

Note: this document may not describe the most recent version of this cognitive test available from TestMyBrain. TestMyBrain cognitive test documentation will be updated over the next several months to align with current test versions.

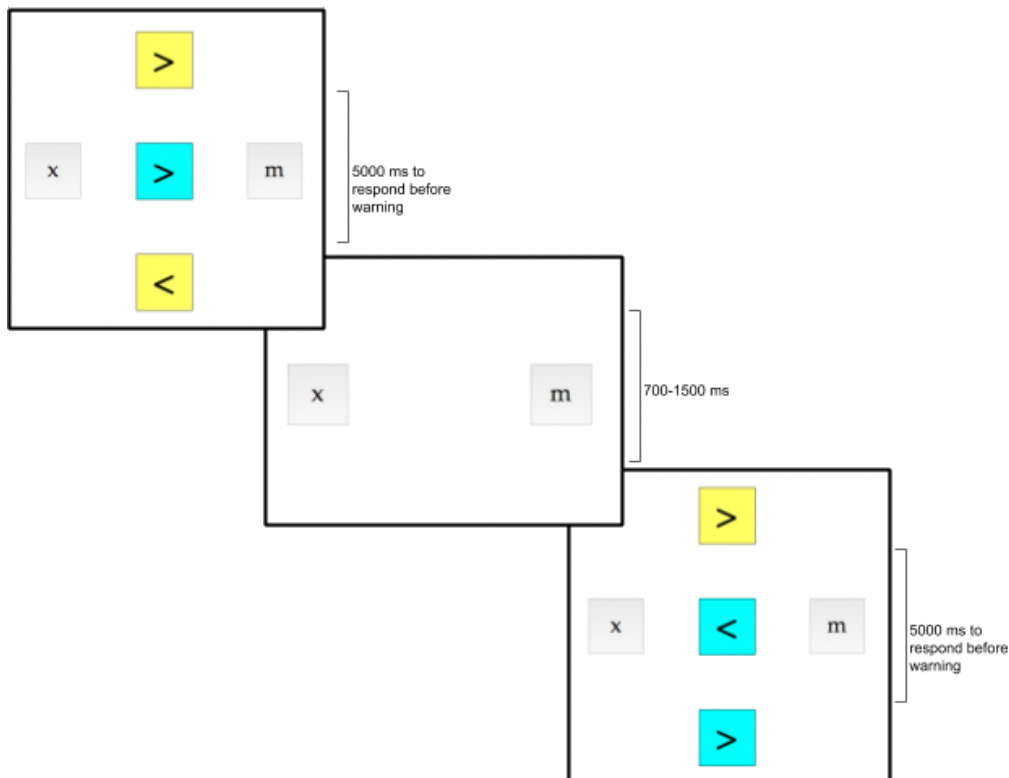
# TMB Choice Reaction Time

**Constructs Measured:** processing speed, cognitive inhibition, cognitive control

**Duration:** 2.5 minutes

**Sample size for which normative data are available:** 18,556

**Description of procedure:** Indicate the direction of an arrow that is a different color from the rest.



This is a standard format choice reaction time task, which requires a participant to efficiently select from multiple competing response options. Advantages are that the task is very short, can be completed across a range of mobile devices, and is enjoyable to participants. Disadvantages are that this particular format of a choice reaction time test has not been validated with respect to clinical conditions or psychopathology. The procedure can sometimes be confusing to participants who do not pay adequate attention during practice trials.

## Psychometric Characteristics

The Choice RT test measures both reaction time and accuracy. The main outcome calculated from this test is median reaction time for correct trials, or median reaction time corrected for accuracy (inverse efficiency score: median RT / proportion correct) where speed accuracy tradeoffs are a concern. For participant feedback purposes, reaction times are transformed ( $10000 / rt$ ) to yield a number that typically ranges between 1 and 25 that corresponds to

“speed”. All analysis in this report has been completed using both median reaction time on correct trials and inverse efficiency score.

This test has shown excellent reliability; for median reaction time on correct trials, internal reliability (split-half) was 0.95 (calculated using the subset of the participant pool enrolled through the Aurora project,  $n = 617$ ). Internal reliability (split-half) for inverse efficiency score was 0.87 (calculated from 5000 participants who completed the test on TestMyBrain).

Sociodemographic effects were estimated based on median reaction times on correct trials for the 15,409 participants for whom demographic data was available. This population has a mean age of 29.9 and is 46.4% female. The distribution of scores is normal (see Figure 1). Reaction time is variable across the lifespan, decreasing throughout adolescence, peaking in speed at approximately age 20, and increasing throughout adulthood (see Figure 2). This pattern is typical of tests that measure processing speed. Male participants showed slightly faster reaction times than female participants (see Figure 3). Reaction time decreases with education (see Figure 4).

Inverse efficiency score showed similar sociodemographic effects as median reaction time. Scores were relatively normally distributed, with a small number of participants showing unusually high scores (see Figure 5). Inverse efficiency score is variable across the lifespan and shows a similar pattern to median reaction time (see Figure 6). Male participants showed slightly lower IES (indicating better performance) than female participants (see Figure 7). IES decreases with increased education (see Figure 8).

This test may have small practice effects; first-time participants had a mean median reaction time of 921.35, while repeat participants had a mean median reaction time of 867.17. These practice effects are also apparent in inverse efficiency scores: first-time participants have a mean IES of 1005.12, while repeat participants have a mean IES of 943.2118.

## **Validation**

Median reaction time on the Choice RT test correlate with performance on other tests measuring cognitive processing speed, cognitive control, and cognitive inhibition. It is correlated with simple reaction time ( $r = 0.40$ ,  $n = 11178$ , 95% CI [0.38, 0.41]) and digit symbol matching, another task requiring quick responses to visual processing tasks ( $r = 0.41$ ,  $n = 12397$ , 95% CI [0.42, 0.39]). It is more modestly correlated with other tests of general cognitive ability, such as vocabulary ( $\rho = 0.15$ ,  $n = 549$ , 95% CI [0.23, 0.070]), but not with tests of entirely distinct domains such as emotion recognition ( $r = 0.078$ ,  $N = 529$ , 95% CI [0.17, 0.0014]). This suggests that this test is able to specifically measure cognitive processing speed as a distinct faculty, separate from other cognitive abilities.

Inverse efficiency score shows similar correlation with other tests, indicating that both metrics are of comparable validity. It is correlated with digit symbol matching (Spearman's  $\rho = 0.46$ ,  $n = 12397$ , 95% CI [0.48, 0.45]) and simple reaction time (Spearman's  $\rho = 0.43$ ,  $n = 11178$ , 95% CI [0.45, 0.42]). It is also correlated to a lesser extent with vocabulary (Spearman's  $\rho = 0.34$ ,  $n = 383$ , 95% CI [0.42, 0.24]). Unlike the median reaction time on this test, inverse efficiency score is slightly correlated with performance in emotion recognition ( $r = 0.11$ ,  $n = 370$ , 95% CI [0.21, 0.0085]).

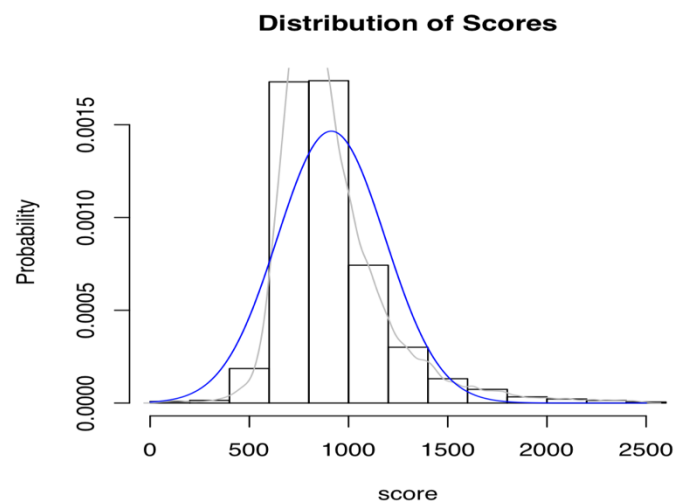
## **Appropriateness for Field Test Use**

This test is brief and well-tolerated by participants. To ensure that participants understand the task, the test includes a series of 4 practice trials before test trials begin. This ensures that scores and completion rates are not affected by participants' difficulty in understanding the requirements of the test. With these practice trials in place, there are minimal barriers to completion.

**Device Effects:** The Choice RT test is easy to administer across a wide variety of device types. However, since this test measures cognitive processing speed using reaction time, differences in device performance (such as device latency in registering input) are likely to impact measured scores. Our data showed that participants using desktop or laptop computers had lower median reaction times than those using mobile devices (iPhone mean: 931.70, SD = 2.53.47, N = 1635; iPad mean = 981.04, SD = 279.60, N = 987; Macintosh desktop/laptop mean = 876.16, SD = 271.51, N = 2303). Differences in device latency likely have a modest impact on median reaction time. Inverse efficiency score shows a similar pattern of device effects (iPhone mean = 998.15, SD = 345.51; iPad mean = 1048.85, SD = 371.03; Macintosh desktop/laptop mean = 948.96, SD = 358.42).

**Participant Burden:** The Choice RT test poses a low burden to participants. The mean participant rating for batteries containing this test was 3.9 out of 5, compared to an average of 3.7 for all batteries hosted on Test My Brain. 88.1% of participants who began this test completed it, which is substantially higher than sitewide completion of 81%.

*Figure 1. Distribution of scores (median reaction time)*



*Figure 2. Age-related differences in performance (median reaction time)*

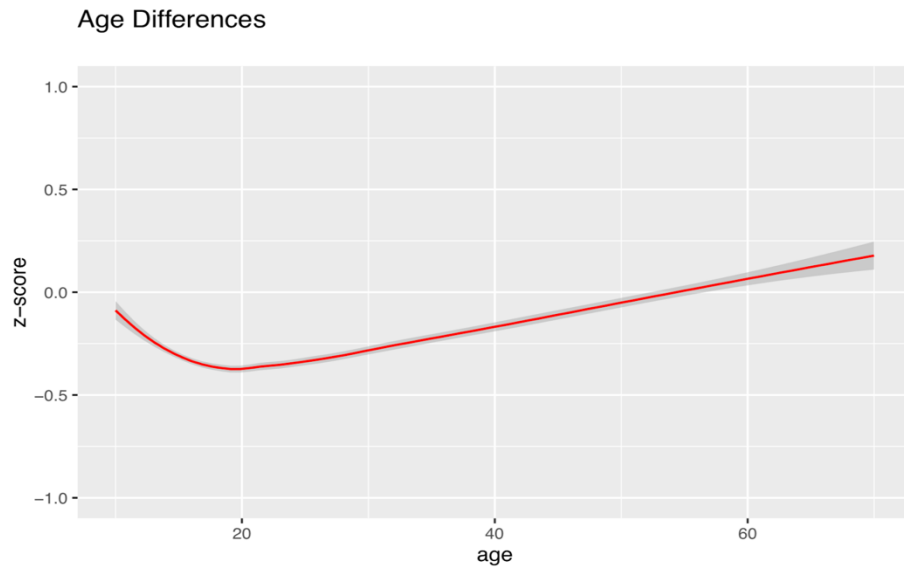


Figure 3. Sex differences in performance (median reaction time)

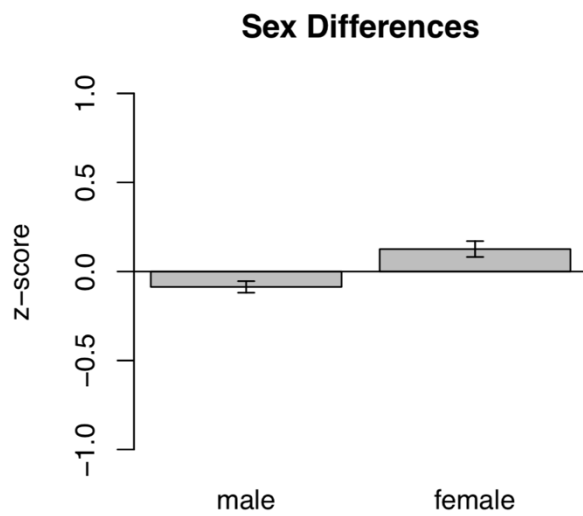


Figure 4. Education-related differences in performance (median reaction time)

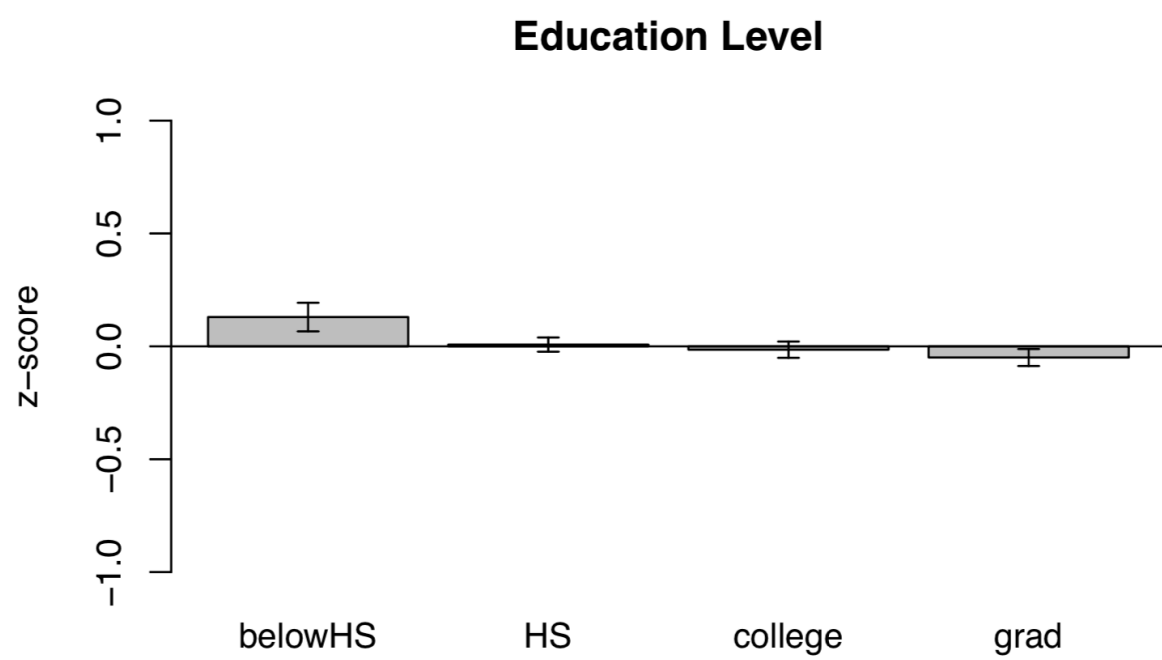


Figure 2E: Distribution of scores (IES)

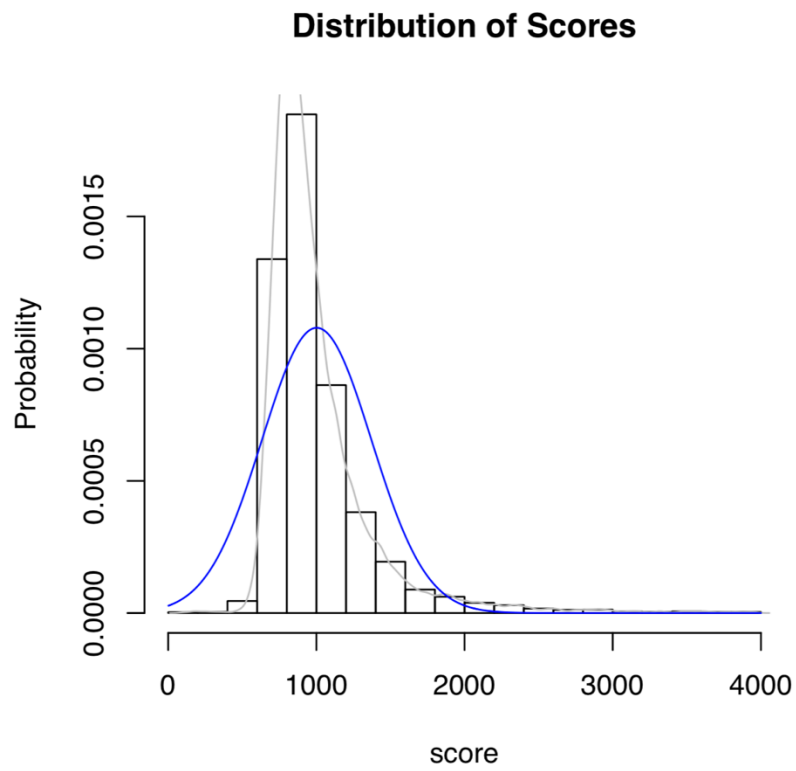


Figure 2F: Age-related differences in performance (IES)  
Age Differences

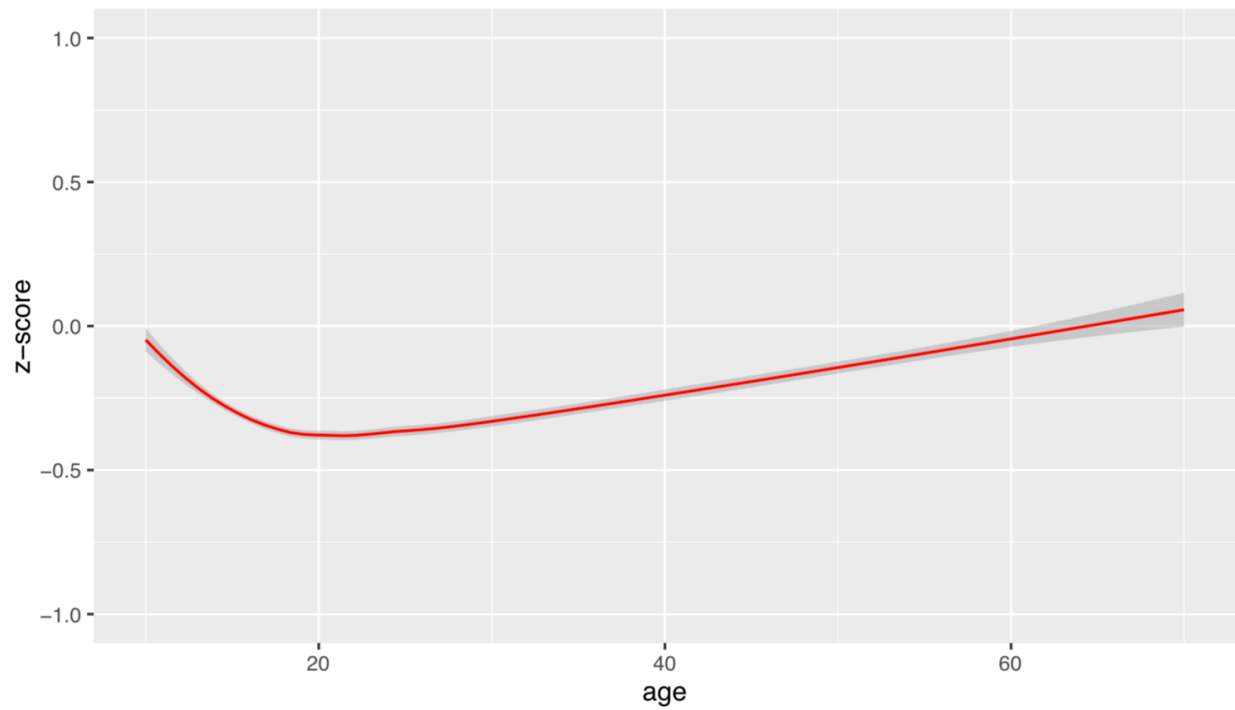


Figure 2G: Sex differences in performance (IES)

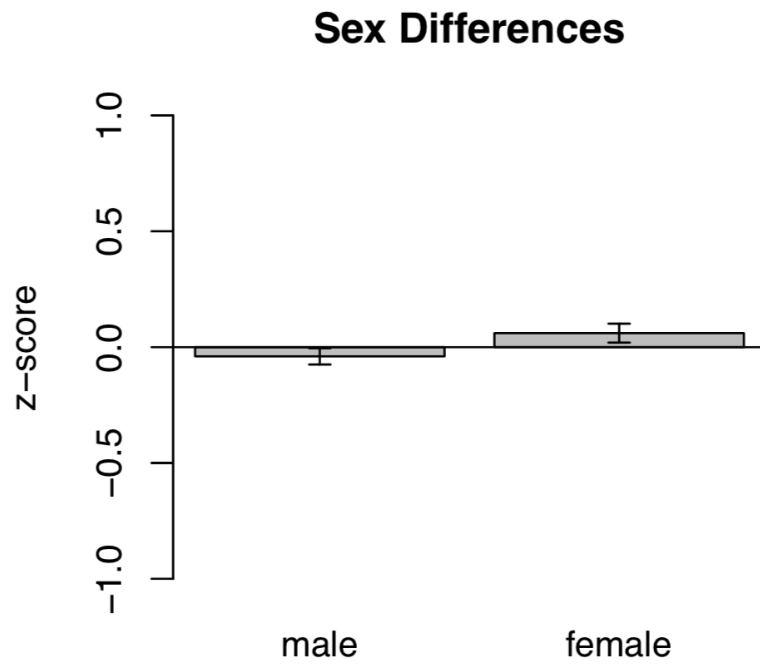


Figure 2H: Education-related differences in performance (IES)

