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A Prime overview

Essentially, the MOXO d-CPT is a task where each individual is required to distinguish between target and non-target stimuli and make a corresponding decision to press a button if a target stimulus is detected or to withdraw from pressing a button when a non-target is presented on the screen. In terms of c cognitive scientists, such test design is called a go/no-go task, meaning that target stimuli should initiate a 'go' response, whereas non-target stimuli are supposed to initiate a 'no-go' response. This setting is classical for the analytical framework known as the Signal Detection Theory (SDT). It was initially developed by radar researchers for the description of the performance and decision-making of the radar observer in 1954 and was immediately adopted for psychological research by Tanner and Swets in the same year as "A Decision-Making Theory Of Visual Detection" (Tanner & Swets, 1954).

The Theory takes the "observer" 's behavior, namely, his 'Hits', 'Misses', 'False Alarms', and 'Correct Rejections' and offers numerous characteristics of the observer's performance. The MOXO d-CPT is at its core a simulation of the 'radar situation', by instructing the test-taker to respond to a certain Picture A, and ignore all other stimuli, despite distractions, i.e. non-Picture A (=noise; non-target stimuli, i.e. non-Hyper/non-ace of hearts).

NB! Each individual's compliance with these instructions is checked by the MOXO system, and the system alerts if a subject fails to demonstrate understanding of the instructions and cooperation with them.

If treated in the SDT framework, each individual is considered an observer, and each timely click following a target stimulus is considered a Hit, an absence of such a click is a Miss. A click in response to a non-target stimulus is a False Alarm, and an absence of such a click is a Correct Rejection. We can compute the Hit and the False alarm ***rates*** for each individual by dividing their individual number of hits/false alarms by the total number target/non-target stimuli of the test (33 target and 20 non-target stimuli per level for kids, and 34 and 20 for the adults).

This approach allows us to evaluate the so-called observer sensitivity, a metric of the observer's ability to detect the signal and discriminate it from noise. When we say that an observer is absolutely insensitive that means that he or she is equally likely to make a hit as they are likely to make a false alarm. Zero sensitivity indicates that the observer's responses are irrelative to the stimuli, i.e., that the test stimuli had no effect on the subject's behavior.

A-prime is one such metric, it reflects how sensitive the subject is to the stimuli of the test. It ranges from 0.5 to 1, where 0.5 corresponds to complete insensitivity (i.e., absence of differentiation of signal from noise) and 1 represents perfect performance.

In this way, by utilizing the SDT framework in the analysis of each individual's MOXO results, we are able to detect individuals who respond erratically, without regard to the instructions of the test even though they passed the instruction compliance check.

To find the optimal cut-off point for the A prime statistic, 3000 children aged below 13 y.o. and 3000 adult individuals who took the test after the 1st of January 2016 were randomly selected from the MOXO data base. A prime statistic was computed for each individual, and such A prime values were found that represent 0.1, 0.2, and 0.24 effect size of difference from 0.5. Effect size of 0.24 is the maximum effect size that can be considered 'small' meaning that a value that is different from 0.5 to the level of small effect size can be considered statistically as not differing significantly from 0.5.

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The following results were obtained:

Group	Effect size	A prime cut-off value	% Above cut-off
Children	0.1	0.50974	2.07%
	0.2	0.51947	3.2%
	0.24	0.52336	3.63%
Adults	0.1	0.50966	0.9%
	0.2	0.51933	1.53%
	0.24	0.52319	1.63%

For future development, it is suggested:

1. *To balance the test from 33 target and 20 non-target stimuli per level to 27 target and 26 non-target stimuli. There is a statistical reason for that – this will make a more balanced test that would yield more precise results and would allow for the extraction of more information on the subjects.*
2. *To intervene in the test play scenario and alter the distractors (as per a client's request). The distractors may be modified to be bright and intense stimuli, like colorful dragon faces, etc.; motion can be added instead of static pictures.*
3. *Randomize stimulus exposition sequence in order to minimize the learning effect.*