



Full length article

Adapting a stand-alone computerized cognitive test battery for online use – A case-study in the context of users with special needs



Dominik Hagelkruys^{a,*}, Christina Böhm^a, Renate Motschnig^a, Semion Kertzman^{b,c}, Alexander Sirota^b, Bernard Lerer^{b,d}, Éva Gyarmathy^e

^a Faculty of Computer Science, Educational Technologies (CSLEARN), University of Vienna, Austria

^b Anima Scan Ltd., Israel

^c Tel Aviv University, Israel

^d Hadassah-Hebrew University Medical Center, Jerusalem, Israel

^e Research Centre for Natural Sciences, Institute of Cognitive Neuroscience and Psychology, Hungary

ARTICLE INFO

Article history:

Received 14 September 2015

Received in revised form

30 March 2016

Accepted 23 May 2016

Keywords:

Special needs

Case study

Human-centered design

Cognitive testing

Online testing

Interface design

ABSTRACT

As computers and internet access become more readily available at home, online testing and self-assessment are growing in popularity. In this article we briefly discuss the challenges and opportunities of online testing in general and then describe our experience with putting a standalone cognitive test battery online for users with special needs. Thereby the emphasis is on adopting the human-centered design process for the design of online tests and on the steps needed to be taken to arrive at a usable and validated online test battery. If the experience and process described in this paper turns out to be of value to researchers and/or practitioners in the field of using computers for human flourishing, this article will have achieved its purpose.

© 2016 Elsevier Ltd. All rights reserved.

1. Introduction

1.1. Context

Dyslexia describes a specific learning difficulty that mainly affects the development of literacy and language related skills. More than ten percent of the population is affected by dyslexia with a growing prevalence (The International Dyslexia Association, 2007). Such difficulties often cause severe burdens on the working- and private lives of the people concerned, not infrequently leading to social isolation with sad and dangerous consequences.

It is quite complex to analyze reading problems as they are multidimensional. Dyslexia is usually not the result of one singular deficit but rather the product of a combination of several

dysfunctions that influence the auditory and visual processing of written material. In order to provide individualized interventions and help the cognitive functions of a person need to be characterized through specific tests. The implementation of such tests in an online-environment as well as the necessary adaptations will be analyzed in the context of the LITERACY Project. The LITERACY Project has created a website, the LITERACY Portal, which, among other functionalities, incorporates a real time, online cognitive test battery to assess the cognitive and learning profile of the user.

The LITERACY Portal (<http://www.literacyportal.eu/>) provides various online supports for dyslexic users. It is funded by the European Commission and aims to support adults and teenagers with dyslexia (or limited reading literacy) and to improve their social inclusion. Its goal is to provide an ICT solution which will enable dyslexic youth and adults to acquire learning skills, accommodation strategies and methods for succeeding at literacy related tasks at work and at home (LITERACY Project, 2012). More information about the LITERACY Portal can be found in previous publications which examined the unique mixture of the Portal's e-learning programs, assistive technologies and community building opportunities (i.a. Hagelkruys & Motschnig, 2014), as well as the

* Corresponding author.

E-mail addresses: dominik.hagelkruys@univie.ac.at (D. Hagelkruys), christina.boehm@univie.ac.at (C. Böhm), renate.motschnig@univie.ac.at (R. Motschnig), kertzman@animascan.com (S. Kertzman), alex@animascan.com (A. Sirota), lerer@hadassah.org.il (B. Lerer), gyarmathy.eva@gmail.com (Gyarmathy).

emphasis on Human-Centered Design of the Portal to facilitate its acceptance by the target population – dyslexic youth and adults with basic computer skills (i.a. Hagelkruys, Struhár, Motschnig, & Balharová, 2013).

1.2. Motivation and research questions

The motivation for this research was quite multi-faceted but clearly originated in the opportunity to create a novel tool that support a special needs user group and holds the potential to have a significant impact on their daily life's. Taking a functional stand-alone testing-battery, adapting it for online-use and connecting it to recommended interventions, creates a number of complicated but interesting questions. Analyzing those questions and finding suitable solutions made up a sizeable part of the work.

The process of taking an existing computerized cognitive test-battery and transforming it into an online tool that can be used autonomously without any supervising expert already makes up a challenging research area. Furthermore applying the HCD-Process to a software tool for people with special needs, doing this research together with future end-users and including them throughout the design process, outlined a great project and interesting research environment. Additionally this testing-battery was identified as a core-element of the LITERACY-portal, enabling the users to use the portal to its full extent and individualize its content to their specific strength and weaknesses. One of the biggest challenges, but also biggest opportunities, while creating this novel tool was to implement ways to allow a special needs user group to utilize it autonomously and independently. Therefore the leading research questions focused on the aspects of Human Computer Interaction (HCI) and Human Centered Design:

- Which design-steps are necessary to create a suitable online testing environment for users with special needs, especially dyslexia?
- How can the system help users handling their re-defined roles in the testing-process?
- In which ways can an interactive system be exploited to improve the user experience while performing the tests?

Through this article the experiences, findings and obstacles encountered while applying a HCD-approach will be shared and the design decisions made throughout the implementation of the online cognitive test battery highlighted.

1.3. Related work

There exist quite a few articles on related topics that cover similar projects, although in different contexts, facing other pre-conditions or applying alternative approaches. Initially a few computerized test-batteries that provided important contributions to the research literature should be mentioned: the Cambridge Automated Neuropsychological Test Battery (CANTAB; Morris, Evenden, Sahakian, & Robbins, 1986), the MicroCog (Devivo, Rothland, Price, & Fein, 1999), the Neurobehavioral Evaluation System (NES; Baker et al., 1985), and CogState (Cysique, Maruff, Darby, & Brew, 2006). One of the main issues of this research is creating cognitive tests for online use. This is a problem that has been encountered by other researches as well. An interesting article covering this topic is fittingly titled “Psychological Testing on the Internet: New Problems, Old Issues” (Naglieri, Drasgow, & Schmit, 2004). An always present issue when creating an online test-battery seems to be concern regarding the validity of the results. This concern was picked up by a number of papers and articles. An example is the WebNeuro-Project to create a neurocognitive

assessment battery (Silverstein, Berten, & Olson, 2007). Although this article does not cover the design of the test-battery it describes a case-study of the WebNeuro supporting the validity of cognitive online-tests. Other examples are the articles “Using the Internet for psychological research: Personality testing on the World Wide Web” (Buchanan & Smith, 1999) and “Internet Cognitive Testing of Large Samples Needed in Genetic Research” (Haworth, Harlaar, & Kavas, 2007), doing a validation with 10–12 year old children for Internet versions of reading, language, mathematics and general cognitive ability tests. Other related work can for example be found in the area of sports and testing for concussions, more specifically “return-to-play” decision-making (Erlanger et al., 2003). It discusses the design process as well as issues and problems that were encountered, some of them similar to the ones presented in this article. Additionally the two articles “Computerized cognitive testing battery identifies mild cognitive impairment and mild dementia even in the presence of depressive symptoms” (Doniger, 2006) and “Computerized Cognitive Testing for Older Adults – A review” (Zygouris & Tsolaki, 2014) should be mentioned as they too describe research in the field of special needs. Within the context of including users, especially special needs users, into the design process, the paper “Designing with users, How?” (Lee, 2008), which investigates user involvement tactics for effective inclusive design processes and describes the inclusive design processes on a general level, as well as the article “Multimedia Software Interface Design for Special-Needs Users” (Lányi, 2009), focusing on interface design for people with special needs in a general way and the paper “A Taxonomical Approach to Special Needs Design in HCI” (Edmondson, 2001), describing a taxonomical approach to the topic of special needs design in context of human-computer interaction, represent more general work on the topic of design and accessibility for people with special needs, that provided a foundation for the research presented in this article. Furthermore, there exists various research and other sources of information on the topic of dyslexia, which proved to be helpful in learning to understand this specific and unique user group. Example include the article “Web Accessibility: Designing for dyslexia” (Bell, 2009), which focuses on web-accessibility and interface design for people with dyslexia and the paper “Layout guidelines for web text and a web service to improve accessibility for dyslexics” (Rello et al., 2012), in which, based on assessment of user studies, a set of layout guidelines was established. Additionally the short paper “What we know about dyslexia and Web accessibility: a research review” (McCarthy & Swierenga, 2010), providing a brief overview over the state of research on dyslexia and accessibility, and the paper “Web Accessibility and People with Dyslexia: A Survey on Techniques and Guidelines” (De Santana, De Oliveira, Almeida, & Baranauskas, 2012), presenting a survey regarding the current state of web accessibility for people with dyslexia, should be mentioned in this context.

Although there exists a variety of research within the areas of dyslexia, creating online cognitive tests, applying the HCD approach and of course designing for and with special needs users, there still seems to be a small research gap. The research presented in this article is unique in two key aspects: (i) No existing portal provides dyslexic individuals with online cognitive assessment, real time online results of testing AND assignment to training on the basis of a cognitive and learning profile; (ii) No existing portal provides comprehensive assessment of dyslexia AND of attention and other cognitive functions in the same context. Designing an online-environment that enables a special needs user to autonomously and independently interact with such a complex tool and retrieve information, otherwise provided by a professional supervisor, in an easy to understand form, represents a new and unique research opportunity.

Download English Version:

<https://daneshyari.com/en/article/6836848>

Download Persian Version:

<https://daneshyari.com/article/6836848>

[Daneshyari.com](https://daneshyari.com)