

# Senior Care Clinic - Modeling a Cognitive Assessment

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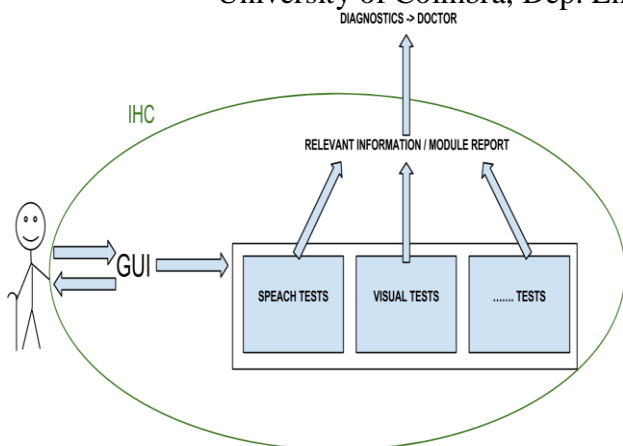


Figure 1: Simple diagrams of the structure of the application.

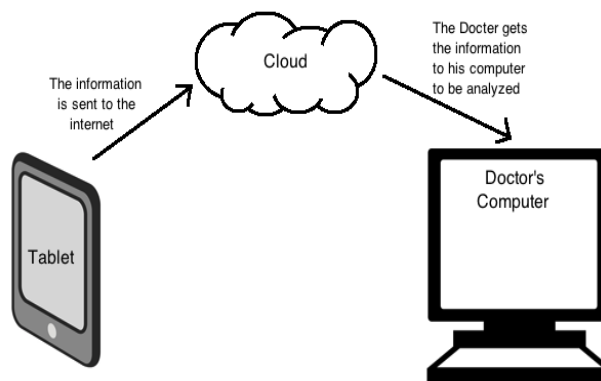


Figure 2: Physical Model.

## Abstract

Given the aging of the population, it is observed that some measures/strategies should be taken to ensure the quality of life and autonomy/independence of the elderly. Due to the common occurrence of cognitive decay caused by various factors in older people, the neuropsychological assessments form part of psychological clinical work, where new approaches and techniques are resulting in tests that have progressed significantly. The objective of this work is to present a practical design in developing a videogame environment which aims to stimulate cognitive factors and provide indicators of cognitive deficits to health professionals, enabling them to develop better strategies that allow foster a better quality of life of the elderly. The methodology used was Research through Design, in which were detailed the four criteria to assess a contribution and research in game design, along with models of designers used to develop a videogame stimulus and cognitive assessment.

**Keywords:** Design for Accessibility, Research Through Design, Active Aging and Cognitive Assessment

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## 1. Introduction

Population aging is a fact that can be observed worldwide, particularly in developed countries. It is a diverse experience between individuals, which contributes to a multiplicity of genetic, biological, social, environmental, psychological and cultural factors. There is a linear correlation between chronological age and biological age [Ferrari 1999]. In this context of aging process, it is observed that

measures/strategies should be taken to ensure the quality of life and autonomy/independence of elderly.

One of the strategies proposed by the World Health Organization, which aims to promote healthy aging, is the "Active Ageing", where physical activity is one of the determinants for adoption of a healthy lifestyle, behavioral factors and active participation in the care of their own health [WHO 2005]. Maintaining health and independence in old age, identified as good quality of physical, mental and social life, are the relevant factors to preserve the potential for achievement and development in this stage of life. It is also necessary to reduce the social impact issues surrounding the care of the dependent elderly. For these and other demographic and socioeconomic motivations, health promotion has been highlighted in the axis of contemporary policies in the area of aging.

The purpose of this paper is to present a design case in developing an application which aims to stimulate cognitive factors and provide indicators of cognitive deficits in users, to healthcare professionals, enabling them create better strategies to ensure a better quality of life to the user.

In the second and third section, we will address the methodology used to develop the work and design processes for the implementation of the videogame.

In the fourth section, we shall explain the proposed artifact and relevance of the research. The extensibility of the research will be discussed in the following section (fifth). Finally, we discuss future work and conclusions of the research developed.

## 2. Methodology

To pursue the objectives of the proposed research and application development, we adopt the methodological approach proposed by Zimmerman et al. [2007] Research through Design. The reason for choosing this methodology, there was the objectivity of the steps required for the development of research, favoring the

author of the research simple and direct ways to continue the development of their study, ie, this approach proposes a set of four criteria indicate what information must be made to evaluate a scientific contribution to be considered in the design, and in particular, for interaction design: **a) Process:** A critical element to judge the quality of a contribution of research in interaction design. By documenting their contributions, the researchers interaction design should provide sufficient detail so that the process can be reproduced employee; **b) Invention:** The contribution of research interaction design should be a significant invention. Interaction designers should detail how advances in technology can result in a significant advance; **c) Relevance:** The work should be documented so that it can reproduce the results, and frame the work within the real world. Researchers interaction design should also develop the preferred status of the project or what you want to achieve and provide support for the community; **d) Extensibility:** defined as the ability of extension related to the results arising from research interaction design, or employing the process in a matter of future project. Extensibility means that design research has been described and documented in a way that the community can take advantage of the knowledge derived from work.

### 3. Process

#### 3.1 Application Idea

Create an videogame application to help diagnose cognitive problems and help to monitor the progression of those problems. It would be used in two different environments: **a) At the doctor:** Always the same exercises, To help diagnose and evaluate progress; **b) At home:** Different levels of difficulty, To train and monitor.

#### 3.2 Scenario

In Figure 1, shows the operation of the proposed application, continuing the scenario definition to use the videogame application. Described following a brief example of use:

“It’s the day for Maria’s Grandmother to visit the doctor again! The doctor gives her the tablet where she’ll do the cognitive exercises again. She always had difficulties with speech and behavior exercises, but today she thinks she’s going to perform better. Of course, the final word is from the doctor who will do a diagnosis of the development of Maria’s frontal temporal lobar degeneration with the help of the application’s feedback”.

#### 3.3 Consolidated Flow Model, Physical Model e Cultural Model

The development of the prototype [Beyer and Holtzblatt 1998]: **a) Consolidated Flow Model** - responsibilities is to represent the people and the communication and coordination necessary to do a job; **b) Physical Model** - shows the physical layout of the workplace and the restrictions it imposes on the design;

**c) Cultural Model** - reveals influences on a person, if external to the company (such as dependence on one supplier) or internal company policies.

The users are exposed in the flow prototype doctors, nurses, patients, responsible for the elderly and finally developers. These users will exchange formal information, eg, the feedbacks between doctor and developer for better development of the prototype in the context of non-formal information, eg, doctor and patient discuss any patient complaints and possible solutions to the problem diagnosed. It is important to remember that the Consolidated Flow Model was shown the two proposed modules: Senior Care Clinic/Tablet (module done in a doctor's office) and Home (module exercises performed at home).

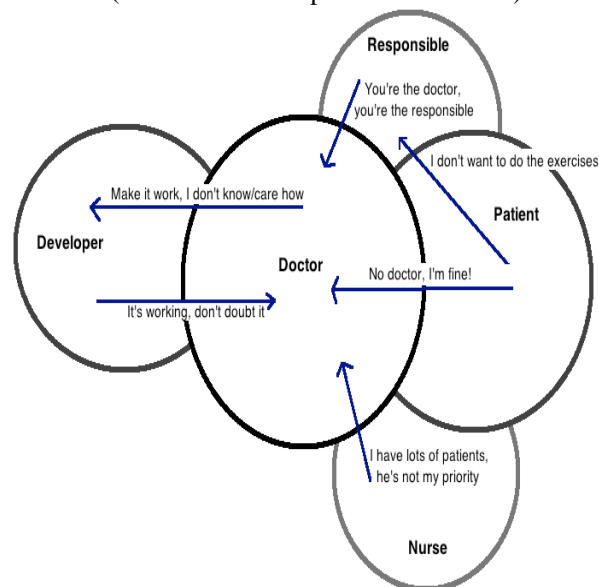


Figure 3: Cultural Model.

For the Physical Model (Figure 2), with the proposal to make the technology accessible to all seniors (bedridden or hassles of going to the doctor), makes use of mobile technology, ie it can be used anywhere enabling meet the elderly in nursing homes or domicile. For this proposal, the physical structure of the prototype is quite simple to use, in which the information is sent using the internet, saved in the cloud and finally sent to the doctor to aid in patient diagnosis.

Finally, the Cultural Model (Figure 3), may be included in the most relevant users in the use and development of the prototype (doctor, patient and developer) and how these people can influence people in the development and use of the device, since the doctor is the user who can most influence the development of the prototype, it is he who communicates with other users, receiving any complaints or information to the prototype developer.

#### 3.4 User Environment Design

The operation of the prototype initially displays the Login interface, which will provide access to the patient record. After performing the registration of the patient, the doctor will perform the settings in the

category of: patient assessment and exercises done at home, so the patient only home will do the exercises set by the doctor. In summary, the doctor will have access to the entire environment. Already, patients only have access to exercises and reviews desired by the doctor. Finally the User Environment Design features such as visible or areas relevant to the user relate to one another throughout the process of application usage [Beyer and Holtzblatt 1998].

### 3.5 Paper Prototype

The Paper Prototyping (Figure 4) that proposes to test design ideas with paper prototype before the implementation phase. This step modeling helps designers to communicate with users when using the new application, collecting any positive or negative aspects, it becomes relevant to the improvement of the prototype [Holtzblatt 2001].

The procedure for collection of feedback (Figure 5) met the following methodology: **1)** Six people were chosen randomly; **2)** there a prior explanation of what was the purpose of the application; **3)** These people have used the application for an average ten minutes; **4)** Finally, wondered what people thought of the application;



Figure 4: Development of Paper Prototype.

Using Paper Prototyping, it can be concluded that although many users had no problems doing the various actions of the prototype, however, some users have had issues with what should really make the application. Especially, since there are two main users who will use the application (doctor and patient), since medical options are hidden in the main menu. Another very common problem is the user does not know what to do from the main menu. It is important to mention that this is not really a problem, because doctors will be taught how to get the hidden menu and hence they will teach their patients to use the prototype. The only action that the elderly have to carry alone is doing the training exercises at home, he can get from the main menu: **a)** Positives mentioned: the Login and Logout buttons are understandable; I liked the way tasks are performed; **b)** Negatives mentioned: The exercises cash are not intuitive account of explanation that gives the application; Users do not know where to press to solve the exercise of boxes;

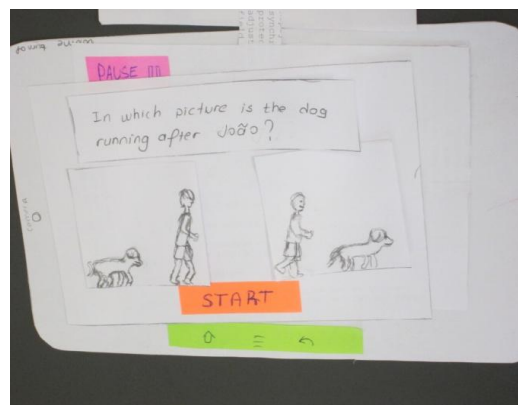


Figure 5: Paper Prototyping.

## 4. Prototype

In order to solve the problems encountered in Paper Prototype relevant steps were modified in the application, such as: **a) Box Game:** entered into agreement that exists some boxes "flashing" and create a story in the context of the boxes in order to involve the user in the activity would be confusing. Therefore, it was decided to change to "flashing" lights / bulbs and created a new context around them closer to the reality of the user; **b) Not knowing what to do in the application:** a help button, where there is a textual explanation and sound was created. The choice of sound explanation aims to combat illiteracy users;

In the technical context of the development of Digital Prototype, whose goal is to make the technological artefact accessible to all seniors, was adhered mobile technology in detail v4.4.2 Android platform, which can be used on Tablet and Smartphone devices. We used the Eclipse IDE and Google plug-in v22.2.1 for application deployment. In the drawing images of the GIMP tool v2.8 was used and, finally, the sound editing was used Adobe Audition CC v6.

For the development of the application to be addressed some concerns with users, in order to make the prototype more enjoyable, engage patients in activities and thus complete the research objective: **1)** The story that aims to engage users to use the prototype is simple and easily understood; **2)** The prototype uses audible artifacts, which narrate the activities and how to execute them; **3)** The vocabulary used during the use of the application is quite simple and focused for the elderly public; **4)** The context of the story developed for the prototype is generic, intended that older people see themselves in the stories thus create empathy in carrying out assessments; **5)** The recording narration be paused and aimed well understood; **6)** The prototype is equipped with audible and visual feedback;

It is important to mention that the prototype is in development, then, until the proper time, could not be applied and evaluated by users, to be refurbished so until you reach a satisfactory condition and ultimately achieve the aim of the authors the paper.

By the due date, there are some pictures of the prototype, which can be seen below and in the context of the flow of the application's operation. Until then,

the following has been implemented: when the application starts, the elderly are faced with the story of a fictional character created by the authors of the application. After hearing / reading the entire context of the implementation and activities, the elderly will perform the evaluations. When you reach the end of the evaluation, the elderly are informed that the evaluation session ended and performance data of the elderly are sent to e-mail the Doctor, so that the patient can be diagnosed.



Figure 6: Communication during the evaluation.

## 5. Relevance and Extensibility

Within the relevance of the development of this work we can say that it is a practical study of Research through Design model applied to develop an application that aims at stimulating and cognitive assessment. Another relevant aspect is the development of a form of cognitive assessment in patients using design for accessibility, which aims at adapting the application with users' interactions and, consequently, the results of the assessment more accurate. In the aspect of speed in obtaining results, lets stand a gain of significant time when creating reports of cognitive evaluations, which allows physicians to design strategies for their patients. On the issue of innovation, there is the adaptation of the traditional cognitive assessments contextualized in a game setting, creating a more relaxed and engaging manner. Because of the mobility of the device, allows a form of continuous assessment of patients and anywhere, pointing to the possible cognitive areas affected. With the development of application in the context of the video game, then it creates cognitive assessment method more enjoyable and less stressful for patients and health professionals. Finally, the research aims to ensure a better quality of life for elderly public in the cognitive environment.

In the context of the extensibility application creates the possibility of using cognitive assessment application in other age groups, allows the reuse of the process design to develop new applications for elderly public, there is the possibility of reuse of entire design process for the development of new applications to the field of assessment and cognitive stimulation and finally the possibility of implementing the new application cognitive assessments.

## 6. Future Works

For future work, we intend to compute the performance of the elderly for statistical analysis and validation of application, compared with traditional methods of assessment.

We intend to deploy the module of cognitive exercise (Home), where these exercises are meant to be games that propose cognitive activities daily, with it, the elderly keep their minds active and prevent or delay any declines aforementioned.

From the point of view of Design for Accessibility, there is a need to know whether the application is to resolve any accessibility problems for users, so they can make an interface easy to use on different mobile device for the user public.

Leveraging technological artifact developed, the aim is to adapt more conventional methods of cognitive assessment for designing video games with the aim of encouraging and evaluating users.

## 7. Conclusion

Today, it is little known the importance of the use of video games as stimulus elements and cognitive evaluation to the senior audience. So much so that there is a technological artefact or a development model for the application. This reality has proven throughout this article, when it was demonstrated that the games are still very incipient in relation to stimulus and cognitive appraisal for the elderly.

This research aimed to pay attention to a practical study in developing an application, which stimulates and evaluates cognitively. Methodological model through Research Design was used, contributing to the development of evaluative applications involving elderly public, via mobile. The work resulted in a proposal for a modeled application step by step, following the instructions of Research through Design aimed at validating the relevance of research.

Therefore, we proposed the creation of an application that can be used by Doctors and patients in their homes or hospitals as a tool that enables provide indicators of cognitive deficits of patients to health professionals, allowing professionals to create better strategies, that aims to ensure a better quality of life to elderly public.

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