



Trail Making Test

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Purpose of this document

This file contains all the information to understand and analyze the Trail Making Test. You will be able to find relevant information about how this assessment task works, what it measures, and all relevant data about the variables recorded during the performance of the activity.

Task Info

In this section information about the task, its structure, and stimuli will be given.

Task Description

The *Trail Making Test* is a 2-phase test that provides information about different cognitive abilities mainly related to visual search, visual scanning, processing speed, flexibility, and executive functions. It is composed of two different phases that need to be completed in a fixed order (Phase 1 and then Phase 2). In Trail Making Test Phase 1, users are presented with a display containing 25 digits (from 1 to 25) each located within a circle and they are asked to connect the numbers in ascending order by drawing lines from one circle to the other or by selecting the circles in the corresponding order. In Trail Making Test Phase 2, users are presented with 13 encircled numbers (from 1 to 13) and 12 encircled letters (from A to L), and users are also asked to connect the circles but this time alternating between numbers and letters (1-A-2-B-...).

The concept of this task is based on the Trail Making Test (TMT; Reitan, 1955; Reitan, 1958).

You can try the *Trail Making Test* for free on [this page](#). If you want more information about its technical details, you can contact us at support@cognifit.com.

Cognitive skills measured

The primary cognitive abilities measured by this task are processing speed, cognitive flexibility, the ability to make an effective visual scan, as well as other underlying executive functions.

Task Structure

The task is divided into two phases, each including two stages. The first phase is the “Trail Making Test Phase 1” which includes one learning/practice stage and one testing stage. The second block is the “Trail Making Test Phase 2” which also includes one learning/practice stage and one testing stage. The items in the learning and test stages of both blocks are the same for all participants, and each element location is fixed, while the numbers and letters inside are randomized.

During the first phase, there are numbers in circles on the screen. The user must select the circles of the numbers in an ascending way, starting from the lower number and moving to the next, in order. During the second phase, there are numbers and letters in circles on the screen. The user must select the circles alternating in order between the numbers and letters. The user must follow the ascendent order for the numbers, and the alphabetical order for the letters.

Phase	Stage	Type of stage	Number of digits	Number of letters	Total items
1	1	Learning	8	0	8
	2	Testing	25	0	25
2	1	Learning	4	4	8
	2	Testing	13	12	25

Task Stimuli

There is a specific amount of static circles, clearly differentiated from the background, distributed on specific coordinates on the screen. Each circle will display inside it a number or a letter. The circles are white and the content (number or letter) is black. When the user clicks the correct circle in the correct order, its border turns green and, if there is a previous number, it is joined to it with a straight green line. When the user presses the wrong circle, the circle turns orange until the correct circle is pressed.

Variables Info

In this section details about the variables, their definition, range, and other pieces of relevant information will be given.

Basic Variables

Basic variables refer to variables and indices that are commonly used in experimental research and clinical settings.

Total time in Phase 1

This variable measures the total time in milliseconds measured from the presentation of the target screen of the test stage of phase 1 to the final correct response of the user when clicking on number 25. The minimum allowed would be 0 and the maximum would be 300000 (a timeout), and a lower total time indicates better performance.

Total time in Phase 2

This variable measures the total time in milliseconds measured from the presentation of the target screen of the test stage of phase 2 to the final correct response of the user when clicking on number 13. The minimum allowed would be 0 and the maximum would be 300000 (a timeout), and a lower total time indicates better performance.

Number of errors in Phase 1

This variable measures the total number of clicks on incorrect circles, calculated only on the responses to the 25 elements of the test stage of phase 1. The minimum allowed would be 0 and no maximum is determined, and a lower total time indicates better performance.

Number of errors in Phase 2

This variable measures the total number of clicks on incorrect circles, calculated only on the responses to the 25 elements of the test stage of phase 2. The minimum allowed would be 0 and no maximum is determined, and a lower total time indicates better performance.

Omission Errors

This variable measures the total number of test stages that were not completed before the time limit. The possible values of this variable are 0, 1, and 2.

Time difference between Phase 2 and Phase 1

This variable measures the result of the operation “Total time in Phase 2” minus “Total time in Phase 1”. Its value should range from -300000 to 300000.

Error difference between Phase 2 and Phase 1

This variable measures the result of the operation “Number of errors in Phase 2” minus “Number of errors in Phase 1”.

Validity Index

The user's performance will be considered to deviate from what is expected to the point of invalidating the results of the assessment when it falls outside these ranges.

Task validity

This variable represents the validity of the whole task, and it is ‘true’ only when all the individual variables of the Validity Index of the task are ‘true’. Otherwise, it is ‘false’.

Total time in Phase 1 validity

This variable measures the validity of the variable “Total time in Phase 1”, and it is ‘true’ when its value is between 5000 and 300000. Otherwise, it is ‘false’.

Total time in Phase 2 validity

This variable measures the validity of the variable “Total time in Phase 2”, and it is ‘true’ when its value is between 5000 and 300000. Otherwise, it is ‘false’.

Number of errors in Phase 1 validity

This variable measures the validity of the variable “Number of errors in Phase 1”, and it is ‘true’ when its value is < 0 . Otherwise, it is ‘false’.

Number of errors in Phase 2 validity

This variable measures the validity of the variable “Number of errors in Phase 2”, and it is ‘true’ when its value is < 0 . Otherwise, it is ‘false’.

Time difference between Phase 2 and Phase 1 validity

This variable measures the validity of the variable “Time difference between Phase 2 and Phase 1”, and it is ‘true’ when its value is between -300000 and 300000. Otherwise, it is ‘false’.

Omission errors validity

This variable measures the validity of the variable “Number of timeouts”, and it is ‘true’ when its value is > 0 . Otherwise, it is ‘false’.

References

Reitan, R. M. (1955). The relation of the trail making test to organic brain damage. *Journal of Consulting Psychology*.

Reitan, R. M. (1958). Validity of the Trail Making test as an indicator of organic brain damage. *Percept. Mot Skills*. 8 (3): 271–276. doi:10.2466/pms.1958.8.3.271