

# Guiding Principles for Using the Trail Making Testing in Forensic Assessment

Eugene J. Boyle, J.D. & Kristine M. Jacquin, Ph.D.  
Fielding Graduate University

## Abstract

The Halstead-Reitan Trail Making Test (TMT) is one of the most widely used tests for measuring executive functioning (Faria, Alves, & Charchat-Fichman, 2015). However, by following TMT test administration instructions in the manual, critical information for forensic assessments may be overlooked. This poster describes the benefits of using the TMT in forensic assessments. For example, the TMT is valid for use across ethnic and cultural groups (Faria et al., 2015) and for a wide age range (Nussbaum & Bunner, 2009). In addition, this poster provides guiding principles for using the TMT in forensic assessments. For example, the importance of analyzing errors will be discussed, as well as the use of the TMT in assessing malingering.

## Administration

- ❖ TMT consists of parts A and B.
- ❖ TMT-A: client uses a pencil to connect a series of 25 encircled numbers in numerical order.
- ❖ TMT-B: clients connects 25 encircled numbers and letters in numerical and alphabetical order, alternating between the numbers and letters.
- ❖ The numbers and letters are placed in a semi-random fixed order, in such a manner as to avoid overlapping lines being drawn by the examinee.
- ❖ The primary variables of interest are the total time to completion for parts A and B.
- ❖ A cutoff time of 300 s is generally used to discontinue test administration and is therefore the typical maximum score (Bowie & Harvey, 2006).

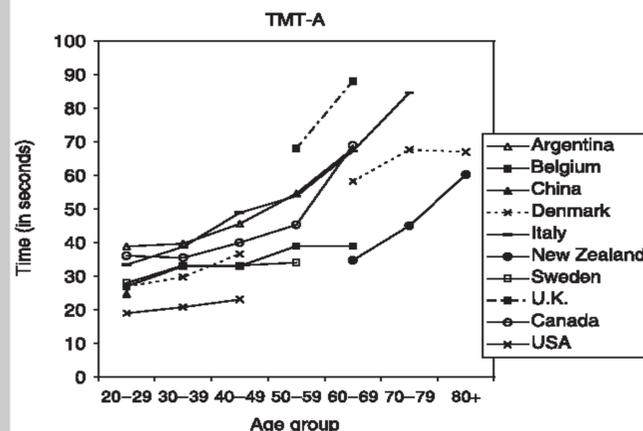
## Popularity of the TMT

- ❖ The TMT is the most frequently used test by neuropsychologists (42%) and forensic psychologists (32%) to assess attention, concentration, and working memory (LaDuke, Barr, Brodale, & Rabin, 2018).
- ❖ The TMT is the second most frequently used (41%) test by forensic psychologists (41%) to test for executive functioning. Executive Functioning is an umbrella term for various cognitive processes and sub-processes (LaDuke, Barr, Brodale, & Rabin, 2018).
- ❖ The TMT is the eighth most frequently used test by neuropsychologists (12%) to assess everyday judgment skills (Rabin, Borgos, & Saykin, 2008).

## Forensic Uses of the TMT

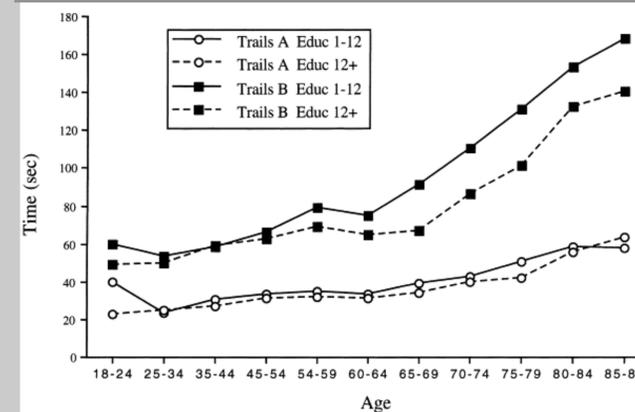
- ❖ Generally considered a measure of an individual's sequencing, visuomotor speed, cognitive flexibility, and set shifting ability (Spree & Strauss, 1998).
- ❖ There is a strong significant correlation between mental flexibility measured by the TMT and anger control in violent offenders (Seruca & Silva, 2016)
- ❖ The TMT is considered to be a reliable and valid measure for assessing cognitive impairment associated with acquired brain dysfunction (Zakzanis, Mraz, & Graham, 2005).
- ❖ A meta-analysis indicated the TMT is sensitive to frontal lobe damage (Demakis, 2004).
- ❖ The addition of TMT to an HIV-dementia scale improved the sensitivity of the scale from 79% to 86% (Chalermchai et al., 2013).
- ❖ The TMT can be used to screen for cognitive impairment due to drug abuse (Roberts & Horton, 2001).

## Language Proficiency & Cultural Bias



- ❖ The TMT has normative data for different countries by adapting the numbers and letters with the native language (Fernandez & Marcopulos, 2008).
- ❖ There are significance differences in time to complete the adapted TMT compared to the English version (see figure above from Fernandez & Marcopulos, 2008).
- ❖ Administrative procedure accounted for most of the variance with bias (Fernandez & Marcopulos, 2008).

## Demographic Effect

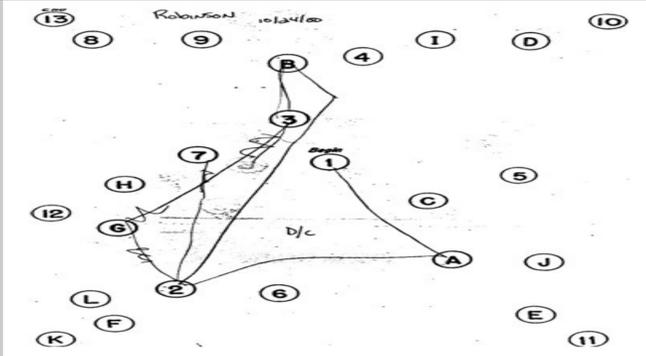


- ❖ The time to complete the TMT-B starts to be affected by age above age 65 (see above figure from Tombaugh, 2004).
- ❖ For TMT-A, educational effects become apparent when the population includes poorly educated subjects.
- ❖ For TMT-B, educational effects are apparent starting at the 6th grade level.
- ❖ Gender had no impact on performance on the TMT (all results from Tombaugh, 2004).

## Analyzing Errors

- ❖ There are three types of errors on the TMT: sequencing errors, perseverative errors (failure to proceed from a number to a letter), and proximity errors (Mahurin et al., 2006).
- ❖ Errors can be a source for differentiating among types of psychopathology or brain damage (Mahurin et al., 2006).
- ❖ Kopp and colleagues (2015) found that, compared to completion time, the number of errors on the TMT was a superior indication of frontal lobe lesions in stroke patients.
- ❖ The number of errors is a good predictor in the differentiation between anorexia nervosa and bulimia nervosa patients (Vall & Wade, 2015).
- ❖ Research by Mahurin et al. (2006) found schizophrenia patients made more sequencing errors on the TMT compared to normal and major depression patients.
- ❖ Error analysis on the TMT-B may provide information to differentiate patients with motor neuron disease from other neurodegenerative disorders (Christidi, Kararizou, Triantafyllou, Paraskevas, & Zalonis, 2013).

## Assessing Malingering



- ❖ Greater deficits on the TMT-A than on the TMT-B was the best red flag for malingering (O'Bryant, Hilsabeck, Fisher, & McCaffrey, 2003).
- ❖ A tendency to pause on circles during C-TMT-A testing is associated with malingering.
- ❖ Cutoff scores below the 5<sup>th</sup> percentile was a positive predictor of malingering for patients with mild brain injury but not for serious brain injury (Iverson, Lange, Green, & Franzen, 2002).
- ❖ Less than four TMT errors did not discriminate between suspected and unsuspected malingerers. More than four TMT errors was considered a red flag (O'Bryant, Hilsabeck, Fisher, & McCaffrey, 2003).
- ❖ See example above.

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