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Assessment of selective attention in children through Digital Teddy: preliminary study

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Abstract

Cancellation tests are adequate to detect selective attention in children. These tests are usually performed using paper and pencil, which considerably reduces the capacity to register important parameters and requires some motor skills. In this paper, we present a mobile application that replicates the original Teddy Bear Cancellation Test and adds new features so that therapists can carry out broader studies.

1 Introduction

Efficient selective attention is essential in daily life and plays an important role in childhood as it facilitates the development of movement or cognition. Multiple studies have reported attention deficits in children with neurodevelopmental disorders. Specifically, in relation to children with motor difficulties, brain injury and cerebral palsy have been reported to present scholar neglect and higher occurrence of Attention-Deficit/Hyperactivity Disorder (ADHD) (Craig, Savino, and Trabacca 2019). Among the tools that assess attention in children, cancellation tests have been shown to have greater validity in preschool children, because they are similar to their school tasks. However, these clinical tests are difficult to implement, depend largely on motor skills (usually using pencil and paper) and have been poorly studied in relation to their psychometric properties.

The cancellation test called Teddy BearTest Cancellation Test (TBCT) was designed by Laurent-Vanier and her team in 2001 for children aged between 3 and 8 years old (Laurent-Vannier et al. 2006). The TBCT consists on the "cancellation" of a target (teddy bear, TB) on a sheet with 60 distractors.

2 Digital Teddy test

The Digital Teddy app was developed for the Android operating system. Since the original test was made in an A4 sheet of paper, a good device for comparison with the TBCT would be a tablet with a screen diagonal of 14 inches and an aspect ratio of 4:3, which would result in a screen of 213x284 mm, very close to that of an A4. The examiners can create tests or edit an existing of one using the interface showed in Figure 2, which contains a large number of options: number of rows or columns, random placement of targets and distractors, etc.

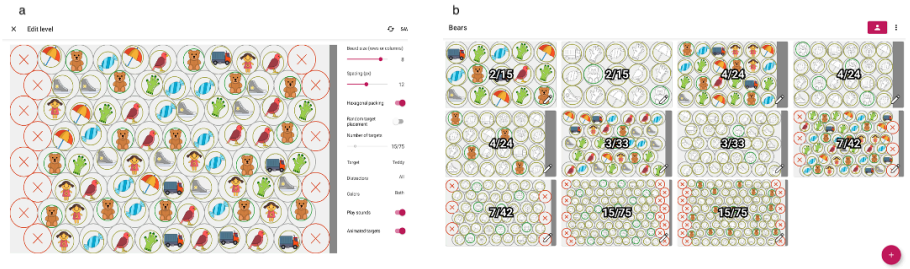

Figure 1: (a) Configuration screen (b) Main screen of the app, showing a grid of configurations.

During the sessions, each interaction of the child with the tablet is recorded in a comma-separated value (CSV) file (timestamp of the touch, x and y coordinates, and whether the touch corresponds to a target, a distractor, or a empty space), as well as the configuration of the level (board size and packing; coordinates and type of each item; colour, sound and animation status, etc.).

3 Preliminary study

In this study, the usability of the application and the validity of the data obtained were determined, comparing digital and original versions in a sample of 8 children aged between 3 and 8 years, in a single test session, using the snowball technique. Inclusion criteria were: (1) having born at term; (2) having typical psychomotor development; (3) having normal or corrected-to-normal vision and (4) being able, and their parents, to communicate in Spanish. Children with learning or academic problems were excluded. The two versions were randomly located firstly on the middle of a table. Children cancelled with the finger ($\leq$ 4 years old) or a pen depending on the age. The study lasted a maximum of 10 minutes. Results recording were: number of omissions (NO), number of TB not crossed out; number of errors (NE), number of distractors crossed out; location of the first three TB crossed out (START-S); accuracy (acc), distance between target and pulsation of the user and time between the beginning and the finalization of each test (in seconds). The parent of the child was present along the session and was asked to observe the test. At the end, parents filled out an online Usability Test form.

The results (see Table 1) showed similar data between both test versions, also revealing a very good satisfaction in the use of the Digital Teddy and advantages such as the automatic recording of the variables. Paper registration showed more omissions than digital. The number of errors was higher in digital version (the cause of this is the existence of attempts near the target but without hitting the object). Digital version can record variables more reliably than the paper one, as well as register other variables, that cannot be recorded with the paper version, as shown in Table 2.

	NO		NE	
	Paper	Digital	Paper	Digital
Mean	0,25	0,125	0,25	0,62
STD	0,46	0,35	0,71	0,74

Table 1: Comparison between the results obtained with paper and digital version.

	START-S	Acc	Time
Mean	-0,37	35.869	38.625
STD	2.13	19.438	33.351

Table 2: Resume of Digital Teddy results obtained during the test sessions.

All parents reported they would select Digital Teddy as a substitute for the paper format, as it´s more practical. They also thought that tools were well integrated, and that the quality of the interface is simple and clear. About learnability, parents felt very trustful using the tool after just one trial.

4 Conclusions

This study shows that Digital Teddy is suitable reproduce the original TBCT because of it is easy to use, guarantees adequate data registration and allows to record extra variables. In a next phase, children with typical development and with pathologies with risk of attention deficit will be evaluated. If the results are positive, the influence of different parameters that may affect the attention process will be studied together with the effect of attention training.

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Conflicts of Interest: The authors report no conflict of interest.

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