

Assessment of Attention-Deficit using a Dynamic-body Electronic Testing System

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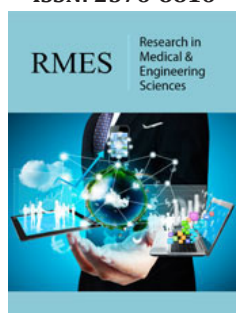
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Abstract

This case study seeks to examine the changing nature of attention-deficit testing using a new wireless electronic tool called B-percept® protocol. The testing protocol consists to measure the participant's perception of simple or complex visual (light), auditory (sound) and kinesthetic (vibration) stimuli, as triggered simultaneously or randomly. Tested with sportsmen and sedentary participants, the B-percept® system revealed that sportsmen accustomed to facing a changing human and/or physical environment are able to anticipate, to adapt and to react better-faster than sedentary participants. In future investigations, it might be possible to use B-percept® in a wider context where outcomes in the field of medicine, rehabilitation, disability or even training in specific task professions

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Introduction

Recent trends in detection of behavioral disorders have led to a proliferation of studies having as primary concern the assessment of attention-deficit processes for children, young people and adults' patients. Consequently, one of the most used testing processes since the 1970s is called 'paper/pencil' tests Nobel [1] to assess visual-spatial skills and attentional functions. There have been a number of longitudinal studies involving attention-deficit processes (e.g., Attention Assessment Test-TEA) cited by Sturm, et al. [2]; Zimmermann, et al. [3]. Moreover, others study were focused in particular on "spatial neglect" with visualperceptual tests [4].

However, a major problem with this kind of application is to be disconnected from reality concerns related to the daily experienced situations in everyday life. Thus, questions have been raised by specialists about the ecological validity of these tests. The causes of attention-deficit has been the subject of intense debate within the scientific community about of clinical testing results of visuo-perceptual skills because the generalizability of much-published research on the perceptual aspect attention-deficit issue was problematic [4].

Despite its long clinical success, the 'paper/pencil' test has a number of problems in use. Long with this growth need of focus ecological test studies, there was an increasing emphasis researches to the computer-assisted tests. Accordingly, patients were placed in front of computer screens where visual stimuli represented by figurative items (e.g., letters, crosses, geometric shapes) were combined with distractors; the computer tool (screen/keyboard) has improved the possibilities to test the capacities of the patients by pressing the mouse keys and the keyboard (stimuli/responses). However, much of the research up to now has been descriptive about the ecological validity of the interaction between patient and his environment, since these computerized tasks do not allow a dynamic-body interaction with the world.

This stand for a need is to understand the disparate configurations among in vitro and in vivo studies. Accordingly the aim of this study was to clarify several aspects of virtual reality and dynamic-body testing processes in the areas of therapy, rehabilitation and research. Indeed, in virtual configurations the patient could interact in 3D dimensions environment

in real time laps, which, could bring the subject to be closer to the needed ecological environment. Doctors, therapists, psychologists, but also entrepreneurs, managers, teachers are increasingly looking for solutions using IOT and virtual reality tools to treat, test, learn as well to evaluate the attention-deficit.

Le protocole B-percept®: a proof process for Attention-Deficit

This case study seeks to examine the changing nature of attention-deficit testing using a new wireless electronic tool called B-percept® protocol [5]. The testing protocol consists to measure the participant's perception of simple or complex visual (light), auditory (sound) and kinesthetic (vibration) stimuli, as triggered simultaneously or randomly. Indeed, reaction time results are measured in milliseconds with an accuracy of $(1 \times 10^{-4} \text{sec})$.

The B-percept® system has been designed to perform accurate measurements in an outdoor conditions environment which involve the participant dynamic-body behavior. Moreover, the

testing process allows measuring attentional focus as a part of performance and endurance task. By working on the B-percept® system this study provides an exciting opportunity to advance our knowledge about modeling traditional social games. Thus, the B-percept® model was inspired from a paradoxical game called 'game of the Four Corners' [6,7]. By studying and analyzing the specific geometry design and players interactions in the four corner game (e.g., how players exchange places and how the middle player is decrypting information about opponents movements), we transposed the Four Corners game form into Eight corners situation (Figure 1a). Thus, the first advantage of modeling was to create a new geometrical organization of players which multiply by two the number of informational requests for the middle player. The second advantage was to be able to model the Eight Corners form into a digital and electronic experimental protocol using B-percept system (Figure 1b). Thus, the electronic and digital, wireless, innovative measurement system was used to assess and compare attention-deficit (Figure 1c).

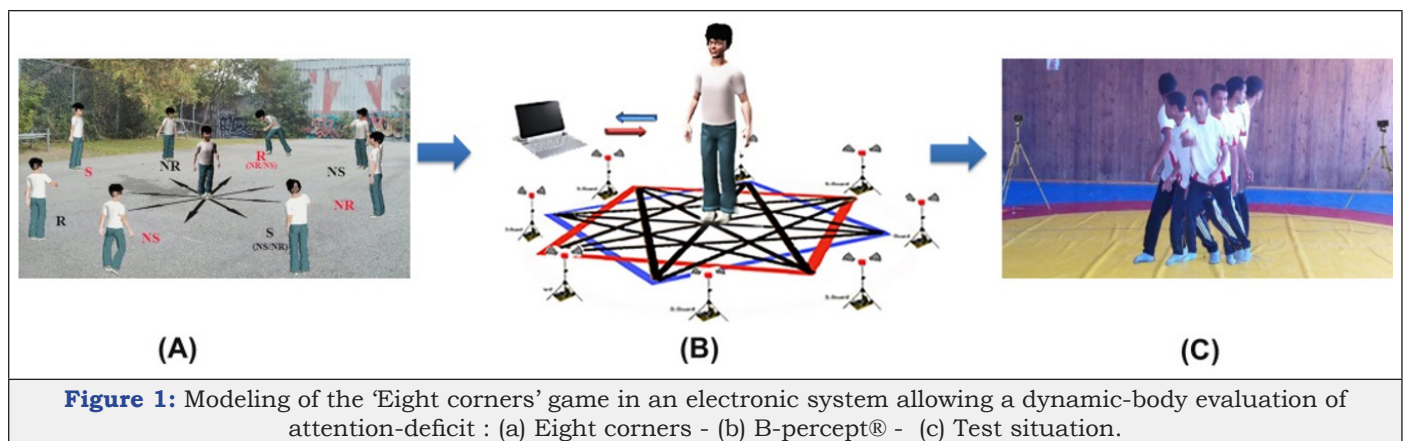


Figure 1: Modeling of the 'Eight corners' game in an electronic system allowing a dynamic-body evaluation of attention-deficit : (a) Eight corners - (b) B-percept® - (c) Test situation.

The B-percept visual stimuli modeled by a preprogrammed randomizing java application made possible to reproduce uncountable visual stimuli in eight directions around the participant. thus, the `[math.random()]` program [8], produced stimuli in a manner not to repeat the same led light direction. thus, 'a personal network in nodes' [9], is formed to manage the randomized emission of visual and/or audio signals (leds and buzzer sounds). indeed, the B-percept® protocol limits the action of intervening of the examiner to the strict minimum in order to guarantee scientific objectivity of results which displayed, using B-percept® statistical software, in matrix and graphs. B-percept® system is proposed as well all other innovative tools [10,11], to overcome approximations of clinical tests carried outside the laboratories conditions.

Teste with sportsmen and sedentary participants, the B-percept system revealed that sportsmen accustomed to facing a changing human and/or physical environment are able to anticipate, to adapt and to react better-faster than sedentary participants [12]. Moreover; participants habituated to the full body interactions assimilated by body experince all over the years into training and competitions conditions, positively impact the ability of visual

searching behavior for sensory information in human and artificial space.

Discussion

Together these results provide important insights into to test B-percept® with young and adults having different clinical cases of attention-deficit disorder. As a result, the originality of the B-percept system is linked first to: the full-body interaction (which here is not reduced to a simple interacting with a computer keyboard a virtual headset). Second, there are similarities between the attitudes and behaviors expressed by participants in the B-percept® testing conditions attitudes and the real Eight-corners playing behaviors regarding to the fun aspect of the practice. In addition, our proposed measurement system is increasingly improved by using most IOT and wireless communications technology to improve, flexibility of use and to be as close as possible from real space sounds and visual stimuli. B-percept® system is trying to transform in vitro testing conditions to an in vivo ones through a 'simulated reality' which could be closer to the real world than and 'virtual reality'. Further research should be done to assess the participant trouble while interacts with his close accustomed or in experienced environment.

Indeed, we are convinced that attention-deficit is related to a whole inseparable complexity between participant and his framework (e.g., human, physical, material, cultural and societal, temporal, etc.) [12,13].

Conclusion

The B-percept® system has already been tested and validated as reaction time and decision-making measuring process for several sensorial stimuli on sportsmen, sedentary participants, students, high-level shooting athletes [14,15]. However, in future investigations, it might be possible to use B-percept® in a wider context where outcomes in the field of medicine, rehabilitation, disability or even training in specific task professions (military, conduct of machines, etc.).

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