ActiveBrain4All
A Social Brain Gym Online Platform

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Abstract

Ageing has been increasing. Not only in Portugal but also across Europe, demographic involution has been the trend. Imagina® is involved in a project to design and build a social online platform with cognitive games for brain gym, promoting active ageing and rehabilitation. In this paper we will present how we came to a first design solution using two complementary techniques: a benchmarking study, trying to identify what is relevant and how we can propose a better and smarter solution, and a survey by questionnaire to refine our assumptions taking into account the opinion of specialists in the field. Another challenge is how to design and develop a solution that is easily accessible anytime, everywhere, consistent and transparent to the user from any operating system and any device, with particular awareness to tablets and smart phones.

Keywords

active ageing, brain gym, ActiveBrain4ALL, multiplatform.

INTRODUCTION - CONTEXTUALIZATION

ActiveBrain4All arises as a result of a broader research project (*TOPQX - Everyone can learn Anytime, Anywhere*), where we combined, through different methodological strategies, a set of theoretical and empirical studies that may be applied on the design and implementation of a set of different resulting products.

In the case of ActiveBrain4All, from the information collected and analyzed we are now on the process of designing a technological solution targeted to adults and seniors in order to maintain and exercise their mental abilities. This solution is consistent with the development of a new generation of tools and resources to support education and training, whenever, wherever. Extending its use to PCs, smart phones and tablets, the ActiveBrain4All platform seeks to promote greater involvement of the elderly in society, preserving their health and promoting greater control over their own lives.

Ageing is seen as a physiological process of living itself, which has long been seen as an evolutionary unchangeable process (Verissimo et al., 2008). Several studies document a change in memory during ageing; but studies also indicate that training produces a significant increase in performance of the elderly (Neri et al., 2006). The memory impairment is one of the main topics of discussion in the ageing

process (Chariglione, 2010). To this scenario we should add the increased risk of dementia or other decline (Verissimo et al., 2008), having a role the recognition of dementia in the elderly (Chariglione, 2010). Based on this we may conclude that there is a direct relationship between ageing and memory decline in brain function, which is a hotly debated topic not only because of the ageing population increase, but also because this process is associated with impairment of memory (Verissimo et al., 2008).

Being our purpose to come out with an innovative solution that benefits this target population, in the context of active ageing, our research work followed two complementary strategies, distinct and previously defined, benchmarking and inquiry. We believe that with the intersection of these two methods new questions and answers will arise, better adjusted to the needs and interests of the users.

Active ageing

The ageing phenomenon has been a topic increasingly discussed, due to increased life expectancy of the population. The increased life expectancy associated with the decrease of birth rate, has a tremendous incidence on the socio demographic structure of industrialized countries (Cardoso, 2012). This worldwide debated phenomenon that has received the name of "demographic revolution", has a great incidence in Portugal, bringing political, economic and social consequences (Vasconcelos & Carneiro, 2005).

The ageing process is associated with a number of brain changes that lead to changes in cognitive abilities (Parent, 2008) as cognitive deficits in memory, changes in speed of reasoning, emergence of confusion episodes and of psychological disorders and changes on activities of daily life, which may relate to dementia and depressive symptoms (Schlindwein-Zanini, 2010). This has several impacts that brought together constitute a barrier to social inclusion of the elderly, leading to a greater concern with the improvement of active and healthy ageing. Therefore, a multidimensional approach is required in order to provide an intervention directed to an active and healthy ageing, promoting the "capacity for an adaptive response to the challenges related to the age advancing " (Verissimo et al., 2008).

The gradual decline of cognitive capabilities is inherent to the physiological process of normal ageing and therefore, arises as a natural consequence of chronological age advancing, and is not automatically an obstacle for normal functioning (Moreira and Oliveira, 2005). This decline, also known as a transient state for dementia, is characterized by very subtle changes in cognitive functions, especially of memory, called mild cognitive impairment (MCI) (Marques-Teixeira, 2011). In addition to "normal" cognitive decline ageing, age is a risk factor for the emergence of an increasing number of patients with dementia, particularly with Alzheimer's disease (AD) (Cardoso, 2012). Dementia is a syndrome attributed to brain disease, usually of chronic and progressive nature, in which there are multiple cerebral function disorders (Woodford, 2009). The relevance of Alzheimer's disease becomes even more important because, despite clinical and biochemical research in recent years, a clinical or biochemical marker allowing early diagnosis of the disease was not yet identified and there is no curative or stabilizer (Santana, 2005). These facts lead to a greater focus on the improvement of active ageing as a challenge to the development of specific rehabilitation programs (Cardoso, 2012).

Currently seniors are increasingly present in different segments of society and therefore a new vision of ageing is needed, with emphasis on cognitive rehabilitation, focused on cognitive functions loss and aiming to improve the patient's condition both within neuropsychological side and within quality of life (Schlindwein-Zanini, 2010).

Some authors showed that high levels of physical, mental and social activity are associate with a reduced risk of dementia and that the simultaneous practice of two or three components exert even more pronounced risk reduction (Karp, 2006).

In fact the memory train is fundamental at the same time to an active and healthy ageing. It is, therefore, of greater concern to understand which are the needs of the elderly, particularly in the cognitive area, in order to slow the effects of ageing and of degenerative diseases, such as Alzheimer and other dementias.

Taking into account both sides of active ageing and rehabilitation and getting advantage of technological advances, Imagina intends to develop ActiveBrain4All a social online platform, dynamic and interactive, with cognitive brain fitness games and high level of personal customization. Exercises are planned, directed and focused with the objective of stimulation and reorganization of cognitive areas in deficit, through different games that work on different cognitive areas: memory, attention, language, reasoning, concentration, among others.

Caveat here is the level of neural plasticity that perseveres even in old age. And this means, the ability of the brain to reorganize its neural circuitry after injury, trying different ways of performing an activity (Cela & Herrera, 2005). "The brain has a singular plasticity" (Neri et al., 2006) thus presuppose that there is a cognitive reserve, even in cases of Alzheimer's disease, where the training and stimulation of preserved skills may induce plasticity of the nervous system (Lima, 2006).

The neuropsychological rehabilitation, refers to the process of recover their powers by people who have suffered a brain injury, and when not possible, the process of, at least, rearrange the capacity for physical, mental, social and occupational functioning (Pulido, 2006).

Neuropsychological rehabilitation, cognitive stimulation and cognitive training emerge as therapeutic practices inherent to the intervention in cognitive functioning deficits in dementia (Cardoso, 2012). These intervention techniques should include motivational, social, physical and psychological aspects (Boccardi & Frisoni, 2006). We considerer these theoretical points as a guidance on the development of this research project.

METHODOLOGICAL TOOLS

To outfit the objectives of this study, we choose two instruments to collect distinct information: a market analysis - benchmarking - and an inquiry. These resources have enabled us to obtain qualitative and quantitative data and a set of relevant information based on the knowledge and the awareness of experts who work directly with the target population of these kinds of platforms with cognitive games.

Benchmarking

The contributes of ageing applied theories and the benchmarking study, led us to better understand what is now available and what is the effectiveness and the impact of a cognitive training program in the life quality of this group. We studied a vast group of platforms similar to the one we intended to develop. This study was based on a content analysis of the available platforms, seeking to identify the qualitative features present in them and trying to understand their relevance. In our analysis we identified some common features like: sets of questions to profile the initial score to launch a personalized training, information on how each game should be played and categorization of the games by cognitive areas. We tried also to identify features generally present, but with different implementation, learning about how to better design and implement them. We got a set of problems and solutions from the platforms we studied, having to create a hierarchy by order of their relevance. We realized that to launch a new product we need to go beyond this benchmarking, looking for better alternatives, enhancing up important features and adding new flavors like a social sense of proximity and belonging.

On the design and specification process we paid attention to two fundamental concepts: accessibility and usability, revealed in the ease of navigation, simplicity, relevance of content, uniformity and clearness.

Inquiry

In parallel, the technique of survey by questionnaire, served as a research tool in order to collect other information that would be useful for specifying the Active-Brain4All, broadening the vision of the project team when confronted with a set of technicians and specialists of the field. We used this technique because we needed to interrogate a large group of people in a short time. This process went through three phases: planning, execution and data analysis. The questionnaire was sent by mail and addressed to rehabilitation technicians, therapists, geriatricians, nurses and caregivers of the elderly.

DISCUSSION OF RESULTS

Through the questionnaire we gather information incorporating the views of the target group of this survey, enabling us to improve the platform specification. From around 900 surveys sent, we obtained valid answers from 60 respondents. The majority of respondents were between 25 to 34 years. 80% of respondents revealed a profession different from our expectations, like nurses and rehabilitation engineers. Professional experience got variations from 2 years to over 20 years.

All respondents using the proposed Liker scale considered very important to train all the cognitive areas that have been appointed: memory, speed of thinking, attention, executive function, concentration, language skills, spatial vision and auditory memory. They also revealed a common use of cognitive training when exercising their patients. The majority found that doing games, logic solving exercises and an active social life were the most effective methods to stimulate cognitive areas.
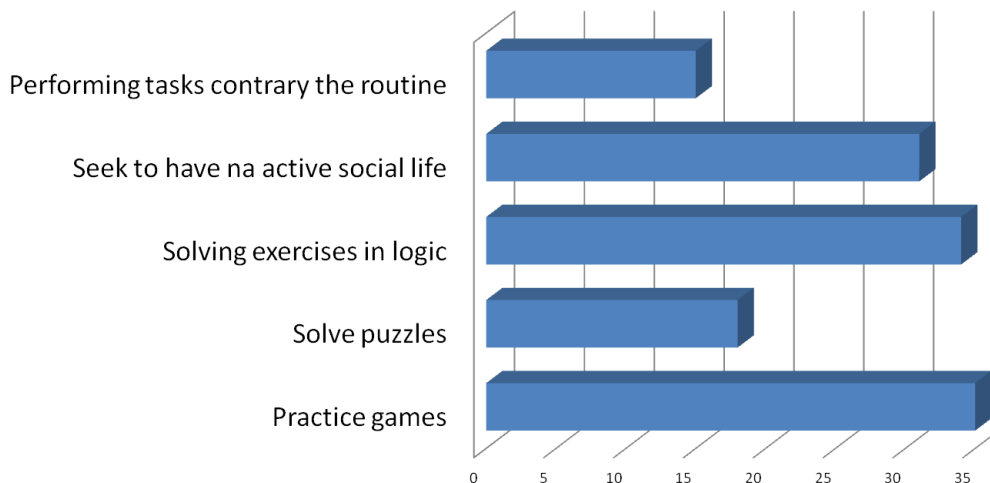
Most effective Methods

Figure 1: Most effective methods

54% of respondents revealed that they use cognitive training as the preferred method to exercise their patients. Most respondents don't have knowledge of similar platform for brain exercise, however the discrepancy between those who know (46%) and those who don't know is small.

In general respondents have a quite positive opinion about the possibility of using such platforms. Respondents also considered important, that the games are classified according to the purpose of training and especially according to the cognitive needs of the patient. Age, psychic development and the diagnosed conditions were also considered as fundamental aspects for the leverage of the games. When choosing the equipment to use the platform, 65% of responses pointed to the computer.

In this inquiry were also considered very important aspects like graphic characteristics, visual and cognitive clarity of information and the amount of information. 86%

of respondents think that games should be defined by the system, with the possibility of changing them. Regarding the mode of access, 83% preferred to get this platform for online access.
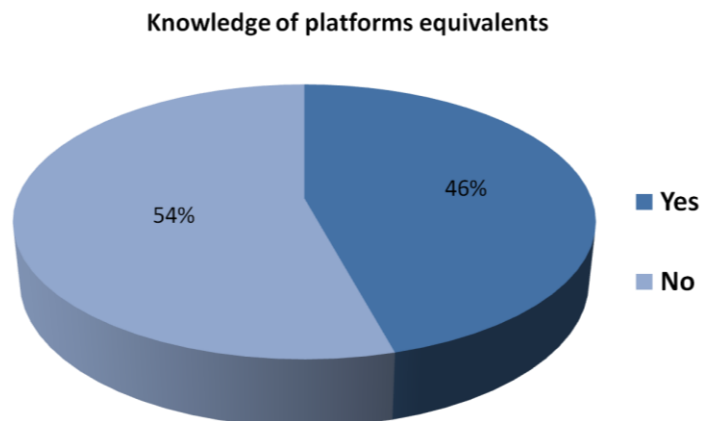

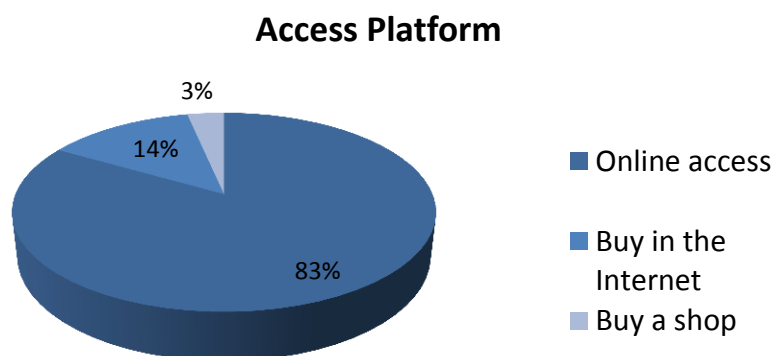**Figure 2:** Knowledge of platforms equivalents

Figure 3: Access platform

75% believe that the best way to get information about the platform should be through the Internet. 65% of people would like to have access to a similar system of cognitive training, because it allows a more effective cognitive training. The main reasons leading to dislike such a platform are divided between the low attractiveness of this kind of platforms and the fact that they consider them complicated. When asked if they will buy such a platform, 63% said they did not know if would pay for a platform of this kind and within those who would pay, 42% would pay between €2 to €5 per month.

Functionalities of ActiveBrain4All

Taking into account the benchmarking and analysis studies, a first version of the product is being specified, whose main functionalities are specified below.

The development of this social online platform for active ageing and cognitive rehabilitation will considerer the following components: socialization, cognitive training and chronic diseases. The platform pretends to address some of the challenges of active ageing, contributing to a better quality of life, giving a greater independence to older people, and helping to promote social inclusion of the elderly. The target population encompasses people with cognitive impairment, people with dementia or other injuries that compromise their mental abilities, but also healthy people in risk while

ageing. The socialization involves the promotion of self-participation and social interaction through the integration of the platform within social networks.

A main part of the platform is based on a set of social games focused on the cognitive areas, through the stimulation of cognitive skills and by implementing cognitive rehabilitation/prevention training. This training is directed and adjusted to the capabilities and requirements of the user, tracking the performance on the games and integrating the user knowledge and past experience.

Neuropsychological assessment should be part of the overall clinical evaluation of a patient with spinal / brain dysfunction, suspected cases of dementia, or complaints of decreased memory (Cardoso, 2012). The assessment should include a comprehensive analysis that takes into account aspects of the clinical picture (Cardoso, 2012). It is important to consider the context of the patient asking questions according to their interests (Petersen, 2004), in order to set up a profile from which we outline a process of intervention based on the capabilities preserved on the subject (Guerreiro, 2005). The component of chronic diseases support will offer to elderly people greater control and quality of life and a significant reduction in costs associated with chronic diseases at ageing. The platform should work online and offline on any operating system and different mobile devices, taking advantage of the mobility and portability of mobile devices. Accessibility is also a feature to consider by offering intuitive and transparent navigation in and between platforms.

The platform will be developed in English, Portuguese (European and Brazil variants), and will be prepared to incorporate any other language. The business model is based on annual subscription by individuals (person, professional) or by institutions (health unit, hospital), but most of its components will be also available as independent apps based on the model of Serious Funny Games (a point of differentiation compared to other analyzed platforms).

All devices, all operating systems - technological challenges

Most software enterprises are creating software that can work natively or using virtual environments (like JavaScript) in the main platforms. Imagina within TOPQX project is following this trend, creating software using both methods: native, using cocos2d-x(C++), and HTML 5, running in the browser device. The first method brings more solid experience to the user; the last one brings a unique experience in web environment. Both of them work on the main systems (windows, Mac, Linux, iOS, Android).

Over the last few years there were several improvements on technology creating smaller and easier devices for mobile work and mobile learning. The 90s brought smaller phones with more than basic functionalities: calculator, scheduler and basic games. By the end of the 90s market begun growing for business smart phones, leaded by Nokia and palm phones. In the last 5 years, with iPhone operative system, the iPad appears. It becomes a huge hit all over the world, with Android devices trying to catch up, with cheaper alternatives. During 2012, just on the first two Quarters, almost outsold the total number of units sold on previous year. The gadget market it's growing fast, but without common compliance, making apps that can run in so different devices with different operating systems and versions it is a great challenge for mobile learning.

HTML is an old standard, but lacks functions that modern systems need. Web browsers begun to implement a new common standard for the new needs - HTML 5. Created on 2004, by Web Hypertext Application Technology Working Group (WHATWG), together with World Wide Web Consortium (W3C) it suffer a lot of improvements until today. This technology was known by the world at April 2010 after Steve Jobs issued a public letter titled "Thoughts on Flash". Last year, Adobe, has discontinued flash for mobile, and begins to create HTML 5 tools to replace flash technologies. Since then several companies adopted HTML 5 as a new standard. Microsoft implemented HTML 5 as the main technology on metro environment at

windows 8; Adobe created the Edge suite for HTML 5; Facebook uses it, on the mobile version. The Financial Times swapped its mobile app for an HTML5 web-based app that is now more popular than the native app (Reuters).

In order to achieve that our applications will run and migrate between almost any kind of platform and device, we will use HTML 5 as the main programming language. Anyway we are aware that this may be not entirely possible and we are considering also other alternatives that can better deal with the different capabilities of different devices and operating systems. This is a big challenge that we only are pointing on this paper. Our main concern is to get out with applications that will run in any operating system and device and that can migrate between them in a transparent and consistent way for the user.

In the case of ActiveBrain4All this is particularly relevant, as the target population may use different devices with different operating systems and we want to offer a great social experience where the technologies can't be a barrier, but an easy and accessible medium. The platform will run virtually in any device online and offline, with data synchronization, so the user gets a sense of continuity when moving between different devices.

CONCLUSION

The ActiveBrain4All is a solution designed for the adults and senior population in order to maintain, anytime, anywhere and in any language, cognitive skills in a social context. This platform is based on a set of games and other socializing online activities. The main objective is to promote pro activity, stimulating areas in cognitive deficit through games that work on various cognitive areas: memory, attention, language, reasoning, and concentration, among others. Another purpose of this platform is to take advantage of the portability those technological changes offers us, so this online platform extends to PC, smart phone and tablet, enabling greater involvement of the elderly in society, and promoting a greater control over their lives. The accessibility and portability are components to favor preserving health and promoting socialization.

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Biographies

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