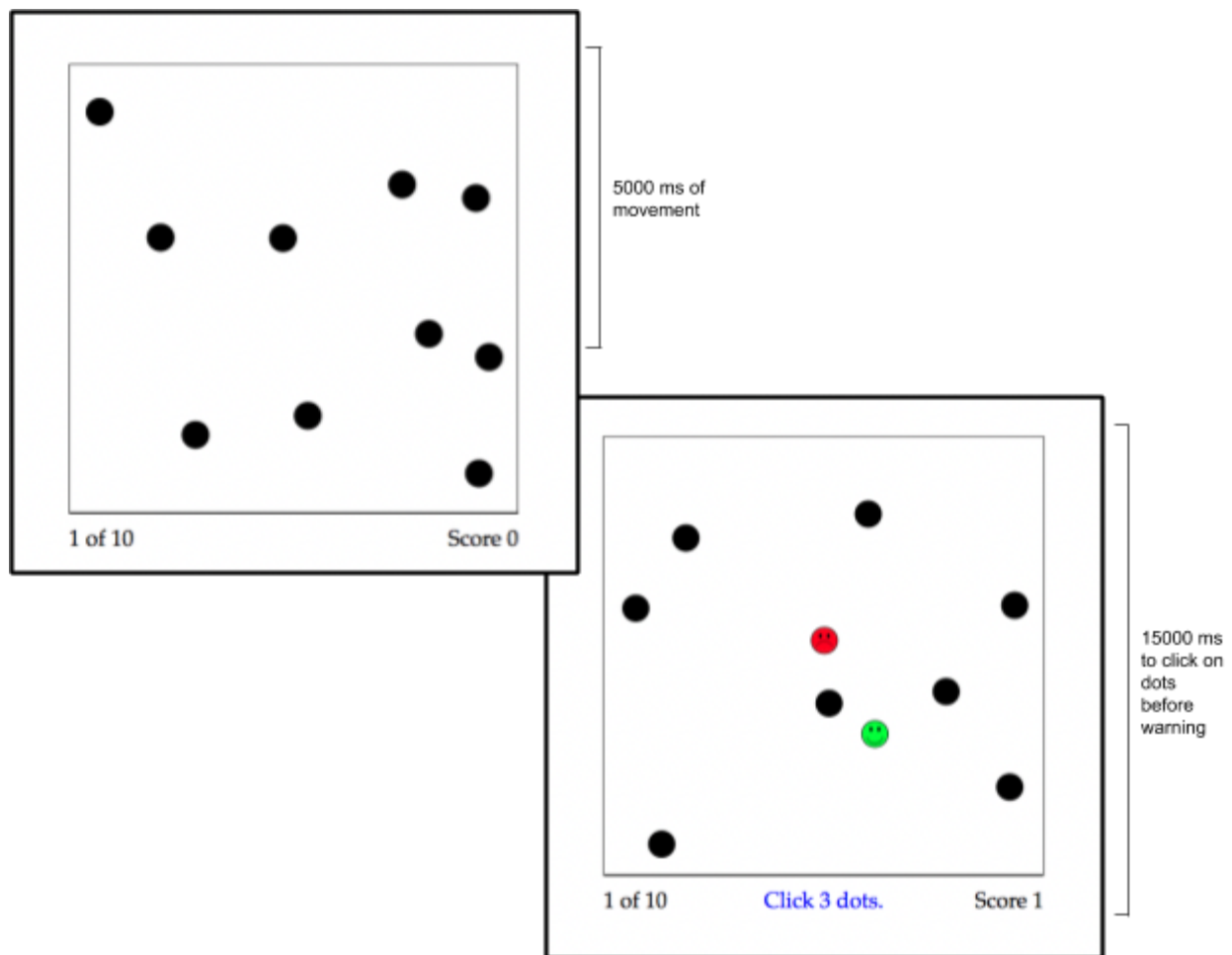
TMB Multiple Object Tracking

Constructs Measured: visuospatial attention, visual working memory

Duration: 10 minutes (standard length); shorter versions available

Sample size for which normative data are available: 43,805

Description of procedure: Remember and track a set of target circles as they move around the screen, among a larger set of identical distractor circles.



This is a standard multiple object tracking task that measures visuospatial attention and short-term memory. The task varies both the number and speed of dots that need to be tracked. Advantages of the task that it is available in short format (5 min) and is considered very engaging by participants. It also dissociates almost entirely from sustained attention, giving it interesting psychometric characteristics for a demanding cognitive test. It can be administered quickly and easily on a range of mobile devices. Disadvantages are that the task relies on complex stimuli that may be affected by future changes in device displays. There are also may be potential limitations in stimulus delivery on a smaller screen.

Psychometric Characteristics

The primary outcome measure for this test is the number of dots that a participant was able to track and identify successfully (a score ranging from 0 to 120). There are other reaction time-based measures that could be derived from this test (e.g. mean response time), but since this is not a speeded test the interpretation of these measures would not be clear.

This test shows excellent reliability; internal reliability (split-half) was 0.92, calculated from the scores of 5000 participants who completed this test on TestMyBrain.

Sociodemographic effects were estimated based on the scores of 6882 participants for whom demographic data was available. This participant group had a mean age of 28.92 and was 52.48% female. The distribution of scores is relatively normal, but shows some ceiling effects (see Figure 1). Performance is variable across the lifespan, increasing throughout adolescence and young adulthood and peaking at approximately age 25 before declining throughout adulthood (see Figure 2). Male participants show higher scores, on average, than female participants (see Figure 3). Performance increases with education, though this effect is not apparent when comparing the more highly educated participant groups (see Figure 4).

Practice effects on this test are minimal. The mean score for first-time participants was 80% correct, while the mean score for repeat participants was 81% correct (Cohen's $d = 0.1$).

Validation

Performance on the Multiple Object Tracking test correlates with other tests of attention, cognitive control, and working memory (all correlations are controlled for age where age data was available). This test showed moderate to high correlation with Flicker Change Detection, another test of visual attention ($r = 0.48$, $N = 10,557$, 95% CI [0.47, 0.49]). It showed much lower correlation with the Gradual Onset Continuous Performance Task, a test of sustained attention ($r = 0.063$, $N = 1066$, 95% CI [0.0032, 0.12]), as well as with self-reports of impaired attention ($r = 0.003$, $N = 813$, 95% CI = [0.071, 0.066]). It also shows moderate to high correlation with Matrix Reasoning, a test of visual pattern recognition ($r = 0.51$, $N = 84$, 95% CI [0.33, 0.65]; this correlation could not be controlled for age). However, it does not correlate significantly with other tests of memory, such as vocabulary ($r = .0093$, $N = 95$, 95% CI [0.19, 0.21], not age-adjusted) or forward digit span ($r = 0.0053$, $N = 34$, 95% CI [0.33, 0.34]). Scores on this test are correlated with math SAT scores ($r = 0.27$, $N = 3,304$, 95% CI [0.24, 0.30]) but less so with verbal SAT scores ($r = 0.1$, $N = 3,329$, 95% CI [0.07, 0.13]).

Appropriateness for Field Test Use

In order to ensure that participants understand the task presented to them, the test includes two practice trials that give direct feedback to participants before test trials begin. Thus, difficulty in understanding the test should not present a barrier to completion.

Device Effects. Users of all device types perform at similar levels on this test (iPhone mean = 79%, SD = 10%, $N = 526$; iPad mean = 79%, SD = 11%, $N = 404$; Macintosh laptop/desktop mean = 80%, SD = 10%, $N = 1426$), with slightly higher performance on laptop or desktop computers than users of mobile devices. Given the complex nature of the visual stimulus, cautioned should be used, however, before administering these tests on mobile devices with small screens.

Participant Burden. This test was rated as highly engaging by participants (3.9 / 5 vs. 3.7 / 5 for other tests), although completion rates are only modestly higher than average (85% vs. 81% for other tests), likely due to the test's long length relative to other tests.

Figure 1. Distribution of scores

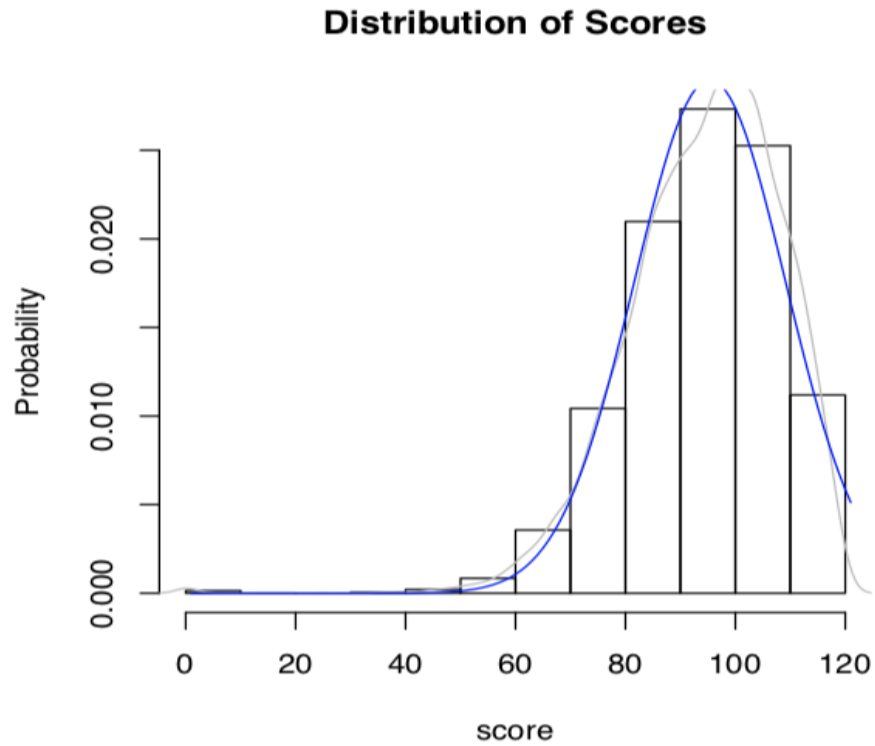


Figure 2. Age-Related differences in performance

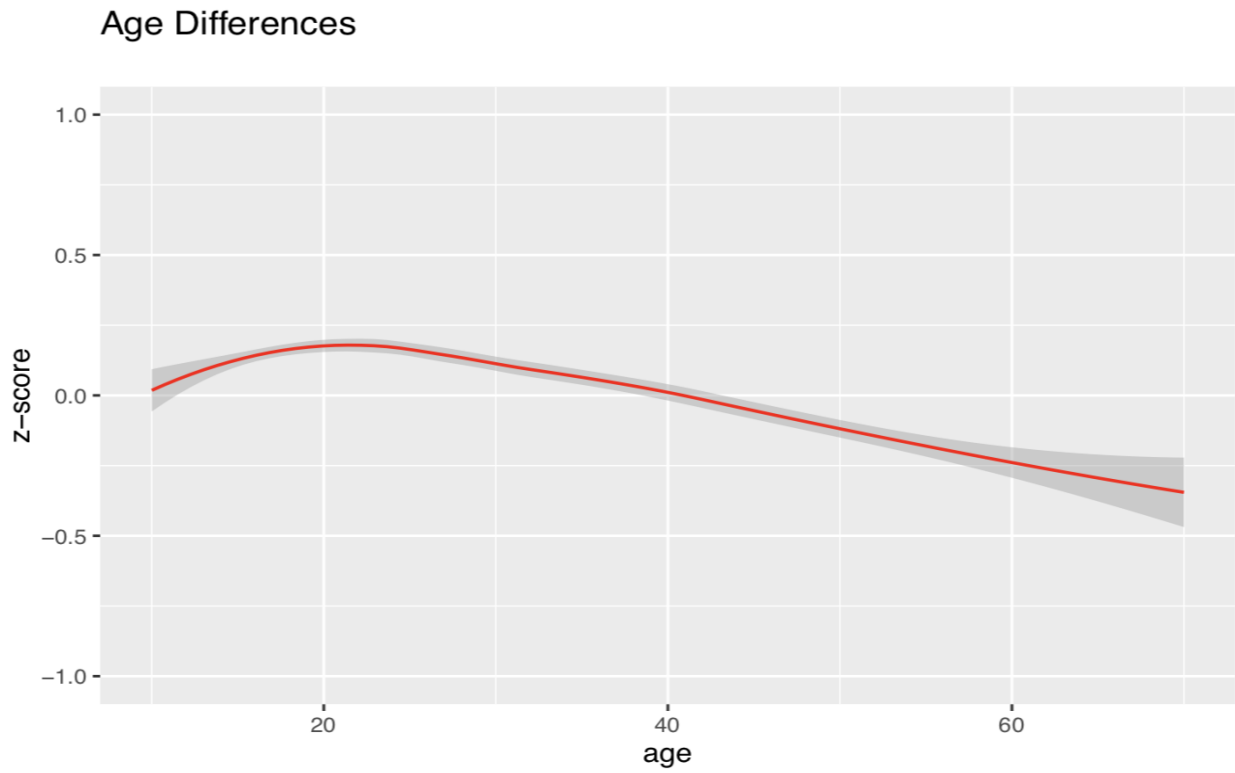


Figure 3. Sex differences in performance

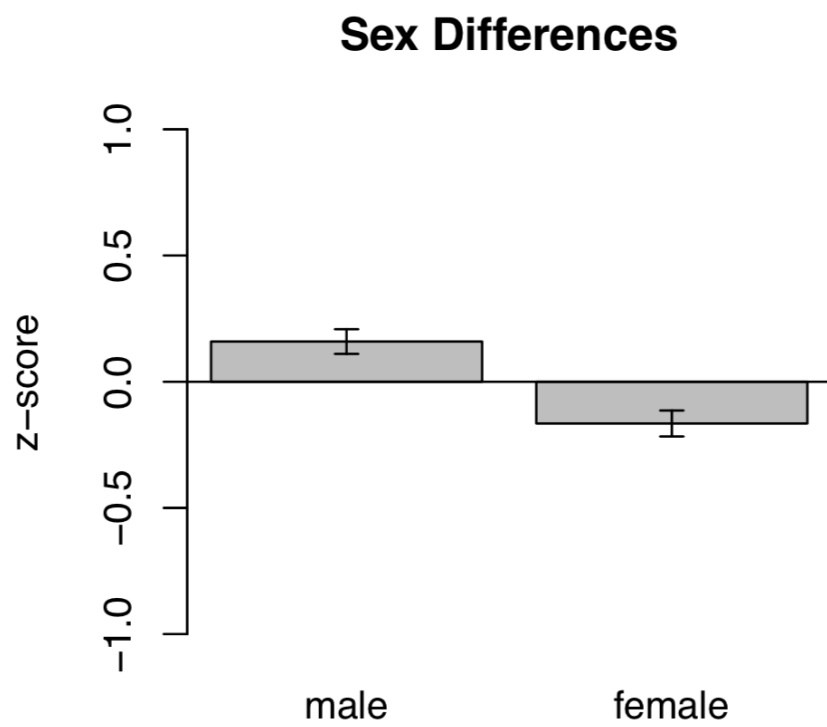


Figure 4. Education-related differences in performance

