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# **Monitor and Visualize Schizophrenic Patients' Performance in e-Therapy Contexts**

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**PhD Thesis**

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*por ti... maria...*



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# Abstract

---

*e-Therapy appears in the context of e-Mental Health as a new way to conduct therapy sessions using new Information and Communication Technologies (ICTs). e-Therapy's main goal is to improve the quality of the services delivered and provide well-being to people, offering services and information through the Internet and other ICTs. This new way of helping people in their daily life habits, and enhancing existing relationships, works as a complement to improve the traditional therapeutic process. The work here described is a part of an e-Therapy project with a multidisciplinary team of health professionals and software and graphical designers. This project's ambition was to conceive, create and deploy an e-Therapy tool especially dedicated to a population of schizophrenia-diagnosed inpatients of the psychiatric Hospital of Sant Joan de Déu, in Barcelona, Spain. eSchi is the e-Therapy system that we developed. It appears as a solution that provides a web portal with an integrated set of multimedia tools that help in the cognitive rehabilitation process of schizophrenia-diagnosed individuals. This custom-made application provides an e-Therapy setting for schizophrenia patients and enables therapists to conduct cognitive-related therapy sessions using the multimedia tools. This system will also allow its users, both patients and therapists, to monitor and visualize the outcomes of the patients in the sessions. It is important to provide feedback to end users and let them know if he/she achieved the goals established for a session. As a result, the system uses a monitoring model to keep track of the patients' performance and a visualization model to provide adequate and graphical feedback to patients and therapists.*

*In summary, the key ambition is to study what we can learn from the monitoring and visualization of the outcomes of schizophrenia patients involved in e-Therapy sessions.*

*In order to provide an answer to our research question, we adopted an effective research methodology to conduct our empirical work. We elected the case study approach, specifically a multiple-case exploratory study. Only after collecting the data,*

*can the information be analyzed and explored and the outcome of such case studies is not predictable.*

*Upon the selection of the case study method, care was taken to collect the data involving a broad variety of techniques (interviews, participant observation, fieldwork and written data sources such as memos, letters, reports and email messages). By using multiple sources of evidence, triangulation becomes possible and this allowed us to obtain more valid and complete results. The sites for application of the study are rather harsh environments. There are scarce resources available; including patients and therapists, and most times, it is not possible to gather a reliable amount of information. Therefore, our reality is a social construct defined by the human perception of those involved in the usage of the information system, influencing and being influenced by the system.*

*To design and develop the system we used a Patient Centered Design (PCD) approach. First, we listened to the patient's needs and requirements besides considering the social and technical context for the implementation of the product. The method implies the active engagement of end-users in all the design phases starting from early in the life-cycle development process. This PCD approach improved communication between health professionals that were early involved in the system development, and the development team.*

*We conducted the study in real clinical settings and we were fortunate to have access to two rich samples, which is something unusual in the e-mental health context. Despite the efforts to minimize existing confounding factors that might distress the results collected, we were unable to guarantee the perfect environment. The number of users that actually used the system was low.*

*However, with our study we discovered some particularly relevant aspects. There are some new insights into the patient's behavior during his/her sessions that improved the effectiveness of the decision-making process. The results obtained revealed that patients seem to develop their ability through training. Repetition of the same activities though a certain period seems to improve their outcomes, which is relevant when con-*

*sidering schizophrenia patients. Each patient's results seem to follow the pattern formed by all the users of the system and it appears that the repeated usage of the tool and the performance improvements in the activities encourages the users' acceptance of the tool, improving their satisfaction level. Finally, there are two more aspects worth mentioning. First, all the users that engaged in the study asked for further enhancements of the system, requesting new and improved activities. This reveals their interest in keeping on using the system. Second, eSchi is currently in use in a third site, at the Sant Joan de Déu Institution – Serveis Socio Sanitaris, by a new group of users. This application of the system occurred through a professional recommendation of the therapist of the first site. The psychiatrist found eSchi suitable for her professional usage and worth of recommendation to other professionals in the area.*





# Resumen

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*La e-Salud Mental consiste en la utilización de las nuevas Tecnologías de la Información y de la Comunicación (TICs) para mejorar la calidad de los servicios de la sanidad mental. Se basa en la aplicación de la electrónica para la mejora del bienestar de las personas y ofrece servicios e información a través de Internet y de otros medios de comunicación. La e-Terapia es una parte de la e-Salud Mental y se presenta como el modo de conducir las sesiones de terapia mediante la aplicación de las TIC. Esta nueva forma de ayudar a las personas en su actividad cotidiana permite mejorar sus relaciones y, además, es un complemento que facilita el proceso terapéutico tradicional. En este entorno, se desarrolla una aplicación “ad-hoc” para el hospital psiquiátrico Sant Joan de Deu, en Barcelona – el sistema eSchi. eSchi es un portal multimedia que recrea un escenario de e-Terapia para pacientes con esquizofrenia y que facilita a los profesionales de la salud la realización de las sesiones de terapia cognitiva con el apoyo de las herramientas informáticas. El sistema provee a los usuarios, tanto a los pacientes como a los profesionales de la salud, el monitoreo y la visualización de los resultados de los pacientes en sus sesiones. Las sesiones de e-Terapia recurren a técnicas semejantes a las de los ambientes tradicionales y, como cualquier proceso de entrenamiento/rehabilitación, cuando el terapeuta establece el conjunto de actividades a ejecutar en una sesión concreta también los objetivos específicos para el paciente. De esta forma se define una programa de evaluación en el cual hay objetivos a cumplir. Un aspecto destacado de esta evaluación es el feedback que se ofrece a los usuarios, en el que se usa un modelo de monitoreo para registrar el desempeño de los pacientes y un modelo de visualización para representarlo gráficamente de forma adecuado a las necesidades de los usuarios.*

*De este modo, el principal objetivo de la investigación ha sido definir el modelo con el que se deben registrar y visualizar los resultados de los pacientes involucrados en las sesiones de e-Terapia. Este modelo ayudará en el proceso de toma de decisiones de los profesionales de la salud.*

*Para responder a las cuestiones de la investigación se ha elegido una metodología eficiente para conducir el trabajo empírico. Escogimos el método del caso de estudio como medio para abordarla y la aplicamos en múltiples casos de estudio exploratorios. Sólo después de que los datos de la investigación sean obtenidos será posible analizar y explorar la información. Los resultados de estos casos de estudio no son del todo previsibles.*

*En la selección del caso de estudio se tuvo en especial consideración la posibilidad de obtener los datos recurriendo a una gran diversidad de técnicas (entrevistas, observación participativa, trabajo de campo y fuentes de datos escritas como informes, cartas y mensajes de correo electrónico). Al usar varias fuentes de evidencia se hace posible la triangulación que nos permite obtener resultados más válidos y completos. Los entornos de aplicación del estudio han sido complejos y arduos. Se caracterizan por la escasez de recursos disponibles, tanto para los pacientes como para los profesionales de la salud, que dificultan la consecución de información fiable en grandes cantidades. Por ello, nuestra experiencia se apoya en un constructo social que se define por la percepción humana de los que están involucrados en el uso del sistema de información y que influyen y son influenciados por él.*

*Se ha recurrido a la aplicación del diseño centrado en los pacientes (PCD) comenzando por oír atentamente sus necesidades y considerando el contexto socio-técnico para la implementación del sistema. El método ha implicado el compromiso activo por parte de los usuarios en todas las fases del proyecto. La aplicación del PCD aumentó la comunicación con los profesionales de salud que estaban directamente involucrados en el desarrollo de proyecto.*

*El trabajo ha sido implementado en un entorno clínico real y hemos tenido la suerte de contar con dos muestras muy ricas, algo poco frecuente en el contexto de la e-salud mental. Se han intentado minimizar los factores de confusión que podrían impactar en los resultados recogidos, pero el entorno perfecto no se ha obtenido. El número de usuarios que finalmente han usado el sistema ha sido muy bajo.*

*A pesar de esto, el estudio nos ha permitido descubrir algunos aspectos particulares o relevantes. El proceso de toma de decisión de los profesionales de la salud fue mejorado en eficiencia y eficacia. Los resultados obtenidos permiten obtener algún conocimiento sobre el comportamiento de los pacientes en las sesiones realizadas, en general revelan mejoras en sus habilidades derivadas del entrenamiento con el sistema. La repetición de las mismas actividades en un determinado periodo de tiempo parece mejorar sus resultados. Estos resultados parecen seguir un patrón de comportamiento definido por todos los usuarios del sistema y, aparentemente, la utilización continuada de la herramienta y las mejoras del nivel de desempeño de las actividades favorecen la su aceptación por parte de los usuarios y aumenta su nivel de satisfacción. Finalmente, hay dos aspectos relevantes en la evaluación de eSchi que son merecedores de mención. Todos los usuarios que han participado en el estudio han solicitado mejoras del sistema: nuevas y mejores actividades, lo que revela su interés por seguir utilizándolo. Actualmente el eSchi es usado en la división Socio Sanitaria del Hospital Sant Joan de Deu por un tercer grupo de usuarios, gracias a la recomendación profesional de la psiquiatra que ha participado en el primer estudio. La psiquiatra ha considerado que eSchi no sólo es adecuado para ser usado en sus sesiones sino merecedor de ser recomendado a otros profesionales del área.*



# Resumo

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*A e-Terapia surge no contexto da e-Saúde Mental como uma nova forma de conduzir sessões de terapia através da utilização das Tecnologias da Informação e da Comunicação (TIC). A e-Terapia tem como principal objectivo melhorar a qualidade dos serviços fornecidos e o bem-estar das pessoas, oferecendo serviços e informação através da Internet e de outras TIC. Esta nova forma de ajuda permite melhorar a qualidade de vida das pessoas no seu dia-a-dia e, eventualmente, os seus relacionamentos interpessoais. O trabalho aqui descrito está integrado num projecto de e-Terapia com uma equipa multidisciplinar de profissionais de saúde, engenheiros de software e designers gráficos. O intuito deste projecto consiste na concepção, criação e entrega de uma ferramenta de e-Terapia especialmente dedicada à população dos utentes diagnosticados com esquizofrenia do Hospital Sant Joan de Déu, em Barcelona, Espanha. eSchi é o sistema de e-Terapia que desenvolvemos. Surge como solução que fornece um portal web com um conjunto integrado de ferramentas multimédia que ajudam no processo de reabilitação cognitiva dos utentes com diagnóstico de esquizofrenia. Esta aplicação, feita à medida, fornece um ambiente de e-Terapia para os utentes esquizofrénicos e permite aos profissionais de saúde conduzirem sessões de terapia relacionadas com a cognição usando ferramentas multimédia. Este sistema também irá permitir aos seus utilizadores, tanto aos utentes como aos profissionais de saúde, monitorizar e visualizar os resultados obtidos nas diversas sessões. É importante fornecer feedback aos utilizadores finais e dar-lhes a conhecer o seu desempenho e, em que medida, atingiram os objectivos pretendidos para cada sessão. Como resultado, o sistema usa um modelo de monitorização para registar o desempenho dos utentes e um modelo de visualização para apresentar o feedback gráfico e visual adequado para os utilizadores.*

*Resumindo, o principal objectivo é estudar o que se pode aprender quando se registam e visualizam os resultados de utentes diagnosticados com esquizofrenia envolvidos em sessões de e-Terapia.*

*De forma a obter uma resposta para a questão de investigação, adoptámos uma metodologia eficiente para conduzir o trabalho empírico. Elegemos o caso de estudo como meio de abordagem e, mais especificamente, optámos por múltiplos casos de estudo exploratórios. Só depois de obter os dados será possível analisar e explorar a informação. Os resultados destes casos de estudo não são previsíveis.*

*Perante a selecção do método de caso de estudo foi tido em especial consideração o facto de se obter os dados recorrendo a uma grande diversidade de técnicas (entrevistas, observação participatória, trabalho de campo e fontes de dados escritas tais como memos, cartas, relatórios e mensagens de correio electrónico). Ao usar múltiplas fontes de dados, a triangulação torna-se possível e isto permite-nos obter resultados mais válidos e completos. Os locais de aplicação do estudo são ambientes difíceis. Os recursos são escassos incluindo utentes e profissionais de saúde e, muitas vezes, não é possível obter um conjunto de informação confiável. Assim, a nossa realidade é um construto social definido pela percepção humana dos que estão envolvidos na utilização do sistema e que influenciam e são influenciados pelo próprio sistema.*

*Recorreu-se à abordagem de desenho centrada nos utentes (PCD) que começou por ouvir atentamente as suas necessidades e requisitos para além de considerar o contexto sócio-técnico para a implementação do produto. O método implicou um compromisso activo por parte dos utilizadores finais, em todas as fases do projecto e desde uma fase inicial do processo de desenvolvimento. Esta abordagem melhorou a comunicação com os profissionais de saúde que estavam directamente ligados ao desenvolvimento do projecto.*

*O trabalho foi conduzido num contexto clínico real a partir do qual se obteve duas amostras, o que é algo extremamente raro no contexto da e-saúde mental. Tentou-se minimizar factores de confusão que pudessem influenciar os resultados obtidos, não se conseguindo, no entanto, obter o ambiente perfeito para o desenvolvimento do trabalho de campo. Tal foi devido, essencialmente, ao número reduzido de utilizadores que usou o sistema.*

*Contudo, o estudo permitiu descobrir alguns aspectos particulares e relevantes. O processo de tomada de decisão dos profissionais de saúde foi melhorado a nível de eficiência e eficácia. Os resultados obtidos pelo sistema permitem fornecer algum conhecimento sobre o comportamento dos utentes durante as sessões realizadas, nomeadamente, revelam as melhorias das suas habilidades através do treino. A repetição das actividades, durante um determinado período de tempo, parece melhorar os resultados de cada utente sujeito a este sistema. Estes resultados parecem seguir o padrão de comportamento formado por todos os utilizadores do sistema e, aparentemente, a utilização continuada da ferramenta bem como as melhorias ao nível do desempenho das actividades, encorajam a aceitação da ferramenta por parte dos utilizadores, melhorando o seu nível de satisfação. Por fim, há dois aspectos relevantes para a avaliação do sistema eSchi que são merecedores de menção. Por um lado, todos os utilizadores que participaram no estudo, solicitaram melhorias no sistema, bem como novas e melhores actividades, o que revela o seu interesse em continuar o uso do sistema. Por outro, o eSchi está actualmente a ser utilizado por um terceiro grupo de utilizadores, num terceiro local do Hospital Sant Joan de Déu. Isto deve-se a uma recomendação profissional da psiquiatra que participou no primeiro estudo e que considerou que o eSchi era, não só, adequado para ser usado nas suas sessões, como merecedor de ser recomendado a outros profissionais da área.*





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# List of Acronyms and Abbreviations

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ALS	Amyotrophic Lateral Sclerosis
AMIA	American Medical Informatics Association
APA	American Psychiatric Association
ASQ	After Scenario Questionnaire
CBT	Cognitive Behavioral Therapy
CDSS	Clinical Decision Support System
CINP	Collegium Internationale Neuro-Psychopharmacologicum
CSUQ	Computer System Usability Questionnaire
DALY	Disability-Adjusted Life Year
DSM	Diagnostic and Statistical Manual
ECGs	Electrocardiograms
EEGs	Electroencephalograms
EU	European
GBD	Global Burden of Disease
GUI	Graphical User Interface
HCD	Human-Centered Design
HCI	Human Computer Interaction
HCIL	Human Computer Interaction Laboratory
HE	Heuristic Evaluation
HIS	Health Information System
HML	Hospital Magalhães de Lemos
HP	Health Professional
HSJD	Hospital Sant Joan Déu
HTTPS	HyperText Transport Protocol Secure
IAPT	Improving Access to Psychological Therapies
ICD	International Classification of Diseases
ICT	Information and Communication Technology
IPA	International Psychopharmacology Algorithm
IPAP	International Psychopharmacology Algorithm Project
IPBC	Interactive Parallel Bar Chart
IPR	Integrated Patient Records
IS	Information System
ISMHO	International Society for Mental Health On-Line
ISO	International Organization for Standardization

IT	Information Technology
ITO	Interpretation Tool
LIWC	Linguistic Inquiry and Word Count
LPM	Learning Progress Monitoring
MA	Monitoring Agent
MATRICES	Measurement and Treatment Research to Improve Cognition in Schizophrenia
MD	Monitoring Database
MDI	Medical Data Index
MHIS	Mental Health Information System
MM	Monitoring Manager
MNS	Mental, Neurological and Substance Use Disorder
MO	Monitoring Object
MOD	Monitoring Objects Database
MP	Monitoring Points
NASA	National Aeronautics and Space Administration
NIMH	National Institute for Mental Health
PACT	Program for Assertive Community Treatment
PANSS	Positive And Negative Symptoms Scale
PCD	Patient Centered Design
PCs	Personal Computers
PDAs	Personal Digital Assistants
PSI	Psychiatric Society for Informatics
PSUQ	Post-Study System Usability Questionnaire
RCT	Randomized Control Trial
SM	Service Manager
SMI	Severe Mental Illness
SOPO	Set Of Possible Occurrences
SST	Social Skill Training
ST	Session Try
SUMI	Software Usability Measurement Inventory
TVD	TimeLine a Visualization Dictionary
UCD	User Centered Design
UPA	Usability Professional's Association
UPC	Polytechnic University of Catalonia
USA	United States of America
UX	User eXperience

UXD	User eXperience and Design
VT	Visualization Tool
WHO	World Health Organization
WSDL	Web Service Definition Language
WWW	World Wide Web



# 1. Introduction

---

e-Therapy, according to experts, is the process of conducting therapy using electronic mediums to complement traditional therapy sessions. eSchi is an e-Therapy solution that provides a web portal with an integrated set of multimedia tools that help in the cognitive rehabilitation process of schizophrenia-diagnosed individuals. eSchi has a functional side that helps the health professionals and an entertaining side that provides multimedia activities for patients. It enables the collection of data that later provides some insights on the patients' behavior and performance in therapy sessions. This section introduces the characteristics of our work, clarifying the motivation, the goals and the major contributions.





## 1.1. Motivation

The mental health area is a major concern in the global health context (World Health Organization, 2004). Mental health is the 21<sup>st</sup> century epidemic since almost everyone currently suffers or will suffer, in the near future, from a mental condition. The number of patients and future patients seems to grow exponentially each day (World Health Organization, 2008; World Health Organization, 2009).

The topic is receiving growing attention both by the scientific community and by the public. In fact, even world governments are reassessing their health funding system to increase mental health assistance and their main idea is to provide mental health services via emerging ICT (Agence d'Évaluation des Technologies et des Modes d'Intervention en Santé, 2006; Christensen, Griffiths, & Evans, 2002; K. M. Griffiths, Farrer, & Christensen, 2007; D. M. Hilty, Luo, Morache, Marcelo, & Nesbitt, 2002). In 2011, health professionals use computer based training/learning/rehabilitation systems that have proven their effectiveness, especially the ones that provide cognitive behavioral therapy (Christensen, 2007; C. Jones, Cormac, Silveira da Mota Neto, & Campbell, 2004; Sams, Collins, & Reynolds, 2006).

e-Therapy is a relatively new concept applied to health contexts where therapy is involved. According to experts, it is the process of conducting therapy in a digital manner or using electronic mediums to complement traditional therapy sessions (Castelnuovo, Gaggioli, Mantovani, & Riva, 2003a; Manhal-Baugus, 2001). This intends to provide a better service both for patients and for therapists and will allow them to access distinct activities and engage in distinct therapeutic sessions, different from the ones available in traditional settings. The literature refers that this type of solution should work mainly as a complement to the traditional therapy process. It does not intend to replace it (Carroll & Rounsaville, 2010; N. Titov, 2007). Thus, these solutions are actually information systems with functionalities that facilitate therapy sessions (Christensen, 2007; Copeland & Martin, 2004).

e-Therapy has several advantages and disadvantages specified in the literature, but in fact, few controlled and reliable studies have proven its effectiveness or “lack of” (D.

M. Hilty, Liu, Marks, & Callahan, 2003). Thus, an effective assessment of this type of solution is essential (Reis, Freire, & Monguet, 2010).

End users of such systems include not only patients and health professionals (therapists and caretakers) but also the patients' families. The inner benefit for patients is obvious; they will be able to access a set of more diversified therapeutic activities (Marks, Shaw, & Parkin, 1998; M. G. Newman, Consoli, & Taylor, 1997). Health professionals will be able to focus on aspects that are more important for therapy sessions, leaving the recurring and minor work for the system (Carroll & Rounsaville, 2010; Marks et al., 1998). As far as families are concerned, they will be able to follow their relatives' treatments and evolution more closely.

Schizophrenia is a chronic mental condition with a high prevalence. A valid treatment for schizophrenia is not known and there is a wide spectrum of typologies of the illness that provide a large amount of distinct medical situations, including comorbidity states, that lead to rather serious and poor prognoses (World Health Organization, 2007a). There are an increasing number of schizophrenia-diagnosed patients despite the fact that according to the experts, a simple schizophrenia diagnosis is rare. The wide spectrum of existing typologies of the pathology and the fact that morbidity is a reality produces a rather complex working scenario, especially for non-experts in the field (Bhugra, 2005; McGrath, 2008; S. Saha, Chant, Welham, & McGrath, 2005; S. Saha, Barendregt, Vos, Whiteford, & McGrath, 2008).

It is imperative to have an effective way to monitor patients diagnosed with a schizophrenia typology that have a poor prognosis and a cognitive rehabilitation training program as part of the treatment plan (Marks et al., 1998). Their progress, evolution and performance during the treatment sessions should be available for future use in their own personal treatment or for other, similarly diagnosed patients (C. B. Taylor & Luce, February 2003).

There is a scientific belief that the treatment of schizophrenia patients should not follow a pattern and that there is no cognitive enhancement whatsoever. There is a lack

of tools to help health professionals conduct their research studies (IPAP, 2004; World Health Organization, 2007a).

A project in this e-Therapy context already existed. This e-Therapy project is a joint effort of a multidisciplinary team that includes a team of health professionals and software and graphical designers. The members of the health team work at the Hospital Sant Joan de Déu in Barcelona, one of the biggest mental health institutions in Spain, with a large population of schizophrenia-diagnosed inpatients. The software and graphical designers are students and professors of the Multimedia Engineering PhD group at the Polytechnic University of Catalonia. The project's ambition was to conceive, create and deploy an e-Therapy tool. The team of the e-Therapy project had already done some of the work regarding the requirements elicitation. Nevertheless, the actual design, conception and implementation of the e-therapy tool – the eSchi system, was yet to be conducted. The team lacked software developers to implement the eSchi system.

According to my software engineer profile and background, my first contribution to the existing e-Therapy project was the initial design and implementation of the eSchi system's prototype that later evolved to a full-scale modular system.

In this context, eSchi appears as an e-Therapy solution that provides a web portal with an integrated set of multimedia tools that help in the cognitive rehabilitation process of schizophrenia-diagnosed individuals. Besides, eSchi monitors the patients' usage of the system, transforms the data collected and provides useful information in a visual format to both patients and health professionals. Hence, while health professionals are able to conduct cognitive-related therapy sessions, patients are able to engage in new activities using a new context.

In the eSchi system, e-Therapy sessions have the same concept as a training plan. The health professional must specify a set of activities that a patient will conduct in a session and establish specific goals for her. After this, patients can execute their training plan by engaging in sessions and undertaking the activities. This implies that some sort of evaluation occurs, patients have goals to achieve and eSchi assesses their work. One

important aspect of evaluation is the feedback provided to the users. eSchi provides detailed performance statistics regarding patients' performance.

Considering the requirements of the system, the final product – eSchi – is the *de facto* implementation of a monitoring model to register patients' performance data during e-Therapy sessions and a visualization model to provide adequate graphical feedback to the users. These data gathering, analysis and visualization processes let users track the performance presented in e-Therapy sessions, by schizophrenia patients. It provides feedback that therapists can use in the therapeutic process in order to improve future e-Therapy sessions. eSchi provides insights on the patients' behavior, while in therapy.

Bearing in mind the specific context that is the mental health area and especially the schizophrenia field, we considered the patient centered design (PCD) method as the best approach to develop the system. After establishing the initial conceptual model for monitoring and visualization of patients' performance in e-Therapy contexts, we made an actual code-implementation and eSchi was born.

## 1.2. Objectives and Major Contributions

The key ambition of this work consists in the development of a conceptual model that allows monitoring and visualizing the outcomes of patients involved in e-Therapy contexts.

In order to achieve the development of this model we had to develop an entire system that could provide an e-Therapy context for patients and for therapists. eSchi is an e-Therapy system that provides a set of multimedia tools to be used in therapy sessions and that includes monitor and visualization' modules where the conceptual model developed, is applied.

We developed the eSchi system accordingly to current software engineering methodologies and usability standards, in an iterative way. Then, two distinct settings lodged the system: at the Hospital Sant Joan de Déu, in Barcelona, Spain, and at the Hospital Magalhães de Lemos (HML), in Porto, Portugal. Two distinct scenarios implied not only distinct patients and health professionals but also completely different clinical settings.

The first site is a psychiatric clinical hospital with a population of inpatients, while the second site is a psychiatric clinical hospital where all the patients were outpatients.

The analysis of the outcomes produced on these e-Therapy contexts should enable the study of performance signs, as far as cognitive skills enhancement and rehabilitation are concerned. It will show both similarities and differences between the two sites and supply feedback into the therapeutic model, to help health professionals while conducting future e-Therapy sessions. Advances in the empirical work led to advancements in the theoretical framework and vice-versa. Thus, we updated and improved the developed system, accordingly to the literature reviewed and the actual experience of the fieldwork.

Health professionals could use eSchi as a useful complement for their work, an auxiliary tool in the therapy process and an aid tool to complement the patient's clinical evaluation and enhance further scientific studies. Besides, the data gathered by the system will be available for further and future research studies that will open new frontiers in the research of this field.

The research methodology selected is the exploratory case study approach that, used together with a set of valid instruments, allowed us to answer to the following question:

- What can we learn with the introduction of an ICT system that monitors and provides visualization of the performance of schizophrenia patients, in e-Therapy settings?

The details that relate to the research questions, choice of methodology, research method and the research design are later depicted in chapter 4-Research Design.

In order to obtain some insight over the theoretical aspect that leads the investigation we researched the theoretical background on the subject of e-Therapy, specifically applied to e-Mental Health circumstances. This work lead to the proposal of assessment items specifically for e-Therapy settings that includes quality of care, education and empowerment, access, costs and satisfaction (Reis et al., 2010).

Finally, the results obtained and their analysis allowed the acceptance of the system by the end users. This led to the acceptance of the new model that enables the monitoring and visualization of patients' performance in e-Therapy settings.

### 1.3. Reading Guidance

This work proposal begins with this chapter, 1-Introduction that describes the motivation, major goals and contributions of the research. First, we present the motivation that led to the development of this work and was responsible for the orientation of the research. Then, we present the objectives and the major contributions of the work.

We describe the theoretical basis for the work in chapter 2-Conceptual Framework, introducing concepts such as Mental Health Information Systems (MHIS) and e-Therapy. Several guidelines and best practice' recommendations on these systems' design and development were included in the review, since we identified them as one of the existing voids in the field.

Another relevant theme introduced in that same chapter is the subject of Schizophrenia as a unique and complex disorder that leads to extremely specific considerations that later have a direct impact in the work produced, e.g. the medication made by some patients interferes with their performance while conducting the multimedia activities.

Chapter 3-Related Work provides some insight over the areas of monitoring models and visualization models. We present an overview of what these systems should provide generically, the available systems, techniques and tools and then, describe in detail their specificities in order to apply them in the empirical work conducted.

The research methodology selected is the "case study" approach that we further complement with valid instruments that help us in the collection of information. The research questions, the options available for the design of the research and the selection made, as far as research method is concerned, are depicted in chapter 4-Research Design.

Chapter 5-Empirical Work provides a description of the empirical work conducted. We describe the analysis, design and development of the eSchi system, besides the layout and design of the case studies for the deployment of eSchi. Another deliverable is the list of assessment items and guidelines for e-Therapy systems, present in this chapter.

Chapter 6-Results and Discussion presents a summary of the major findings in the studies, supporting a comparison of the results in the two sites of application.

Chapter 7-Conclusions offer the observable contrasts between the findings and the conceptual framework depicted. This chapter also presents additional insights discovered during the fieldwork that we considered relevant, as well as the study limitations that were possible to identify. This dissertation describes a specific period that includes fieldwork and theoretical research. However, this is just a first-step approach to this research field. The work is still in a beginning phase and has several directions for further evolution and growth, as it is shown in chapter 7.4-Future Work.

Each section of the dissertation includes a summary that in an articulated way provides the necessary awareness of the work. Thus, it is easy to skip the extended reading and accompany the progress through a skim reading of the summaries.

In order to have an overview of the work here described, one can use the following list of sections for guidance:

- a global understanding of the problem (1-Introduction);
- the conceptual framework that defines the field of action (2.4-Summary);
- the related work that will contribute to achieve the proposed goals (3.3-Summary);
- the research design that includes the sites established for the deployment of the proposed solutions (4-Research Design);
- the eSchi system (5.1-eSchi – the system’s design);
- the outcomes of the fieldwork (6.3-Summary);
- and the major contributions of the work developed (7.1-Contributions).





## 2. Conceptual Framework

---

Mental Health Information Systems (MHIS) provide mental health information and services using digital communication mediums (e-Mental Health). These systems provide services that improve health care of mental health disorders such as schizophrenia – a chronic disorder with unique characteristics. E-Therapy is a specific service available through an MHIS that appears as a necessary evolution on the mental health field. This section provides the theoretical background for the context of the empirical work conducted, introducing concepts such as mental health information systems (MHIS) and e-Therapy.



## 2.1. Mental Health Information Systems

“There is no health without mental health” is the guiding principle to improve health worldwide (Health and Consumer Protection Directorate-General, 2005; World Health Organization, 2008).

The World Health Organization (WHO), through its Global Burden of Disease (GBD) project, draws on a wide range of data sources to quantify global and regional effects of diseases, injuries and risk factors on the population’s health (World Health Organization, 2004). The GBD project uses the Disability-Adjusted Life Year (DALY), a metric based on years of life lost from premature death and years of life lived in less than full health. DALY quantifies the burden of disease – the gap between the current health status and the ideal situation. Thus, it becomes possible to evaluate the status of global health in the world, despite the fact that there is still much information unavailable, concerning mental disorders (Levinson et al., 2010). The latest assessment of GBD, completed in 2004, includes updated projections up to the year 2030. According to the published information and the summary of the most relevant facts, mental disorders (e.g. bipolar disorder and schizophrenia) are among the 20 leading causes of disability worldwide. Depression alone, affects around 120 million people worldwide. Around 450 million people suffer from a mental disorder and 25% of adults will develop a mental disorder at some point in their lifetime. The authors of the report believe that these figures will increase in the upcoming years as can be seen in Figure 1.

Mental health is “not just the absence of mental disorder. It is defined as a state of well-being in which every individual realizes his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community” (World Health Organization, 2007c).

2004 Disease or injury	As % of total DALYs	Rank	Rank	As % of total DALYs	2030 Disease or injury
Lower respiratory infections	6.2	1	1	6.2	Unipolar depressive disorders
Diarrhoeal diseases	4.8	2	2	5.5	Ischaemic heart disease
Unipolar depressive disorders	4.3	3	3	4.9	Road traffic accidents
Ischaemic heart disease	4.1	4	4	4.3	Cerebrovascular disease
HIV/AIDS	3.8	5	5	3.8	COPD
Cerebrovascular disease	3.1	6	6	3.2	Lower respiratory infections
Prematurity and low birth weight	2.9	7	7	2.9	Hearing loss, adult onset
Birth asphyxia and birth trauma	2.7	8	8	2.7	Refractive errors
Road traffic accidents	2.7	9	9	2.5	HIV/AIDS
Neonatal infections and other <sup>a</sup>	2.7	10	10	2.3	Diabetes mellitus
COPD	2.0	13	11	1.9	Neonatal infections and other <sup>a</sup>
Refractive errors	1.8	14	12	1.9	Prematurity and low birth weight
Hearing loss, adult onset	1.8	15	15	1.9	Birth asphyxia and birth trauma
Diabetes mellitus	1.3	19	18	1.6	Diarrhoeal diseases

**Figure 1 – Ten leading causes of burden of disease in the world (World Health Organization, 2004)**

Some authors explicitly state the “well-being” factor in their definitions of mental health as a “must-have” to accomplish health as a whole (Campion & Nurse, 2007; Cloninger, 2006; Keyes, 2002; D. G. Myers & Diener, 1996). This also encourages the development and implementation of action plans for general well-being, mental health promotion and mental disorder prevention (Cloninger, 2006; D. G. Myers & Diener, 1996).

Since 2005, action areas and principles appeared as guidelines to help countries in this important aspect that influences society’s prosperity, solidarity and social justice (Campion & Nurse, 2007; Jané-Llopis & Anderson, 2005; World Health Organization, 2008; World Health Organization, 2009). In 2008, WHO launched a program, the Mental Health Gap Action Program (mhGap) to provide a set of activities and programs for countries to scale up care for mental, neurological and substance use (MNS) disorders (World Health Organization, 2008). The mhGAP provides a set of key suggestions, especially dedicated to countries with lower/middle incomes. Their limited resources, both financial and human, allow them to have the potential for maximum impact. Conditions identified as priorities include depression, schizophrenia, psychotic disorders and disorders due to the use of alcohol and illicit drugs. The mhGAP delivers an integrated package of interventions for priority conditions on the grounds of the best scientific and epidemiologic evidence available. One of the aspects highlighted in the

guidelines is the need to ensure an adequate planning and delivery of the services, through the establishment of mental health information systems (MHIS) (World Health Organization, 2009).

### **2.1.1. Mental Health Information Systems Overview**

A Mental Health Information System (MHIS) is a system that collects, processes, analyses and disseminates the information about a mental health service and the requirements of the population it serves. It “(...) is a system for action: it should exist not simply for the purpose of gathering data, but also for enabling well-informed decision-making in all aspects of the mental health system” (World Health Organization, 2005).

These systems have many stakeholders that might become end users of the system, whether for professional or personal/health reasons: people with mental disorders and their relatives; clinicians; managers and policy-makers. For managers and policy-makers, such systems provide an assessment mechanism for goals and objectives. For mental health workers, they provide as assessment mechanism for the needs of the users and their response to interventions. For users of mental health services and the wider population, it provides an access medium for the mental health services available.

Such a system is so much a planning tool, as a service delivery tool or a monitoring tool. It improves the way policies are implemented and evaluated, the way to deliver services, the usage of resources and improve their quality and efficiency. It also helps in the definition of the measures needed for providing equitable care with scarce resources.

In 2010, information systems usage in the health sector is widespread, and in the mental health arena, besides the typical applications of clinical administration, there are new and innovative applications on diagnostic procedures, self-help, communication and delivery of psychotherapy. According to Plovnick (2009), mental health information systems implement many aspects of care, including screening and treatment.

Electronic health (e-Health) is the provision of health services over a wide range of information and communication technologies (ICT). The services include electronic health records, contained in health information networks, applications, databases, and telehealth, e.g. videoconferencing. e-Health refers to ICT to improve or enable health and health care, delivering services in new ways (Le, 2007).

Telehealth, also known as telemedicine, or the way to conduct medicine at a distance, exists since the beginning of the twentieth century with the use of the analogue telephone to transmit electrocardiograms (ECGs) and electroencephalograms (EEGs) (Guler & Ubeyli, 2002). Some designate the National Aeronautics and Space Administration (NASA) as the pioneer in the area, with the use of remote monitoring of astronauts since 1960 (Myron & Irene, 2004). It is impossible to state a specific date to the beginning of telemedicine, but information and communication technologies (ICT) advances have brought a new breath to this concept. In 2010, telemedicine can be defined as the use of ICT to provide medical information and services, like health information, assessment, diagnosis, education and other services across geographical distance (Castelnuovo, Gaggioli, Mantovani, & Riva, 2003). Hence, the principles of telecommunications and computer systems, Internet-applications such as email and web browsers, videoconferencing, and remote data monitoring and file transfers provide the basis for telemedicine. Clinical Decision Support System (CDSS), also known as expert systems, try to help in the clinical decision making process that receives the characteristics of individuals and submits patient-specific assessments and recommendations to health professionals' consideration (Hunt, Haynes, Hanna, & Smith, 1998).

Despite the current efforts to provide several services of the health field using ICT, there are still many unexplored potentials. Mental Health is no exception. The introduction of new technologies in this field is usually referred as e-Mental Health (Agence d'Évaluation des Technologies et des Modes d'Intervention en Santé, 2006; K. M. Griffiths et al., 2007; D. M. Hilty et al., 2002; McGinty, Saeed, Simmons, & Yidirim, 2006; Walter & Matheson, 2008). The goal is to allow an equal access to therapies and

counseling, as well as other services, to those who may suffer from mental disorders and, for some reason, do not seek face-to-face professional help.

e-Mental Health is, as a result, an approach to provide support for the “well-being” state, while using electronic mediums. Campion & Nurse (2007) define it “as that form of e-health which deals with mental health and mental health disorders. Thus, the term e-mental health refers to mental health services and information delivered or enhanced through the Internet and related technologies.”

Other terms used to define this scope include Telepsychiatry, the use of electronic communication mediums and information technologies that provide or support psychiatric care to individuals, in the form of services and e-Psychiatry or “online psychiatry” (K. M. Griffiths et al., 2007; D. M. Hilty et al., 2002). In 2010, the Internet seems to be the most tried medium to offer psychiatric information. It combines the mass communication effect with interpersonal communication and provides an effective mean to conduct behavioral health interventions. Interactivity is one of the strengths of on-line interventions, besides the flexibility and the convenience of use (Christensen, 2007; Copeland & Martin, 2004; Mutter, Bouras, & Marescaux, 2005).

Some authors refer that the most successful services available in 2010 are the ones that address the most unmet needs of both patients and doctors (Lauriks et al., 2007). Some of the identified needs include dissemination of information, clinical care, social contact and education (Christensen et al., 2002).

Dissemination of information includes the offer of general content regarding an illness, support for treatment and prevention information. Education relates to patients, families/caregivers and doctors that learn new activities and the training of patients and doctors, including formation programs. Social contact is a transversal topic and it enables tracking patients, and the interaction of patients and families in communities, sharing their real and practical knowledge with interested parties, such as other families and caregivers. Clinical care is the area where the term teleconsultation is considered. Several topics are included in clinical care services such as assessment and confirmation of diagnosis, development of clinical care plans, psychiatric therapy, medica-



tion monitoring and review, treatment follow-up and review, psychological assessment amongst others (Agence d'Évaluation des Technologies et des Modes d'Intervention en Santé, 2006).

Mental disorders such as depression already have Internet-based interventions that might range from interactive multimedia applications that are self-contained and have no direct intervention from the therapist to online treatments where structured assignments and therapist feedback is employed (Copeland & Martin, 2004).

Regardless of the type and extent of the MHIS required for a specific context, the WHO provides a set of guidelines to conduct the process for the design and implementation of such systems.

### 2.1.2. Guidelines for Design and Implementation

Data in an MHIS flows through several stages: collection, processing, analysis, dissemination and use. The first stage, data collection, can occur at four distinct levels also known as subsystems, from the episode level up to the system level (Figure 2). An episode occurs when an individual has contact with the service. A case is a set of episodes that occur over time. The facility level implies keeping track of the entire service with all its cases and, finally, the system level includes all the existing facilities and is the level at which policies and plans are developed and monitored.

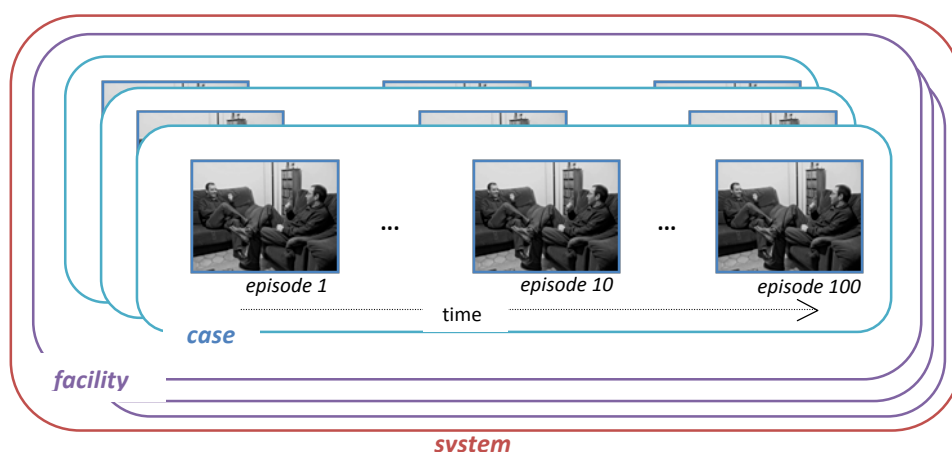
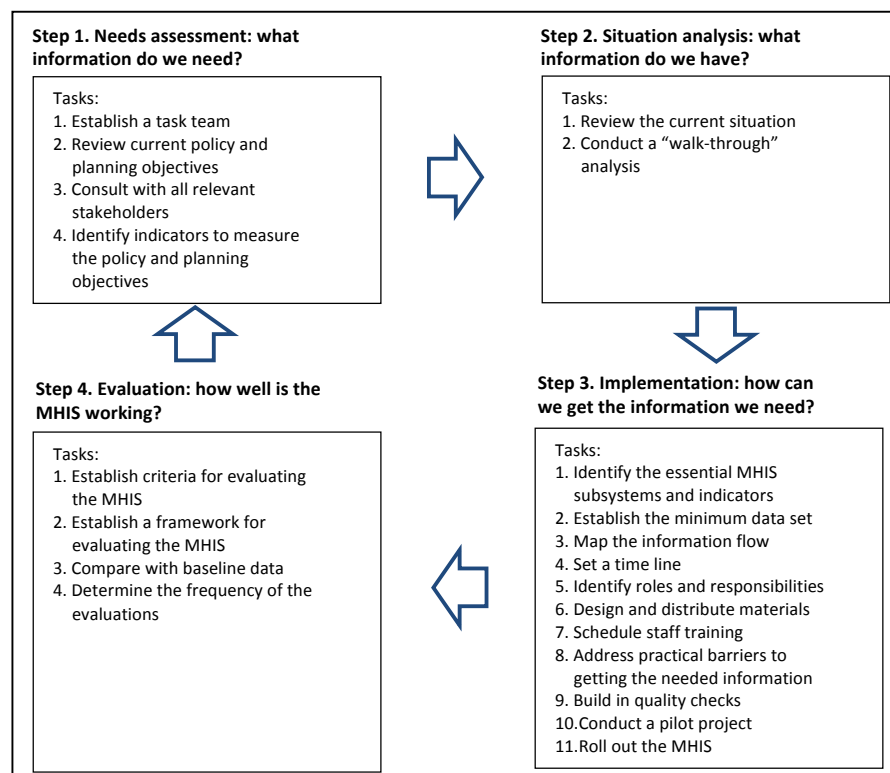


Figure 2 – MHIS subsystems

The WHO has several recommendations to what it considers essential for achieving success in the development and implementation of an MHIS. One should start small but keep an eye on the big picture, use indicators and consider data collection frequencies (routine and non-routine) while establishing a minimum data set. Make it user-friendly and make sure to consult all the stakeholders, clarify its relationship with other existing health systems and link its development to a wider service development are extremely important aspects. Finally, consider how to include epidemiologic data into the system, ensure privacy, confidentiality, access to information and consent and address specific mental health needs are some of the recommended principles.

Figure 3 presents the steps advocated by the WHO to design and implement an MHIS. The cycle they form represents an ongoing process, where the evaluation of the MHIS starts early in the design and implementation phases. The revision tasks that the WHO proposes for steps one and two, the quality checks of step three and the framework established in step four are major indicators of the concern with the evaluation process.



**Figure 3 – Steps in the development of a mental health information system – adapted from (World Health Organization, 2005)**

The first thing to establish is a task team responsible for the design and implementation of the information system. This task team should be multidisciplinary to include all the organizational, managerial and technical complexities inherent in such systems (Lippeveld, 2000).

The team's first task is to identify indicators, structure the expected goals for the system and transform them into measurable items (Lippeveld & Sauerborn, 2000). Indicators are measures that summarize the relevant information for the system stakeholders. They allow the assessment of the distribution of the resources and services' activities across the distinct service levels of mental health as well as discovering the data to collect. The identification is not a linear process and the list of indicators usually grows exponentially. Thus, it is necessary to keep the list simple and straightforward selecting only the most relevant indicators (Bodart & Shrestha, 2000; World Health Organization, 2005).

Discovering the existing MHIS, their issues and areas of improvement, is the "walk-through" analysis that the team should do. This analysis shows existing indicators and their function – enabling the task team to know what data is currently being collected and for what purpose. The task team should visit clinics and hospitals; track data collection and corresponding flow. This process might include interviews with the health professionals in the services and will provide a valuable insight on problems and shortcomings of current information systems.

As a result of this background analysis, the task team can choose to or extend current MHIS to encapsulate the new indicators found or reduce the list of indicators to fit in the current MHIS or combine the two previous options. It is thus necessary to identify which indicators are viable and then operationalize them. A minimum data set needs to be established and each indicator depicted. A compromise is required between what is desirable to collect and what is feasible to collect.

Agile methods offer a fast way to develop a system that can accommodate all the requirements. This software development methodology tries to lessen friction as much as possible to deliver the final product, while keeping the development process in a

sustainable way, with special consideration on requirements handling and testing (Boehm & Turner, 2003).

Another valid concern is to consider the thoughts and opinions of all stakeholders. At least one representative for each group should be listened to in order to bring some insight into the discussion. This process raises the cost and time of the entire design process, but it has proven to be rather successful when engaging all the actors. Each party should have a role and responsibility attributed in a formal list so that managers, administrative and clinical staff clearly understand how to interact with the MHIS. The usage information to deliver to end-users should be prepared in advance and should be simple and easy to understand (Castelnuovo et al., 2003a; Guler & Ubeyli, 2002; Kanani & Regehr, 2003). Such documentation includes instruction and procedure manuals as well as data collection forms. Further, training should be available and scheduled (Le, 2007).

Upon the introduction of a new MHIS into a site, the team should consider the implementation of a pilot project that provides valuable lessons for the design, development and implementation of wider systems.

Quality is the key for the system's success and evaluating a system improves its quality. It is essential to measure the real value of the system to introduce evaluation milestones where users measure the extent of the systems' impact and its usefulness. Assessment occurs with the introduction of quality checks that enable the continuous improvement of the evolving system.

Criteria such as reliability, validity, sensitivity, accuracy, completeness, timeliness, relevance and utility, simplicity of administration, acceptability, feasibility and flexibility are the general principles to evaluate an MHIS, according to the WHO. Establishing how to conduct the assessment with the users of the system and the frequency of these evaluations is important. Interviews, observation, record reviews and self-administered questionnaires are the proposed approaches to engage in the evaluation of the MHIS (World Health Organization, 2005).

In the deployment process of an MHIS, as it happens with every information system, several barriers will inevitable be encountered. Staff opposition and inadequate technology introduction, are two common problems that the team should detect as early as possible and avoid.

Staff opposition can occur for several reasons that include changes in established work patterns; requirements for new skills; added responsibilities or demands on their time. One of the most important explanations is certainly the fact that health workers have a work overload or see no use in proceeding with the data collection. Thus, simplifying the collection process, prioritizing the data to collect, providing adequate training to the personnel involved and awarding benefits to successful data collectors are some of the proposed solutions. Changes of structure and staff turnovers are also important aspects. These oppositions might take direct, e.g. outspoken refusal to complete a task and indirect, e.g. poor data quality, forms. The team should address these oppositions as soon as possible. Prevention mode is preferred to ensure that the system runs smoothly.

The team should pay attention when trying to introduce a system with inadequate technology into an existing environment that does not have the resources to support it. Sometimes, and especially for low-income countries, a blended approach with a “paper-and-pencil” plus a “computerized” mixture is the perfect and practical choice. When a technology solution is proposed, health professionals should receive adequate training and managerial support is essential.

Recommended proceedings to overcome the barriers include ensuring that local collected data is used locally before being used at superior (national) levels and providing feedback – applying and presenting the obtained results for each of the indicators, according to the level of the service. Furthermore, presenting the information to the users of the system in a simple and attractive way and plan training on a regular basis and in a consistent way to enable health workers to know accurately what is being asked of them, is also important.

Another important aspect relates to managing information systems. After their implementation and deployment, there should be enough flexibility to allow the system to change and expand.

Actually, the guidelines here depicted resemble the ones used in the analysis, design and development of general information systems (B. W. Boehm, 1984; Ghezzi, Jazayeri, & Mandrioli, 2002; Laudon & Laudon, 2001; Schwalbe, 2003). Hence, development teams only need to consider the general guidelines and apply them to a specific context for which they are developing the system, the mental health area.

### 2.1.3. User Centered Design

In the software development industry, the major aim is to obtain a high quality product that satisfies its end-users. To achieve this goal it is essential to first define what “high quality” means and then, make the product according to it. Usability is a high-level quality objective and serves as the base principle for User-Centered Design (UCD) as we shall see.

UCD was proposed and referred by a large amount of authors and the industry has already proven, like IBM and Google for instance, that the best reason for using UCD is that “if the user can’t use it, it doesn’t work” (attributed to Susan Dray by (Anderson, 2007)). The easy-of-use is a key differentiator (Beyer & Holtzblatt, 1998; Cooper, 2004; Hix & Hartson, 1993; Mayhew, 1999; J. Nielsen, 1993; Rosson & Carroll, 2002). “People ignore design that ignores people” says Frank Chimero (Chimero, 2008).

User Centered Design (UCD) has three principles: focus on users and tasks, measure usability empirically and develop usability iteratively (Dabbs et al., 2009). These processes should be cyclic and imply several iterations before reaching a solution (Wijk, 2006).

It might seem obvious that users should be involved directly in projects, but when real-life projects are concerned, several difficulties arise (Catarci, Matarazzo, & Raiss, 2002). For instance, many organizations do not seem to realize the cost-benefit of involving users right from the start of the software development process; also, there is a cultural

issue. According to some authors, UCD has cost benefits, while according to others (R. G. Bias & Mayhew, 1994; Karat, 1997) the usability evaluation methods are not cost effective.

Some disambiguation is required at this moment: UCD is often used seamlessly to refer to Human-Centered Design (HCD). In fact, the terms are regularly used in the same context and bearing the same meaning. Despite the existence of these two terms, we consider that there is no difference amongst them and either one is a valid reference. From this point forward, we will only use UCD, conscientiously, to refer to the process described here.

Several ISO standards are defined and currently in use in the industry. IBM, Apple and Google are some of the companies, to name a few, that use them and are widely known and successful. They seek to provide effective, efficient and satisfying products for use in a specific context. This requires the design of an appropriate interaction and interface, achieved through a user-centered process that is only viable with a consistent organizational capability. IBM is rearranging their development methodologies to lodge the usability experience centered in the final users. Now, the User Experience and Design (UXD) professionals have to adapt their tasks, activities and deliverables to center their work in the users' feedback and iterative development ((IBM Design, 2010)). As far as Google is concerned, in 2007 its User eXperience (UX) experts' team published a set of *Googley* Design Principles that defines smart design approaches (Google User Experience Team, 2010). The ten published principles flow from well-known facts acquired by Google's experience and the UX team' stated mission: "design products that satisfy and delight our users". Thus, a product that accomplishes a harmonious balance between being useful, fast, simple, engaging, innovative, universal, profitable, beautiful, trustworthy and personable, is considered a *Googley* product.

The most referred standards are the ISO 9241 series (ISO, 2009a). These series are concerned with describing usability and the ergonomics in a specific context of use. The oldest part of the series comes back from 1992 and the newest was published in 2009 (ISO, 2009b).

The ISO/IEC 25000:2005, current combination of the former ISO/IEC 9126 and 14598 series, defines the software engineering approach to take when considering the quality of software products and its corresponding evaluation (ISO, 2005).

In order to provide requirements and recommendations to apply in the development of interactive systems, the ISO 13407:1999 (ISO, 1999) is currently under revision by the upcoming ISO/FDIS 9241-210 (ISO, 2010). This revision process is trying to enhance the human-system interaction of the systems.

An important part of the 9241 series is the ISO 9241-171:2008 (ISO, 2008; ISO, 2009a) that provides the guidelines specifically for the design of accessible software including the elderly and persons with disabilities and that complements the more general ones provided by ISO 14915 and ISO 13407 (ISO, 1999).

There are other important standards related to the theme and that somehow influenced our work, but we specially refer to both ISO/IEC TR 19766:2007 (ISO, 2007b) and ISO/IEC TR 19765:2007 (ISO, 2007a). These are the technical reports that provide guidelines and a list of icons and symbols to improve the use of information technology products by elderly and persons with disabilities.

Usability is an important aspect of software products. Probably the most used definition on usability is by Nielsen and dates from 1993: "usability is about learnability, efficiency, memorability, errors, and satisfaction" (J. Nielsen, 1993). The current standard definition of usability introduced in 1998 is as follows: "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use" (ISO, 1998). The later definition is gaining ground in the research area and thus it is of major importance to contextualize and describe the concepts involved in the definition:

- effectiveness: the ability of producing or being capable to produce a desired effect,
- efficiency: the quality or degree of being efficient, producing a desired effect,



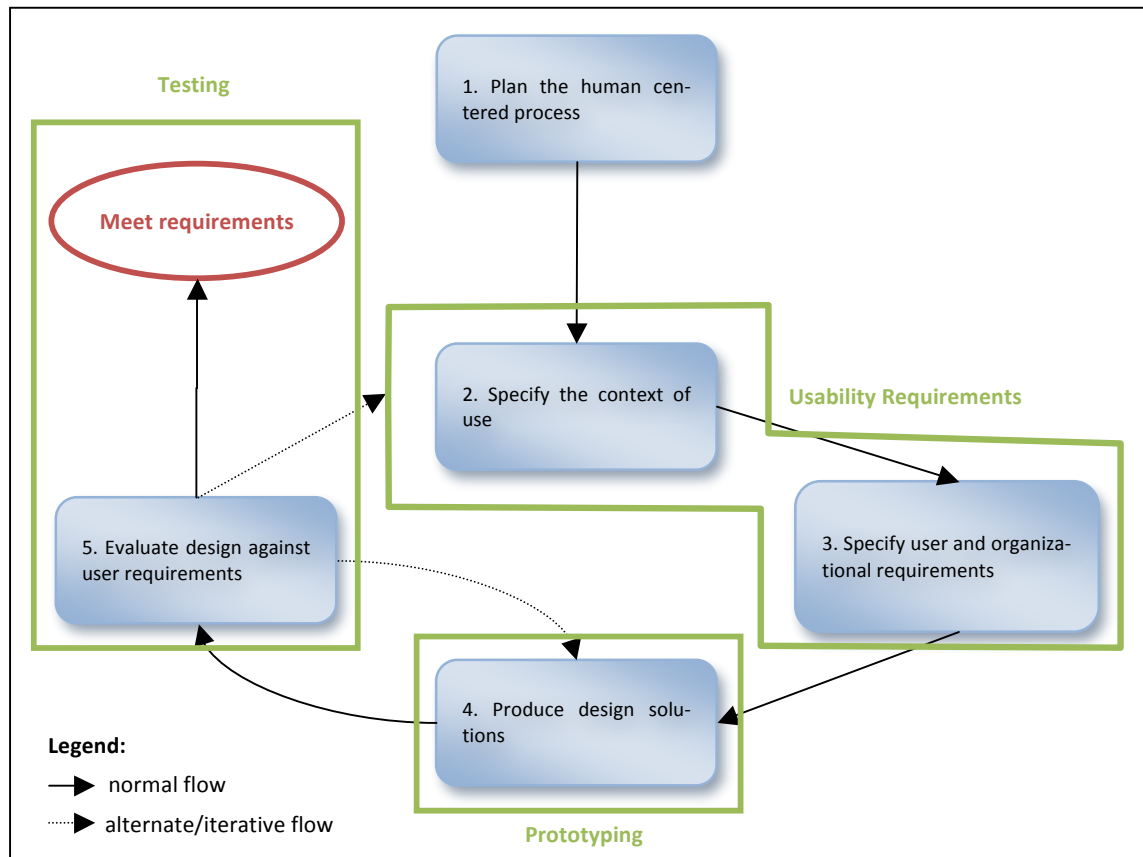
- satisfaction: fulfillment of a need or want (product provides what users want or need),
- context of use: environment where the product is to be used (knowledge on the users' profiles, tasks where the product is to be used and the physical and organizational ambience of usage),
- goal: the specified and desired effect, depicted as a set of results.

While ISO 9241 defines usability, another standard, the ISO 13407 refers to specificities of designing usability, the process of achieving usable systems (Jokela, Iivari, Matero, & Karukka, 2003). The product/system to be developed has humans/users in the center of the operations. Established since 1999, this standard aims to provide guidance into how to develop interactive computer systems centered on its future users. The idea is to accomplish a usable system.

There is relevant work done that discusses the usefulness and characteristics of ISO 13407 (Earthy, Jones, & Bevan, 2001; Jokela, 2002; Maguire, 2001). Reduced training and support costs, user satisfaction and productivity guarantees are some of the benefits depicted in the standard's rationale. All the previous referred work agrees on the fact that the standard is for those who manage design processes and does not provide detailed information of methods and techniques. Nevertheless, the standard identifies the following four general principles that characterize the user-centered design:

- The active involvement of users and a clear understanding of user and task requirements,
- An appropriate allocation of functions between users and technology,
- Iteration of design solutions,
- and Multi-disciplinary design.

The handbook by the European Usability Support Centers (EU INUSE project) publishes the techniques to support the user-centered design process (Bevan & Curson, 1999). It includes the most available-relevant, mature and cost effective techniques.



**Figure 4 – User Centered Design Process (adapted from (Bevan & Curson, 1999))**

The UPA – Usability Professional’s Association – defines a typical UCD methodology named “Designing the User Experience” based on the principle: “Providing a great user experience is an ongoing process” (UPA, 2010). In this methodology, UCD activities appear arranged into the four typical software development phases: analysis, design, implementation and deployment. Every phase of this methodology entails the five steps defined for UCD (Figure 4).

After identifying the need for human-centered design, the designer team should plan which methods to use during the distinct phases of the approach (step one). The referred handbook is particularly helpful here, since it provides useful information on the methods to use during the UCD process (Bevan & Curson, 1999). Teamwork and communication are extremely important.

Knowing the environment where the product will be used is essential for a good outcome (step two). The Usability Context Analysis tutorial, based on ISO 9241-11 defines

how to gather and document such information and provides guidelines for use in specific organizations (ISO, 2009b).

In order to determine the tasks that users should accomplish when using the product (step three), the team should define users and personnel involved in the system and this specification can be achieved using direct user observation, interviews, questionnaires, focus groups or brainstorming.

To gather the requirements of the system, in step two and three of the UCD process, contextual inquiries, multi-disciplinary workshops and user interviews might be used (Catarci et al., 2002; Jokela, Koivumaa, Pirkola, Salminen, & Kantola, 2006). Furthermore, the Usability Maturity Model (ISO TR 18526) includes a set of base practices to ensure the representation and inclusion of users in a system lifecycle. To help in the development of a UCD approach there are the following well-known methods:

- Focus groups: meetings where all interested parties, including future users share their opinions and thoughts on a specific subject. These meetings are extremely useful to know the context of use of the system since people are able to build on one another's response, enabling crosschecking for factual errors or extreme points of view. Focus Groups directives refer a restricted number of participants (six to seven) and the production of a final report containing the relevant information on the profile of the attendants;
- Usability engineering: a selected person uses a system, following a series of tasks while someone keeps track of its actions and its difficulties (Malhotra, Laxmisan, Keselman, Zhang, & Patel, 2005; J. Nielsen, 1993). Users can use the Think-Aloud Protocol and verbalize every action they are doing (Lewis, 1982). This protocol is useful, inexpensive, but time consuming and if moderators decided to time users' actions in order to evaluate their performance, they must be aware of the fact that the protocol increases the measured times. And some authors state that it might influence the user's performance (Lewis, 1982);
- Participatory design: besides asking the users their opinions on design issues, users are invited to take part in the decision-making of the design process

(Clemensen, Larsen, Kyng, & Kirkevold, 2007; Greenbaum, 1993; Johansson, 1999). This method creates the initial prototype, where a participatory design workshop involving developers, users and designers will accomplish the initial prototype. Participatory Design includes social factors and assumes a limited, rather homogenous user group, despite a group of heterogeneous users with multiple level hierarchies and temporary jobs is becoming a reality and designers in this process might influence users (Pilemalm & Timpka, 2008; Wright & Monk, 1991). Conducting walkthroughs is a useful process where users describe their actions and future use of the system, but is hard to accomplish and time consuming (R. Bias, 1991; Polson, Lewis, Rieman, & Wharton, 1992);

- **Contextual Design:** includes contextual inquiries to end-users to show how they, in their usual setting, conduct their tasks, the same tasks that will be assisted by the future ICT solution. Contextual inquiry is a specific interview done in the user context and that has little to none interference in the task being conducted. This interview starts as a traditional interview that evolves to a “master-apprentice” connection where the interviewer (apprentice) should be observing and occasionally interrupting the user (master) to ask things about what has happened (Dabbs et al., 2009; Kushniruk & Patel, 2004);
- **Questionnaires:** asking users their opinions can provide statistical information to increase the study’s credibility through the scientific appearance. There are also explanatory questionnaires that do not provide such statistical information. Usually developers that are geographically distant from end-users use this method. Examples of standardized questionnaires include the Software Usability Measurement Inventory (SUMI); the After Scenario Questionnaire (ASQ); the Post-Study System Usability Questionnaire (PSUQ) and the Computer System Usability Questionnaire (CSUQ). Questionnaires are a good example of subjective measurement (Åborg, Sandblad, Gulliksen, & Lif, 2003). While being inexpensive, they are hard to build and their results analysis is time-consuming. They often show low response rates;

- Interview: a conversation on a one-to-one basis between a developer and a future end-user. Interviews can present open-ended questions or close-ended questions. This allows a better understanding of the user's individual unique point of view. Early in the design process, this method allows a better requirements gathering.

Rapid prototyping presents itself as a fast way to develop, demonstrate and evaluate user interface designs (step four).

Several usability inspection methods, including heuristic evaluation, user satisfaction methods, and the performance measurement method evaluate the proposed design (step 5) (Macleod, Bowden, Bevan, & Curson, 1997). Nielsen's Heuristic Evaluation (1993) is a method for usability testing that enables the identification of problems supported by factor principles. Based on a set of evaluative criteria, the testers (or experts) should experiment with the system (prototype or actual implementation) and record their observations as a list of issues to solve. A priority can be set to each one of the issues in order to express the tester opinion on what to correct first in the development. It is a method extremely easy to learn and inexpensive to use.

The whole idea in testing is to assess the degree of achievement of requirements. In order to answer a simple question: "does this design support the user's tasks?" it is required to diagnose eventual usability problems and evaluate the achievement of the objectives. Testers often do not have the knowledge, instruments and/or time available to test for usability (B. Rahimi & Vimarlund, 2007).

As far as research methods are concerned, most studies identified in the literature refer surveys. These surveys can be set after the system enters the production phase. The most frequent analytical approach is the case study technique, usually retrospective cases that try to measure the impact of ICT in a context and studies that describe the design process (Keen & Packwood, 1995; B. Rahimi & Vimarlund, 2007; Rodriguez, Casper, & Brennan, 2007; Sjöberg & Timpka, 1998). Qualitative research methods also include interviews and existing documents on organizational change (Dabbs et al., 2009; Faber, 2003; Samaras & Horst, 2005). Within the case study scope, video record-

ing and transcriptions are also used techniques. Randomized Control Trials (RCT) type studies, according to Kaplan's study on Clinical Decision Support Systems, do not seem to be the solution for discovering the reasons that lead a system to be used or why and when it is useful (Kaplan, 2001).

On the other hand, narratives and explanations of study participants through the think-aloud method or post-study open-ended interviews are some of the techniques mostly used for these systems' evaluation. There is still much work to be done, moments of reflection and observations of changes in work practices or home routines are extremely hard to capture (Smuc et al., 2009).

It is important to evaluate these tools. Rester (2007) proposes a classification system based on the outcomes as the measure that is highly dependent on the tasks the subjects have to solve. Rester proposal was used in a psychotherapeutic setting for anorectic young women, helping therapists to discover the success or failure in therapy. The evaluation was based on reports that formulate and document the findings of the exploration process that was conducted using distinct techniques. It was followed by the statistical analysis of the outcomes and focus groups were held with a discussion of relevant topics.

Actually, most of the published studies suffer from a weak methodology that includes poor design and leads to inconclusive results (Demiris et al., 2008). The outcome of the existing studies seems to be related to guidelines and instructions for both designers and non-designers with respect of design objectives, processes and ideologies.

#### 2.1.3.1. Patient Centered Design for Mental Health Contexts

Patient Centered Design (PCD) is the designation of a methodology that implies involving patients in the decision-making and development process of an ICT solution. When using such a methodology, patient empowerment occurs and starts to have an active role that allows them to make choices and provide input regarding their treatments (Demiris et al., 2008).

This approach to design is tightly linked to the current development of patient-centered healthcare delivery processes (Dabbs et al., 2009). However, introducing ICT in clinical settings should be done cautiously, namely to support clinicians tasks and augment the services' delivery to patients (B. Rahimi & Vimarlund, 2007; Rothschild et al., 2005). The main idea is to replace pen and paper for computers and digital media with most of these services provided to the citizens through the Internet (NykÄNEN, 2008). In fact, this approach is a fundamental piece to provide Healthcare ICT solutions and implies partnerships between practitioners, patients and families/caretakers (Demiris et al., 2008). Some identify the partnerships as clinical microsystems where everyone is responsible for the actual care conditions, patients included. These liaisons and their nature will have a direct impact on the social context for the product implementation and its complete acceptance, later. The product is an artifact that results from the social exchanges in the group and is close to the users (Sjöberg & Timpka, 1998). This multiplicity of users usually implies multiple user interfaces and plenty to describe regarding approaches to the concept, design and development of such systems (Samaras & Horst, 2005).

In summary, PCD is a particular type of User Centered Design (UCD) where the end-user is a patient that will use a healthcare solution that should meet his/her expectations (Dabbs et al., 2009; Demiris et al., 2008). UCD focus on needs, wants, skills and preferences of the product's primary user. Thus, as a specific type of UCD, PCD starts by listening to the patient's needs and requirements besides considering the social and technical context for the implementation of the product. Most failures come from the absence of feedback from end-users and success is achieved when product designers attend to the needs and wants of users, engaging them early in the design and test process (Pare, Sicotte, Jaana, & Girouard, 2008; Pilemalm & Timpka, 2008; B. Rahimi, Moberg, Timpka, & Vimarlund, 2008; Sjöberg & Timpka, 1998). Human factors engineering knowledge should not be ignored, neither assumed that the already acquired knowledge is enough (Samaras & Horst, 2005). To develop a better fitting organizational system and discover ways to achieve the proposed goal, user involvement is as important as it is necessary. Such a system should meet several goals as well as serve

distinct types of users, while ensuring that their work routines are available (Nykänen, 2008; Rodriguez et al., 2007; Sjöberg & Timpka, 1998).

PCD should be the central point of a system implementation engineering process, based on existing guidelines for software development. Several approaches gather the vital knowledge needed to prevent rejection of the system, and reduce the information asymmetry usually existent in the implementation process (Pilemalm & Timpka, 2008; B. Rahimi, Vimarlund, & Timpka, 2009). Few have used a PCD approach in the development of ICT healthcare solutions (Asaro, 2000; Sjöberg & Timpka, 1998).

Benefits of PCD include the increase of the communication between the healthcare figures (Demiris et al., 2008). Involvement of clinicians and other staff in the system development and in human computer interface design is crucial for success (C. M. Johnson, Johnson, & Zhang, 2005; B. Rahimi et al., 2008). There should be an interest in linking organization goals with the user goals and the features delivered by the system.

Examples of undesirable outcomes include missing deadlines, poor user adoption and not achieving the expected benefits. Understanding the risks and prioritizing them enables the development team to conduct proper risk management (Pare et al., 2008; Schmidt, Lyytinen, Keil, & Cule, 2001). Amongst the findings of the referred studies, the risks considered most important include the importance of a project champion, the lack of commitment from upper management, the perceived usefulness associated with use of an information system, the project ambiguity and the result of the quality of alignment between the system characteristics and the organization of clinical work.

When it comes to the mental health arena, there are already some services available in the field, but there is no evidence of a sound and systematic method to develop ICT for schizophrenia or psychosis patients (Dabbs et al., 2009; R. B. Jones et al., 2001; Walker, 2006).



## 2.2. Schizophrenia – a unique and complex condition

Schizophrenia is one of the disorders identified as a priority by WHO in the mhGAP project (World Health Organization, 2008). Currently, it affects about seven per thousand of the world adult population, mostly in the age group 15-35 years, summing up to almost 24 million people worldwide. Nearly 50% of persons with schizophrenia do not receive appropriate care and almost 90% live in developing countries. Although the incidence rate is rather low, three per 10.000 inhabitants, the prevalence is high due to chronicity (World Health Organization, 2007a). The last known study on estimation of prevalence of schizophrenia in Spain indicates an average of three per 1000 inhabitants per year and uses a model to compare incidence figures with the ones reported in prevalence studies (J. L. Ayuso-Mateos, Gutierrez-Recacha, Haro, & Chisholm, 2006). The fact is that the epidemiology of schizophrenia is rather heterogeneous, geographically speaking, and mirrors the clinical and neurobiological heterogeneity of the disorder. Factors such as incidence, prevalence and mortality, together with clinical outcomes, vary according to many variables, e.g. cultural and socioeconomic factors, genetic differences between groups and geographical origin, thus providing the diversity of numbers present in the literature reviewed (Bhugra, 2005; McGrath, 2008; S. Saha et al., 2005; S. Saha et al., 2008).

Schizophrenia is a severe mental disorder characterized by disruptions in thinking. People find difficult “to tell the difference between real and unreal experiences, to think logically, to have normal emotional responses, and to behave normally in social situations” (MedlinePlus, 2008). Someone that endures this condition sees his/her language, perception, and sense of self affected. Seldom, the condition includes psychotic experiences, such as hearing voices or delusions, and can impair functioning through the loss of an acquired capability, disabling the person to earn a living or continue with its studies.

Schizophrenia is a condition usually detected in the early adulthood and there is no known cure. Yet, it is treatable and allows some of those who suffer from it to have an adequate and productive life, enabling them to integrate fully into society.

Eugen Bleuler is a Swiss psychiatrist known for having coined the term schizophrenia for a condition previously known as *dementia praecox*, introduced by the German physician, Emil Kraepelin. In the beginning of the 20<sup>th</sup> century, Bleuler made a distinction between schizophrenia and *dementia praecox*, since, according to his knowledge, the condition did not always implied a mental deterioration and could occur anytime, both early or later in lifetime. Their work has been highly cited in the last century (Aleman, Hijman, de Haan, & Kahn, 1999; Bleuler, 1963; Harrison, 1999; Kandel, 1998; Meehl, 1962; Stevens, 1982). It is still used as a reference in 2010, despite recent scientific evidence that shows some gaps in their findings (Kalkstein, Hurford, & Gur, 2010; Levy et al., 2010; M. A. Taylor, Shorter, Vaidya, & Fink, 2010).

In the 1920s, Kurt Schneider introduced a list of symptoms (first-rank symptoms) that differentiated schizophrenia from other psychosis, namely hallucinations, delusions and disorganized thinking and speech. A rather common classification for schizophrenia, currently in use, is the Positive and Negative symptoms scale (PANSS) (Kay, Fiszbein, & Opler, 1987). While positive symptoms relate to first-rank symptoms, referred above as negative symptoms, include characteristics that are usually found in healthy persons but are not present in schizophrenic persons, e.g., alogia, anhedonia and asociality. Together, they allow health professionals worldwide to diagnose schizophrenia and provide adequate treatment.

First-rank symptoms were used as the basis for the standardized criteria present in the International Classification of Diseases and Related Health Problems, tenth revision, from WHO (ICD-10). Recent studies questioned the accuracy of these criteria suggesting that upcoming versions of the ICD de-emphasized them. Other standardized criterion for the diagnosis of schizophrenia is the “Diagnostic and Statistical Manual of Mental Disorders”, from the American Psychiatric Association, currently in the fourth “text revision” edition (DSM-IV-TR). The two classification scales subsist: ICD-10 is the

international standard that includes the classification for all the diseases known by humanity and DSM-IV-TR is specific for mental disorders. Despite the existence of these two scales, they have a high level of agreement and support the following schizophrenia' subtypes: paranoid; hebephrenic or disorganized; catatonic; undifferentiated and residual (Carpenter & Stephens, 1979; McGlashan & Fenton, 1991). DSM-IV-TR is currently under revision and the new DSM V, estimated for 2013, has already received recommendations to drop the existing subtypes from the classification (American Psychiatric Association (APA), 2010). Nevertheless, the categorical classification of schizophrenia in distinct subtypes is still the current standard, widely used, and will be a reference for this document.

Severe cognitive deficits such as memory loss are a reality for schizophrenia patients, regardless of the schizophrenia' subtype considered (Elvevag, Maylor, & Gilbert, 2003). Schizophrenics suffer from grossly disorganized behavior that can range from very unpredictable agitation to inappropriate behavior. Some of the most common examples include little or no attention to personal hygiene, inability to organize meals, dressing in an unusual manner or becoming agitated and shouting.

Treatment is available in developed countries for affordable prices. A recent study shows its burden is bigger in the first year after the onset and corresponding initial diagnose and afterwards becomes stable (Nicholl, Akhras, Diels, & Schadrack, 2010). Based on new data, recent studies lead the revision of long-time established principles, namely the dogma of superior schizophrenia outcomes in developing countries when compared with high income countries (Cohen, Patel, Thara, & Gureje, 2008; McGrath, Saha, Chant, & Welham, 2008; S. Saha, Chant, & Mcgrath, 2008). Either way, in developing countries, e.g. India, Tanzania and Guinea-Bissau, pilot programs are showing that is feasible to provide effective treatment through primary health care systems.

Health professionals consider both pharmacological and psychosocial interventions effective, but there is a general belief that pharmacological interventions are, besides mandatory, the most effective treatment. WHO recommends the Schizophrenia Algorithm, developed in association with the *Collegium Internationale Neuro-*

*Psychopharmacologicum* (CINP) and published by the International Psychopharmacology Algorithm (IPA) Project, to be used in the management of schizophrenia (IPAP, 2004). This algorithm encloses 12 steps and illustrates the belief in the effectiveness of the psychotropic drugs. It only introduces the psychosocial treatment in the last step – the maintenance treatment. According to the experts, the reasons for the late inclusion of the psychosocial component in the treatment relate to the fact that patients in this stage accept these treatments better. Patients become more amenable and provide improved cognitive responses.

One major problem of treating schizophrenia is the non-adherence problem since it significantly contributes to the possibility of relapse. Patients easily forget or simply decide not to take the prescribed medication that helps in the control of the disease's symptoms. Fighting this problem is of utmost importance because relapses of schizophrenic patient bring back not only the return of augmented psychotic episodes, but also increase the risk of suicide (Zygmunt, Olfson, Boyer, & Mechanic, 2002). Thus, it has a severe impact in the lives of patients and their family and caretakers. Hence, the need to reinforce the psychosocial component in the maintenance phase.

Adolf Meyer (1957) and George Engel (1977) are accountable for introducing a biopsychosocial approach. Recent studies show the relevance and demonstrate the effectiveness of this approach, despite of an initially undermine by the biomedical reaction to anti-psychiatry (Double, 2007). One of the recognized mental health treatments for numerous illnesses, especially depressive or smoking and eating disorders, are psychotherapies (Briffault, Sapinho, Villamaux, & Kovess, 2008).

The National Institute for Mental Health (NIMH - USA) funded the Measurement and Treatment Research to Improve Cognition in Schizophrenia (MATRICS) initiative that assumes making cognition a rationale for treatment (Green et al., 2004). Cognitive deficits of schizophrenia are a core feature of the illness and relate to the daily functioning of patients.

The subgroup of the Neurocognition Committee of the MATRICS reached a consensus for a battery of clinical trials in the following cognitive domains: working memory; at-

tention/vigilance; verbal learning and memory; visual learning and memory; reasoning and problem solving; speed of processing; and social cognition.

Psychosocial approaches consider each patient as unique and the treatment should consider his/her individual background, psychological makeup, service needs and social support network. Thus, after guarantying the provision of basic needs and services, a set of recommended general treatment approaches are in order. Namely, the attitude towards the patient, providing patient's respect, the education about the illness, to develop partnerships with both patients and families in treatment planning, handle complications due to the illness (side effects) and equal access to rehabilitation opportunities. As far as selecting specific psychosocial interventions, mental health professionals should consider each patient's needs and preferences. These professionals can consider several types of intervention such as Cognitive Behavioral Therapy (CBT) and Social Skills Training (SST).

CBT tries to link feelings with patterns of thinking which influence subjective well-being. This type of intervention may engage patients in real life tasks, where the therapist may help improve the social skills and reinforce the vocational skills of schizophrenic patients (Beck & Rector, 2000; Vauth et al., 2005; Velligan, Kern, & Gold, 2006). Social skills training studied by Liberman (1986) include the impact of teaching aspects of everyday life in patient's autonomy – independent living skills. Other interventions consist in socio-psychological modules, e.g. Program for Assertive Community Treatment (PACT) and family/community integration programs. Together with CBT and SST, rehabilitation programs emerge and introduce the follow up of the treatment for both patients and their families. Society can provide care with active family and community involvement.

Back in 2004, CBT was a scarce commodity, provided by highly skilled and experienced professionals, and thus, a limited resource not available on a daily basis (*Cognitive-behavior therapy*2004). In 2010, it has a growing number of adepts and is actually one of the psychosocial interventions most widely used in the mental health arena (Brent et al., 2008; Kuyken et al., 2008; Leichsenring et al., 2009).

Several studies refer CBT efficacy has reducing relapse rates and of overall symptoms, especially delusions, when compared to routine care (C. Jones et al., 2004; Krabben-dam & Aleman, 2003). In fact, research suggests that the best practice in first-line treatment, for most adolescents and adults with mild-to-moderate depression, consists in CBT instead of medication (Christensen, 2007). Besides that, psychological therapy is also the first choice of patients.

CBT resides in an active engagement between a patient and a therapist where they both undertake several tasks such as mood monitoring, identifying and registering thoughts, identifying links between thoughts, feelings and behaviors (Sams et al., 2006). One basic aspect for CBT to work is that the patient should be able to recognize and refer to distinct emotions. Patients should also be able to share and understand some basic concepts such as thinking, doing and feeling.

According to some studies, the record of the sessions, including multi and complex interactions between groups' members is not an easy task to accomplish (Haug, Strauss, Gallas, & Kordy, 2008). Several tools such as questionnaires, sociograms, audio or video recordings, and session transcripts were suggested for providing process information for the therapist but were never integrated into clinical practice routine since gathering the data is too time consuming.

## 2.3. e-Therapy

e-Therapy is a component of an MHIS that enables the electronic provision of a specific health service, the therapy, where both patients and health professionals are involved. It is a novel mode of delivery for an already existing type of health intervention. There are several computer-assisted approaches available for a wide range of disorders, including physical issues, but the focus given here relates only to the mental area, e.g. CBT (Carroll & Rounsaville, 2010).

### 2.3.1. Overview

e-Therapy “is a new modality of helping people resolve life and relationship issues. It uses the power and convenience of the Internet to allow simultaneous (synchronous) and time-delayed (asynchronous) communication between an individual and a professional” for Castelnovo et al. (2003a) (p. 376). While Manhal-Baugus defines e-Therapy as “a licensed mental health care professional providing mental health services via e-mail, video conferencing, virtual reality technology, chat technology, or any combination of these” (Manhal-Baugus, 2001) (p. 4).

e-Therapy is also referred by other terms such as online psychotherapy, Internet based therapy, online therapy, cybertherapy, web counseling, behavioral telehealth, and sometimes as telepsychiatry. It uses text-based forms of communication such as e-mail or chat, and/or video and audio conferencing (Ganapathy, 2005; Heinlen, Welfel, Richmond, & O'Donnell, 2003). These communication mediums usually imply live involvement of a therapist, whether in real time or through asynchronous services, and provide an alternative to the traditional face-to-face context (Mutter et al., 2005).

Using the Internet for online psychotherapeutic interventions covers unmet needs of the mental health arena and includes areas such as clinical care, social contact and education and research (information dissemination). Online interaction might solve the social stigma issue and help working out inhibition issues related to receiving support. Some people disclose their problems more openly to a computer system than to other

people (M. Griffiths & Cooper, 2003). On the other hand, people that have mobility limitations, that do not have access to the needed mental health services, e.g. rural areas or that have time constraints, can use the online delivery of the service (Kanani & Regehr, 2003).

According to Wangberg et al. (2007), psychotherapists' theoretical bases may influence the tendency to embrace or reject e-media. Psychotherapists who practice the dynamic-oriented approach, based on transference processes occurring in an established relationship, typically used in group therapy, seem to hold negative attitudes towards e-Therapy. On the other hand, psychotherapists who practice cognitive approaches appear to hold positive attitudes towards e-Therapy. It is important to refer that e-Therapy does not intend to modify theories of already existing approaches, but can affect the patient-therapist relationship (Castelnuovo et al., 2003). e-Therapy can occur at home and facilitate communication between patient-therapist to a friendlier mode minimizing the therapeutic process (A. Barak, 2007; Lester, 2006; Recupero & Rainey, 2006). According to Kanani (2003), there is already evidence of highly intimate-professional relationships over the Internet that becomes closer in less time than those in face-to-face sessions.

The quality of care provided by e-Therapy must demonstrate no significant difference between the one provided in face-to-face contexts (Agence d'Évaluation des Technologies et des Modes d'Intervention en Santé, 2006). Ample evidence shows that services are being provided with satisfactory levels of quality similar to those in traditional settings (Neufeld, Yellowlees, Hilty, Cobb, & Bourgeois, 2007; Postel, de Haan, & De Jong, 2008).

Then again, e-Therapy raises legal and ethical issues. It is important to address privacy and confidentiality considerations and regulate guidelines (Childress, 2000; Christensen, 2007; M. Griffiths & Cooper, 2003; Kanani & Regehr, 2003). Despite these legal concerns, computer-delivered Cognitive Behavior Therapy (cCBT) over the Internet exists and, in general, some of the controlled trials that study their effectiveness have shown that there are no differences between CBT delivered by a therapist or a com-



puter (Christensen, 2007). These interventions seem to be the best ones to adapt to computer software, especially when all the information is taking on some new and more appealing formats such as multimedia content (Copeland & Martin, 2004).

### 2.3.2. Actors

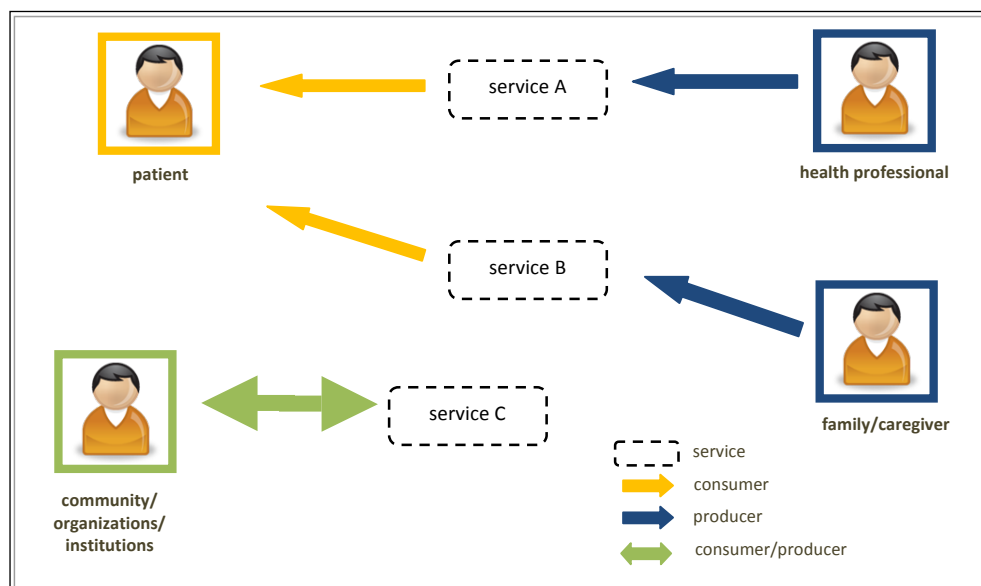
In the e-Mental Health context there are many actors involved and contributing to the global welfare such as patients, families, caregivers and health professionals such as psychiatrists, therapists and psychologists (R. P. Liberman, Hilty, Drake, & Tsang, 2001). People who suffer of mental disorders have multiple needs related to health and even to other common things, like employment, education, among others (World Health Organization, 2007b).

Whenever there is a service there is always someone that provides the service (provider) and someone that consumes it (consumer) (Castelnuovo et al., 2003). Usually, and particularly in e-Therapy, a patient is regarded as a client, the consumer of the service, while the health professional is seen as the provider of the service (A. Barak, 2007; Castelnuovo et al., 2003; M. Griffiths & Cooper, 2003; Grolleman, van Dijk, Nijholt, & van Emst, 2006; Kanani & Regehr, 2003; Wangberg et al., 2007). As depicted in Figure 5, several actors (patient, health professional, family and caregivers) play the provider and consumer role while providing or consuming e-Therapy services.

One of e-Therapy's goals is to decrease the existing dependency on the health professional by providing a service through electronic communication mediums, to enable patient empowerment. Hence, patients will be able to complete, in an autonomous way, a therapy session – a set of activities that their therapists previously arranged. In an e-Therapy session, the dependency of a patient on the health professional is time consuming and obstructs the health professional real work. In fact, health professionals' main concern is to assist and provide autonomy to the patient. They are not supposed to conduct a set of repetitive tasks that will retain them away from being vigilant of the patient's health (Castelnuovo et al., 2003).

Families and caregivers may also act as “providers” assisting patients in the completion of their therapy sessions at home (Grolleman et al., 2006). They play an important role supporting patients whether in the task to take their medication and help in their daily tasks (World Health Organization & World Organization of Family Doctors, 2008).

The community also has an important role contributing to patient welfare. Patients suffer with fear and prejudice of others. The stigma increases personal pain, which contributes to social exclusion (Health and Consumer Protection Directorate-General, 2005). This results in a low adherence to treatments and decreasing clinical and functional outcomes. Thus, organizations, institutions and communities are also actors. The most common communities generated around e-mental health services are the patients’ communities. There are also families and caregivers communities (independent or included in patient communities). Primary care practitioners, experts and medical staff create a large health professionals’ community.



**Figure 5 – Actors roles in e-Therapy**

There is a clear need for education and training of all these actors regarding mental health issues. e-Therapy may have an important role contributing not only to the patient’s treatment but also in the education process. Thus, several sites, known as points of services, namely hospital emergency rooms, schools, patients’ homes, foren-

sic facilities and even in the “battlefront”, the military sites where actual war combats take place, should be considered as places to deliver e-Therapy (McGinty et al., 2006).

In the near future, new contexts could appear and evolve, namely the family that takes in the role of “provider” but in a family setting – at home or even a first primary care provider trained to conduct an e-Therapy session by an outsider that is an expert in the field (Castelnuovo et al., 2003; Grolleman et al., 2006).

### **2.3.3. Computer based learning and training systems in e-Mental Health**

According to the Institute of Medicine’s report, *Crossing the Quality Chasm*, developing “patient-specific clinical information” computer systems is critical to improve the care of individuals with a chronic illness such as a severe mental illness (SMI) (Chinman et al., 2007). Computer systems have the potential to improve the quality of health care, they are able to summarize patients’ specific information, perform evaluations, present results to therapists and support clinical decisions (Hunt et al., 1998). The majority of existing expert systems (or CDSS) and other general knowledge management computer based systems do not relate to the mental health area, neither to e-Therapy. Online psychotherapy will facilitate the development of the therapeutic relationship between patient and therapist as it usually happens in contexts that are more traditional. Hence, developers of such systems should pay special attention to this requirement (Childress, 2000). Cognitive training involves a guided practice of a set of activities that reflect the cognitive domains. Therapist support is essential for this training, whether it is an individual or group session. Family members can also conduct this training, using the before mentioned professional support. They can take the format of paper-and-pencil, computerized format or analogues to daily activities (Clare & Woods, 2004).

Computer-guided therapy is an innovative strategy that can play an important role in the future of psychological treatment (M. G. Newman et al., 1997; Postel et al., 2008). When this option is available to patients, they are free to accept/reject it with all the benefits of traditional Cognitive Behavior Therapy (CBT) available in a computer and

with less therapist involvement. In fact, Computer-assisted therapy programs can increase the cost-effectiveness of CBT by reducing the therapist contact time.

Computerized Cognitive Behavioral Therapy (cCBT) is a set of “computer programs that present the principles and methods of CBT in an interactive manner via a computer interface in two or more sessions. These sessions of cCBT can be presented either on-site (in a treatment facility), online (via the Internet), or via palmtop computers, and the level of therapist involvement can range from none to considerable.” (N. Titov, Andrews, Schwencke, Drobny, & Einstein, 2008) (p. 96).

“Intherapy” seems to be the most recent designation for internet-based psychological interventions (Carlbring & Andersson, 2006). The author subdivides the available interventions into four distinct categories: 1 – self-administered therapy; 2 – predominantly self-help therapy; 3 – minimal contact therapy and 4 – predominantly therapist administered therapy. The studies reviewed and that reflect this division suggest the Internet as a promising medium for the dissemination of psychological treatments, specifically for cognitive behavioral therapy.

Computer-aided cognitive retraining programs have several benefits for both patients and clinicians involved.

As it happens with self-help treatments and patient empowerment services, patients can self-administer these programs (Marks et al., 1998). These programs provide more therapeutic-time; allow an easy scheduling and a boost in the access to treatment. Some find it easier to disclosure to a computer system that provides safety/confidentiality guarantees. The consistency of the treatment instructions, plus the content adaption to users’ preferences, e.g. language, accent, age and gender of the voice of the program, enhances the patients’ motivation (Marks et al., 1998; M. G. Newman et al., 1997).

For clinicians, these programs allow for an unlimited number of repetitions of a given task with changes in the level of difficulty; provide reliable records on patients’ performance and do not interfere with other medication (Solari et al., 2004). They free up

some of the time to improve the given care and provide easier access to updated information (Carroll & Rounsaville, 2010; Marks et al., 1998). The first step in therapy is assessment and diagnostic evaluation. Health professionals can administer these programs using a computer in an extremely effective way. It becomes possible to avoid the lack of responses to questions, as well as, all paper related expenses (M. G. Newman et al., 1997). It also improves control on therapeutic conditions since systems provide the same instructions always in the same way. Ethical considerations are easier to preserve and the usage of these systems speeds up data collection, retrieval and analysis (including word content), that can provide feedback into the therapeutic process (Marks et al., 1998; C. B. Taylor & Luce, February 2003).

These systems also present some disadvantages: technophobia by users; inability to detect and deal with complications not solved by the system; the lack of flexibility according to a specific cognitive process and it is difficult and risky to design and maintain such a system without the help from a health professional (Marks et al., 1998).

As far as existing counseling and therapy, the online procedure mimics a face-to-face psychotherapy session, using email, virtual chat rooms, web telephony and videoconferencing (A. Barak, 1999). These programs are highly structured and use several multimedia techniques such as web pages, animations, video, sound and cartoons, they include homework assignments, follow-up and feedback sessions (N. Titov, 2007). "Traditional paper-based self-report instruments are easily adapted to the computer format and offer a number of advantages that include ensuring data completeness and standardization." (C. B. Taylor & Luce, February 2003) (p. 2).

Treatment programs available through the Internet are being designed to blend computer assisted psychotherapy and psycho-education with case management. These programs will include face-to-face contact and support groups. The expectations are that therapists include these technical approaches into their standard care practice. This is hard to accomplish since usable programs are not easily available (C. B. Taylor & Luce, February 2003). Nevertheless, the act of designing a computer-aided system can clarify what therapists really do, and so naturally, that do not even realize it. This is

easy to understand for any software engineer that had to develop a system to assist an expert in another area. Experts rarely describe their work functions accurately; they tend to minimize some steps considering them non-important (Marks et al., 1998).

It is important to keep in mind that these tools will not replace the therapist, but in fact, they will extend their power and avoid time-consuming and less profitable tasks (Carroll & Rounsaville, 2010; N. Titov, 2007).

A recent Delphi poll with a panel of 62 psychotherapy experts predicted that computerized therapies, use of virtual reality, self-help resources, and self-help techniques would substantially increase in the next 10 years (M. G. Newman, 2004).

There are several software systems available for personal use by patients such as Beating the Blues, Overcoming Depression, FearFighter, Cope and BTSteps, MoodGym, RehaCom, to name a few (Schuhfried, 2010; Tumur, Kaltenthaler, Ferriter, Beverley, & Parry, 2007). Several online sites that hold information – data banks – cover psychological occurrences, symptoms and diseases. Some provide specific self-help topics and psychological assessments that lead to counseling on whether the patient needs therapy (A. Barak, 1999).

More recently, new mobile technologies are starting to be used and there are some reports on the usage of smartphones, handheld computers, tablet PCs and personal digital assistants (PDAs) to collect real-time data on a variety of variables such as patients' thoughts and behaviors. Thus, they are extending the potential for data gathering, even though ubiquitous technology has not proved to be useful when incorporated into clinical practice (C. B. Taylor & Luce, February 2003).

In fact, there is still much work to do as far as proving the utility of all these approaches when used in clinical practices.

#### **2.3.4. Effectiveness: Assessment and Guidelines**

Effectiveness is the power to produce a decisive effect (Merriam Webster Online Dictionary, 2010). Effectiveness is a measure typically employed in the assessment of

telepsychiatry to find what technology is used (D. M. Hilty et al., 2003). How it incorporates with other services, already existing or non-existing? What are the costs? How it compares to other services and its quality?

Telepsychiatry has already proven to be effective regarding quality of care, satisfaction and education (Ganapathy, 2005). It empowers patients, providers and communities, but it is still not possible to claim that it is cost-effective (D. M. Hilty et al., 2003). Hilty provided a table with recommendations to evaluate telepsychiatry's effectiveness and, in summary, refer to the following items: access; quality of care; satisfaction; costs; realistic estimates of costs; education; empowerment and miscellaneous. There are reports on guidelines for telepsychiatry services in general, for email practices and electronic records such as the Medical Data Index (MDI) (Gadit, 2006; D. M. Hilty et al., 2002; Lauriks et al., 2007; McGinty et al., 2006; Pheby & Thorne, 1994; Todis, Sohlberg, Hood, & Fickas, 2005). Some Internet sites that also provide telepsychiatry guidelines and recommendations are the International Society for Mental Health On-line (IS-MHO), the Psychiatric Society for Informatics (PSI), the Canadian Psychiatric Association Web site, the National Guideline Clearinghouse and the American Psychiatric Association (Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services, 2010; American Psychiatric Association, 2010; Canadian Psychiatric Association, 2010; Dyer, 2001; Styra, 2004).

Evaluation is "the act of measuring or exploring some property of a system, the result of which informs a decision concerning that system in a specific context" (E. Ammenwerth et al., 2004). Evaluation of health information systems (HIS) has to deal with the actors, the people, the artifacts, the technology and the environment in which it is implemented, as well as with their interaction (Friedman & Wyatt, 2006). HIS includes "all computer-based components which are used by health care professionals or the patients themselves in the context of inpatient or outpatient patient care to process patient-related data, information or knowledge" (E. Ammenwerth & de Keizer, 2005).

The most common focus of evaluation studies are: appropriateness and efficiency of patient care, user satisfaction, and software quality.

User acceptance and satisfaction sheds a light into the usefulness of the system. Usability description from the perspective of the end-users is required. Indicators such as the time of service delivery, feasibility and changes in the number of visits and improvements in the processes of work and management (the needed higher quality of care) exist in several studies. In addition, the amount and the quality of the information provided by the system is a good usefulness indicator (Dabbs et al., 2009; B. Rahimi & Vimarlund, 2007; Rodriguez et al., 2007). Accessibility for these ICT specific solutions implies special design considerations. Consequently, it is mandatory to account for the different needs for disabled people or for the elderly, where functional limitations are a fact. A simple example to enhance access includes the translation of the application to the native language. Other examples include text colors and typefaces that are more adequate to read (Rodriguez et al., 2007; Välimäki et al., 2008).

Cost effectiveness of these applications is yet to be proved. While economic benefits can be measured as the reduction of the time spent per patient during the visits, Vimarlund et al. (2002) suggests that time and effort invested in the participation of healthcare staff in the development of information systems, exceeds in benefits the costs.

It is not straightforward to know the exact impact at the health and social levels of computer-based patient-centered applications (*E-health: Current situation and examples of implemented and beneficial E-health applications*2004; NykÄNEN, 2008; Wilson & Leitner, C. and Moussalli, A., 2004). No known standard framework exists to evaluate ICT in a healthcare setting, namely the system's productivity and effectiveness (B. Rahimi & Vimarlund, 2007).

There is a proposal with assessment items specifically for e-Therapy settings based on the existing recommendations for telepsychiatry and for MHIS in general that includes quality of care, education and empowerment, access, costs and satisfaction (Reis et al., 2010). Chapter 5.1.6-Assessment and Guidelines for e-Therapy Systems presents further and detailed information on these items.



## 2.4. Summary

Mental disorders such as schizophrenia are amongst the 20 leading causes of disability worldwide (World Health Organization, 2004). Current national policies are especially dedicated to prevent and improve mental health assistance, considering mental disorders as a public health case (World Health Organization, 2008). One of these policies includes the digital provision of mental health (e-Mental Health) information and services through Mental Health Information Systems (MHIS) (World Health Organization, 2009). There are already innumerable health information systems available in the field, and some are specific for the use in the mental health context. Nevertheless, they are not yet widely accepted and often, users report issues with their usage. Therefore, guidelines for their correct design and implementation are mandatory and the world health organization (WHO) provides a list of steps based on simple principles such as start small but keep an eye on the big picture, make it user-friendly and ensure privacy, confidentiality and address specific mental health needs (World Health Organization, 2005).

User Centered Design (UCD) is a technique based on three principles: focus on users and tasks, measure usability empirically and develop usability iteratively (Dabbs et al., 2009). Patient Centered Design (PCD) is a particular type of UCD where the end-user is a patient that will use a healthcare solution that should meet his/her expectations (Demiris et al., 2008). Several standards relate to these design approaches such as the ISO 9241 series (ISO, 2009a), that includes a revision of the former ISO 13407:1999 (ISO, 1999) and the ISO/IEC 25000:2005 (ISO, 2005). They provide practical recommendations to apply in the development of interactive systems, the software engineering approach to take when considering the usability and quality of software products and its corresponding evaluation.

e-Therapy stands as a subsystem of an MHIS that enables the electronic provision of a specific health service – therapy – where both patients and health professionals are involved. It is a novel mode of delivery for an already existing type of intervention

(Castelnuovo et al., 2003a). There are several computer-assisted approaches already available but the focus here relates only to the mental area and schizophrenia in particular. The act of designing computer-aided systems like these can clarify what therapists really do, including those tasks that they do so naturally; they do not even realize it. In addition, in the actual implementation of these systems, it is important to keep in mind that these tools will not replace the therapist, but in fact will extend their power and avoid time-consuming and less profitable tasks. One should use a framework for measuring the effectiveness of e-Therapy since this field lacks evidence of systems' effectiveness (Improving Access to Psychological Therapies (IAPT) Programme, 2007).

Experts in the field often debate what produces effective feedback; but they all agree that continuous monitoring of the patients' treatment response and provision of the information to the treating clinician are vital.



## 3. Related Work

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e-Therapy contexts should deliver quality services and provide adequate feedback to its users. Providing therapy through new ICTs requires suitable models to correctly monitor and provide visualization to health professionals, assisting them in their tasks and allowing patients to be more aware of their performance. Hence, it is important to have a model to capture the system's usage allowing the continuous monitoring of the users' actions and, on the other hand, have a proper way to provide feedback to the system users. Information visualization's primarily role is to communicate with the end-user and provide insight to them, increasing their knowledge. This section provides background material concerning models for monitoring performance in specific contexts and information visualization models.



### 3.1. Monitoring Performance Models

e-Therapy will provide training to patients and will help them in their rehabilitation process. One of the effective items credited to computer-based systems was their ability to provide feedback to end-users. Hence, e-Therapy contexts should also provide adequate feedback to its users (Bailey & Forbes, 2005; Marrs & Novak, 2004; Thelwall, 2000).

Health professionals configure activities to setup sessions for their patients and, as a result, establish specific goals for each one of them. In other words, the health professional establishes an evaluation process where the activities defined will help the patient achieve the specified goals. Therefore, when a patient engages in a session and completes the activities defined, an evaluation occurs, and end-users are able to get immediate feedback from the activity that was just completed. This session-evaluation process is similar to what happens in traditional educational settings.

Besides the feedback provided “on-the-fly”, in real time, it should also be available “on demand”, both for patients and health professionals. While a patient needs more real-time and user-related information, gathered from his/her sessions, a health professional requires a deeper knowledge about his/her patients’ performance. The information provided to health professionals regards not only the performance of patients on a specific activity of a particular session but also the complete overview of their performance within a specific timeframe. Moreover, the health professional will need access to this type of information for all of his/her patients.

In order to gather the data to use while providing the evaluation feedback, it is necessary to monitor each e-Therapy session. Thus, keeping a record for all the activities completed in every session.

Recent work offers a literature review of monitoring models in learning contexts and provides a conceptual model for monitoring e-learning contexts (Sampieri, 2008), the Learning Progress Monitoring (LPM) model.

As mentioned before, e-Therapy has numerous similarities to a learning environment where evaluation occurs naturally and is essential to provide adequate feedback to end-users. To accomplish this, it becomes crucial to have a monitoring model that effectively supports such a structure. Thus, special attention is given to the conceptual model (LPM) presented by (Sampieri, 2008).

The LPM defines a monitoring system as an implementation that supervises a process. It has the simple assumption that it is possible to monitor a learning environment using a set of pre-established indicators. An indicator is a measure obtained from the data of an event in the process, inside a predefined context (Sampieri, 2008). The indicator is a variable whose evolution on time, is of special interest. Records will support the tracking of the data that will provide the information for the established indicators. Techniques, tools and methods used to explain (interpret) the evidence present in the data collected compose the interpretation items.

Visualization is the graphical representation of the indicators' state in a specific moment of their evolution, from one state to the next, during certain periods.

The LPM model allows the supervision of the behavior of students in their interaction with the learning management subsystems, contents, tools and activities during the course. It provides feedback to the teachers, organizations, students and other subsystems. Figure 6 represents its main components:

- Indicator Components: Monitoring Objects (MO)

Each monitoring object holds their indicator definition, the description of the variables required for the data collection and the context for its interpretation.

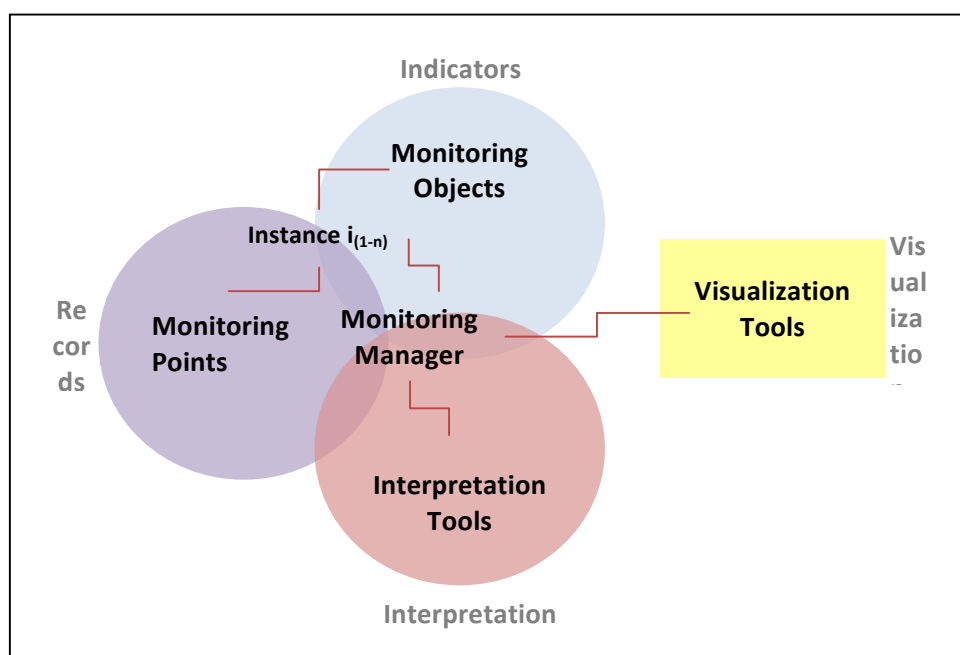
- Record Components: Monitoring Points (MP)

Each monitoring point holds the reference of at least one monitoring object. All these objects will be instantiated upon the monitoring point's scheduling. The Monitoring Agent (MA) might ask for information from the monitoring point or a specific event might occur that allows the monitoring point to work autonomously

and send the information to the monitoring agent. Hence, there are two distinct types of monitoring points: synchronous (timer and on schedule) and asynchronous (when a specific event occurs).

- Interpretation Components: Interpretation Tools (ITO)

Each monitoring object may have several and distinct interpretations, for instance goal achievement and participation index. An Interpretation tool will define the usage of a monitoring object to provide the explanation of the existing context.



**Figure 6 – Basic components of the Learning Progress Monitoring Model - adapted from (Sampieri, 2008)**

- Visualization components: Visualization Tools (VT)

Every report and chart, with distinct formats, e.g. text, charts and data structures, is suitable for tailoring, for specific system users. The idea is to provide feedback to the users according to the interpretation tools implemented in the system. This part of the system is significant enough to be included as an independent chapter (3.2-Information Visualization).



- Monitoring Manager (MM)

This is the main module of the monitoring system that enables communication through the system's agent, allows the definition of system procedures (service manager) and storing information in the database.

- Monitoring Agent (MA)

Integral part of the monitoring manager (MM), this agent is responsible for the communication between modules, it uses messages to write data or ask for data.

- Service Manager (SM), Event (E), Monitoring Database (MD) and Monitoring Objects Database (MOD)

The system has external and internal services that managed through the Service Manager (SM). This management is conducted inside the monitoring manager (MM) of which the SM is a part. The state of the system in a given time, the Event (E) works in conjunction with the interpretation tools and there are two databases used to keep information on the generated events, the Monitoring Database (MD) and the monitoring objects database (MOD).

The LPM provides a first approach for the type of monitoring that is required in an e-Therapy system. Nevertheless, temporal considerations require specific attention.

Continuous monitoring of the patient treatment's outcome, providing feedback to therapists, is a good practice that helps to improve the treatment's success and can be easily accomplished using ICT (Percevic, Lambert, & Kordy, 2004). This concern is included in the required quality management for the evolution of managed care. Some authors have already demonstrated how worthy it is to provide feedback to therapists regarding patients at risk or to motivate and educate therapists to adapt therapy length to the impairment of a specific patient. Others consider that the feedback provided should be correctional – should state what had or has to be done and why. Despite the opinion on what produces effective feedback, frequent monitoring of patient

treatment response and provision of the information to the treating clinician, are required (Percevic et al., 2004).

To provide adequate feedback, systems usually use psychometric instruments such as short symptom-oriented scales and self-report scales, e.g. questionnaire presentation module and the scoring/feedback module. These instruments allow the surveillance of progress and are already available in electronic format.

To enhance ICT tools for monitoring psychotherapy progress, one can use contributions from research on statistical data presentation (visualization). User interface design and its evaluation should get more attention (van Veenendaal, 2002). While providing feedback has demonstrated positive effects, further research will help to determine what factors contribute to their effectiveness. Why do therapists accept the suggestions proposed by the systems? Are the “soft factors” such as expectations, learning, attention and psychological reactance, considered?

## 3.2. Information Visualization

“A picture is worth a thousand words” is a popular saying usually labeled as a Chinese proverb that refers to the idea that a graphic representation is the best way humans have to understand concepts (Dansereau & Simpson, 2009). In fact, our neural processes optimize the organization of visual displays that allow us to recognize important complex patterns, otherwise difficult to understand.

Information Visualization, also known as InfoVis, “starts with information in the form of data” and then proceeds with the process of transforming information into knowledge. Finally, knowledge assumes a visual form that makes use of humans’ natural visual capabilities (S. K. Card & Mackinlay, 1997; Chittaro, 2001). Visualization provides an interface between the human mind and the modern computer (Gershon, Eick, & Card, 1998). The idea is to enable this knowledge transformation using computers and provide a better understanding of the information available. Thus, users will be able to use their visual pattern recognition, detecting aspects that are unnoticed by automatic systems (Larkin & Simon, 1987).

The primary role of functional information visualization is to communicate with the end-user, while the goal of aesthetical information visualization is to elicit an emotional response from users (Chen, 2010). *“Beauty and brains, pleasure and usability go hand-in-hand in good design”* (Norman, 2005). Emotion is essential for every human being. It goes hand-in-hand with affect and cognition. While cognition allows us to interpret the world, affect, that includes emotion, provides a judgment mechanism that allows us to evaluate a context (good or bad, safe or dangerous) and provides means to improve our probability of survival. An attractive design is not necessarily the most efficient one. On the other hand, while utility and usability are important, emotions, fun, pleasure, joy, excitement, anxiety, danger, fear and range affect the way we behave and think. Beauty is a fact in our everyday life and has a direct impact on the products we buy and use.

One of the greatest challenges of the 21<sup>st</sup> century is to effectively understand and make use of the vast amount of information produced in distinct areas (C. Johnson et al., 2006). InfoVis allows the illustration of large datasets and provides users with the ability to manipulate data interactively. This way, it is easier to detect patterns, assess situations and prioritize tasks. It reduces and refines data streams rapidly, providing a competitive edge to its users. A computational tool allows users to derive knowledge from data. Contrary to other computer science disciplines, visualization does not try to replace humans with some type of automation; it requires explicit human interaction in the system's loop to extend its capabilities.

Edward Tufte (1983) has an excellent exposition on visualization of data and methods to display information. Tufte provides two and three dimensional (2D/3D) semantics and general rules for layout, color composition and attribute mapping. However, aspects such as data abstraction, dynamic interaction and utility of the display assessment are practically ignored (Martins et al., 2008). Later, Shneiderman (1996) proposed a useful approach for designing advanced user graphical interfaces the Visual Information-Seeking Mantra – Overview, zoom and filter, and details “on demand”. Shneiderman classified InfoVis approaches according to two dimensions data type and task each with seven levels.

InfoVis data types include: one dimension (1D) for linear data sequentially ordered, e.g. alphabetical list of names, program source code and textual documents, two dimensions (2D) for planar or map data covering some part of an area, e.g. maps, newspapers layouts and photographs, three dimensions (3D) for data with volume, e.g. molecules, human body and buildings and multi-dimensional for data with  $n$  attributes in a  $n$ -dimensional space, e.g. records in relational and statistical databases. Other dimensions include temporal data with start time, end time and possible overlaps on a timescale, e.g. medical records, project management and video editing, trees for collection of items hierarchically linked, e.g. computer directories, business organizations and genealogy trees and network for collection of items linked through a graph structure, e.g. telecommunication networks and the Web. Visualizing  $n$ -dimensional data and,

particularly, temporal dimensions, where data can be linear as well as cyclical over time and is collected and presented in different granularities of time, is a real challenge (Bade, Schlechtweg, & Miksch, 2004).

InfoVis tasks considered by Shneiderman, include overview of the entire data set at a glance, zoom to watch more closely a subset of the data, filter out uninteresting items, details-on-demand to select a couple of items to get more details, view relationships amongst items, support undo, replay and progressive refinement (history) and allow the extraction of a subset of items. While not being a part of the initially proposed set, interactivity is gaining respect in the field (Heer, Card, & Landay, 2005). It increases the user engagement with the observed data and enhances the exploration abilities.

These tasks and data types mixed and combined into InfoVis tools and techniques allow users to explore their data sets and obtain some insight.

The best information visualization is the one that conveys meaning, insight, to its users (Rester et al., 2007). Insights are something unexpected that provides a deeper understanding, a new-way of thinking, and eureka-like experiences. Discovering hidden connections and patterns is important. A brokerage mechanism and a burst function of recognition characterize the nature of an insight. A brokerage mechanism occurs when previous unconnected thoughts are linked together while the burst function usually appears connected to emotional reactions. Insight is “the understanding gained by an individual using a visualization tool (or parts thereof) for the purpose of data analysis which is a gradual process towards discovering new knowledge” (Smuc et al., 2009).

Van Wijk (2006) refers that an InfoVis system can be, at its most simple, a visualization of a “single bit” – the smallest quanta of information. Card, Mackinlay and Shneiderman (1999) extend its meaning to support that InfoVis aims to amplify cognition and provide insight. Pousman et al. (2007) presents a set of different types of insights that are not mutually exclusive:

- Analytic – the most traditional approach. It relates to exploratory analysis and extrapolation. Awareness is a special case of insight that mostly relates to social

communication and people's abilities to keep up to date on the outside world and on the information that will influence the future.

- Social – relates to social networks, their social situations and life. These insights are usually something that the user already suspects but requires confirmation.
- Reflective – relates to the personal perspective one can have of the data, by adjusting the point of view to accomplish a certain “distance” from the situation.

Medical staff, e.g., in intensive care units, monitors a huge amount of high-dimensional and time-oriented data that, when visualized, helps in the diagnosis and in the treatment planning (Bade et al., 2004). The visualization process aims to provide insight. Nevertheless, much of the available techniques do not provide adequate interaction techniques to explore and navigate the data and its temporal dimensions.

Medicine requires new methods to improve health. These methods should allow the visualization and monitoring of development, progress and therapies, thus enabling researchers and providers to adjust policies to the actual situation, based on the vast amount of information available today. Visualization has the power to transform health care enabling users' empowerment, improving quality, research and lowering the associated costs (C. Johnson et al., 2006).

It is important to evaluate InfoVis tools and techniques in order to know whether they are actually useful or not for their users. Rester (2007) proposes a classification system based on insights as the outcome measure. Results are highly dependent on the tasks the subjects have to solve. According to a recent review of the state of the art in information visualization, there is a substantial lack of theoretical foundations in the field (Chen, 2010). Moreover, there is no adequate quantitative measure for information visualizations. They can relate to different perspectives, the technological perspective measures in terms of efficiency and effectiveness, the economical one, benefits and costs associated with the development of the visualization method and the ones for user tasks perception and exploration, and its consequences and limitations (Wijk, 2006). InfoVis can be seen both as an art form, as design and as a scientific discipline.

The human visual system allows us to detect interesting patterns rather quickly. This helps in the discovery of insights in large amounts of somewhat unstructured data.

### 3.2.1. InfoVis Tools and Techniques

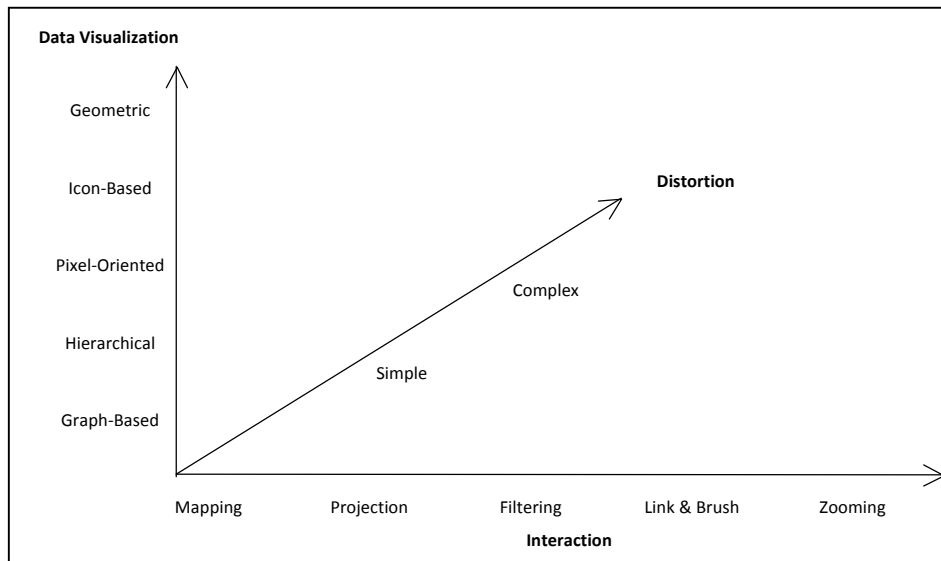
Several methods and processes used in applications allow users to visualize and interact with the presented information. These are the so-called InfoVis tools and techniques.

According to Keim (1997), visualization techniques have three major goals, explorative analysis, confirmative analysis and presentation. Explorative analysis starts with a set of data and no hypotheses, the process is interactive, usually in the search for patterns, structures or trends. The outcome of the process is the visualization of the hypotheses discovered. Confirmative analysis starts from a set of hypotheses, the examination of the data is goal-oriented and the visualization allows the confirmation or rejection of the hypotheses. Presentation assumes that the facts and the visualization techniques are pre-determined, so the facts are final, static and visualized in high quality.

In his review, Keim classified visualization techniques according to three distinct dimensions: data visualization, distortion and interaction, as can be seen in Figure 7.

Data can be represented as geometric transformations and projections, symbols, colored pixels, hierarchical partitioning into subspaces, graphs or a hybrid combination of all of them. Data visualization techniques frequently used include scatterplots, landscapes, projection pursuit, hyperslice, parallel coordinates, chernoff faces, stick figures, tilebars, recursive pattern technique, circle segments technique; dimensional stacking, worlds-within-worlds, treemap, cone trees, infocube and basic and specific graphs.

Distortion implies a modification of the image to allow a visualization of larger or smaller amounts of data. Perspective wall, bifocal lenses and fisheye views are examples of simple modifications.



**Figure 7 – Visualization Techniques Classification** (D. A. Keim, 1997)

Interaction allows a more effective exploration of the data, enabling the dynamic generation of new visualizations. It is possible to have a simple and direct mapping between data attributes and axes or variations of the data with projections and animations in 2D or 3D. Some techniques allow the selection of subsets (filters), linking and brushing with other visualizations, upon change, zoom to provide an overview of the data and the possibility of interactively obtaining further details on a subset of the data presented.

The above mentioned visualization tools have much to gain from other areas of interest, such as statistics, data mining and image processing, to facilitate the analysis of both the qualitative and quantitative perspectives. The visual exploration process is based on the nature, options, limitations and effects of human perception and cognition. One should research new possible systems and techniques and design interaction according to it, in order to lead visualization to its maximum power (McCandless, 2010).

Wijk (2006) presents a simple model for visualization (Figure 8). The model does not provide a taxonomy to position the different visualization methods; it simply tries to describe the context where visualization occurs. Rectangles indicate containers while circles refer to processes.



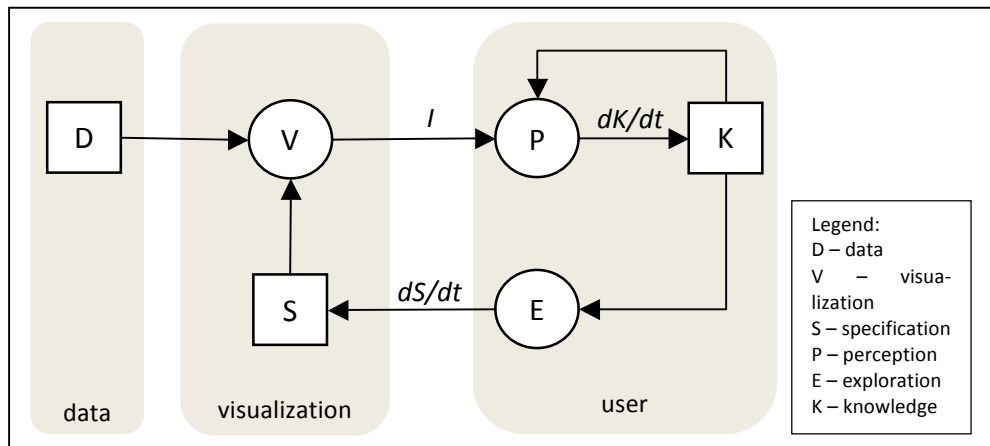


Figure 8 – A Simple Model for InfoVis - adapted from (Wijk, 2006)

The central process in the model is the visualization ( $V$ ) that occurs upon application of a certain specification ( $S$ ) to the transformation of the data ( $D$ ). This produces a specific image ( $I$ ) that varies according to time. The user has a perception ( $P$ ) of the image presented and this process augments its knowledge ( $K$ ). This increase in knowledge depends on the current knowledge of the user and its perceptual and cognitive abilities. The process itself will also change these abilities. The available interactive exploration techniques ( $E$ ) will allow users to change the specification and, thus, obtain new visualizations with new timely images.

Visualization tools' success is highly dependent on the interaction techniques used (Saraiya, North, & Duca, 2005). Designers of such tools should provide a consistent and usable interface and clear feedback to the users. Another important aspect that usually is not well thought-out is the domain relevant inference linking that enriches the insights' discovery process.

Saraiya et al. (2005) conducted the evaluation process of these tools in a different way. They started by providing their own definition of insight and then, measured them accordingly, using their characteristics as parameters, for instance, the amount of time taken to reach the insight. They used the think-aloud protocol in a rather extensive way, as it allowed a deeper and qualitative explanations of the qualitative results obtained.

Keim (1997) also provides a comparison table of the techniques and concludes that different techniques are more useful when used with different types of data among others, relational databases, hierarchies, graphs and time-related data.

### 3.2.2. InfoVis in Medical Systems

Information systems in the health domain have changed in the last 30 years especially in shifting from knowledge to data-intensive systems (Horn, 2001). There has been also a shift from static to dynamic systems where, besides capturing the patient's current situation, they capture continuous data from the patient's treatment process. A treatment is a medical procedure that is highly correlated with time, and patient data grows over time and forms the basis for many medical decisions (Kosara & Miksch, 2001).

Presenting the data and information in a coherent way in order to support the data analysis process is a major concern expressed by Aigner & Miksch (2006). So far, information regarding treatments, plans, steps performed and results obtained in the process, is roughly included in the analysis process by means of physicians' memory recall. In the health domain, data is collected on a "per patient" and "per episode" basis, growing exponentially over time. Time-related data has a substantial large number of data points present in a simple visualization when compared to what usually happens with other data types (Lammarsch et al., 2009). Therefore, aggregation and scrolling becomes necessary for a single conventional visualization. The corresponding medical databases are becoming even more complex and are growing continuously (Dugas, Kuhn, Kaiser, & Überla, 2001). Hence, patient data monitoring systems face a variety of challenges that include the combination of low frequency and high frequency data and the corresponding processing of high dimensional data.

Hence, InfoVis becomes essential for health professionals and patients (Heer et al., 2005). It is one of the stages in the process of continuous monitoring, querying and analysis of time-oriented clinical data (Spokoyny & Shahar, 2004), that is crucial for making sense of complex data. Visualization techniques have proven to be useful in data exploration for discovering patterns and trends (D. A. Keim, Hao, Dayal, & Lyons, 2007).

The chief goal of InfoVis in a medical system is to provide a more intuitive visual presentation of data that is easy to learn, understand, recognize, navigate and manage (Martins et al., 2008). It delivers the visual possibility to magnify subtle aspects otherwise difficult to notice such as the diagnostic, therapeutic, patient management and healing processes. It also prevents information overload, allowing users to master larger quantities of information. Horn (2001) refers several aspects to explore such as analysis and abstraction of temporal data, plus graphical visualization tools. The tools will provide a better understanding of the recent past of a patient and will be able to present the large extent of information gathered by current ICT systems. By providing this information in an adequate and useful way, it will be possible to enhance the effectiveness and efficacy of the decision-making process (Martins et al., 2008).

It is essential to prove the usability of these tools in order to improve both time and accuracy when performing clinical interpretation. In fact, systems such as computer-supported protocol-based care must demonstrate immediate benefits in solving the patients' problems in order to be more widely used (Gorman & Helfand, 1995).

Plaisant (2004) supports that, while it is possible to measure the usability of information-visualization tools in a laboratory, the real test should be done in a real setting, with real end-users. Empirical evaluations of information-visualization methods will help in the development of innovative information visualization techniques and in their assessment (Martins et al., 2008). To evaluate such systems and techniques, a laboratory setting that allows a quantitative user study that measures user performance on selected tasks might not be enough. In fact, qualitative methodologies can work as a complement to discover if a visualization tool has helped a person solve a problem. Such studies include ethnographic analysis and are a powerful measure of success, especially when the tool becomes so widespread, that its use is considered commonplace.

There is an actual need for models, methods and tools to improve analysis and visualization of data in the decision-making and learning process in health related contexts, namely in the support of the daily diagnostic work (Falkman, 2001). It is necessary to

understand how to implement the “formalize-collect-view-analyze-learn” flow. The available clinical information needs to be integrated and presented in multiple and understandable ways to provide new perspectives to research (Bui, Aberle, & Kangarloo, 2007).

Despite the fact that this growing concern with information visualization has started rather recently, visualization techniques such as maps, bar and pie charts and flow diagrams, have been available for a while now (Kosara & Miksch, 2001). Nevertheless, experts that need to perform data analysis on large multidimensional data sets need to rapidly identify problem areas and easily drill into them, to get detailed information. This type of feature is not achievable through charts and tables since they lack data distribution of the attributes, patterns, correlations, trends and detailed information (D. A. Keim et al., 2007).

There are multiple methods to visualize data, especially of time-oriented data in medical domains (Martins et al., 2008; Shahar, Dina Goren-Bar, Boaz, & Tahan, 2006). The time dimension includes both temporal reasoning and data maintenance. The first one refers to the data acquired upon patient monitoring, disorders diagnosing, therapy scheduling and application. While the second refers to the post-fact data stored and further extracted (Spokoyny & Shahar, 2004). Time-dimension conditions possess time annotations such as start time, stop time, and duration (Kosara & Miksch, 2001). A mandatory technique in temporal visualization is time lines, that according to Tufte (1983), is a very powerful visualization technique used long before computers even appeared.

Currently, there are innumerable InfoVis systems and techniques in use in the health context. Several systems include one or more techniques, and seldom, the literature treats a system and corresponding techniques as one, a unique and single item.

Temporal Objects provides visualization of temporal data with distinct granularities and depict complex time annotations. The Set of Possible Occurrences (SOPO) view provides special consideration on uncertainty and indeterminacy of temporal constraints, but does not make time notions easy to understand. Facets are vertical seg-

ments that represent a group of similar events that show different views of the same information. TimeFinder is an ontology-based approach that constructs queries from the underlying data, a distinct approach to temporal-abstraction ontologies. Multiple Views is a proposal for an information visualization method that provides numerous representations focusing on distinct aspects of the data and includes two focus plus context techniques: overview plus detail and fisheye view (Aigner & Miksch, 2006; Combi, Portoni, & Pincioli, 1999; Kosara & Miksch, 2001).

Besides these time-related systems, there are also others and more general options such as the use of concept and mind mapping as a way to express and organize knowledge and pass it from experts in a field to others, MediMap is such an example. MediMap is a data mining and decision support system that tries to improve health-care knowledge management. The *mdplot* is a medical database plot that uses a XML-based graphical straightforward representation of structure and content of medical databases. Table lens displays large data tables by distortion of spreadsheet's table cells, the same transformation function used for the Bifocal Lens applied to two dimensions. There is a Fisheye View for hierarchically clustered networks, called Variable Zoom. It provides a method for zooming into clusters magnifying the zoomed content and shrinking the other nodes/clusters. InfoZoom displays multiple data sets in a highly compressed table that fits into the screen. Another information-visualization technique is the Interactive Parallel Bar Charts (IPBC) system that is the outcome of integration of two and three-dimensional interactive techniques. These are all adapted and widely used in the health context. SimVis and The Cube were designed to help in the classification and clustering of clinical examination data. They possess an architecture that separates the recording of data from the visualization process. SimVis has a similarity assessment-based interaction model and The Cube appears as the preferred option of clinicians since it suggests that the visualization model, space of interconnected points, is closer to the conceptual model of clinical experience. A 3D experience is preferred to a 2D visualization that seemed obvious and easier to understand. Most 3D layout techniques include visual clues like transparency, depth cueing and shadows, among others

and the ability to navigate and traverse the structure (Dansereau & Simpson, 2009; Falkman, 2001; Lavrac et al., 2007).

Aigner et al. (2006) researched several commercial software products that include IntelliVue, Chart +, Visual Care and QCare. IntelliVue by Philips Medical Systems, formerly known as CareVue by Hewlett-Packard, is a highly customizable patient data monitoring system used for a broad range of different medical units. Chart+ is a module of a comprehensive software package for critical care units offered by Picis. Visual Care is another software module offered by Picis, which mainly focuses on patient care, and planning. The Critical Care Company that offers a palette of applications for critical care is the owner of QCare. None of these commercial solutions provides visualization logic for treatment plans and do not include several temporal concerns that are extremely important to make sense of the existing information.

We refer here only the most relevant systems available and currently in use in our context of action, although there are many systems available that are not mentioned. Thus, and according to the specificities of our context, a health context with patients' treatments data gathered through time, we will consider with greater depth, two classes of systems: desktop standalone applications and online applications. The scientific visibility and the online report of community usage are the chief aspects considered in the selection of the systems presented below.

#### 3.2.2.1. Standalone Systems

The LifeLines project enables the exploration and visualization of personal histories using patients' personal records. The project had its origins inside the Human Computer Interaction Laboratory (HCIL), Visualization Area, of the University of Maryland, USA. The prime investigators of the project were Catherine Plaisant and Ben Shneiderman that first described the system in 1996 (Plaisant, Milash, Rose, Widoff, & Shneiderman, 1996). LifeLines introduced lines that translated into graphical form the lives of patients. Cousins and Kahn (1991) first introduced the concept of graphical clinical timelines and temporal visualizations. LifeLines further developed the idea to display chronologies of medical data and social histories. It is based on lines that repre-

sent time spans and is extremely similar to Gantt charts. It cannot represent time uncertainty or undefined values and, thus, cannot be used to depict time annotations (Kosara & Miksch, 2001). While it presents the temporal abstractions in a quite intuitive way, i.e. treatment plans with different states such as suspend, reactivate, and abort it is not able to provide domain-specific abstraction knowledge (Plaisant, 2004). It lacks an abstraction knowledge module, similar to the one present in KNAVE-II, a client for the visualization, explanation and the interactive navigation through temporal data from the medical domain ontology (Martins et al., 2008). Currently, the system has evolved to LifeLines2 (2010) where some new interaction techniques were added. The “Align-Rank-Filter” framework, for instance, has shown to improve user performance speed in the tool usage, but this recent version shows no further improvements on dealing with time uncertainty or knowledge abstraction.

Another rather relevant project is the Asgaard Project that includes Asbru, an XML-based language, used to represent clinical guidelines, protocols and plans. The authors included flow-chart and structograms (Nassi-Shneiderman diagrams), PERT charts, Petri nets and state transition diagram (Aigner & Miksch, 2006).

AsbruView is a graphical tool that supports creation and manipulation of time-oriented, skeletal plans, clinical protocols and guidelines (Kosara & Miksch, 2001). Its purpose is to provide a user interface for comparing and analyzing treatment plans as well as patient data of several patients on a single screen. AsbruView’s Time Annotation Glyph is a timeline and glyph based visualization specially designed to depict time annotations, thus making time easy to understand.

#### 3.2.2.2. Online Systems

“Many Eyes” is a web site that enables each individual user to access to the visualizations and data sets contributed by other users, trying to reach a broader audience and “democratize” visualization technology (F. B. Viegas, Wattenberg, van Ham, Kriss, & McKeon, 2007). “Many Eyes” is a joint program by IBM Research and IBM Cognos software group that continue to provide a free public experiment, betting on the “power of human visual intelligence to find patterns” (F. B. Viegas et al., 2007). “Many

Eyes<sup>'''</sup> visualizations are always created online; users do not have to create them separately and then publish them. The system provides several visualization options suggesting categories to end users. Thus, users have categories that range from relationships among data points, scatterplots and network diagrams, to temporal representations, line and stack graph, passing through text analysis and geographical map representations. "Many Eyes" provide guidelines for the data format to upload for their site, enables users to create their own visualizations, share them, and comment on theirs and others results.

Another web site that also makes use of several techniques for visualization of clinical information is "PatientsLikeMe" (Frost & Massagli, 2008). It is a health information system where online communities of patients, with the same disease, share their clinical data. Each patient reports its health information, which is then, presented graphically. The first implementation of the system assisted patients with amyotrophic lateral sclerosis (ALS), also known as motor neuron disease or Lou Gehrig's disease (Frost & Massagli, 2008). The goal was to discover how the data-sharing model affects patients' participation in medical decisions and their daily organization. This community tool currently provides support to patients from other disorders including epilepsy, organ transplant and mood conditions. It offers a graphical display of health information instead of static lists and tables. There is a line graph chart with the individual's functional level over time and a backdrop of the population-level data. Several modified Gantt charts show all the treatments and symptoms experienced by the patient. It also houses a set of user-generated comments about the data or other medical information.

On the same line, but more recently, *CommentSpace* (2010), a new visualization tool that allows users to interact socially while exploring the data, appeared. It works within a social network, the Facebook<sup>™</sup> and enables users to explore existing datasets and discuss their data analyses with other users. This tool was developed by researchers of the Berkeley Institute of Design (BiD) from where the *prefuse* development kit (Java) and the corresponding *flare* development kit (Actionscript), also appeared. These last



two tools are open source libraries that allow a configuration for a specific context and reflect existing theoretical models, information visualization' reference model or data state model.

Recently, the founders of "Many Eyes", Fernanda Viégas and Martin Wattenberg, considered informal visualizations not only important but fundamental sources for InfoVis development (F. B. Viegas & Wattenberg, 2008). Techniques such as tag clouds that did not emerge from within the visualization research community, can and should be acknowledged and adopted by theorists. "Phrase Nets" is based on tag clouds and is a success example of this line of thinking (van Ham, Wattenberg, & Viegas, 2009). Both researchers are currently leading Google's "Big Picture" visualization research group in Cambridge, Massachusetts.

The TimeLine project approaches the situation from a different perspective (Bui et al., 2007). The framework enables the reorganization and filtering of clinical data and specification of relationships and conditions that dictate the presentation of a data element (graphically). The system provides visualization of Integrated Patient Records (IPR) and has three modules: data access and integration, data mapping reorganization and clustering and data visualization. The time-based display can support context-sensitive visualization, while providing a problem-centric solution. TimeLine uses a visualization dictionary (TVD): a 3D space (data type, medical problem and visualization metaphor) where each point defines for each data item a preferred visualization method. The system classifies time using chronological clusters or time semantics. The k-means algorithm and a later reference to the time between events as the distance is the way to form clusters. Semantic periods encompass several time abstractions such as episodes of care, diagnostic phase, treatment – onset, intervention and resolution. Since then, several authors have used to the timeline technique to improve their data sets visualization (Gill, Chearman, Carey, Nijjer, & Cross, 2010; Mazur, 2008).

Nevertheless, whenever considering temporal visualizations, there are still open problems to handle and solve. How can one represent cyclical events in the best way? How

should one deal with uncertainty? How can one introduce context and domain-specific semantic and produce useful knowledge?

### 3.3. Summary

Continuous monitoring of the patient treatment's outcome, providing feedback to therapists, can improve the treatment's success and can be easily accomplished using ICT. Experts in the field often debate what produces effective feedback; but continuous monitoring of the patients' treatment response and provision of the information to the treating clinician are required. The Learning Progress Monitoring (LPM) model defines a monitoring system as an implementation that supervises a process. It provides a first approach for the type of monitoring that is required in an e-Therapy context.

Nevertheless, temporal considerations are an important aspect and require specific attention. Especially in an e-Therapy setting, patients do not use the system at specific moments of time. Despite the fact that sessions are scheduled, patients are free to conduct their virtual sessions whenever they feel like it. They can repeat the sessions and inclosing activities and this produces a vast amount of information with corresponding timestamps. There is no specific time pattern in the information gathered, but it still needs to be presented in a suitable and useful way for users.

The best information visualization is the one that conveys meaning – insight – to its users. Something unexpected that provides a deeper understanding and eureka-like experiences, allows user to discover hidden connections and patterns. The InfoVis model proposed by Van Wijk (2006) is quite simple and tries to describe the context where visualization occurs. Data undergoes trough a transformation according to a certain specification, an interactive exploration technique, and visualization occurs. The user has a perception based on the image presented and this process augments his/her knowledge. The user controls this cyclic and interactive process. Visualization tools' success is highly dependent on the interaction techniques used and should contain a consistent and usable interface and provide clear feedback to the users.

Following the guidelines provided by Keim (1997) a system that integrates visualization techniques must aim at three goals: enable an explorative analysis, allow a confirmative analysis and present the information. Therefore, an e-Therapy system must, be-

sides presenting and providing the final information in a static and high quality environment, possess an interactive process, allowing users to search for patterns or trends.

Although the existence of many InfoVis systems, visible in the selection mentioned above, there is an actual need for models, methods and tools to improve analysis and visualization of data in the decision-making and learning process in health related contexts, namely in the support of the daily diagnostic work (Falkman, 2001).



## 4. Research Design

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According to Munzner (2008) one should present one's work as a possible option amongst the alternatives available and then, demonstrate why it is the best choice. Simply documenting the end result is not enough to justify why it is a solution for the problem (Wijk, 2006). Results can rely on laboratory settings, or can rely on field studies, that involve a set of well-combined techniques.

This section presents the design of the research conducted. First, we clarify the domain of the problem and the specific intervention point of the work. Then, we present the research question of the study and describe the methodology and research method chosen, to collect and analyze the data.



## 4.1. Problem Statement

e-Mental Health is still in an embryonic phase and so are the related and currently available e-Therapy's sites. Schizophrenia is a chronic mental condition with a high prevalence. Its treatment is not yet known by the scientific community and there is a wide spectrum of typologies of the illness that provide a large amount of distinct medical situations, including comorbidity states, that lead to rather serious and poor prognoses (World Health Organization, 2007a). There are an increasing number of schizophrenia-diagnosed patients despite the fact that according to the experts, a simple schizophrenia diagnosis is rare. The wide spectrum of existing typologies of the pathology and the fact that morbidity is a reality produces a rather complex working scenario, especially for non-experts in the field (Bhugra, 2005; McGrath, 2008; S. Saha et al., 2005; S. Saha et al., 2008).

Furthermore, clinicians often refer a certain loss of accuracy since some of the information generated in therapy sessions with the patients is often lost or only remains in the health professional's memory. The few ICT tools available, mostly commercial and proprietary are only available as standalone installations on a per-desktop licensing base (D. M. Hilty et al., 2002). Moreover, besides not being very appealing for the end-user, they are extremely difficult to work with (Christensen, 2007).

Another typical situation occurs for outpatients that need to access the information from outside of the clinical facilities. Suggestions to solve the problem include providing a web-enabled solution available anywhere and at any time (K. M. Griffiths et al., 2007).

It is imperative to have an effective way to monitor patients diagnosed with a schizophrenia typology that have a poor prognosis and a cognitive rehabilitation training program as part of the treatment plan (Marks et al., 1998). Their progress, evolution and performance during the treatment sessions should be available for future use in their own personal treatment or for other, similarly diagnosed patients (C. B. Taylor & Luce, February 2003).



Therefore, it is important to create an ICT system that proposes a solution to overcome some of these difficulties while satisfying the needs here described. It should provide support to traditional therapy sessions, presenting the similarities and differences regarding patients' outcomes. It should also enhance the cognitive training at home, outside the clinical settings that allows families to be an active part of the treatment process of their relative. Health professionals could use it as a useful complement for their work, an auxiliary tool in the therapy process and an aid tool to complement the patient's clinical evaluation and enhance further scientific studies.

## 4.2. Research Questions and Objectives

As new data accumulate, only a few lucky hypotheses survive the fresh empirical onslaught. Over time, most hypotheses eventually need amendment or outright rejection (McGrath et al., 2008). This thought allowed us to provide an answer to the following research question:

- What can we learn with the introduction of an ICT system that monitors and provides visualization of the performance of schizophrenia patients, in e-Therapy settings?

The analysis of the outcomes produced on specific e-Therapy contexts should enable: the study of performance signs, as far as cognitive skills enhancement (rehabilitation) is concerned and the feedback of obtained results provided into the therapeutic model. Besides, the data gathered by the system will be available for further and future research studies that will open new frontiers in the research of this field.

Several additional questions emerged naturally during our study. The following are other significant questions to which we provide some insight in this dissertation:

- How is it that the introduction of an ICT system influences the existing therapy process? Which is better: the traditional setting or having an ICT system as an e-Therapy tool that complements the session?
- How do patients use an ICT system?
- How do psychiatrists and therapists use an ICT system?

- Why do patients and health professionals use an ICT system? Are there differences amongst sites of application of the system?

In order to achieve the initial proposed goal we had to accomplish the following milestones:

- Develop an e-Therapy platform that provided an actual therapy environment for patients and health professionals;
- Monitor patient's execution of activities in e-Therapy sessions - develop a system that collects information, using established measures (indicators) and records states, during e-Therapy sessions;
- Apply the system in a real setting (with real users: patients and therapists);
- Visualize the results obtained in e-Therapy sessions - develop a system with a graphical representation of the state of the indicators and states considering a temporal axis. Thus, it should be possible to see the system global state, the statistical information centered on the performance of the patients that use the system, in a specific moment and its evolution from a state to the next, during certain periods of time;
- Establish a monitoring and visualization model that easily translates the outcomes measured and how the results were obtained - develop a model that, using the actual measures (indicators and states) of real users of a system, can be applied to set up and conduct new e-Therapy sessions;
- Apply the model to a new real setting, monitoring and visualizing the obtained results;
- Identify the level of satisfaction of the users with the system's usage;
- Provide additional insights on the data collected, presenting the information under different perspectives, such as graphical representations of the indicators considering a temporal axis.

In order to complete all the milestones listed above, provide an answer to the research question and achieve the established goals, we adopted an effective research methodology to conduct our empirical work.

### 4.3. Methodology

In order to select an adequate research strategy, we compared the available strategies. These strategies incorporate tried and valid methodologies that have already proven to be adequate for specific circumstances.

The first major distinction in the classification of methodologies is usually between quantitative vs. qualitative methods. Initially, quantitative methods were related to natural sciences but nowadays are commonly accepted in social sciences, e.g. surveys and laboratory experiments. Qualitative methods were initially developed for the social sciences. They include methods such as action research and case studies. In recent times, researchers suggest triangulation that deals with the combination of methods and approaches to conduct a better evaluation study (Kaplan & Duchon, 1988). It usually refers to the employment of multiple sources of data, observers, methods and theories while investigating the same event. The goal is to obtain more valid and complete results.

In science, it is important to know the philosophical assumptions that provide “validity” to a specific research, and, which research methods are more appropriate. There are many and divergent perspectives on this subject, including authors that state that philosophies are not always on opposite sides and can be lodged into the same study (Lee, 1989). The position, followed by Orlikowski (1991) and later adopted by Myers (1997), assumes three distinct philosophies or paradigms: positivist, interpretative and critical. For the positivist approach, researchers assume that reality is objective and, as such, is measurable independently of the researcher and instruments used. Generally used to test theory, includes formal propositions, hypothesis testing and quantifiable variables. The critical approach assumes reality in social terms, produced and reproduced by people. In this line of thought, a social critique tries to shed some light into the oppositions, conflicts and contradictions that exist in society. The interpretive approach con-

siders reality as a social construct based on language, consciousness and common values. Used to attempt to understand phenomena, without the strictness of pre-defined variables, an interpretive researcher relies on the human perceptions upon the phenomena.

For Information Systems (IS), the interpretive approach is "aimed at producing an understanding of the context of the information system, and the process whereby the information system influences and is influenced by the context" (Walsham, 1993) (p. 45). For our study, this appears as the most adequate paradigm since the sites for application of the study are rather harsh environments. There are scarce resources available; including patients and therapists, and most times, it is not possible to gather a reliable amount of information. Therefore, we can say that our reality is a social construct defined by the human perception of those involved in the usage of the information system, influencing and being influenced by the system.

Another important aspect of the strategy to employ in the study is to choose a qualitative research method that is accountable for the process used by the researcher to collect the data. Amongst the various options available, "Action research aims to contribute both to the practical concerns of people in an immediate problematic situation and to the goals of social science by joint collaboration within a mutually acceptable ethical framework" (Rapoport, 1970)(p. 499). Ethnography is another approach that implies that the researcher must live in the context of study, and then describe and contextualize the observed phenomena (Orlikowski & Baroudi, 1991). Grounded theory is "an inductive, theory discovery methodology that allows the researcher to develop a theoretical account of the general features of a topic while simultaneously grounding the account in empirical observations or data" (Martin & Turner, 1986). As far as the "case study" method is concerned, there are several interpretations available. The most cited author is Yin (R. K. Yin, 2002) that defines a case study as "an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used" (R. K. Yin, 2002) (p. 23).

From the methodologies presented above and as far as qualitative approaches are concerned, each has its own advantages and disadvantages. Nevertheless, they all provide the collection and analysis of empirical evidence. The data collection is achieved in distinct ways and can be used for three purposes: exploratory, descriptive or explanatory.

According to Yin (R. K. Yin, 2002; R. K. Yin, 2003) the selection should consider the following three conditions: the type of research question posed; the control the investigator has over behavioral events and the focus on contemporary over historical events. The research question and secondary questions proposed in section 4.2 refer to “how” or “why” questions about a contemporary set of events, over which the investigator has little or no control. Thus, the reviewed literature suggests that the viable option in the methodology falls within a group of case studies’ typologies.

Distinct typologies of case studies are available, regarding both the number of cases to study and their implementation conditions. Upon the possibility to replicate a case study, enhancing the analytical conclusions that can be drawn from the two cases, using multiple-case designs is favored over a single-case option (R. K. Yin, 2002). Using more than two cases produces a stronger effect, but at least two cases should be a goal, since single-case studies are highly criticized for their uniqueness conditions. Multiple-case studies are likely to have higher quality the more they include positivist-like features, such as hypotheses and rival explanations. Case study protocols with a clear distinction between evidence and interpretation are also considered valid approaches (R. K. Yin, 1999).

An important fact is that for case studies, data collection should involve a broad variety of techniques. We already depicted, in the conceptual framework chapters, the most frequently used techniques (M. D. Myers, 1997). Interviews, participant observation, fieldwork and written data sources such as company reports, memos, letters, reports and email messages. By using multiple sources of evidence, triangulation for a given fact becomes possible (Keen & Packwood, 1995). Hence, the integration of methods

and approaches to conduct a better evaluation study will allow us to obtain more valid and complete results (E. Ammenwerth, Iller, & Mansmann, 2003).

The empirical work was conducted in a realistic and full-scale e-Therapy project, where the eSchi system was deployed – and the goals defined in section 4.1 led to an exploratory study. This typology of case studies states that only after collecting the data can the information be analyzed and explored. The outcome of such case studies is not predictable. Actually, according to the classification of the design typology provided by Juaréz (1993) both case studies can be thought as pre-experimental design. Namely, posttest designs without control groups defined by an “X O” approach. There is a single case observation made directly by the experimenter replicated at distinct geographical locations. Despite the well-known weaknesses of this approach, pre-experimental designs are adequate when it is not possible to conduct true experimental designs. To take on conclusions of such studies require extreme caution and are not appropriate. Hence, these studies’ results are explanatory for a specific situation and, at best, provided as suggestions for future and similar cases.

The work involves the use of a new information and communication technology and, related case studies usually compare the effect of a new technology with that of other technologies or current practices (Kitchenham, Pickard, & Pfleeger, 1995). There are several examples of similar work depicted as case study and previous work in the evaluation of medical informatics applications. Kaplan (2001) shows that there are few field tests and that the majority of studies use quantitative methods such as the Randomized Control Trial designs (RCT). Nevertheless, the author states that this specific research method is not enough to define whether the systems will be used or not.

Kitchenham (Kitchenham et al., 1995) extended the “how?” and “why?” questions suggested by Yin (2002). Kitchenham added other question: “which is better?” that is specific to the software engineering and development area. The aim is to provide an additional insight into which option is the most useful choice, amongst the possibilities.

We followed a seven-step checklist of guidelines to accomplish the design and administration of the proposed case studies (Kitchenham et al., 1995) with the adjustments we considered necessary for our context of study.

The first adjustment regards the set of hypothesis that we should define in order to provide the initial exploratory base for our research. Instead of hypothesis, we will call them propositions, as we will explain later. Then, we chose the sites for application of the pilot projects and defined a results' comparison method. Attention was given to a set of possible confusing factors that might undermine the work' results; and we depicted the plan to conduct the case studies. This plan was, later, implemented and monitored; and the results obtained were analyzed and are discussed in later sections of this dissertation.

Despite its exploratory nature, the initial proposal for the fieldwork was based on generic premises. We adjusted this initial statement of premises and presented them as propositions. The following list of statements provides our proposal of propositions, the premises, for the study:

- *there is a difference between using an ICT system as a complement in therapy sessions and conducting the traditional therapy sessions;*
- *there is a difference between automatically keeping track of the performance of a patient while conducting a set of virtual activities in a therapy session or not;*
- *there is a difference between visualizing the performance of a patient in e-Therapy contexts and within a specific period or not;*
- *a custom-made ICT system does not suffer updates upon its application to a real setting;*
- *the application of a custom-made ICT system has differences when applied to distinct sites.*

The pilot project sites were selected for several reasons. The willingness of the institutions and their availability for conducting the fieldwork in their facilities were the most important. Mental Health institutions are not easily accessible to the general public, because not only there is still some ICT introduction resistance, but mainly because

these environments enclose an intense emotional level where people are frail and confidentiality and security issues must be highly considered.

Two distinct sites, real clinical settings, were selected to serve as an umbrella for the project and serve as the unit of analysis for the multiple-case study approach. The first site is the Hospital Sant Joan de Déu (HSJD), in Barcelona, Spain, a psychiatric institution whose population mainly suffers from schizophrenia or schizoaffective disorders. The entire patient population consists in interns of the institution, some of them in acute stage of the treatment. The second site is the Hospital Magalhães de Lemos (HML), in Porto, Portugal, a psychiatric institution whose population mainly suffers from depression and depression-related pathologies. They have a small population with schizophrenia or schizoaffective disorders that makes use of the facilities on an external visit basis.

For both sites, the only subjects considered in the study are the ones selected by their psychiatrist or therapist amongst the schizophrenia-diagnosed patients. The two sites are located in distinct countries and will be using the same system, but in their own language, namely Spanish and Portuguese. Each site has its own internment policy and thus patients even when correlated by type of pathology are not grouped. At the HSJD some of the patients have been living in the facilities for several years while at the HML all the patients live outside of the facilities and some are totally integrated into society and in an actual family environment.

The results obtained in each site are compared with the corresponding initial baselines. Neither baseline was collected in a systematic way. They are mostly based on the professional opinion on the medical team about the treatment sessions. Afterwards, we compare the results of each site with one another and depict the similarities and differences. As far as the mode of analysis, the approach that we will use when gathering, analyzing and interpreting the data, there are several options available. Hermeneutics relates to the meaning of a text: what is the meaning of this text? When used in an IS context, this technique aims to make sense of the organization and the relationship between people and information technology. Semiotics is primarily concerned with the



meaning of signs and symbols and deals with patterns of text and context, by content or conversation. At last, narrative and metaphor play a rather relevant role in types of thinking and social practice. In the IS field, it has been focused on understanding the communication that occurs between system developers and organizational members (M. D. Myers, 1997). In our study, we use the hermeneutics approach since we are mainly interested in analyzing the meaning and the relationships that involve the use of a specific ICT system.

A protocol plan was elaborated for each case study (9.6-Case Studies Implementation Protocol Plans). It was presented to and approved by the psychiatrists and therapists involved. The protocol plans specified the training phase, the schedule and a brief description of the procedures that will be considered in the study. These protocols assumed an extremely important part in the study since it was impossible for me to monitor in person the implementation of the system. It was part of the communication medium used between the end users and the development and research team. Being geographically distant from the implementation sites (either in Barcelona or in Porto), the development and research team had contact with the system users through the system's usage logs and specific monitoring data from the system. In order to minimize possible confounding factors an initial training phase was conducted at each site in order to enable the psychiatrists or therapists to adequately use the system. According to the software development methodology chosen, the user-centered approach, the development team was open to every suggestion made by the future users of the system. Their indications were promptly introduced into the system (annex B-Personal Communications). Every situation that occurred during the implementation phase was recorded, in order to improve future procedures. All the data that was collected, either automatically or upon request of the research team was analyzed and the corresponding results are presented in later sections of this document.

#### 4.4. Research Design Approach

After the methodology and research methods chosen, we planned a set of iterative steps that allowed us to conduct our research work (Figure 9).

First, we conceived a conceptual framework in order to obtain some insight on the theoretical aspects that led the investigation. We researched the theoretical background on the subject Mental Health Information Systems (MHIS) and of e-Therapy, specifically applied to e-Mental Health circumstances. A better understanding of the actual needs in the area as well as the existing work and ICT applications available led to the description made in chapter 2-Conceptual Framework. We also presented a brief overview of schizophrenia as a chronic condition, mentioning the relevance that led to its selection for the case study application. Throughout this process of defining and contextualizing the major themes for the conceptual framework, we reviewed the current software engineering methods and usability standards in order to select and apply the most suitable to the development of the requested system.

Chapter 3-Related Work describes other concepts that relate to the state-of-the-art as far as monitoring and visualization models are concerned. The literature presents these two models connected through a common database that the monitoring process fills in (*input*) and the visualization process uses (*output*).

Both the conceptual framework as the related work has evolved in an iterative way according to the needs of the empirical work.

The first step of the empirical work consisted in the production of a proposal with a list of guidelines to use in the assessment of e-Therapy ICT systems. The proposal depicts a list of items based on the previous work we were acquainted with and the feedback provided by the process of design and development of the eSchi system as well as its deployment to both case studies.

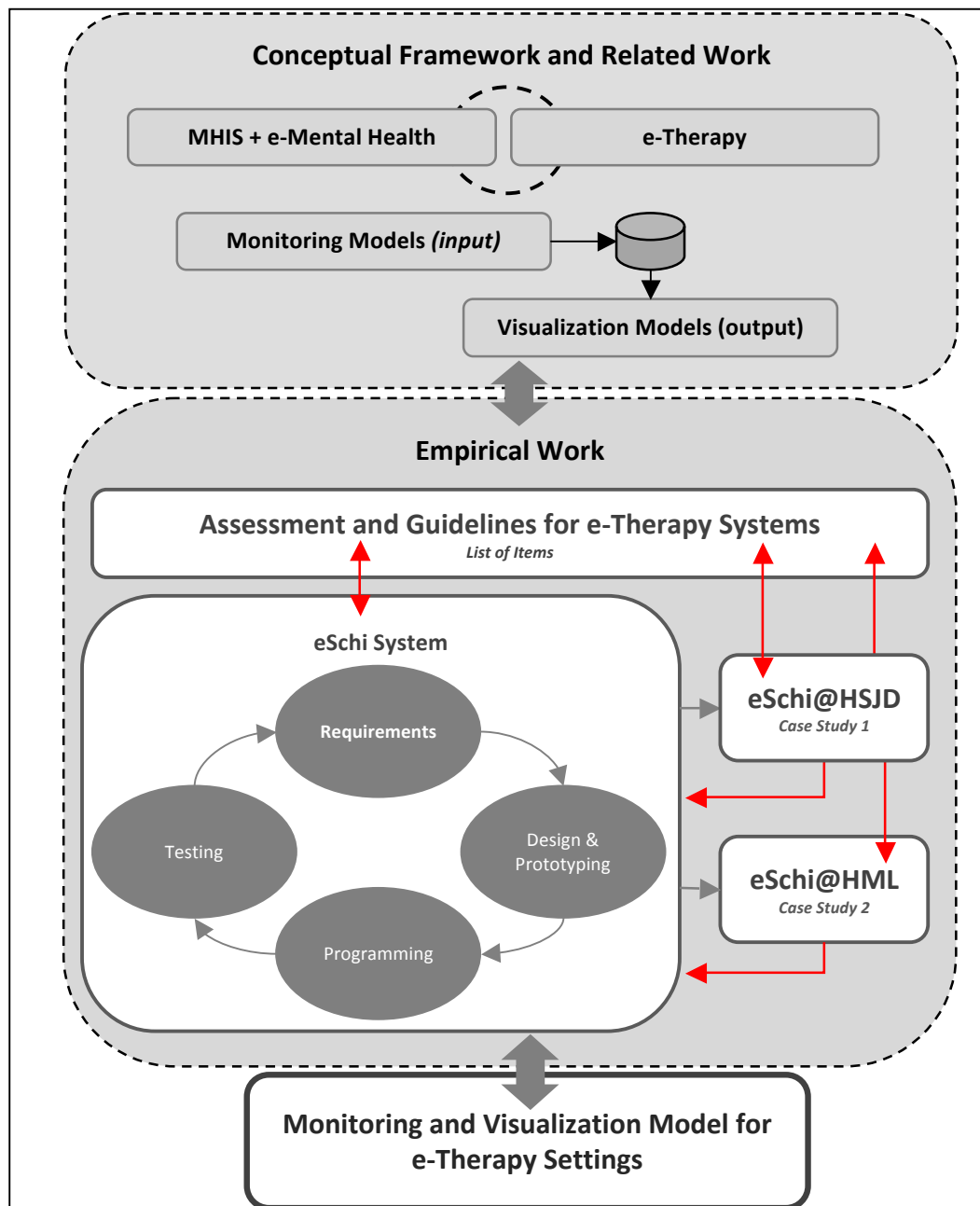


Figure 9 – Research Design Approach

We developed the eSchi system accordingly to current software engineering methodologies and usability standards, in an iterative way. Then, two distinct settings lodged the system: at the Hospital Sant Joan de Déu, in Barcelona, Spain, and at the Hospital Magalhães de Lemos (HML), in Porto, Portugal. The e-Therapy project founders had already established the circumstances for the application of the eSchi system to the Hospital Sant Joan de Déu (HSJD). The e-Therapy project's initial plan did not include a second site. It appeared as an opportunity to test the system under distinct environ-

mental conditions, patients and health professionals and even nationality. The studies occurred in a chronological sequence. The first study conducted was the one at HSJD after which, the system was deployed at HML. Currently, the system is still in use in both sites, plus an additional one, also in Barcelona, at the Hospital Sant Joan de Déu, *Serveis Socio Sanitaris*.

Advances in the empirical work led to advancements in the theoretical framework and vice-versa. Thus, we updated and improved the developed system, accordingly to the literature reviewed and the actual experience of the fieldwork.

We describe the work done in the next sections, where we provide the analysis, design and development process of the eSchi system according to the current software engineering methodologies and usability standards, described in chapter 2-Conceptual Framework.

We provide the list of assessment items and guidelines used in the design of the system. Finally, we present the deployment of eSchi at two distinct sites: at the Hospital Sant Joan de Déu at Barcelona, Spain and at the Hospital Magalhães de Lemos at Porto, Portugal. These are the sites referred in Figure 9 as the case studies.

The results obtained with the case studies and their analysis allowed the acceptance by the final users of the system of the new model that enables the monitoring and visualization of patients' performance in e-Therapy settings, presented in chapters 6 and 7.



## 5. Empirical Work

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In this section, we discuss the design and implementation process for the exploratory study conducted. eSchi, an e-Therapy application was designed and developed. To achieve this, we followed a User-Centered Approach. A conceptual model for monitoring and visualizing schizophrenic patients' performance in e-Therapy settings is presented as well as the assessment items and guidelines used to develop the system. eSchi was deployed into two distinct sites and used in the rehabilitation process of schizophrenic patients.



## 5.1. eSchi – the system's design

eSchi is a web-enabled multimedia system intended for use in therapy settings. The system provides a commonplace for patients, health professionals and caregivers to relate and communicate with each other. eSchi, amongst other functionalities, allows the management of patients and therapy sessions, as well as carrying out sessions and visualizing the results obtained in those sessions. While patients can conduct cognitive-related activities, where the system plays a more entertaining role, health professionals can monitor and visualize the patients' performance in e-Therapy settings.

The eSchi system contains a set of multimedia tools, available online, that enable schizophrenic patients' cognitive enhancement (Freire, Reis, & Monguet, 2008). The tools help patients in their cognitive rehabilitation and therapists in their work. The main idea was to develop an e-Therapy tool that can be seen as a learning tool to teach and train schizophrenic patients to acquire basic skills that were once lost because of the cognitive impairments suffered.

eSchi is designed as a modular system with two separate modules: the patient module and the therapist module. While the patient module relates to aspects concerning the learning and training of cognitive functions of the patients, the therapist module is more dedicated to the management issues regarding patients and sessions.

Patients will first have to train their motion skills with simple games for the usage of the mouse: moving objects around, clicking on specific places and dragging and dropping objects. Accurate data regarding the patient performance, during the training is recorded. Hence, it is possible to know the patient behavior during a specific activity. There are also basic cognition activities related to recognition and association of objects. In a recognition activity, a stimulus object is shown to the patient for some seconds and after that time, the stimulus disappears. The patient is presented with a set of distinct stimuli, and he/she must identify the stimulus he/she has seen before. In an association activity, a stimulus object is shown associated with other stimulus (for instance, milk associated with the color yellow). When these stimuli disappear, the pa-



tient will be presented with unrelated stimuli and the patient must identify the previous relationship between stimuli.

Therapists are able to manage information regarding patients' data, see patients' performance and configure sessions and activities for the patients. The therapist may choose an easier or more complex activity, with more or less time dedicated per activity, according to the type of patient. After conducting the session with the patient, the therapist is able to see the patients' performance during a specific period of time and program future sessions according to the observed results.

The eSchi system was analyzed, designed and implemented using a PCD approach, depicted in the next topics.

#### **5.1.1. Plan the User Centered Process**

The eSchi system is the resulting product of an e-Therapy project conceived by a multidisciplinary team with health professionals (HP Team) and information systems analysts, designers and developers (IT Team). The HP Team was composed by health professionals of the Hospital Sant Joan de Déu (HSJD), in Barcelona, and the IT Team by analysts, designer and developers of the Polytechnic University of Catalonia (UPC) Multimedia Engineering PhD Group of the Polytechnic Institute of Leiria. Both teams shared the dream to improve the quality of life of schizophrenic patients and the quality of their therapy sessions while recurring to new information and communication technologies.

The e-Therapy project started back in 2006. Previously to the work here described and evolved through a series of interviews and meetings to discuss the best way to approach the issues at hand. In the later months of 2008, two new PhD students entered the IT Team and in a certain way boosted the development and implementation of the system. A User Centered Approach was defined to allow the system to evolve and reach an actual and real implementation on site. In 2008, the status of the e-Therapy project was rather well documented (9.1-Meetings and Focus Groups) and all the initial interviewing work had already been done.

### 5.1.2. Specify the Context of Use

There were many informal conversations and meetings before the first focus group session actually occurred. In this first official meeting, the initial requirements for the system were defined. The meeting was recorded on camera and later a written transcript was made (9.1-Meetings and Focus Groups).

The focus group recognized the system's magnitude and complexity and settled in a prototype approach to the system that complied with the first basic functionalities that could be provided to both patients and the health professionals (9.2-Requirements Specification). Thus, an initial web portal with only two profiles would be available: patient and health professional. Health professionals would be able to manage their patients and manage their patients' therapy sessions. For each session, they could choose from the set of existing multimedia activities. As far as the patients were concerned, they could conduct a session with the activities that were defined by their health professionals. An aspect that was considered relevant was feedback information. Thus, every user should be able to visualize statistical information on the sessions' performance with distinct detail levels.

It was established that the HP Team would provide the contents for the specific therapy activities to be developed under the system and that the IT team would be responsible for the design and development of the system's architecture.

Several focus group meetings took place. It was extremely important to include all the stakeholders including final users as a part of the entire process; to listen and take into consideration their ideas and professional remarks. The following summarizes the main ideas achieved:

- Multimedia activities will be electronic versions of the traditional settings of therapy sessions, tailored to the online environment;
- The act of a therapist creating a session, defining activities as learning and building blocks to be used in the therapy session can be regarded as the definition of a treatment protocol. The protocol algorithm is built for a specific

treatment goal and can be reused or new ones created for specific patients' needs;

- There will be an option available that enables the therapist, or family or caregiver, to take textual free-form notes. The goal is to keep a record of all the visual and non-verbal cues provided by the patient, observed by the person who conducts the session;
- Security issues are contained. Patient records will have restricted access and will not be integrally available. There are already some digital records for patients that will not be included in eSchi;
- A built-in authentication system will limit the access only to known users that provide a valid username/password pair;
- A secure and encrypted access using the HyperText Transport Protocol Secure (HTTPS) technology that enables a secure communication channel, data encryption, and authenticity certificates and signing will also be provided.

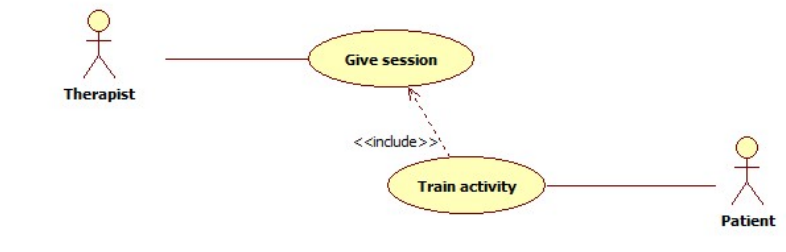
Hence, the system was defined in simple diagrams that include the results of the meetings. The following section presents the definition of a therapy session mapped to the digital world.

#### 5.1.2.1. Therapy Session

The initial focus group allowed the non-health professional members of the team to have a more accurate perception on the aspects of a classical therapy session, including its real surroundings.

A classical therapy session takes place in a quiet and comfortable place (an office) and involves a therapist, usually a psychiatrist, and a patient. During a session, both therapist and patient engage in a conversation about the patient's state of mind, its life and its current medication. After that, the patient is invited to take on a couple of activities that will train his/her motion skills and cognitive domains, such as memory.

Carrying out the session involves a major participation of the Therapist, while conducting a specific activity mainly involves a Patient, as depicted in Figure 10. Carrying out a session (“Give session”) requires the therapist to follow a set of steps.



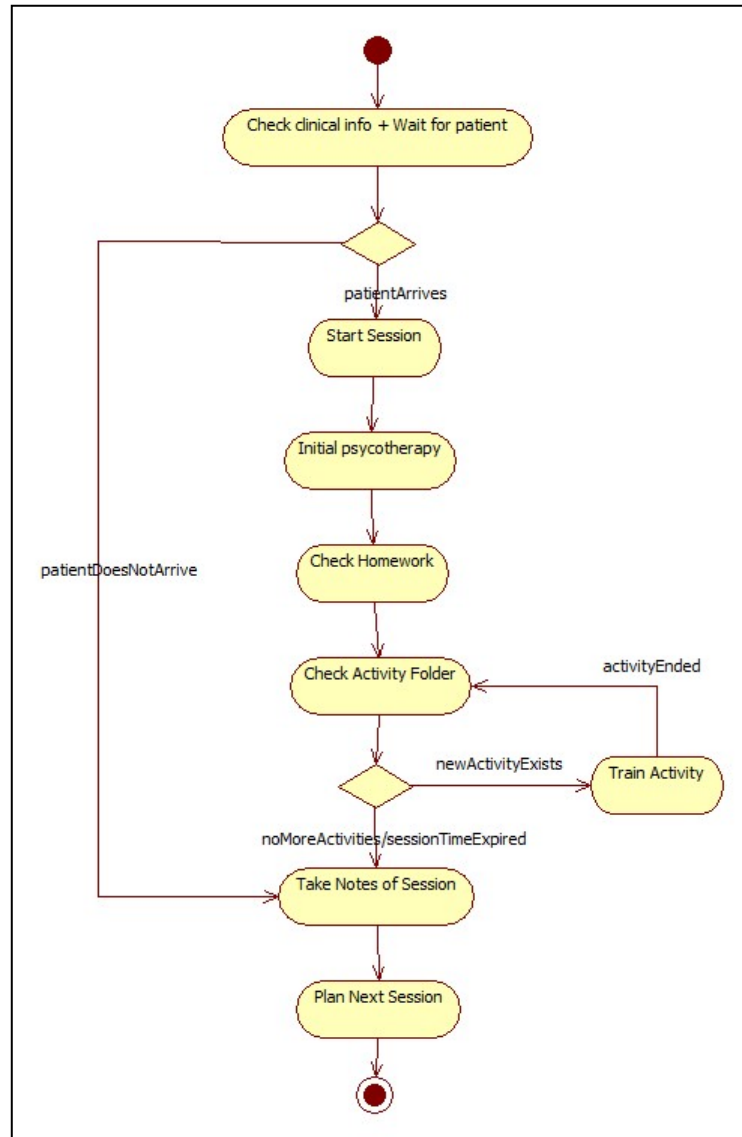
**Figure 10 – Actors and activities involved in a traditional therapy session setting**

Figure 11 depicts the sequence of steps (algorithm) that are traditionally followed by a therapist in a session, and that the system mimics.

Each session has a predefined length of time. First, the therapist checks the patient clinical information and previous therapeutic sessions' notes and simply waits for the patient to attend to the session.

When the patient enters the office, the session begins and the therapist gives initial psychotherapy to the patient, a casual talk regarding how he/she has been since the last session. The main idea is to assess the physical and psychological situation of the patient in that moment.

After that assessment is done, the therapist checks the patient’s personal folder with the activities to be carried in the session. The first activities to be conducted are the ones included as homework in the previous session. Figure 12 presents the flow of activity training.

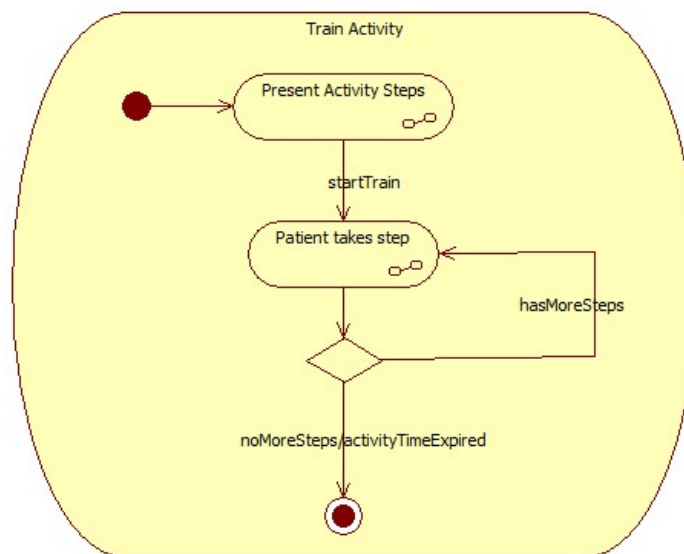


**Figure 11 – Treatment Algorithm of a Therapeutic Session – Activity Diagram**

Whenever an activity is presented to the patient, “Train activity”, he/she might choose to conduct it or not. The activity has a maximum duration time during which the patient should demonstrate its motion or cognitive skills following a pre-defined set of steps. The patient succeeds in the completion of the activity if he/she totally completes the sequence of steps within the proposed time. If, on the other hand, the activity reaches its maximum duration time, the therapist terminates the activity and registers the patient’s results.

After each activity is completed, the therapist proceeds with the next one in the folder and hands it over to the patient. The session ends when there are no more activities to carry on or when the time for the session expires.

The therapist can take notes from what occurred in the session and then make plans for the activities for the next session, according to complexity issues of each session-patient.



**Figure 12 – Patient Steps to Train an Activity – Activity Diagram**

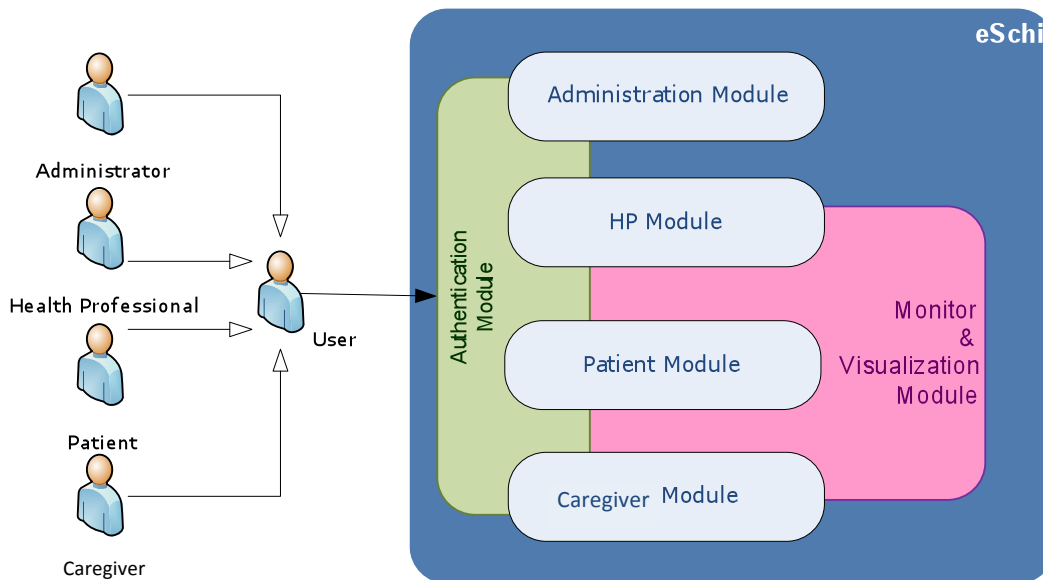
If the patient does not attend the session, the therapist registers the absence, registers this situation and then prepares the next session.

### 5.1.3. Produce Design Solutions

In this phase of development of the system, we designed it according to the knowledge we had gathered in previous phases. Therefore, we provide our considerations while designing the eSchi system architecture, its major functional modules: health professional and patient and the monitor and visualization module.

### 5.1.3.1. eSchi System Architecture

Figure 13 presents eSchi as a modular system, with the different profiles a user may assume before it.



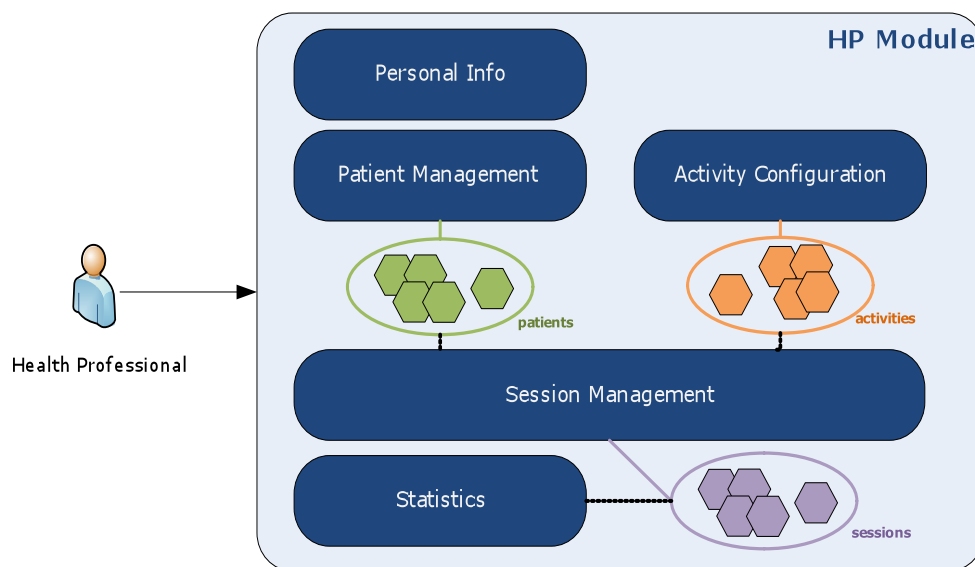
**Figure 13 – ESCHI Architecture**

Every user can access the system through the authentication module. Upon verification of the user credentials (username and password), the system redirects the user according to its profile and thus enables access to user specific features and data. For instance, a health professional is only able to manage sessions for his/her patients, and is not able to manage his/her colleague's sessions. On the other hand, a patient conducts his/her sessions but not, other patients' sessions.

The following sections will describe the design of the most relevant modules: the health professional module, the patient module, and the monitor and visualization module that assumes a transverse role in the system.

### 5.1.3.2. Health Professional Module

The health professional (HP) module provides configuration, planning and basic management features to health professionals.



**Figure 14 – Health Professional Module Architecture**

As Figure 14 shows, the health professional (HP) is able to create new and manage existing patients (green pool of items displayed as patients), as well as activities (orange pool of items displayed as activities) and sessions (purple pool of items displayed as sessions). The HP has access to the pool of patients and to the pool of activities and uses them when performing sessions' management, whether by creating new sessions or updating existing ones (in the sessions pool).

The HP creates new system users, enabling system access to new patients. Besides, it is also possible to update and remove existing patients, disabling their access to the system.

Several activities were defined in the initial focus group and implemented for the first milestone of the system. A list and description of the implemented therapy activities is available in 9.3-eSchi Users' Manual.

There are two types of activities available in the system: motion training activities and simple cognition activities. Motion training activities provide users with a first approach to the system and improve their usage of the physical system: computer, sound system, mouse and keyboard. The activities include sound target shooting, visual target shooting and drag and drop activities. Simple cognition activities are cognitive do-



main training tasks. The idea is to recall stimulus (recognition) and match up pairs of stimuli (association).

Each type of activity in the system has a small set of configuration parameters. Name, description, activity type, stimulus complexity and duration are the parameters common to all activities and Table 1 provides the configuration parameters that are specific to each one:

**Table 1 – Configuration Parameters per Activity Type**

Activity Type	Parameters
Sound Target Shooting	number of stimuli
	time between stimulus
Visual Target Shooting	number of stimuli
	time between stimulus
Drag and Drop	number of moving stimuli
	number of target stimuli
Recognition	number of stimuli
Association	number of stimuli pairs

Each parameter configuration combination creates a new activity that can be used in a session by a patient. Specific values for these parameters are responsible for defining a unique environment for the end user/patient. The configuration of parameters is done by the health professional that will try to adapt an existing exercise to the actual needs of a specific patient. A patient could have more difficulties completing an activity on time and that could jeopardize her engagement in the therapy process. If the extent of the activity were altered to comply with her needs, he/she would probably feel more cared, secure and understood.

The above parameters are the ones used internally as monitoring objects and corresponding indicators, for the LPM model, as we will describe in section 5.1.3.4.

A therapy session is a meeting between a health professional and a patient on a specific date and time. Throughout the meeting, the health professional proposes a set of distinct activities to the patient. These activities are cognitive training activities similar to the ones previously referred above.

A health professional creates new therapy sessions choosing the patient it is intended to, the date for the session to be held and the activities that will be undertaken during the session. In the context for implementation of the system, sessions occur on a daily basis, thus, there is only one session configured per day. Nevertheless, a patient is able to repeat its daily session every time he/she desires.

Every session has a status that changes automatically according to the usage of the system. Both HP users and patients have a direct influence on a session state, as can be seen in Figure 15.

Upon its creation, a session enters in the “Created” state. When the patient starts taking a session, the session automatically enters the “OnGoing” state, where it remains up until the instant the patient ends the session. At this point, the session is considered as being “Terminated”. Nevertheless, since a patient can repeat his/her daily session countless times, the session can re-enter the “OnGoing” state after being “Terminated”. A session can only be updated while it is still in the “Created” state. Once the session starts for the first time and then ends (being both in the “OnGoing” and in “Terminated” state) it cannot be updated.

These state changes are the internal monitoring points for the LPM model. They determine the instants in time for recording the indicators of the monitoring objects and are responsible for obtaining the system’s “usage data”.

According to the LPM model used, every system that monitors and then provides some sort of visualization to its users, requires visualization interpretation tools. The details on how the interpretation tools and corresponding visualization tools are implemented are described in section 5.1.3.4. Here we only provide some screenshots that show some of the results, in chart format provided to end-users.

Figure 16 shows the performance of a patient for every try he/she has on a specific activity. This scatterplot provides details such as total time and precision (number of correct guesses) for each try of the activity.

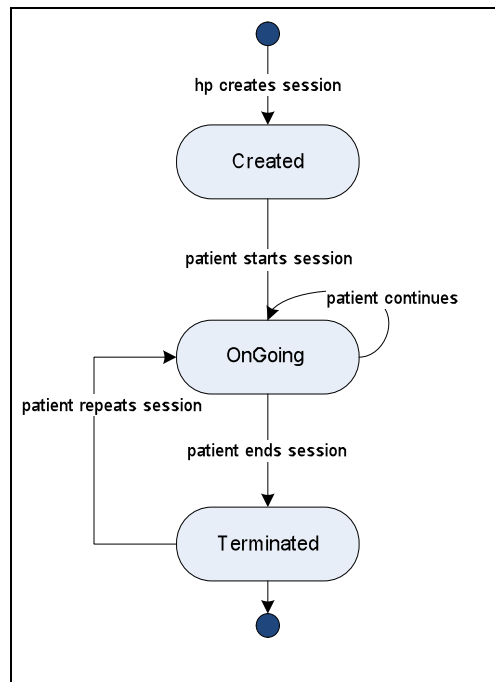


Figure 15 – Session state chart

This is the visualization available for a patient in a specific session or day, where he/she has conducted the activity several times. For instance, he/she has tried the activity twice at 14h13m, once at 14h19m and at 14h30m,... and the last try was at 15h04m. There was a loss of precision up until 14h38m and that was majored by the last try of the day.

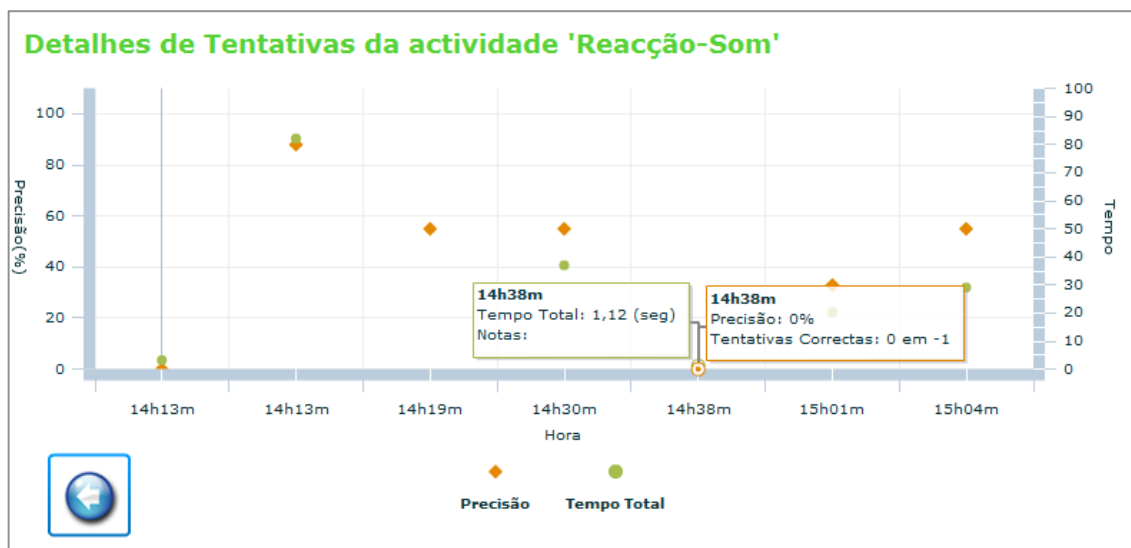
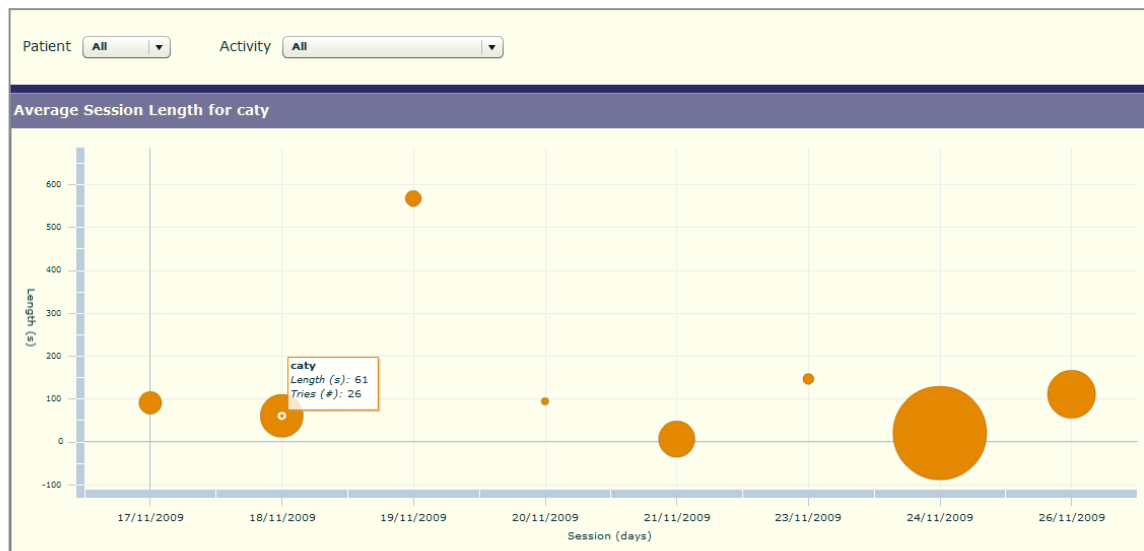


Figure 16 – Visualization of the Details for the Performance of a patient for all his/her tries of a specific activity

Figure 17 presents the average session length for a patient. This bubble chart provides additional information regarding the number of attempts to conduct activities the patient made. Thus, the health professional can visualize the performance of the patient according to the days. One possible instant insight from this visualization is the fact that the patient was more dynamic or involved in 24 November. The number of attempts, visible by the size of the circle on that day, surpasses the other days.



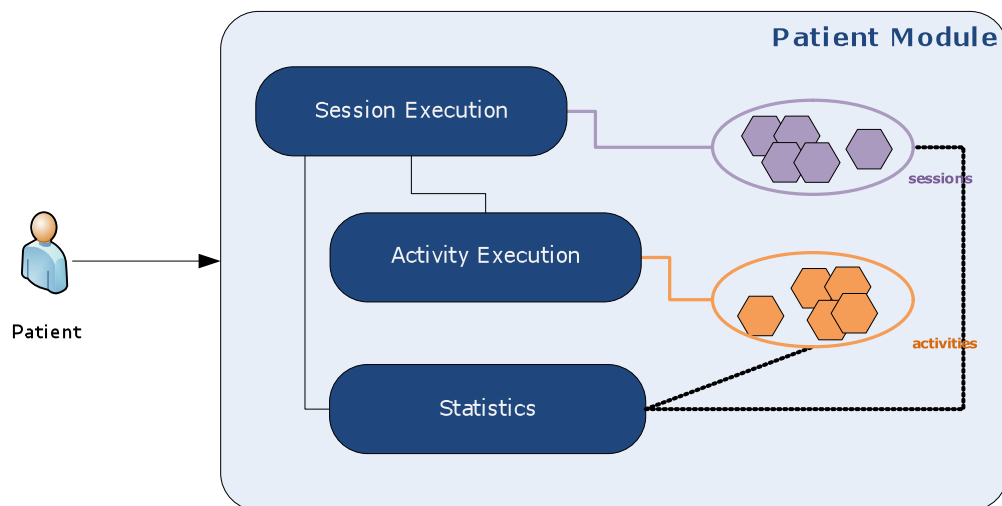
**Figure 17 – Visualization of the Average Session Length for a patient**

There are additional visualization options in chapter 9.3-eSchi Users' Manual.

### 5.1.3.3. Patient Module

This module enables patients to carry out therapy sessions, completing cognitive activities, and to visualize their results. Only patients access this module. Both HP users and caretakers might also access it for therapy matters but they must do it using patient credentials; they assume the role of a session therapy assistant.

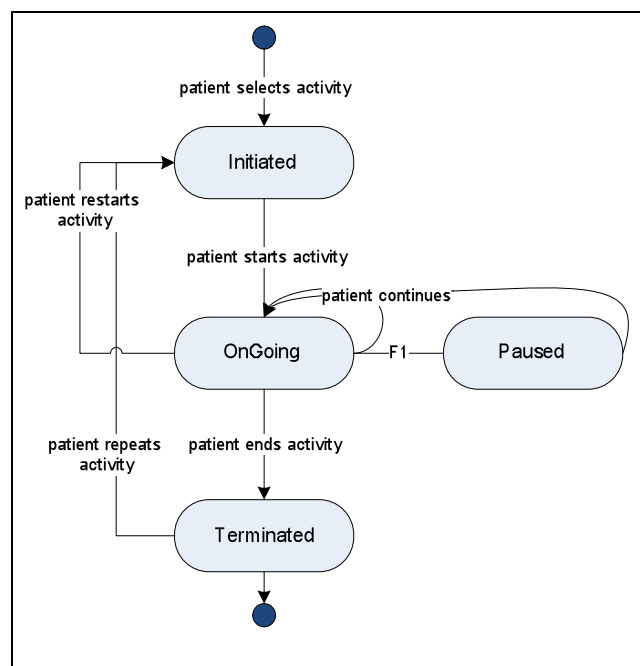
Figure 18 presents the features available for a patient. When he/she accesses the system, the list of activities that were scheduled for the current day is shown and the system considers the “session execution” has started. On the subject of sessions' scheduling, please refer to the previous section (Health Professional Module).



**Figure 18 – Patient Module Architecture**

There are several types of activities implemented in the system and they all comply with the same interface that easily allows any new activity to be added to the system. All the activities follow the same sequence of steps shown in Figure 19.

Similarly, to what happens in the health professional module, these are the internal monitoring points considered for the identified monitoring objects. The execution of an activity starts when the patient selects/chooses the activity to carry out.



**Figure 19 - Activity state chart**

After that, the activity is said to be “Initiated” and an initial message with instructions for the activity is presented. At this point, the patient can actually engage in the activity that assumes the “OnGoing” state. When in the “OnGoing” state, each activity defines a set of actions that the user can take. For instance, in a typical drag-n-drop activity, the patient must select an object, drag and drop it into a specific target (see the description of “The oranges and baskets” activity in 9.3-eSchi Users’ Manual).

The patient can end the activity in two distinct ways: by accomplishing the activity goals and thus, taking all the steps and actions to successfully complete the activity; or, the activity can reach its maximum duration time and end without success. At this point the activity assumes the “Terminated” state.

During the activity, the patient can decide to “stop” or “restart” it. This has a direct impact on the timer with the activity’s duration and the current performance outcome – the results of the patient. When the activity is restarted, the initial message is presented again and the activity proceeds as usual. When the activity is stopped, the patient is taken to the initial list of available activities for the session.

All the features of the patient module are available in a simple way. The graphical interface was kept as plain as possible, removing all the possible confusing items and several artifacts that usually are seen as “must-have” in traditional applications. An initial impression on the application might classify it as “too simple and plain” but the team dissected each detail to produce the simplest and plainest application possible. It was not an easy task, since this required simplicity might be difficult to understand. We present two of such examples in Figure 20 and Figure 21.

In Figure 20 is an initial presentation message for an activity. According to usability standards, there should be a button or another similar artifact that allowed users to proceed with their actions. There is no such button available in this page. According to the feedback that the development team received from the psychiatrist, having such a button was blocking patients. They were unable to proceed and conduct the activities.

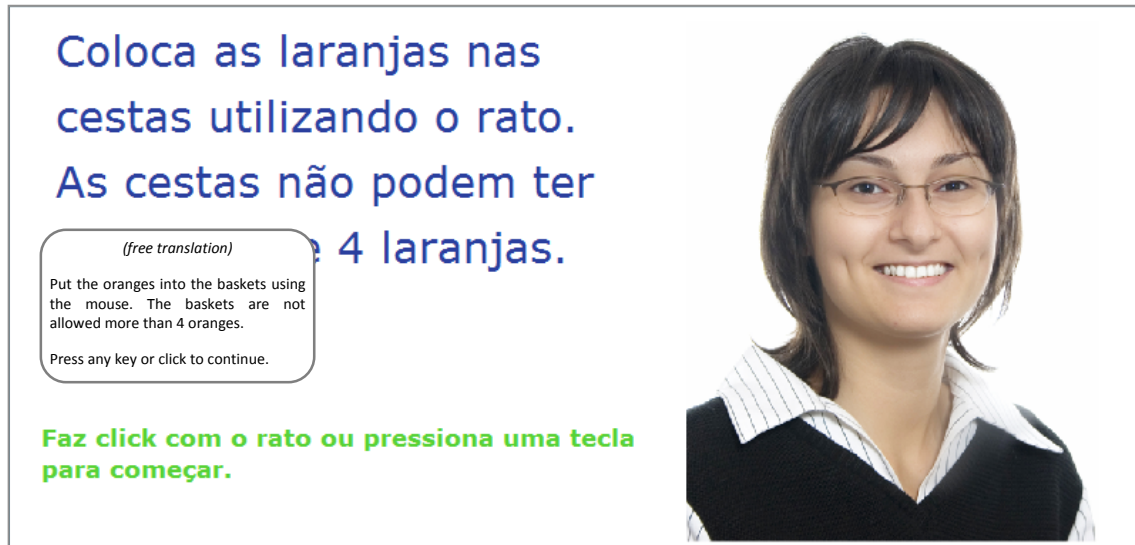


Figure 20 – Initial Message of an Activity with Instructions

Reasons for such an issue are available in 9.8-Personal Communications, where the psychiatrist explains that severe medication is connected with this issue.

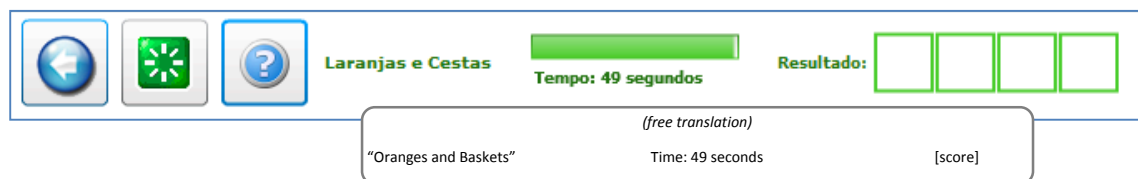


Figure 21 – Toolbar + Status Bar for the Patients Module

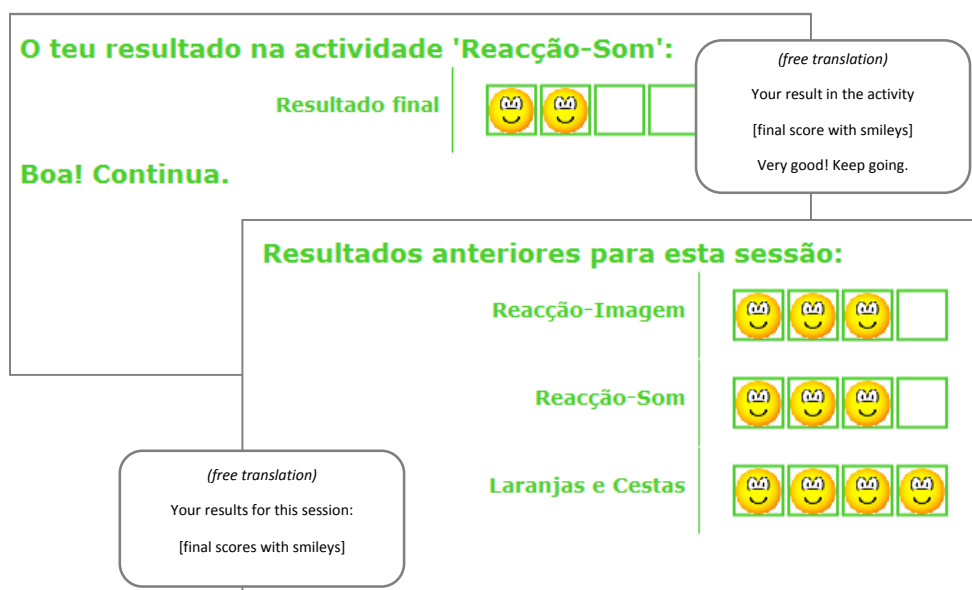
In Figure 21 it is possible to see the toolbar and status bar for the patient module. This bar is always available. The interface only has three buttons: a back button, a restart button and a help button. The remainder of the bar provides information about the current activity, namely the activity name, the time left to complete it and the current score, updated in real time. The “exit” button does not exist since it was a distracting element. If the patient needs to stop the activity, he/she just clicks in the “back” button and if he/she wishes to leave the application, he/she might simply close the browser window.

The patient has access to his/her previous results available from preceding sessions or even of this same session, conducted earlier in the day. A section of the statistics mod-

ules presents the performance result for a specific activity. This result is based on the ratio between number of goals achieved and the total number of goals for the activity. The patient is also able to see a summary chart with the best results achieved in the activities of the current session and there is a data-drill option available to check the performance achieved in the same set of activities in previous tries of the session.

Thus, the patient is able to navigate between the two types of visualization provided in Figure 22. The interaction and drill-down is available upon selection of the name of an activity in the summary chart or through navigation arrows, available in the application (9.3-eSchi Users' Manual).

This visualization had a special handling because of the target audience. The results are visible to patients in the format of "smiling faces". It is a chart of "smileys", where there is a mixture of the usual bar chart with a customized chernoff faces chart.



**Figure 22 – Examples of the Visualization Available in the Patients' Module**

The team, with the health professionals, designed these visualizations with three major concerns in mind: keeping the interface with the application as simple as possible, keeping the results, and thus the performance observation, easy to understand by patients and, finally, in order to keep the patients motivated with their results in the activities.



#### 5.1.3.4. Monitor and Visualization Module

The module is based in the conceptual framework depicted above in chapter 3-Related Work. For the sake of simplicity, the design team projected a single module that contains two sections that are highly interrelated. Hence, the module has two major sections: the monitor section and the visualization section. The first one is responsible for gathering the data in an automatic and transparent way, while the second one is responsible for presenting the data in an understandable and useful way.

As can be seen in Figure 13, this module is transverse to the other modules. This implies that it does the background job when the other modules are in use. Thus, when the patient module is used, the monitoring section gathers all the information possible according to the pre-defined set of indicators. As far as the visualization section is concerned, it is available in both the patient module and therapist module, providing distinct visualization approaches to the data gathered and interpreted by the interpretation tools in the monitoring section.

The monitoring tool, that enables the collection of valuable information during sessions, available afterwards for analysis and feedback, is designed according to a list of items adapted to the conceptual model for monitoring in e-learning contexts (Sampieri, 2008). The existing model, LPM, defines “a system of learning progress monitoring from a general overview of monitoring systems.” that “could be implemented in different learning environments and adapted to different forms of training”, thus making it perfect to adapt and implement to the eSchi system.

An additional statistical module will be a part of this monitoring tool and will keep track of the system’s usage, namely, visitors (demographic data), time per session, number of tries in activities and access to the information available.

According to the LPM model it is necessary to identify, in the design phase, the monitoring objects (MOs), the monitoring points (MPs), the interpretation tools (ITOs) and the visualization tools (VTs) that will provide the support for the eSchi system. Hence:

- **Monitoring Objects (MOs):** four distinct objects will be considered as monitoring objects: Activity, Session, ActivityTry and SessionTry. For each object a set of indicators is established as depicted in Table 2;
- **Monitoring Points (MPs):** each monitoring object requires a specific instant in time to be registered into the application. Thus, every Activity (or ActivityTry) and Session (or SessionTry) should be recorded whenever it occurs. Each monitoring object has two corresponding monitoring points: the first one when the action starts and the second when it ends;
- **Interpretation Tools (ITOs):** two tools allow the system to conduct the mapping between the established goals and the obtained results. The ActivityInterpretationTool and the SessionInterpretationTool provide the interpretation of the results, for each activity and session on a single patient base. Later they could be extended to implement some type of data (text) mining system that allows the cross checking of data with the notes (free form) taken.
- **Visualization Tools (VTs):** the initial set of InfoVis tools available in the system are related to each monitoring object. There are two distinct types of tools: charts and text. They both present the results either from patients or notes taken by therapists. These tools will be further discussed later.

According to the list of items identified below, concerning monitoring objects and corresponding indicators, we will now provide a deeper understanding of how we implemented the monitoring and visualization module. To do this, we will also refer to the monitoring points and interpretation tools identified.

Table 2 – Indicators for each Monitoring Object

<b>Activity</b>	<u>Total number of tries made in the activity</u> <ul style="list-style-type: none"> <li>• Total number of incorrect tries made in the activity</li> <li>• Total number of correct tries made in the activity</li> </ul> <u>Total time spent in the activity</u> <ul style="list-style-type: none"> <li>• Average time between tries</li> </ul> <u>Historic info per try</u> <ul style="list-style-type: none"> <li>• List of all the tries in the activity (ActivityTry)</li> </ul> <u>Activity Start Time</u> <u>Activity End Time</u> <u>Reason to end?</u> <ul style="list-style-type: none"> <li>• Time expired</li> <li>• Concluded correctly</li> <li>• Stopped</li> <li>• Restarted</li> </ul> <u>Notes (free form) taken regarding the activity</u>
<b>Session</b>	<u>List of activities defined</u> <u>Date for session</u> <u>Patient for session</u> <u>Historic info</u> <ul style="list-style-type: none"> <li>• List of tries of the session (SessionTry)</li> <li>• Initial timestamp</li> <li>• Final timestamp</li> </ul> <u>Notes (free form) taken regarding the session</u>
<b>ActivityTry</b>	<u>Description of the action</u> <ul style="list-style-type: none"> <li>• object picked up</li> <li>• start time and position</li> <li>• object dropped</li> <li>• end time and position</li> </ul> <u>Stopped</u> <u>Restarted</u>
<b>SessionTry</b>	<u>Total number of activities</u> <ul style="list-style-type: none"> <li>• Number of activities taken</li> <li>• Number of activities repeated (finished and started over)</li> <li>• Number of activities stopped</li> <li>• Number of activities restarted (not finished and started over)</li> </ul> <u>Historic info</u> <ul style="list-style-type: none"> <li>• List of tries of the activity</li> </ul> <u>Notes (free form) taken regarding the session</u>

The monitoring objects include the previously defined pools of items:

- $P = \text{set of patients} : p$   $= p_i \ i=1, \dots, n$
- $A = \text{set of activities} : a$   $= a_j \ (j=1, \dots, n)$
- $S = \text{set of sessions} : s$   $= s_k \ k=1, \dots, n$

These indicators are directly correlated to actions performed by the users that also have to be monitored by the system. These actions are the monitoring points that specify when to register the indicators. There are two actions that a patient's user initiates and that require monitoring: activity try and session try. When the patient enters the system and the list of available activities is shown, the system interprets this as the beginning of a "session try". The patient can repeat his/her daily session several times per day and each one is considered a new try. Whenever the user selects and conducts an activity from the activity's list, the system is before an "activity try". The user can repeat the activity several times or, since they are not mandatory, an activity can be never completed. The "activity try" action has also other records associated, namely every interaction click of the user with the system's graphical user interface (GUI). Each click has a time and a position for occurring, a when and where information, besides a reason for happening and a status for the outcome of the action (to obtain more detailed information on this please refer to section 9.3-eSchi Users' Manual).

Thus, the monitoring points provide two new pools of items:

- $AT = \text{set of activity tries per activity} : at$   $= a_j t_l \ j=1, \dots, n, \ (l=1, \dots, n)$
- $ST = \text{set of session tries per sessions} : st$   $= s_k t_l \ k=1, \dots, n, \ (l=1, \dots, n)$

Indicators can be either records (rec) or calculated (calc) fields that are shown later in the visualization section. The calculated fields are the outcome of the interpretation tools defined for the system. In order to keep a trace of usage data that includes every action of the user within the system, a "record field" is the name given to a trace of an

actual action. A “calculated field” is the name given to a system’s process output that is based on existing records that are transformed according to specific rules.

The records kept are the most basic form of information gathered automatically by the system (Table 3). The following is the list of available records that trace the usage of the system by a patient profile user.

**Table 3 – List of Basic Records (traceable)**

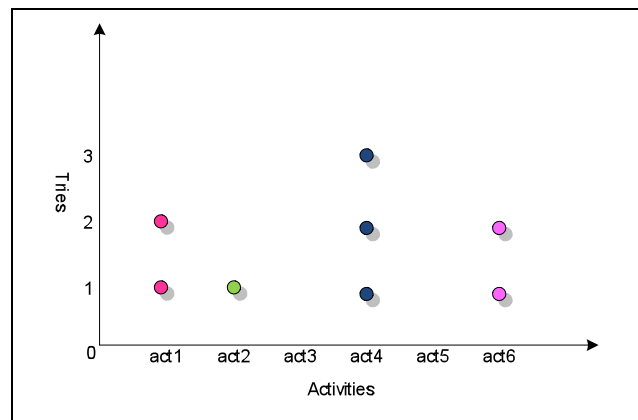
Records	Description
session initial timestamp	when patient enters the system
session final timestamp	when patient leaves the system
activity initial timestamp	when patient starts the activity
activity final timestamp	when patient completes the activity
activity effective time	timer sets off when patient starts the activity and stops whenever the patient pauses or ends the activity
number of correct goals	number of goals achieved for the activity (activity specific)
percentage complete	ratio between the number of goals achieved in the activity and the total goals for the activity.
activity try initial timestamp position	when and where the patient interacts with the GUI
activity try final timestamp position	when and where the patient stops his/her interaction with the GUI
activity try reason	the purpose for the patient interaction (e.g., activity restarted, stimulus OK,...)
activity try status	the patient interaction obtained result (e.g., correct, incorrect)

In Table 4, the list of the most basic indicators (including some calculated fields) is presented. These indicators already use some of the trace records presented above in Table 3.

**Table 4 - Indicators for “Session Try” and “Activity Try”**

Indicators	Type	Description
SessionTry <sub>i</sub> Length	calc	= <i>session initial timestamp</i> – <i>session final timestamp</i>
SessionTry <sub>i</sub> Status	Rec	= current status must take one of up to three possible values: created, ongoing, paused and terminated.
SessionTry <sub>i</sub> Notes	rec	= notes – free text to be used in later text mining.
ActivityTry <sub>i</sub> Length	Rec	= <i>effective time</i>
ActivityTry <sub>i</sub> Performance	Rec	= percentage complete
<i>i = a sequence number for the session/activity try</i>		

In a single “session try” there can be several “activity try” occurrences as Figure 23 shows:



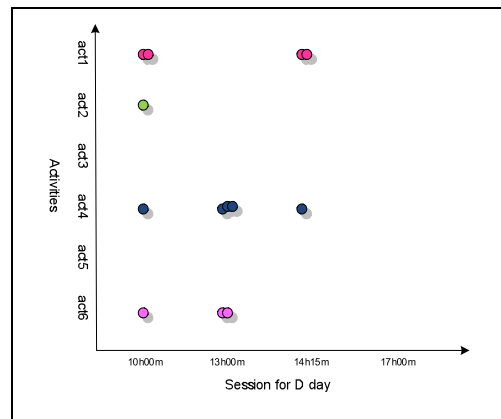
**Figure 23 – Activities tries per “Session Try”**

The list of indicators and related variables specially designed for the monitoring process of “activity tries” per “session try” can be seen in Table 5.

**Table 5 – Indicators for a “Session Try” (ST)**

Indicators	Type	Description
<b>ST Activity<sub>j</sub> Tries</b>	calc	number of entries of initial + final timestamps for a specific activity j.
<b>Average ST Activity Tries</b>	calc	sum of all the tries for all activities divided by the number of activities
<b>Average ST Activity<sub>j</sub> Length</b>	calc	sum of all the activity j’s length divided by the number of activity j tries
<b>Average ST Activity Length</b>	calc	sum of all the activities’ length divided by the number of activities
<b>Average ST Activity<sub>j</sub> Performance</b>	calc	sum of all the activity j’s performance divided by the number of activity j tries
<b>Average ST Activity Performance</b>	calc	sum of all the activities’ performance divided by the number of activities
<i>j = a specific activity conducted within the “session try”</i>		

The same session (for a specific D day) can have several tries (try1, try2, try3,...) and, at each try, the activities (act1, act2, act3,...) may have several occurrences or none. Figure 24 shows the occurrence of “activity tries” where one try implies one color circle, per activity, in all “session tries” for a session (D day).



**Figure 24 – Activities and Session’s Tries per Session**

Thus, a new pool of items appears from the calculated fields by the interpretation tools:

- *STkAT=set of activity tries per activity a per session try*  
 $st: stkat=stkajtlk=1, \dots, n, j=1, \dots, n, (l=1, \dots, n)$

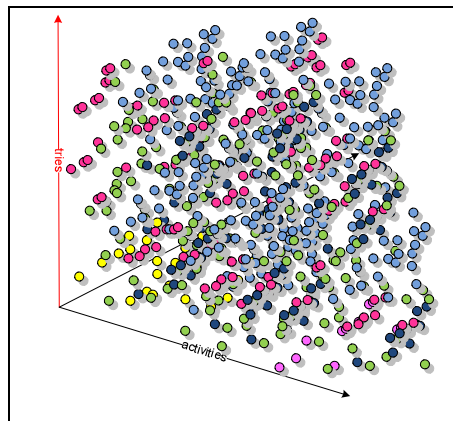
The list of indicators for keeping track of activity tries per session tries for a session (S) is shown in Table 6:

**Table 6 – Indicators for a Session (S)**

Indicators	Type	Description
Session Tries	calc	number of entries of initial + final timestamps for the session.
Average Session Length	calc	sum of all session tries' <u>SessionTry<sub>j</sub> Length</u> divided by the number of session tries
S Activity <sub>j</sub> Tries	calc	number of entries of initial + final timestamps for a specific activity j.
Average S Activity Tries	calc	sum of all the tries for all activities divided by the number of activities
Average S Activity <sub>j</sub> Length	calc	sum of all the activity j's length divided by the number of activity j tries
Average S Activity Length	calc	sum of all the activities' length divided by the number of activities
Average S Activity <sub>j</sub> Performance	calc	sum of all the activity j's performance divided by the number of activity j tries
Average S Activity Performance	calc	sum of all the activities' performance divided by the number of activities
<i>j = a specific activity conducted within the session</i>		

Despite the similarities between the lists in Table 5 and Table 6, the fact is that all the values are distinct and some of the values for a session can be calculated using the ones previously calculated for each one of its session tries. Hence, values in Table 6 are dependent on the values of Table 5.

In summary, a session might have several tries and each session try might imply several activity tries. Sessions occur on a daily basis and each patient can have a multitude of therapy sessions.



**Figure 25 - Session/Activity Occurrences for a single Patient over time**

Thus, for one specific patient, the number of occurrences to monitor grows exponentially over time and it is impossible to predict the data increase. Figure 25 depicts an overview of the amount of data to handle, once in the system.

Table 7 presents the indicators considered for a patient with all its sessions' and activities' tries.

**Table 7 – Indicators for all the sessions of a Patient (P)**

Indicators	Type	Description
<b>Average Session Tries</b>	Calc	sum of all the sessions' tries divided by the number of sessions
<b>Average Activity Tries</b>	Calc	sum of all the activities' tries divided by the number of activities

Each session is directly connected to a specific patient. Thus, the calculations done for a single patient consists on summing up his/her sessions records. When it is necessary



to visualize all the patients in the system, the indicators used for a single patient are applied individually to all of them.

The last pool of items that is generated by the interpretation tool can be described as follows:

- $PiSTkAT = \text{set of } STkAT \text{ per patient } p: \quad \quad \quad pistkat$   
 $= pistkajtlp=1,...,n, k=1, ..., n, j=1,...,n, (l=1,...,n)$

The representations presented above are only to provide the reader with the vast amount of information that the system collects. The temporal dimensions are responsible for the vast amount of information collected that grows exponentially.

Next, we will present additional information regarding the visualization of the data collected concerning the Health Professional module.

To accomplish the implementation of the interpretation and visualization tools under the eSchi system, the following items were considered relevant to filter the data:

- patient: each one is referred by his/her unique username;
- activity: each one is referred by its unique name that is provided upon its configuration;
- session (day of): since each one occurs on a daily basis, there can only be one per day and
- session try (time of): each one is referred by the time of the day when the patient starts or restarts the session.

The first two filters will be used to produce the Patient InterpretationTool and the last two the Activity InterpretationTool. Both interpretation tools will also make use of the aggregated information that exists to all the sessions and session tries.

The visualization tools of the system will follow the model proposed by Wijk (2006) for an InfoVis tool. It is a rather simple model that applies directly to our situation (Figure 8).

In this conceptual model, the central process is the visualization (*V*). In eSchi, there are eight possible visualization options and each one corresponds to a specific image (*I*). The images are dynamically generated, according to the existing data and presented to the end-user. Thus, the eight charts defined and their corresponding images are the *V + I* parts of the model (Table 8). Every image (*I*) is generated upon the application of a certain specification (*S*) to the transformation of the data. We present the definition of the specifications in Table 9. These specifications are implemented according to the equations and calculus provided above. We chose to map the specifications (*S*) of Wijk's model directly to the Interpretation Tools (ITOs) of the LPM model.

As far as the interactive exploration techniques (*E*) that allows users to change the specification (*S*) and, thus, obtain new visualizations with new timely images. We provide two exploration options: filters and data selection for drill-down. The flow and navigation available to end-users is depicted in Figure 26. These exploration techniques are also visible in the screenshots provided early (Figure 17 and Figure 22).

The visualization tools of the system follow the major guidelines of conduct to provide useful information: overview, zoom and interaction (data drill). We defined an initial set of eight charts to comply with the guidelines.

**Table 8 – Chart List with Name and Type**

ID	Name	Type
1	Average Session Length per Patient	overview
2	Average Session Length for + <i>chosenPatient</i>	zoom-in
3	Session Length for Patient + <i>chosenPatient</i> + on the + <i>chosenDay</i>	zoom-in
4	Activities Performance for + <i>chosenPatient</i> + on the + <i>chosenDay</i> + @ + <i>chosenSessionTry</i>	zoom-in
5	Average Activity Performance	overview
6	Average Performance for + <i>chosenActivity</i>	zoom-in
7	Average Performance for + <i>chosenActivity</i> + by + <i>chosenPatient</i>	zoom-in
8	Performance for activity + <i>chosenActivity</i> + for patient + <i>chosenPatient</i> + for session + <i>chosenSession</i>	zoom-in

Table 8 presents the eight charts chosen, classified by type of visualization technique. Both chart 1 and chart 5 were designed on an overview perspective, where context information is presented. All other charts are the outcome of the data drill (down) process accomplished when users filter the available data and, interacting with the chart, ask for a zoom into the data.

From this point forward, we will use the identification numbers (ID) to refer to the charts. The next table (Table 9) describes the indicators and calculus involved in the creation of the charts. For instance, in order to present chart 5, the “Average Activity Performance”, the system must:

- for every patient in the system, check its session tries and average its performance for every try of a specific activity;
- average the results for all the patients in the system.

**Table 9 – Description of available charts**

ID#	Indicators
1	An overview chart that presents the average duration of sessions (all the sessions, including tries, from all the patients) grouped by the day of the session.
2	A data drill chart that presents the average duration of the sessions (including tries) for a specific patient, grouped by the day of the session.
3	A data drill chart that presents the duration of the sessions tries on a specific day, for a specific patient.
4	A data drill chart that presents the performance accomplished by a specific patient on a specific day on a specific session try.
5	An overview chart that presents the average performance and duration of activities (all the activities, including tries, from all patients).
6	A data drill chart that presents the average performance and duration for a specific activity (including all the tries from all the patients)
7	A data drill chart that presents the average performance for a specific activity for a specific patient, grouped by session days.
8	A data drill chart that presents the performance for a specific activity, for a specific patient on a specific day, grouped by session tries.

The system's visualization interaction feature is accomplished through the navigation between the already available distinct charts (Figure 26).

The user has two options to interact with the data:

- using major filters – the round rectangles in the figure above;
- selecting the desired information on the chart – recurring to the data drill/zoom-in signaled in the arrows.

Two major filters are available for selection in the statistics module: Patient and Activity. Thus, it is possible to choose all or one of the available patients and all or one of the available activities. Upon the combined usage of the major filters, the module presents one of five charts: chart 1, chart 5, chart 2, chart 6 or chart 7. For instance, to see the statistical information for all the patients that completed a specific activity, it is necessary to choose the filters “all patients” and the desired activity. The statistics module will present chart 6.

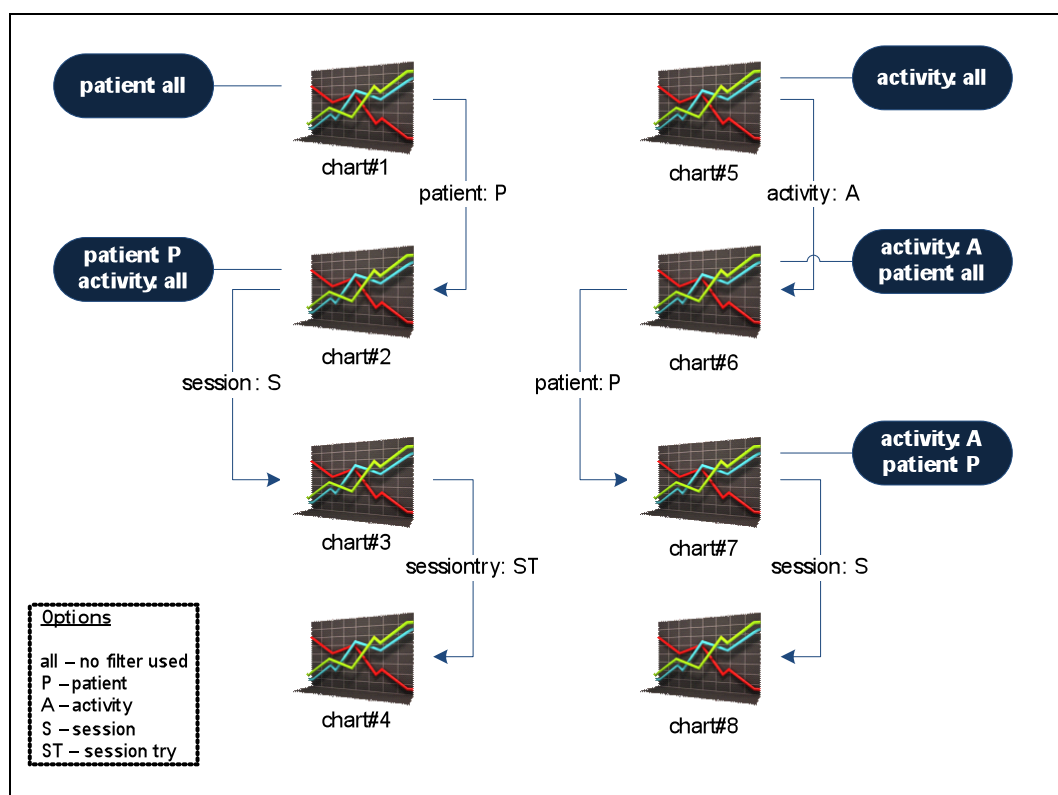


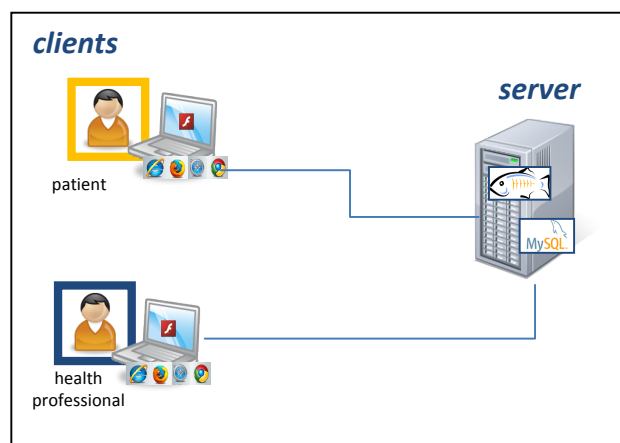
Figure 26 – Flow between charts with the indication of the filters used

The interaction with the currently displayed chart data is done using a data drill process. The health professional selects and clicks in the data to drill, on the chart. For instance, when chart 1 is available with information regarding all the patients of the health professional (one patient == one data point), by selecting (clicking) one of the data points, chart 2 is presented with specific information for the chosen patient.

Figure 26 presents the filters used in the chart flow when data drilling. Thus, for instance, when the system presents chart 4 the data has been filtered by patient, session and session try.

#### 5.1.3.5. Technology Framework

The technology framework used for the development and deployment of the eSchi system is simple and straightforward as can be seen in Figure 27. The main goal was to achieve a simple and universal deployment environment to provide the system on an anywhere-anytime policy.



**Figure 27 – The technology infrastructure for the eSchi system**

The architecture of the system has a typical client-server approach. On the server side the information is kept under a well-known database management system – MySQL – accessed through web services. The web services use the standard communication interface for the Web Service Definition Language (WSDL) and are lodged in a Glassfish Application Server. On the client side, a browser is used to interact with the applica-

tion. The browser has a Flash enabled player that allows the correct visualization of the application developed in a Flex environment and compiled as a Flash resource.

#### 5.1.4. Evaluate Design against User Requirements

In order to obtain some adequate and formal feedback before deploying eSchi into a real setting, a Heuristic Evaluation (HE) was conducted.

Despite several usability techniques have been scientifically proven to be more adequate and better, as far as results are concerned, they are more time and money consuming than this “discount usability engineering” approach. It provides a more agile method to keep track of usability problems, directly applied to iterative development projects and based in early user-focus (J. Nielsen, 1994a).

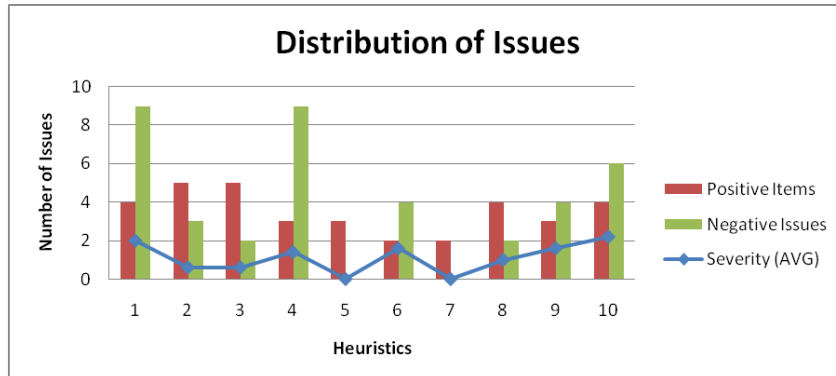
The Heuristic Evaluation method uses only a small subset of heuristics known as the ten basic usability principles. Nielsen’s (J. Nielsen, 1994b) ten basic principles of usability – the heuristics – are: 1-Visibility of system status, 2-Match between system and the real world, 3-User control and freedom, 4-Consistency and standards, 5-Error prevention, 6-Recognition rather than recall, 7-Flexibility and efficiency of use, 8-Aesthetic and minimalist design, 9-Help users recognize, diagnose, and recover from errors and 10-Help and documentation.

Different people should conduct heuristic evaluations since they usually find distinct usability problems. A small subset of evaluators (3 to 5) examines the interface and judges its compliance to the 10 basic principles (the “heuristics”). The number of evaluators should be kept small since there is not much gain in information by using a large number. The interface examination session implies that each evaluator will conduct its evaluation alone, in order to ensure independent evaluations. The evaluator goes through the interface several times and checks the compliance of the various elements with the list of general rules. He/she is also allowed to take notes on something else additional that comes into mind. For each issue found in the examination, a severity degree can be assigned using a rating scale from zero (less serious problems) to four (more serious problems). A severity estimates can help in the prioritization of

solving the usability issues, in the development process. The results can be presented as written reports (one per evaluator) or as verbal comments to an outside observer as they go along the interface.

According to the conceptual study conducted and presented in chapter 2, a test scenario was created to evaluate eSchi's patient module usability. Seven evaluators were asked to conduct a heuristic evaluation to the module and the information needed to conduct the evaluation was sent to each one. Each evaluator was asked to provide a written report with the issues examined, severity levels and further observations they considered useful.

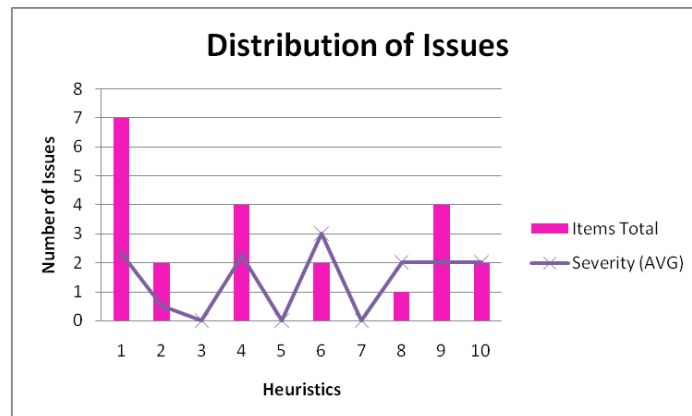
Five evaluators completed the evaluation process and presented a written report with the list of issues grouped by heuristic principle. A total amount of 39 issues was raised besides having 35 items assigned as positive aspects of the interface that respected the heuristic principles. The severity assigned to the negative issues ranged from 0 to 4 points.



**Figure 28 - Original Distribution of Items (Positive and Negative) and the average of severity assigned to the issues**

From the initial list of issues (Figure 28), the positive items were archived and only the negative items received statistical treatment. The first statistical treatment technique used consisted in filtering the items in order to eliminate duplicate items. Since distinct evaluators raised the same five issues, the original list was reduced to 24 unique issues. Finally, items were shifted to another heuristic to comply with the rules and the final distribution of the issues was the one presented in Figure 29.

After having the final distribution of issues per heuristic principle, they were scheduled to be solved in a new release of the application. The list of items was ordered by the severity assigned to an issue and the major issues were the ones that were first revised and solved in the development of the application.



**Figure 29 – Final Distribution of Issues (Negative) and the average of severity assigned to the issues**

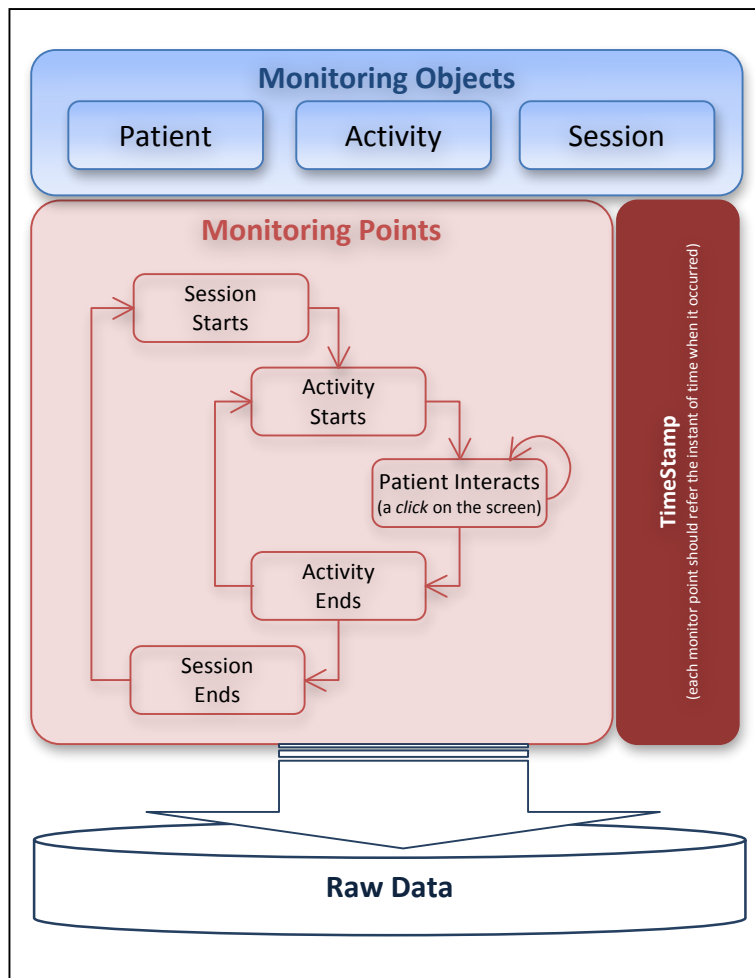
A new release of the system was published, as well as the work conducted (Reis, Freire, Fernandez, & Monguet, 2009) and the system was considered ready to be deployed in a real setting.

The functional tests that mapped each user requirement to the actual features of the system were conducted directly in the field with the final users – patients and therapists.



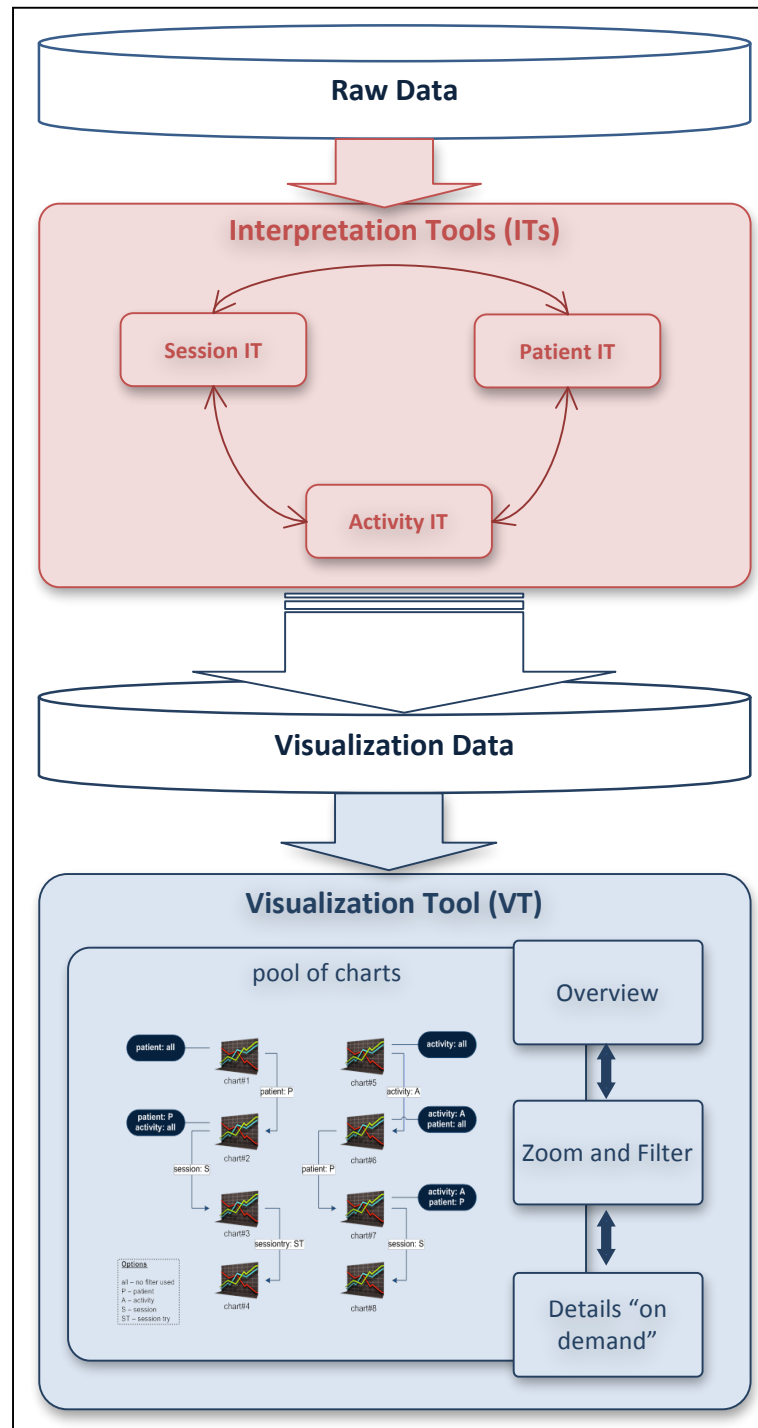
### 5.1.5. Conceptual Model Proposal for e-Therapy Contexts

According to the conceptual framework studied and the needed adaptations to the LPM model, the following figures provide our proposal for a model to monitor and visualize patients' performance in e-Therapy settings.



**Figure 30 – Monitoring Objects and Monitoring Points for e-Therapy contexts**

As shown in Figure 30 the data collected from the application usage is in raw format. At the specified instants of time, known as monitoring points, the system registers the indicators of each monitoring object and corresponding timestamp. After the collection of the raw data, the second level of treatment of the data transforms it according to a set of pre-defined rules provided by the interpretation tools (Figure 31).



**Figure 31 – Interpretation Tools for e-Therapy contexts**

After producing the visualization data, it is used for the charts of the visualization tool that are presented to end-users. The users of the system may filter and drill-down the data, thus navigating in the pool of available charts.

### 5.1.6. Assessment and Guidelines for e-Therapy Systems

Before the system deployment into its actual site, we conducted several informal tests: the functional and integration tests commonly conducted by software development teams. Nevertheless, the team believed that further testing was required. In order to evaluate the design against user requirements, we provide the following list that depicts a proposal with assessment items for e-Therapy settings, based on the existing recommendations for telepsychiatry and for MHIS in general: Quality of Care; Education and Empowerment; Access; Costs and Satisfaction (Reis et al., 2010). The following items were used in the design and development decisions of the eSchi system.

#### 5.1.6.1. Quality of Care

The quality of care provided by online psychotherapy must demonstrate no significant difference between the one provided in face-to-face contexts (Agence d'Évaluation des Technologies et des Modes d'Intervention en Santé, 2006; Childress, 2000; Christensen et al., 2002).

Patient's outcome assessment is possible using valid tests, scores and scales that physicians apply on a daily basis during traditional therapy sessions (Solari et al., 2004). The use of well-validated assessment scales, capable of detecting changes on patients and symptoms assessment, using structured instruments available through informatics systems can improve care and reduce errors (Pheby & Thorne, 1994; Trivedi, Kern, Grannemann, Altshuler, & Sunderajan, 2004; Young, Mintz, Cohen, & Chinman, 2004).

Online group psychotherapy assessment should include process variables such as activity, belongingness to the group and receiving therapist feedback as well as the textual dimensions available through specific tools such as the Linguistic Inquiry and Word Count (LIWC). In fact, the continuous monitoring of patients during a session can provide valuable information to improve the therapeutic processes (Haug et al., 2008).

Care should be taken to overcome the contextual intent loss (non-verbal cues are non-existing) in email and all text-based communication mediums that are extremely important to the therapists' assessment and diagnosis procedures (Childress, 2000).

#### 5.1.6.2. Education and Empowerment

One of the major concerns regarding education and empowerment is the quality of the information that is available. Depression web sites and the ones regarding substance use disorders are reported as having low quality of information and as being harmful to uninformed users. Besides, information is not always correct, since sponsors and potential conflicts of interest are not properly disclosed (Christensen et al., 2002; Copeland & Martin, 2004; K. M. Griffiths & Christensen, 2002).

With the large amount of available information, a person may have difficulty finding the online help to his/her specific problem (Recupero & Rainey, 2006). When trust issues arise, patients depend on the information that physicians' recommend. Health professionals should guide and assist patients while choosing the most accurate information and making an informed choice considering services reputation (Graeff-Martins et al., 2008; K. M. Griffiths et al., 2007; M. Griffiths & Cooper, 2003; Styra, 2004).

The provider of the service should have general and specific expertise to conduct a session and should follow adequate procedures to get the key component(s) of the record to provide them to the consulting physician (D. M. Hilty et al., 2002; Styra, 2004). When establishing communication standards that might, for instance, prevent the abusive use of email as consultation medium, patients and physicians should receive instruction on their rights and duties and should adhere to them. Training regarding the technical and procedural aspects of the service, making them fit to use the technology, is important (Gadit, 2006; McGinty et al., 2006).

Self-help groups allow patients to meet and exchange experiences lessening symptoms of isolation, and to exchange information such as written, visual, audio or recorded material that can be used in a treatment program. Patients can self-administer this kind of treatment program with or without guidance, which may decrease the dependency on the therapist (Castelnuovo et al., 2003a; Castelnuovo et al., 2003).

Some instruments used as a website quality indicator, provided similar results to the quality of site content when evaluating an application developed to provide health

content (K. M. Griffiths & Christensen, 2002). It allows an inexperienced person to rate several aspects of written health treatment information: extent of the treatment alternatives – risks and benefits; degree of balanced and unbiased information; documentation of areas of uncertainty.

Information should be on a standard format that is easy to reuse (Pheby & Thorne, 1994). The standard format should include not only the technological level, but also the semantic and medical level.

#### 5.1.6.3. Access

Some barriers limit the access to the services and reduce the use of e-Therapy: 1 – Resistance to change and technology literacy and 2 – Legal, Privacy, Security and Ethical Issues.

Ganapathy (2005) (p. 860) states: “What is required is not implementing better technology and getting funds but changing the mindset of the people involved”. In fact, one of the major barriers of implementing telepsychiatry is in the attitude, both patients and psychiatrists adapt to new technology and not the installation of the technology by itself (Agence d’Évaluation des Technologies et des Modes d’Intervention en Santé, 2006).

By educating every possible user in the use of the technology and reinforcing its importance in their life quality, it is possible to fight technology illiteracy (Christensen, 2007; Finn, 2002). To carry out e-Therapy, therapists are not required to be experts in technologies but they need to be prepared to face technologies in order to know when and how to use them in patients’ welfare.

Services should use already clinically proven technology and, for each consultation, technology should adapt to the service and needs of the patient and corresponding treatment (D. M. Hilty et al., 2002).

On the other hand, people that have mobility limitations and time constraints; special needs persons, those termed “socially unskilled”, or that live in correctional facilities,

do not have an easy access to standard mental health services (Antonacci, Bloch, Saeed, Yildirim, & Talley, 2008; Finn, 2002; Heinlen et al., 2003; Kanani & Regehr, 2003). E-Therapy breaks out space boundaries, reaching out for underserved population across geographical distance and enhancing the quality of health information any-time and anywhere (A. Barak, 2007; Castelnuevo et al., 2003; M. Griffiths & Cooper, 2003).

Regarding the legal, privacy, security and ethical issues, there are always, security, privacy and confidentiality issues to consider for the type of services that exist in the mental health field, especially for those that use the Internet (Farrell, Mahone, & Guibaud, 2004).

Experts identified privacy issues as the constant tension between the need to access health records and the need to secure them. This dichotomy intensifies since there is useful information hidden away in private records, waiting for its extraction, handling and usage on other medical cases (Christensen et al., 2002).

Anonymity is a major concern for most users of e-mental health services regarding the social stigma they suffer (Richards & Tangney, 2008). Online interaction solves this since the therapist blends in with the virtual world. Actually, some people disclose their problems more openly to a computer system than to other people (A. Barak, 2007; Christensen, 2007; M. Griffiths & Cooper, 2003; Heinlen et al., 2003; Kanani & Regehr, 2003; Lester, 2006; Recupero & Rainey, 2006; Wangberg et al., 2007).

Online therapists need to be aware of their patients' surrounding context. Factors such as location and specific conditions such as risk of suicide, homicide, child abuse, culture and others, e.g. potential violence of a patient, are relevant to avoid inappropriate counseling (Finn, 2002; M. Griffiths & Cooper, 2003; Heinlen et al., 2003; Kanani & Regehr, 2003).

e-Therapy should be used with extreme care and should be avoided in emergencies, when the patient's wellbeing, health or safety is at risk (Agence d'Évaluation des Technologies et des Modes d'Intervention en Santé, 2006).

Like patient's confidentiality, data security is crucial for these systems' success. To prevent unauthorized data access, they should use encryption mechanisms, and secure electronic signatures and record all accesses. Most of the services that use the Internet present severe security concerns, such as eavesdropping, identity theft, invasion of privacy, message modification, false messages, message replay, unprotected backups and repudiation (Childress, 2000; Gadit, 2006; Ganapathy, 2005; Recupero, 2005; Styra, 2004).

The lack of legal regulation might lead to mental health provider resistance in the use of services (Christensen et al., 2002). Legal issues regarding the clinical responsibility, adequacy of client/patient to treatment, e.g. suicidal risk, therapist licensing and treatment effectiveness proliferate in e-Therapy contexts (Finn, 2002; Heinlen et al., 2003; Kanani & Regehr, 2003; Recupero & Rainey, 2006). Some of these issues do not occur in a normal setting, thus, patients able to avail themselves and in writing, should provide their informed consent. However, some of these could also occur in face-to-face contexts and with other communication mediums such as the telephone or fax. All communication technologies can be misused and misrepresentations or frauds are real concerns. It is possible to reach the breakeven by opposing potential benefits that justify the possible risks (Agence d'Évaluation des Technologies et des Modes d'Intervention en Santé, 2006; Childress, 2000; Gadit, 2006; Recupero, 2005).

As far as licensing issues are concerned, one solution includes a national licensing system to assign the responsibility to the physician. Another possible solution is to consider a special licensing system where "cyberdocs" have licenses to practice in cyberspace (Dyer, 2001).

All healthcare professional organizations have ethical standards defined for their associates, but only few have started to address the new concerns raised by the Internet and the behavior taken over this medium. Medical Internet ethics guidelines are yet required to conduct such practices.

#### 5.1.6.4. Costs

This assessment item intersects all the others since every other item directly correlates to and somehow involves costs.

E-Therapy costs may be very attractive. Indeed, when compared with traditional psychotherapy, online communication reduces expenses and enables cost effective interventions (Castelnuovo et al., 2003; Finn, 2002; M. Griffiths & Cooper, 2003; Grolleman et al., 2006; Kanani & Regehr, 2003).

There is a strong correlation between providing free access and the demand for these services. Thus, providing free access might augment the demand for these new services and significantly create more pressure on the already overburden health system (Christensen et al., 2002). Nevertheless, on the other hand, Christensen (2007) states that, making Internet platforms freely accessible is one way to reduce the overall load. Costs with the technology involved in the implementation of e-therapy solutions are not very easy to estimate, but there is a belief that it is possible to dilute them by the amount/volume of use of the services provided (Agence d'Évaluation des Technologies et des Modes d'Intervention en Santé, 2006). For instance, the telecommunication costs considered sunk cost, can be shared between several types of applications besides the telepsychiatry services, such as email and Internet access (McGinty et al., 2006).

There is a growing interest from country governments regarding the costs associated to mental health programs' implementation and maintenance and in bringing the provision of such services into the spotlight (J. L. Ayuso-Mateos, Salvador-Carulla, & Chisholm, 2006; Christensen et al., 2002).

Reimbursement is also a financial issue when online services such as diagnostic interviews, medication management and psychotherapy must be a part of the organization and must integrate with the actual process of patient care and treatment (M. Griffiths & Cooper, 2003; McGinty et al., 2006; Recupero, 2005). This is an important aspect of the e-service: establish a suitable remuneration for the services provided (Styra, 2004).



#### 5.1.6.5. Satisfaction

As far as users' satisfaction is concerned, there is evidence that they like online mental health interventions (K. M. Griffiths et al., 2007). Liking and disliking can be considered a simple way of showing satisfaction and, as far as patients are concerned, their satisfaction is an evaluation of the e-Therapy services used.

Actors' needs considered right from the start, even when designing the system, are important (McGinty et al., 2006). An ICT solution developed within a dialogue between developer and target-users accomplishes a more personalized; more helpful and fine-tuned application for the users' needs (D. M. Hilty et al., 2002; Lauriks et al., 2007; Toldis et al., 2005). For instance, if users are not able to see any real improvements in their quality of life, why should they change to use a new system? Therefore, it is critical to involve target users in the development process of such type of supportive solution.

The flexibility that a new system shows, working as an always-on and trustworthy assistant that can deal with appointments and prescriptions, is a major advantage in order to accomplish physicians' satisfaction (Christensen, 2007).

Sometimes, statistical information gathered by the system complements its assessment and evaluation (Richards & Tangney, 2008). The data collected includes number of page views, unique visitors, time spent per page, number of posts and replies, number of users simultaneously in chat sessions and other demographic data from users. Online questionnaires are also used and provide an easy way to ask for the data required to complement the available system statistical information. All this information relates to the user satisfaction of the system, whether it is the patient or the physician.

## 5.2. Case Study at Hospital Sant Joan de Déu

The medical team of the Hospital Sant Joan de Déu – *Serveis de Salut Mental* – was a part of the development team of eSchi. The initial set of multimedia activities was defined with the help of that team and the actual implementation of the system in the setting was thought has being transparent. The base language support for the eSchi system was Spanish.

Sant Joan de Déu is a religious order that started back in the XVI century and that through the existence of many workers, collaborators, volunteers and benefactors, assists and helps the ill and the disadvantaged. This international institution is one of the biggest non-profit organizations that belongs to the Catholic Church and, thus, is a non-governmental organization that has several assistance points and health centers, hospitals, social services and religious communities. Their main goal is to cooperate in the development of society and eradicate the global poverty. The order has several centers in the Aragón province of Spain, Barcelona. One of them is the *Serveis de Salut Mental* and the other, the *Serveis Socio Sanitaris*. The first one is dedicated to provide specific services for mental health patients while the second one provides a wider range of services (health, social and hygienic) that includes disabled people and other patients, not only the mentally ill. They are both located near each other and close to the city of Barcelona, in Sant Boi de Llobregat and Esplugues de Llobregat.

The *Benito Menni Foundation* mainly acts in the Catalonia area, trying to create special working centers to employ both mental health patients and disabled people. This foundation has currently two centers near the Sant Joan de Déu Hospital, in Sant Boi de Llobregat in Barcelona. There is a joint effort between the hospital and the foundation to try to accomplish a successful reintegration of the mental health patients and of the disabled in the surrounding community. Hence, a sometimes-confusing factor is that the *Serveis de Salut Mental* of the Hospital Sant Joan de Déu is highly related to this foundation and they are considered, sometimes, as “one and the same” center. This case study was implemented in the facilities of the Hospital Sant Joan de Déu, together with the *Serveis de Salut Mental* health professional team.

Near this hospital exists another building where the *Serveis Socio Sanitaris* for the social hygienic services, is located. This is the implementation site where eSchi is currently being used.

#### 5.2.1. Design of the study at the HSJD – *Serveis de Salut Mental*

The first step in the study was defining an implementation protocol plan (9.6-Case Studies Implementation Protocol Plans) that defined the steps to follow in the usage of the eSchi system. The protocol contained a brief explanation of the procedures and a plan with the needed resources: human and temporal.

The system was equipped with an initial set of users, 3 psychiatrists (health professionals and therapists) and 30 patients.

The protocol plan proposed a three-week period intervention subdivided into three distinct and sequential steps, relative to the usage of the system:

- Pre-Usage  
Both patients and psychiatrist, involved in the study, answered a questionnaire that will help identify their expectations regarding the usage of the system and obtain some demographic data. This occurs in the same day that the next phase (usage) starts.
- Usage  
This phase corresponds to a three-week period with a frequency of one session per day. During this phase, a psychiatrist conducts its patients' sessions using the eSchi system as a complement in the therapy and developing cognitive activities. After each session is completed, all the users answer to a simple questionnaire regarding their opinion and satisfaction with the usage of the system throughout the session.
- After-Usage  
Both patients and psychiatrists, involved in the study, are invited to answer to two questionnaires that will help identify their opinion and general satisfaction regarding their usage of the eSchi system. This last step occurs in two distinct

moments in time: in the same day of the last session and after a two-week interval, without using the tool.

#### 5.2.1.1. Data Collection

In order to collect data from the study, from the several options available and previously referred in 2.1.3, both questionnaires and the eSchi system itself – as the monitoring tool – were used.

**Table 10 – Data Collection Tools per Study Phase**

Phase	Tool	Type of Measure
<b>Pre-Usage</b>	custom questionnaire	Quantitative + Qualitative
<b>Usage</b>	eSchi monitoring	Quantitative + Qualitative
	ASQ	Quantitative
<b>After-Usage</b>	custom questionnaire	Quantitative + Qualitative
	CSUQ	Quantitative + Qualitative

The custom questionnaires used (9.7-Questionnaires), besides obtaining an initial set of demographic data, are intended to obtain users' expectations before using an e-Therapy tool and their opinion/satisfaction after using the eSchi system.

Both the After Scenario Questionnaire (ASQ) and the Computer System Usability Questionnaire (CSUQ) were already validated instruments that were carefully translated to Spanish (9.7-Questionnaires) – the users' native tongue. Upon request by the health team and agreement inside the whole team, both the ASQ and CSUQ questionnaires were slightly adjusted to be applied to patients. The idea was to provide a clear questionnaire that could be easily understood and answered directly by patients. These adaptations were tested and validated by the health team. All the translations were verified and validated by the medical team inside the development team.

According to the monitoring model previously depicted in the document, usage data of the eSchi system was collected in an automatic and transparent way. All the indicators that were defined can be used to describe the usage of the system.

All the tools identified as “Qualitative”, in the type of measure available for the data collection, include some form of open ended answer or free text entry form option.

#### 5.2.1.2. Special Considerations

##### User Selection

Only one psychiatrist applied to take part in the study: the supervisor for the schizophrenia ward in the hospital. She made the patients’ selection using as a major criterion the need for cognitive rehabilitation. Hence, the inclusion in the group of users was made upon consideration of having a positive impact on a patient’s treatment, as the psychiatrist’s personal communication included in 9.8-Personal Communications, refers.

##### Confidentiality

In order to assure confidentiality of the study applicants, prevent possible personal detection upon data analysis and maintain the integrity of the information being gathered in the study, a unique codename was given to each user. The codenames endorsed were, for the simplicity of the process, also used as the usernames to login in the eSchi system. Hence, the real names of the users are not known and the only person that can establish the mapping is the psychiatrist, which is obliged to respect the standard patient-doctor confidentiality rules.

#### 5.2.1.3. Study enrolment

The first step to enable the study enrolment was the establishment of a physical scenario – an ICT laboratory – where a limited number of computers, only three, became preferred eSchi access points. Each desktop computer was equipped with a keyboard, a mouse and a set of headphone devices. The laboratory was located in the hospital’s ICT room that has a free access policy for most patients.

By the end of the first week of usage of the eSchi system, with the psychiatrist conducting sessions with the patients, several modifications to the application were requested. The suggestions came directly from the psychiatrist and revealed the pa-

tients' reactions while using the eSchi system (9.8-Personal Communications). According to the psychiatrist, some users were highly sedated and were unable to click the mouse buttons in an autonomous way. It was suggested that the application received key strokes from the keyboard and allowed a better flow of the activities. The updates made to the application concerned the usage of the mouse and keyboard enabling a more efficient use of the system. The changes were implemented and readily applied, as a sign of the patient centered (PCD) approach followed, and, at the beginning of the second week, the users started using the new version.

At the end of the study, all the headphone devices had disappeared, probably taken by the patients that were not engaged in the study. No additional issues or any major problems were reported.

### 5.3. Case Study at Hospital Magalhães de Lemos

The main idea was to replicate the study, similar to a sister-study (R. K. Yin, 2002), that started at the Serveis de Salut Mental at the Hospital Sant Joan de Déu in Barcelona. Thus, several aspects of the study were kept with minor changes, namely the design of the study.

The Hospital Magalhães de Lemos (HML) was created as an institution in the year of 1953 and its first building opened in 1962. Throughout the years, the designation of the hospital has changed from mental health center to specialized central hospital. Since 2002, it is considered a psychiatric-specialized hospital and is the only one that serves the north of Portugal. The hospital directs its available services to anyone that carries a severe and chronic mental illness; and with difficulties in the psychosocial functioning and community integration. The service *Serviço de Reabilitação Psicossocial* ensures the provision of rehabilitation services to patients and social reintegration to those that have no familiar back support and have been living in the facilities for long periods. The service has a multidisciplinary team and enables the acquisition of psychosocial skills by the patient allowing him to feel more confident and happy with his/her social role.

#### 5.3.1. Design of the study at HML – *Serviço de Reabilitação Social*

Upon the selection of the second site for the implementation of the case study, a Portuguese mental health public institution, where the major spoken language is Portuguese, the application had to be available in Portuguese. Since the base language support was Spanish, the application suffered an upgrade to accommodate multilanguage support and became available in Portuguese. In fact, every step and document regarding the study became available in the Portuguese language also (e.g., users' manual, plans, protocols...).

Following the steps used in the first site of implementation, the first step consisted in the definition of the implementation protocol plan (9.6-Case Studies Implementation

Protocol Plans). Just like in the first site, the initial set of users, available in the system, included three psychiatrists (health professionals and therapists) and 30 patients.

It was also proposed a three-week period intervention subdivided into three distinct and sequential steps, already defined previously in the description for the first site implementation: pre-usage, usage and after-usage.

#### 5.3.1.1. Data Collection

In order to collect data from the study, the same type of tools used in the first site was applied to this second site.

All the questionnaires used were translated to Portuguese (9.7-Questionnaires) – the users' native tongue. The translation was verified and validated by the medical team at the Portuguese site.

#### 5.3.1.2. Special Considerations

##### User Selection

Only one therapist applied to take part in the study: the leading person of the occupational therapy section of the hospital. She made the patients' selection using as a major criterion the need for cognitive rehabilitation. Hence, the inclusion in the group of users was made upon consideration of being positive for a patient's treatment, as the therapist refers in the personal communication included in 9.8-Personal Communications.

##### Confidentiality

The same considerations regarding the confidentiality issues that were taken in the first site also apply to this site.

#### 5.3.1.3. Study enrolment

The hospital has an ICT room that has a limited access policy: only patients engaged in computer related activities can access the room and under a specific schedule. There is always the supervision of an informatics technician in the free access periods. Each



desktop computer in the ICT room is equipped with a keyboard, a mouse and a set of headphone devices. It was guaranteed that each desktop computer could become an eSchi access point.

By the end of the first week of a complete engagement from the users in the usage of eSchi, conducting sessions, the study went through a pause. According to the therapist, one of the users was discharged of the services, thus leaving the program and the other users required a higher level of complexity for the activities proposed. Hence, the technical team proposed a new set of activities (9.9-New Activities for eSchi) to the therapist. This was the turning point in the deployment and evolution of the eSchi system, which allowed us to end our study. According to the therapist, it was time to develop and deploy new activities, and this is what we present in section 7.4-Future Work.

## 6. Results and Discussion

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This section provides a summary of the results obtained during the course of the research. The research design approach presented in Figure 9 and described in the previous chapter determined the conditions for the fieldwork conducted. We present the results of that same fieldwork and discuss the similarities and differences of the approach when applied to both case studies.

The studies occurred in a chronological sequence. The first study to be conducted was the one at the Hospital Sant Joan de Déu – *Serveis de Salut Mental*, in Barcelona. After this first study, the system was deployed to the Hospital Magalhães de Lemos – *Serviço de Reabilitação Social*, in Porto. The results are here provided according to the chronological sequence.



## 6.1. Hospital Sant Joan de Déu

The Hospital Sant Joan de Déu (HSJD), in Barcelona, Spain, is a psychiatric institution whose population mainly suffers from schizophrenia or schizoaffective disorders. The entire patient population consists in interns of the institution, some of them in acute stage of the treatment and some of them have been living in the facilities for several years. Subjects considered in the study are the ones selected by their psychiatrist amongst the schizophrenia-diagnosed patients.

### 6.1.1. Socio-Demographic Description

The sample refers to the users that applied for the study and went through the proposed set of sessions. One psychiatrist and nine patients compose the sample of this study.

The group of patients presents an average age of 49 years, within the range: 38 to 60 years. Their distribution according to sex and average age is presented in Figure 32:

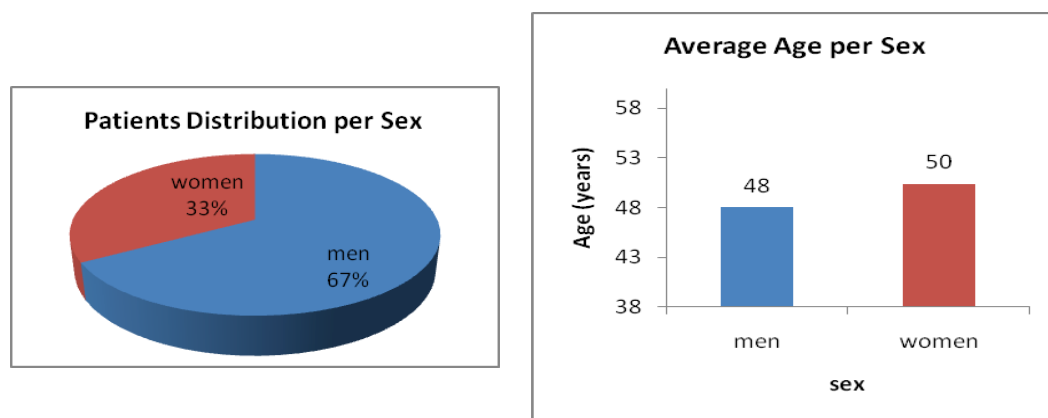


Figure 32 – Socio-Demographic Description of HSJD

Only three out of the nine participants in the study were women and their average age is 50 years, not significantly higher than the average age of the men that was 48 years.

They all declared having the basic-primary school level and primary-basic knowledge in informatics.

Each patient has a diagnosis of a specific typology of schizophrenia. Table 11 has the data provided by the psychiatrist:

**Table 11 – Mental Condition Typology per Patient of HSJD**

usuario1 – paranoid schizophrenia and schizotypal personality disorder
usuario2 – paranoid schizophrenia
usuario3 – paranoid schizophrenia
usuario4 – residual schizophrenia
usuario5 – unspecified psychotic disorder and schizotypal personality disorder
usuario6 – paranoid schizophrenia
usuario7 – chronic undifferentiated schizophrenia
usuario8 – chronic undifferentiated schizophrenia
usuario9 – disorganized schizophrenia and obsessive-compulsive personality

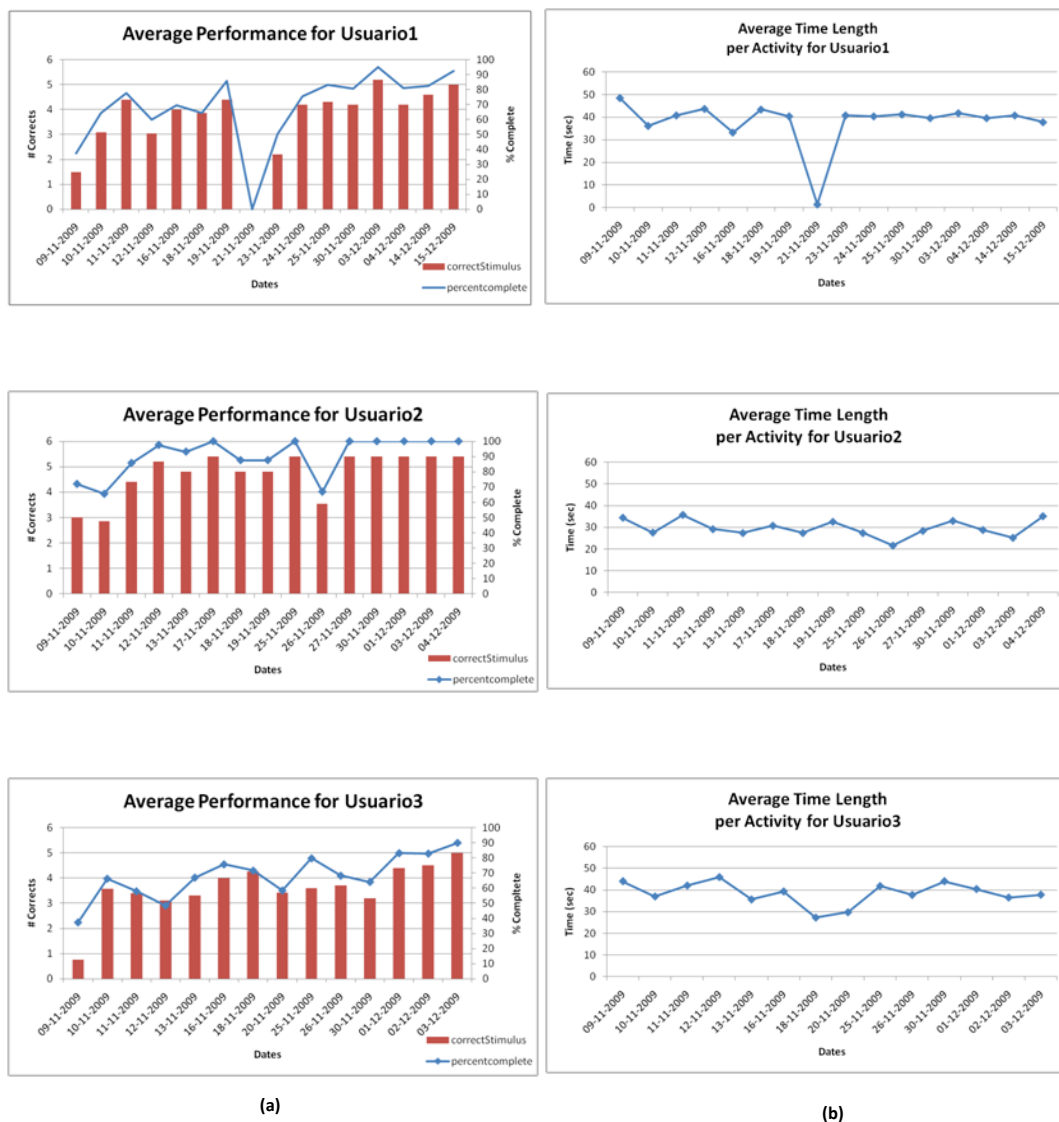
The participant's engagement point in the study can be established by the date of the answer to the first questionnaire (ASQ). Five users answered in November 9 of 2009. The rest of the users joined in on a per week basis, and the last two engaged in January of 2010.

#### 6.1.2. Sessions and Activities Statistics

Figure 33 and Figure 34 provide a summary report on the data that was collected automatically by the eSchi system.

For each patient it is possible to compute the average performance per session ((a) column) and the average time length per activity ((b) column). The performance is composed by two sub measures: the average percentage of the activities completed (% complete) in the sessions and the average number of stimuli that the user accurately got as correct (# corrects). The average time length refers to the actual time spent on an activity while trying to accomplish the specified goals (time in seconds).

For each session, all the activities completed by the user (including all the attempts made) were averaged and the results are presented above.



**Figure 33 – Average Performance (a) and Average Time Length (b) per Patient (1/2) of HSJD**

As it was already mentioned, the sites for application of this system are quite harsh. Patients miss their appointments, do not show at the scheduled therapy sessions and do not take the activities that are planned for the session. Hence, the number of sessions that are actually taken differs from patient to patient. As can be seen in the above charts, the x-axis categories are not identical in neither number nor type and each patient's performance to be presented separately. It is possible to see the progress of each patient in the sessions he/she took. A straightforward approach to the charts seems to indicate that there is a relationship between the average percentage completed by activity and the average number of correct stimuli. They seem to be di-

rectly correlated. As far as the average time length and the average performance there also seems to be a relationship. For usuario4, usuario5 and usuario6, as the average performance grows, the average time length diminishes.



Figure 34 – Average Performance (a) and Average Time Length (b) per Patient (2/2) of HSJD

Another measure is the total effective time for each user. It relates to the total amount of time that a patient effectively uses per session. Thus, it refers to the sum of the actual time spent on each activity for that same session.

As Figure 35 shows, after some sessions, the amount of time patients spend on a session seems to stabilize. In fact, for usuario4, usuario5 and usuario6 the effective time seems to decrease over time.



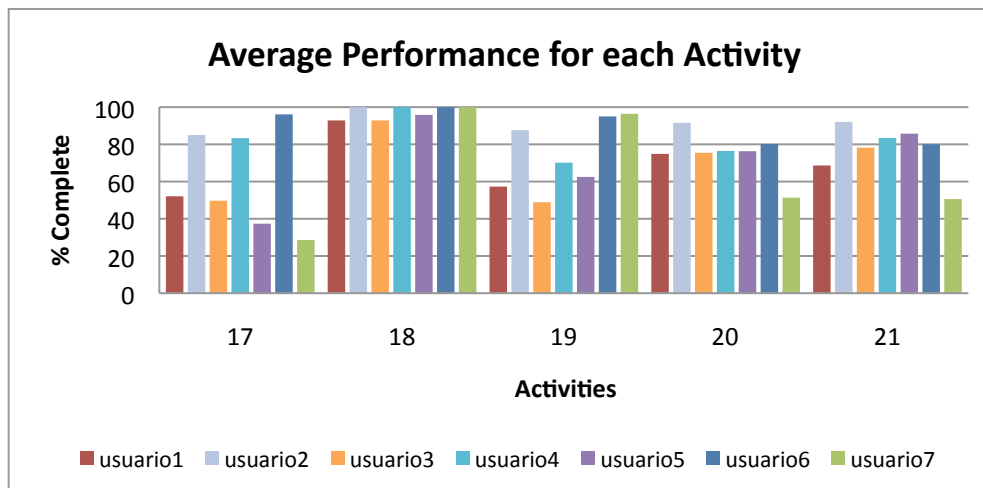
Figure 35 – Total Effective Time per Patient of HSJD



Despite having data available for nine users, both usuario8 and usuario9 completed no more than two sessions. They abandoned the study and did not appear in further sessions, according to the testimony of the psychiatrist in section 9.8-Personal Communications. Thus, since no statistical relevance was found in their results, they were omitted from the report.

Two measures were computed for each activity: the average performance accomplished and the average time length taken by each user.

As can be seen in Figure 36, all the users accomplished averagely at least 50% of what was demanded in each activity. The activity with a better average result is the 18 – Memory, while the worst is activity 17 – Oranges and Baskets.



**Figure 36 – Average Performance per Activity of HSJD**

The following list provides the mapping between the name and the identification number of the activities, previously described in 5.1-eSchi – the system’s design: 17 – Oranges and Baskets; 18 – Memory; 19 – Pairs; 20 – Sound Reaction and 21 – Visual Reaction.

Regarding the time taken to accomplish the demanded results per activity, the chart in Figure 37 presents a significant difference between the average times taken to complete activity 18 – Memory, particularly when contrasting with other activities’ results.

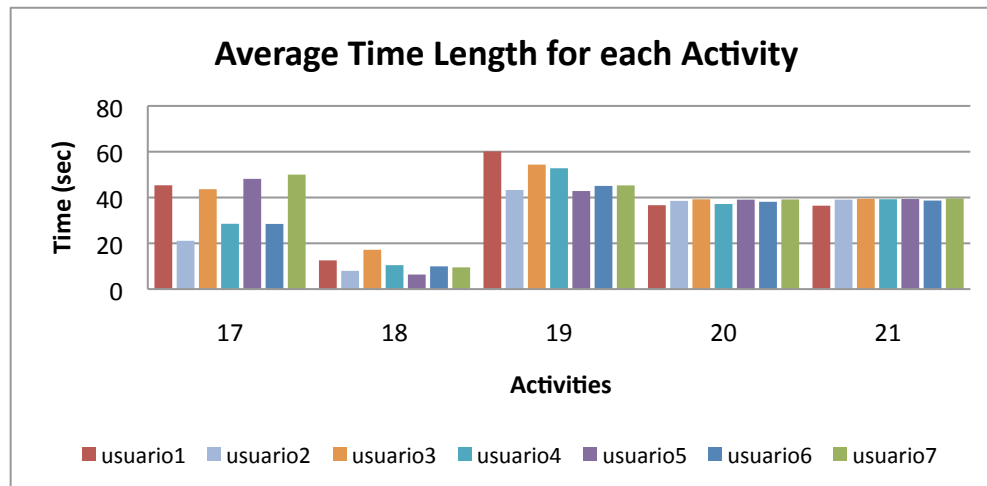


Figure 37 – Average Time Length per Activity of HSJD

Another observed measure relates to the amount of attempts a user makes for each activity through the sessions. The number of attempts diminishes over time for every user and in the last sessions, the patients only conduct one try per activity.

### 6.1.3. ASQ Results

The ASQ instructions for administration and scoring were used to compute the ASQ Scores from the answers that were given by the users engaged in the study (9.7-Questionnaires).

The idea was to evaluate both therapist' and patients' satisfaction regarding the usage of eSchi on a per scenario basis. After each session, one per day, all the users answered to the 3-question questionnaire. According to the instructions, low scores are better than high scores due to the anchors used in the 7-point scales. Hence, a low score demonstrates a higher level of satisfaction with the tool.

The answers from the two profiles were separated for analysis purposes. First, the two profiles have differences in the system usage and, second, the answers have distinct time ranges.

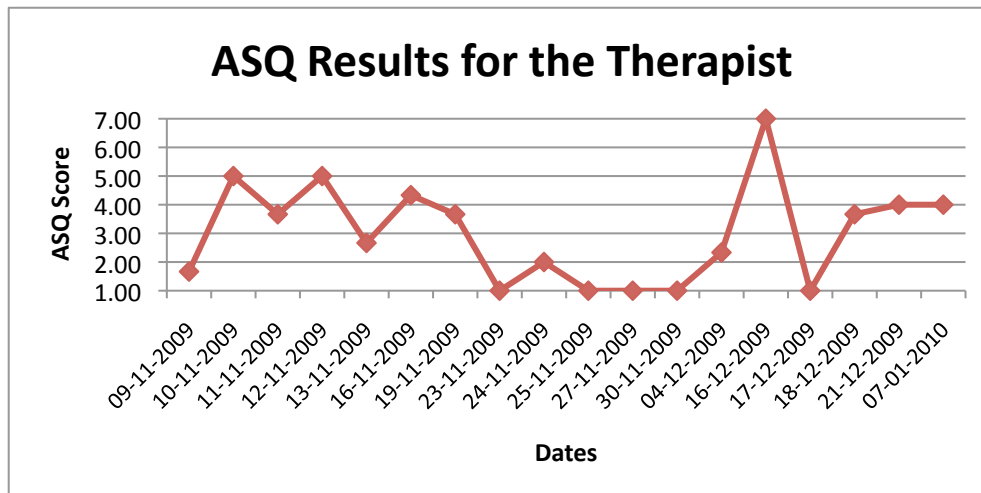


Figure 38 – ASQ Results for the Therapist of HSJD

The answers of the therapist provided an average ASQ score of 3,0 for the entire study length. The distribution of answers given during the study length is depicted in Figure 38. A relevant aspect of the chart is the value presented for day 16-12-2009 where the therapist provided a 7,0 score. This implies a total dissatisfaction with the system but no justification was provided for this fact.

As far as the answers of the patients, we will provide the average ASQ scores grouped by: date of scenario and patient. Additionally, it is also possible to see the ASQ score for each patient for the study length.

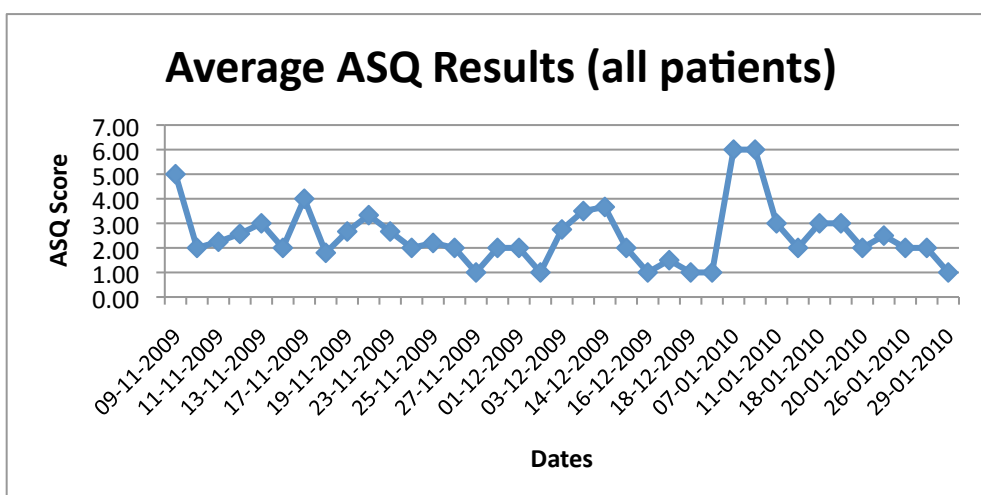


Figure 39 – Average ASQ for Patients of HSJD

The global average ASQ score accounting for all the patients and for all the sessions considered is 2,75. The average ASQ score given by the patients during the length of the study refers their opinion on the usage of the system as it is shown in Figure 39.

Figure 40 presents the number of sessions completed by each user:

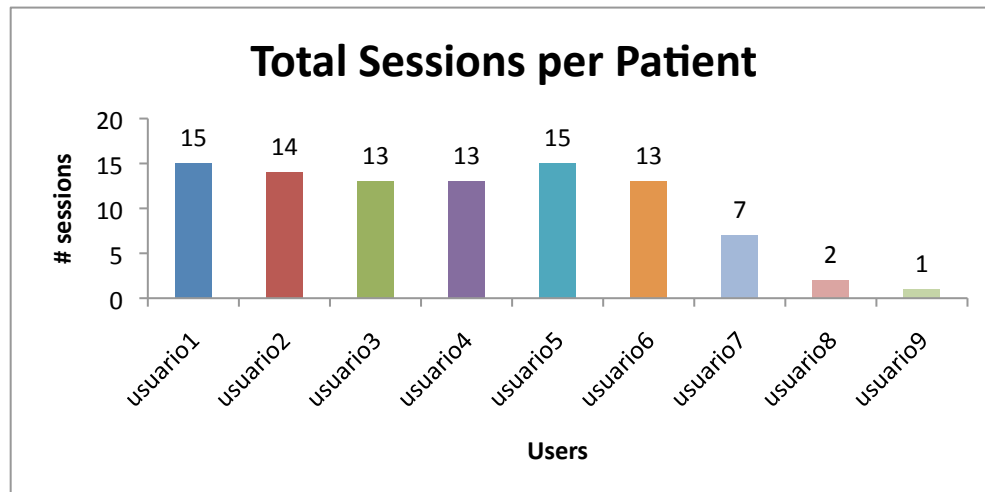


Figure 40 – Total Sessions per Patient of HSJD

Figure 41 presents the average ASQ score given by each patient for the study length. All the patients present similar ASQ scores, within a range of 1,86 up to 3,5.

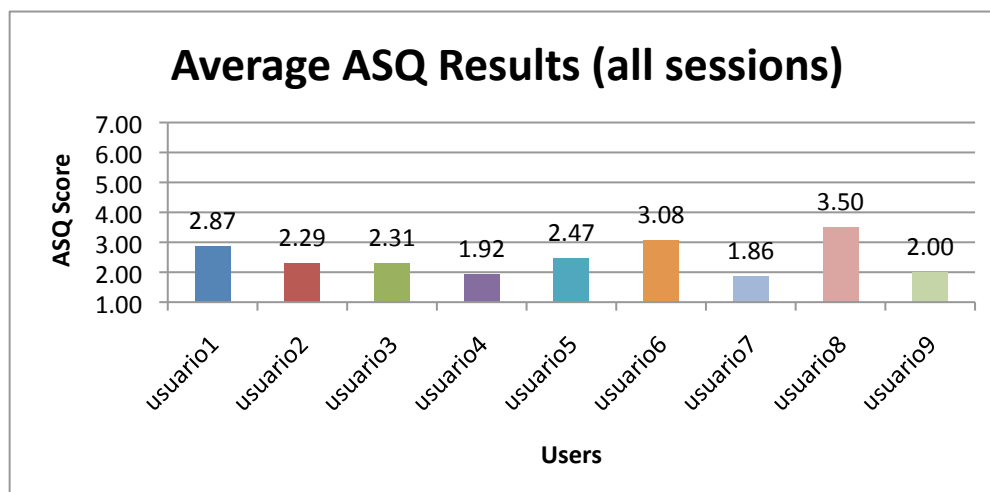
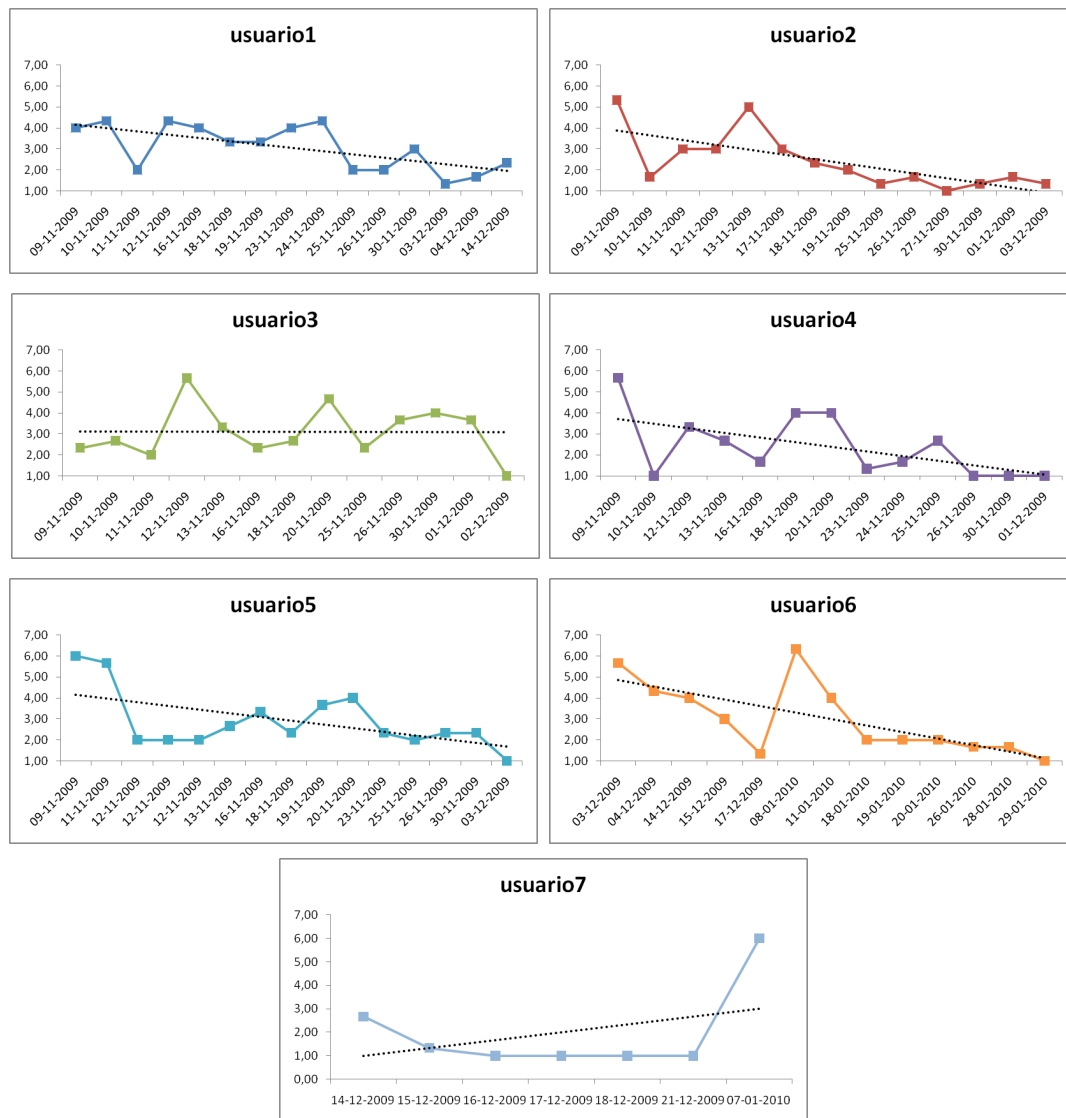


Figure 41 – Average ASQ Results of HSJD

Figure 42 presents an ASQ score chart for each patient through their sessions. Patients that have taken less than seven sessions will not be subject of observation. The trend

lines for each chart are similar and indicate an overall decrease in the ASQ score after an initial period of sessions.

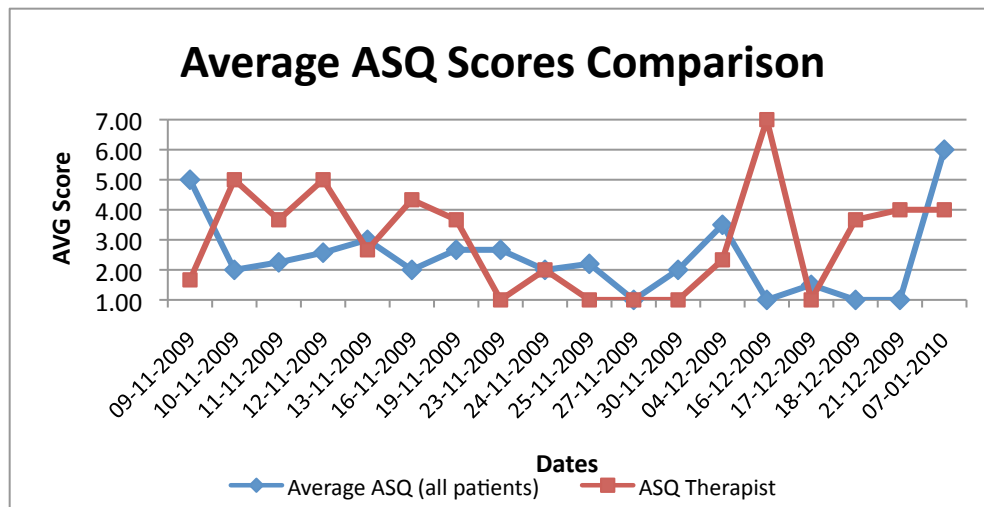
Comparing the average results for all the patients and the score for the therapist, the therapist indicated a higher ASQ score in the last sessions, while the average of patients seems to lower over time, as shown in Figure 43.



**Figure 42 – ASQ score chart per patient of HSJD**

Although not provided explicitly, the reasons for these results can be connected to the therapist's growing concern with the inclusion of further activities in the system. The feedback in 9.8-Personal Communications and the comments provided in Table 13 con-

tain a reference to an expected upgrade in the system with the inclusion of newer activities with further levels of difficulty.



**Figure 43 – Average ASQ Scores Comparison of HSJD**

Comparing the ASQ results per session with the data that was gathered automatically by eSchi, there seems to be a direct relationship between the patient's ASQ score and the average performance demonstrated in the system's usage. They both improve over time.

#### 6.1.4. CSUQ Results

The CSUQ instructions for administration and scoring were used to compute the CSUQ Scores from the answers that were given by the users engaged in the study. The scores include an OVERALL score, a SYSUSE score, an INFOQUAL score and an INTERQUAL score. For further information on the items and CSUQ administration and scoring rules please refer to section 9.7-Questionnaires.

Since the idea was to evaluate both therapist' and patients' opinion regarding the computer system usability, at the end of the study, all the users answered to the 19 questions and were able to make free-text observations.

The answers from the two profiles were separated for analysis purposes since the two profiles perceive the system differently.

The therapist provided two answers to this questionnaire with a time difference of about a month, presented in Table 12. The answer given in January of 2010 is due to the later inclusion of patients' usuario6 and usuario7 in the study. The Overall score provided by the therapist was 1,71 for the first application of the questionnaire and the second score was 5,32. One possible justification for the divergence in the scores is the fact that the second answer might be influenced by the therapist's previous knowledge and usage of eSchi.

**Table 12 – CSUQ Scores for the Therapist of HSJD**

	OVERALL	SYSUSE	INFOQUAL	INTERQUAL
Dates	Items 1 through 19	Items 1 through 8	Items 9 through 15	Items 16 through 18
17-12-2009	1,71	1,33	1,57	2,67
11-01-2010	5,32	5,63	5,43	4,33

The therapist also provided a couple of observations regarding items 16 – graphical user interface “allure” and 18 – functionalities available, presented in Table 13:

**Table 13 – CSUQ Comments - free translation - of the Therapist of HSJD**

16	The keyboard, mouse, visual screens and language used in the application are enjoyable.	The images for the “pairs” activity are too small.
18	The application has all the features and functionalities that I expected.	I expected more diversity of activities and with distinct levels of difficulty. It is too repetitive.

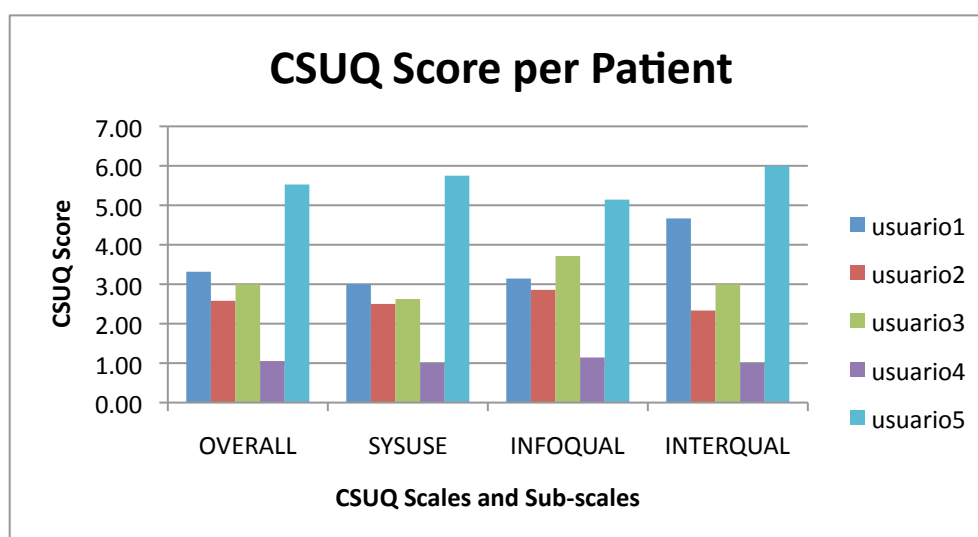
These comments were also endorsed to the development and research team through personal communications of the therapist that requested new and improved activities. According to the informal description concerning the last therapy sessions where eSchi was used, apparently, both therapist and patients thought that sessions had become a routine and it was time to improve the activities of the system. The requested improvements included new and more challenging activities.

The patients also answered to a similar version of the questionnaire and the overall and subscale scores were calculated.

**Table 14 - CSUQ Scores per Patient of HSJD**

	OVERALL	SYSUSE	INFOQUAL	INTERQUAL
Users	Items 1 through 19	Items 1 through 8	Items 9 through 15	Items 16 through 18
usuario1	3,32	3,00	3,14	4,67
usuario2	2,58	2,50	2,86	2,33
usuario3	3,00	2,63	3,71	3,00
usuario4	1,05	1,00	1,14	1,00
usuario5	5,53	5,75	5,14	6,00

The chart in Figure 44 presents another perspective of the calculated scores.

**Figure 44 - CSUQ Score per Patient of HSJD**

As far as observations and comments, only one patient made the following comments on items 15 and 16, concerning the graphical user interface “allure” and ease of use:

**Table 15 - CSUQ Comments - free translation - of the Patients of HSJD**

15	The keyboard, mouse, visual screens and language used in the application are enjoyable.	By being deaf it is difficult for me to use the mouse
16	I like using the keyboard, mouse and screens of the application.	Idem

These comments were also endorsed to the development and research team through personal communications of the therapist. The first comments on the subject of the graphical user interface led to the update of the system (already described in 5.2.1.3. Study enrolment), upon the application changes requested that included a better interaction with the activities using the keyboard. Further comments, according to the



informal description concerning this specific user's sessions, did not seem coherent and the therapist decided to exclude the activity that involved audio stimuli from this user's sessions.

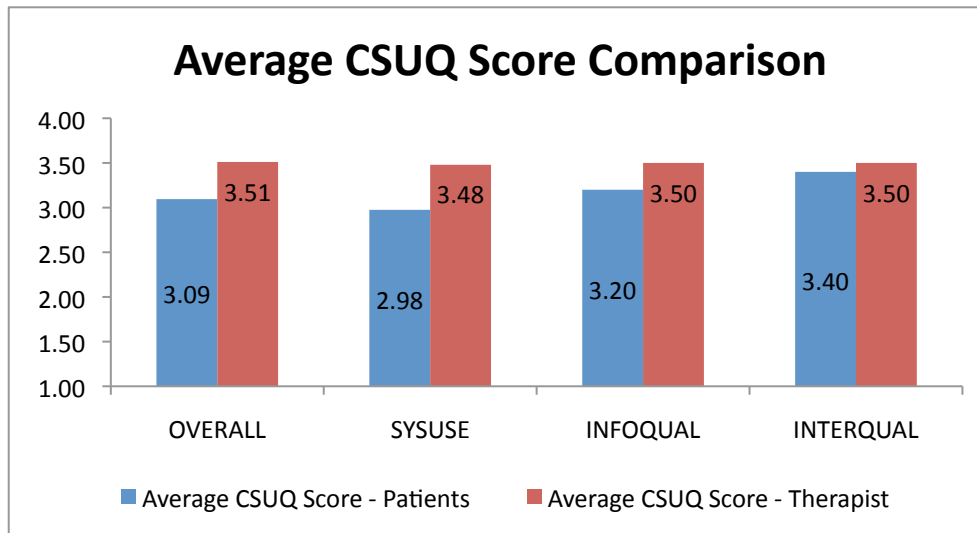


Figure 45 – Average CSUQ Score Comparison of HSJD

The results of both profiles can be compared, becoming visible that the satisfaction level after using eSchi is superior for patients than for the therapist (Figure 45 – Average CSUQ Score Comparison of HSJD). It is important to point out that the therapist answered to the questionnaire twice and that the expectations and usage satisfaction are considerable divergent in the two moments of the answers provided (1<sup>st</sup> CSUQ score = 1,71 vs. 2<sup>nd</sup> CSUQ score = 5,32). The supposed reasons for these deviating values were already pointed out.

## 6.2. Hospital Magalhães de Lemos

The Hospital Magalhães de Lemos (HML), in Porto, Portugal, is a psychiatric institution whose population mainly suffers from depression and depression-related pathologies. They have a small population with schizophrenia or schizoaffective disorders that makes use of the facilities on an external visit basis. At the HML all the patients live outside of the facilities and some are totally integrated into society and in an actual family environment. Subjects considered in the study are the ones selected by their therapist amongst the schizophrenia-diagnosed patients.

### 6.2.1. Socio-Demographic Description

The sample refers to the users that applied for the study and went through the proposed set of sessions. One occupational therapist and four patients compose the sample of this study.

The group of patients presents an average age of 32 years, within the range: 23 to 37 years. Their distribution according to sex and average age is presented in Figure 46:

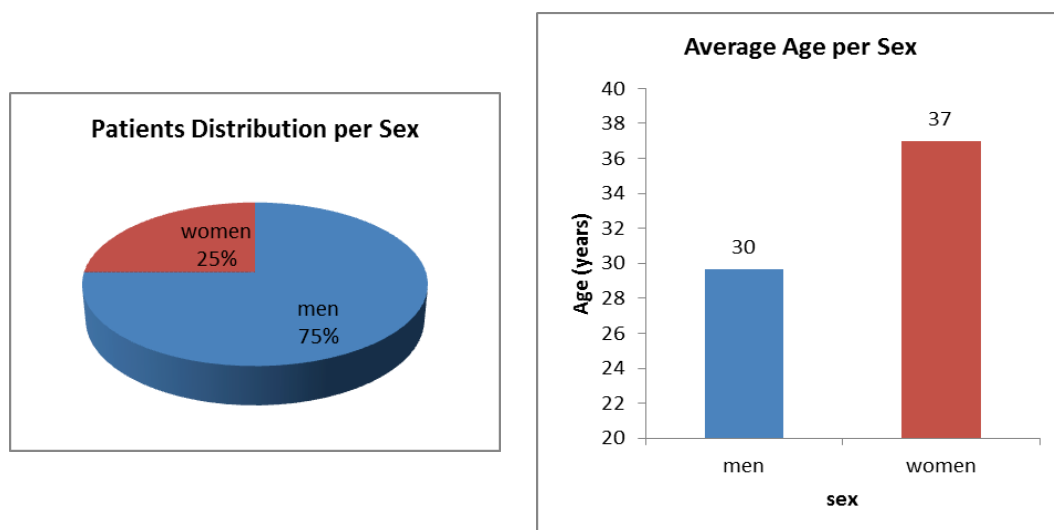


Figure 46 – Socio-Demographic Description of HML

Only one out of the four participants in the study was a woman with an age of 37 years, not significantly higher than the average age of the men that was 30 years.

They all declared having the basic-primary school level and primary-basic knowledge in informatics.

All the patients were diagnosed with psychotic schizophrenia according to the data provided by the therapist.

The participant's engagement point in the study can be established by the date that corresponds to answering the first questionnaire (ASQ). Two users answered in 15 January of 2010. The second user joined in on the 18<sup>th</sup> of the same month and the last one engaged on 22 January of 2010.

### 6.2.2. Sessions and Activities Statistics

Figure 47 and Figure 48 provide a summary report on the data that was collected automatically by the eSchi system.

For each patient it is possible to compute the average performance per session ((a) column) and the average time length per activity ((b) column). The performance is composed by two sub measures: the average percentage of the activities completed (% `complete`) in the sessions and the average number of stimuli that the user accurately got as correct (# `corrects`). The average time length refers to the actual time spent on an activity while trying to accomplish the specified goals (time in seconds).

For each session, all the activities that were completed by the user (including all the attempts made) were averaged and the results are presented above.

Since not every user conducted the same number of sessions and not even in the same days, the statistics for each user had to be presented separately. The x-axis categories are not identical.

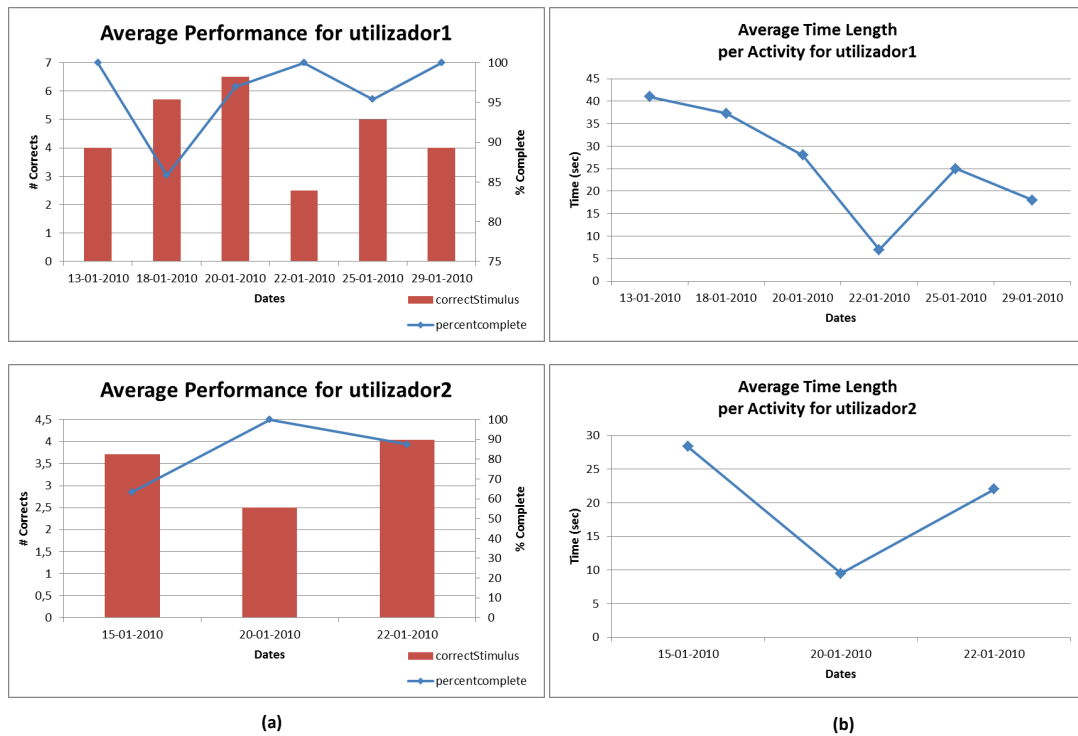


Figure 47 – Average Performance (a) and Average Time Length (b) per Patient (1/2) of HML

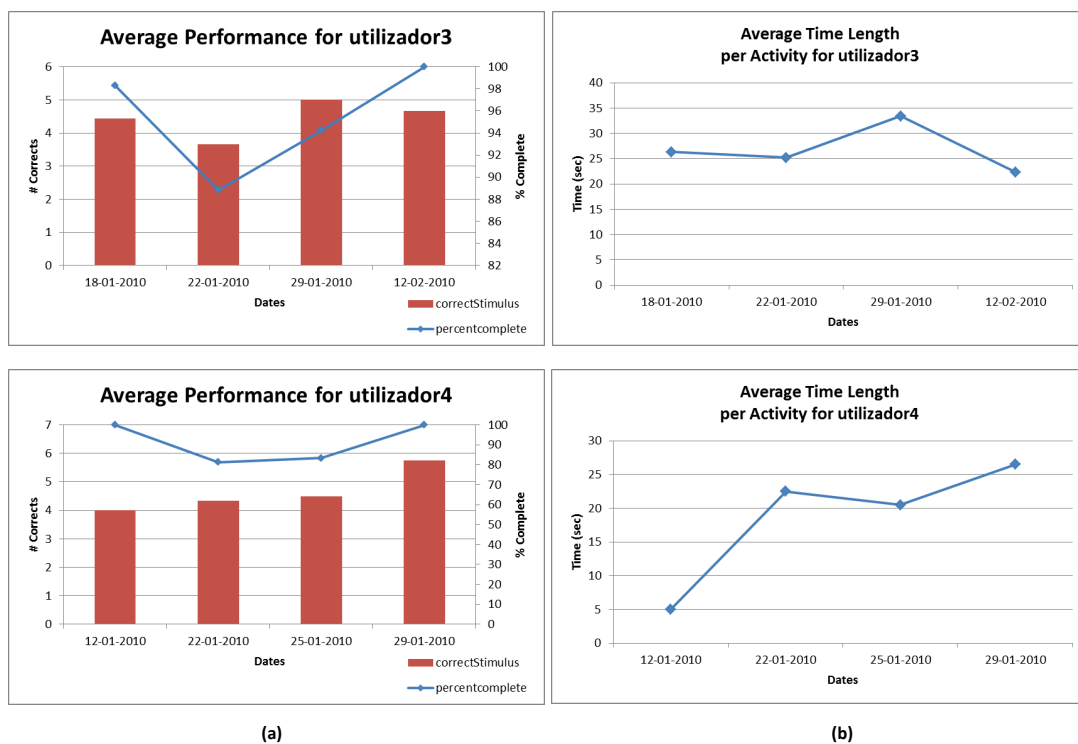


Figure 48 – Average Performance (a) and Average Time Length (b) per Patient (2/2) of HML

Nevertheless, it is possible to see the progress of each patient in the sessions he/she took. A straightforward approach to the charts seems to indicate that there is a relationship between the average percentage completed by activity and the average number of correct stimuli. They seem to be directly connected in direct variance. As far as the average time length and the average performance there also seems to be a relationship. At least for some of the users (utilizador1 and utilizador3), as the average performance grows, the average time length diminishes.

Another measure is the total effective time for each user. It relates to the total amount of time that a patient effectively uses per session. Thus, it refers to the sum of the actual time spent on each activity for that same session.

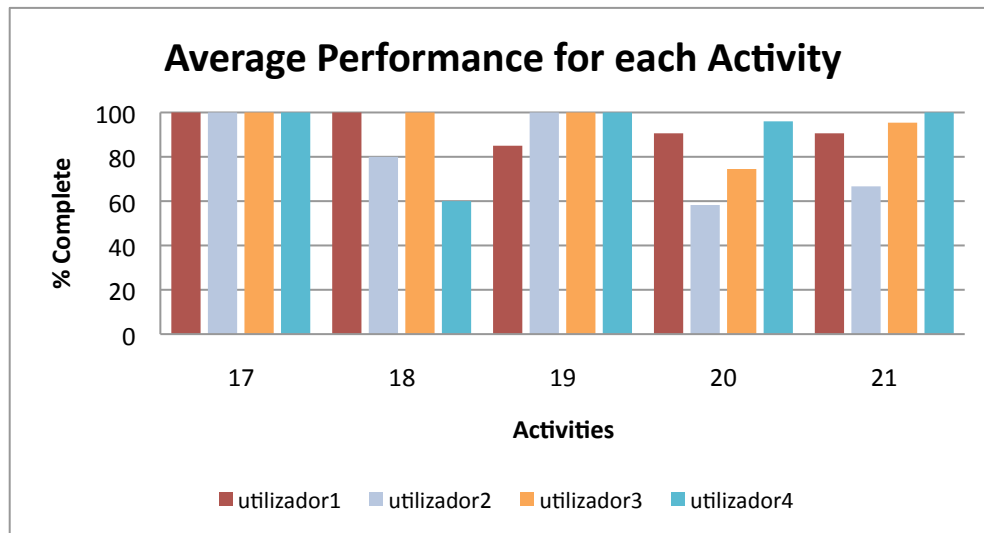
As Figure 49 shows, after some sessions, patients seem to stabilize the amount of time they spend on a session. In fact, for most patients (except utilizador2), the effective time seems to decrease over time.



**Figure 49 – Total Effective Time per Patient of HML**

Two measures were computed for each activity: the average performance accomplished and the average time length taken by each user.

The chart in Figure 50 shows that all the users accomplished averagely at least 75% of what was expected in each activity. The activity with a better average result is activity 17 – Oranges and Baskets. All other activities also present good average results without significant variance.



**Figure 50 – Average Performance per Activity of HML**

The following list provides the mapping between the name and the identification number of the activities, previously described in 5.1-eSchi – the system’s design: 17 – Oranges and Baskets; 18 – Memory; 19 – Pairs; 20 – Sound Reaction and 21 – Visual Reaction.

Regarding the time taken to accomplish the demanded results per activity, the chart in Figure 51 presents a significant difference between the average times taken to complete activity 18 – Memory, particularly when contrasting with other activities’ results. On average, the activity that took longer to complete was activity 19, approximately 40 seconds, while the drag and drop and memory activities present a significant lower difference, approximately 5 seconds. Both activities related with recognition take an average of 35 seconds to complete.

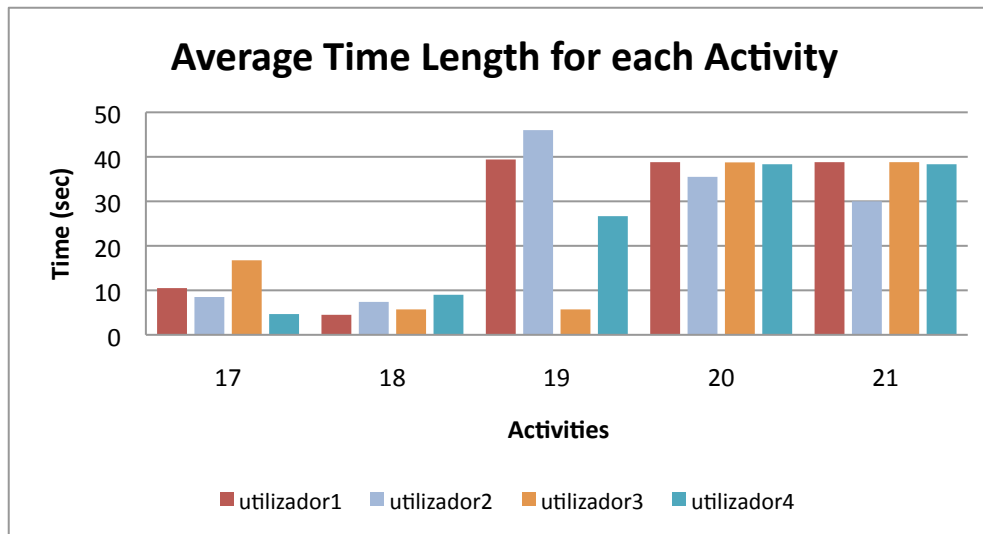


Figure 51 – Average Time Length per Activity of HML

Another observed measure relates to the amount of attempts a user makes for each activity through the sessions. The number of attempts diminishes over time for every user and in the last sessions the patients only conduct one try per activity. The data also provides the information regarding the usage and commonly the users repeat an activity in order to improve their personal outcomes.

### 6.2.3. ASQ Results

The same rules and decisions to present the obtained results, applied early for the Hospital Sant Joan de Déu (6.1.3-ASQ Results) also apply here.

The answers of the therapist were quite consistent and provided a total average ASQ score of 2,67 for the entire study length.

Table 16 – ASQ Score Results for the Therapist of HML

Date	ASQ Score
15-01-2010	2,67
18-01-2010	2,67
20-01-2010	2,67
22-01-2010	2,67
25-01-2010	2,67
29-01-2010	2,67
12-02-2010	2,67

As far as the answers of the patients, we will provide the average ASQ scores grouped by: date of scenario and patient. Additionally, it is also possible to see the ASQ score for each patient for the study length.

The global average ASQ score accounting for all the patients and for all the sessions considered is 2,75. The average ASQ score given by the patients in the length of the study refers their opinion on the usage of the system (Figure 52).

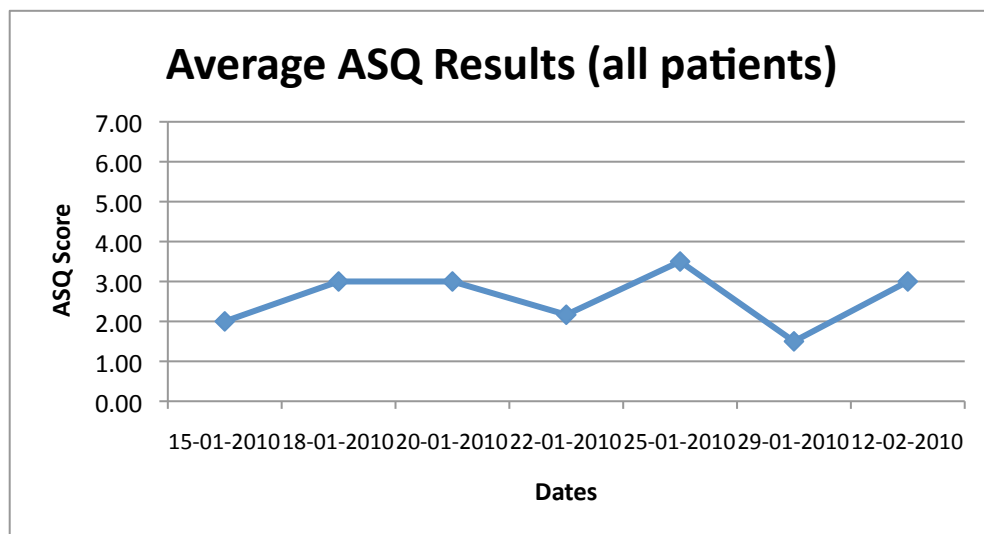


Figure 52 – Average ASQ for Patients of HML

Figure 53 presents the number of sessions completed by each user:

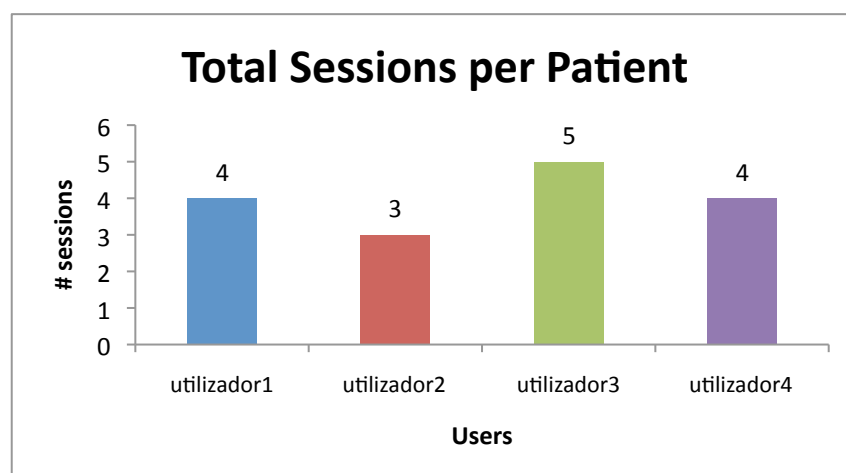


Figure 53 – Total Sessions per Patient of HML



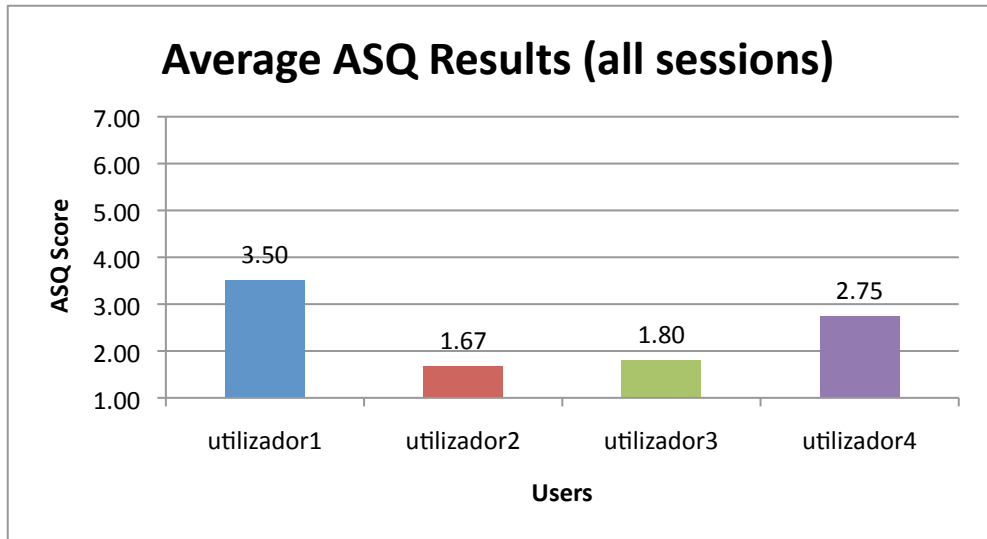


Figure 54 – Average ASQ Results of HML

Figure 54 presents the average ASQ score given by each patient for the study length.

Figure 55 presents an ASQ score chart for each patient through their sessions. The trend lines for each chart are similar and indicate a decrease in the ASQ score after an initial period of sessions.

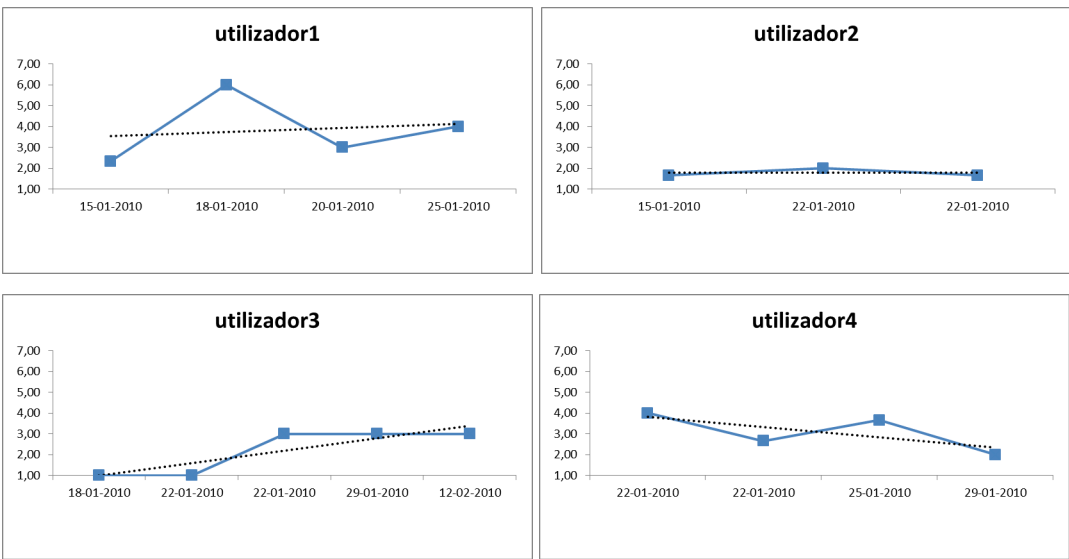


Figure 55 – ASQ score chart per patient of HML

Comparing the average results for all the patients and the score for the therapist, the therapist indicated a higher ASQ score in the last sessions, while the average of patients seems to lower over time.

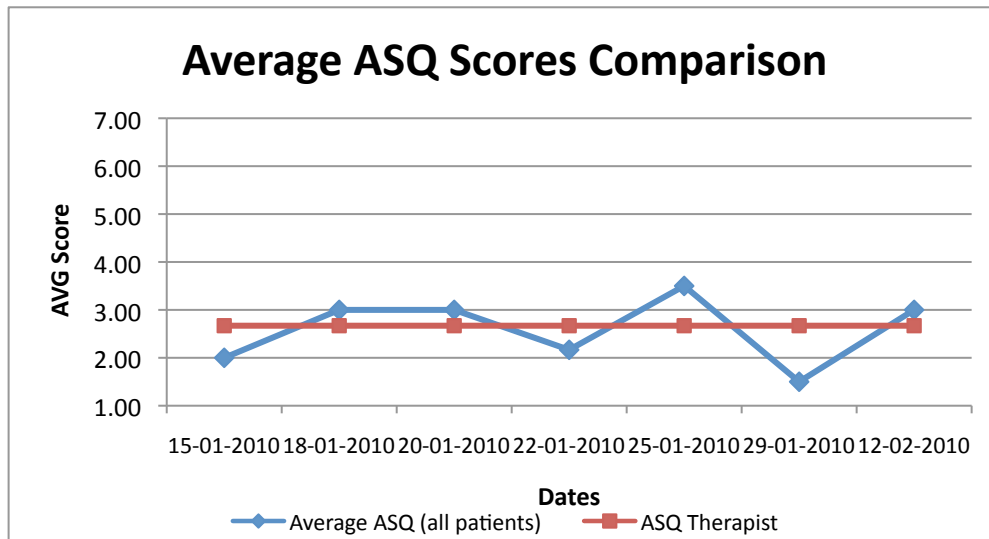


Figure 56 – Average ASQ Scores Comparison of HML

Comparing the ASQ results per session (scenario) with the data that was gathered automatically by eSchi, there seems to be a direct relationship between the user ASQ score and the average performance demonstrated in the system's usage. They both improve over time, as can be seen in Figure 56.

#### 6.2.4. CSUQ Results

The CSUQ results provide information that mainly concerns to the need to upgrade and include new activities in the system. All the users, therapist included, provided feedback on the existing activities of the system and asked for a new activity to be implemented in order to evolve the system.

### 6.3. Summary

The eSchi system was implemented, deployed and data was collected from two distinct case studies. Each one of the case studies has brought some insight into the monitoring and visualization context of e-Therapy that is worth discussing with further detail.

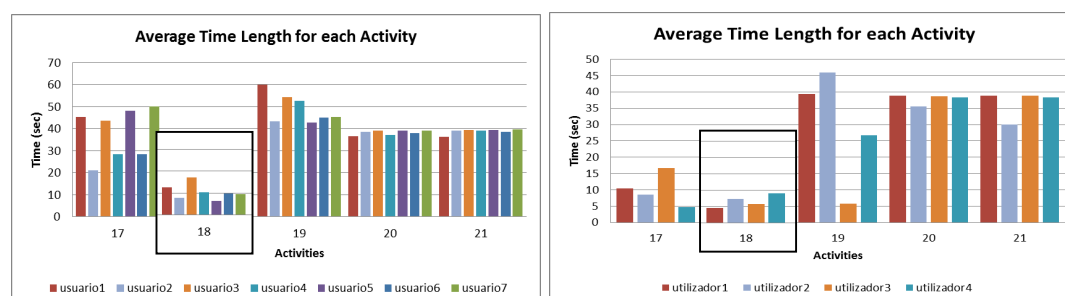
Despite the efforts to minimize existing confounding factors that might influence the results collected, the perfect environment could not be achieved. The idea was to provide three similar sites in which the system would be implemented but reality is actually quite different. It is almost impossible to ensure the same type of conditions from site to site. Each site has its own unique conditions that include aspects such as including an internment ward or an ICT laboratory, schizophrenia typologies present... The number of patients that engaged in the study was considerable different, from site to site, and even the diagnosis, the typologies of schizophrenia and schizoaffective conditions were distinct.

“There are no illnesses, only patients” is a popular saying in the mental health area. Each patient has its own individual and unique condition and cannot, and should not, be grouped into a cluster either in diagnose or treatment. This is the belief of all the health professionals in the mental health field that we had the opportunity to meet. The patient individuality should be respected and this, sometimes, implies a particular treatment protocol. These concerns prove to be highly considerate for the patients and improve the environment lived in the facilities. Nevertheless, this is also one if not the major causes for the harsh situations found when trying to conduct valid research studies, such as this one. Research usually provides new and additional insights on some patterns and characteristics groups, helping in the science discovery process.

Despite the study limitations, presented bellow in section 7.2 and the fact that schizophrenia is a chronic illness that, at present, has no scientific evidence on cognition improvements, indicators attempt to provide some insight into the patient’s behavior within a session and throughout a sequence of episodes in time.

The results show that both the average percentage of the activities completed in the sessions and the average number of correct stimuli improve over time. Patients seem to develop their ability through training. Repetition of the same activities though a certain period seems to improve the outcomes. The actual time spent on an activity while trying to accomplish the specified goals helps to the validation of the other indicators. After some sessions, patients seem to stabilize the amount of time they spend on a session and actually, the effective time seems to decrease over time.

For each activity in the system, the average performance accomplished and the average time length taken by each user to complete it are also shown in chart format. It is possible to see a behavior pattern of patients through the distinct activities. Each patient's results seem to follow the pattern formed by the entire group's results and even the pattern formed by all the users of the system (both sites). The best example of such insight is the set of results presented for the memory related activity (number 18), both in Figure 37 – Average Time Length per Activity of HSJD and in Figure 51 – Average Time Length per Activity of HML, here grouped in Figure 57.



**Figure 57 – Possible Insight on Patterns**

All the patients, at the distinct sites, conducted the memory activity. It presents the lowest average performance and time for all the patients in both sites.

Another aspect worth mentioning is the fact that upon comparison of the ASQ results per session (scenario) with the data gathered automatically by the eSchi tool, they both improve over time. It appears that there is a direct relationship between the user ASQ score and the average performance demonstrated in the system's usage. This could mean that the repeated usage of the tool and the performance improvements in

the activities encourage the users' acceptance of the tool, improving their satisfaction level.

On this line of thought, another possible insight is the fact that, simply by using the automatic and transparent monitoring available in the system is possible to have an insight on the users' satisfaction level. Answering to the ASQ, that occurred on a daily – per session – base and, that despite being only a 3-question questionnaire, is somewhat time consuming. Thus, since there seems to be some redundancy on the information, the ASQ answering could possibly be replaced by the data collection analysis enabled by the InfoVis features of eSchi.

The last data collection tool used was the CSUQ questionnaire that evaluated the therapist' and patients' opinion regarding the computer system usability. This tool was used after, at least, a two-week period from the last utilization of eSchi.

Regardless of the fact that the average CSUQ scores obtained were actually low enough to be considered satisfactory, there was some additional feedback worth mentioning. Some free-text comments, mainly made by the therapists, requested new and improved activities, based on their perception on the e-Therapy sessions where eSchi was used. Therapists considered eSchi as a valuable tool to be used in their e-Therapy sessions and even requested that improvements were included in future versions. This includes new and more challenging activities.

When both profiles (therapist and patient) are compared, it is obvious that the satisfaction level after using eSchi is superior for patients (Figure 45 – Average CSUQ Score Comparison of HSJD). It is important to point out that the fact that the therapist actually answered to the questionnaire twice and that the expectations and usage satisfaction are considerable distant in the two moments of the answers provided. This can be explained by the fact that therapists had higher expectations regarding the evolution of the tool, and the satisfaction score of using the system was strongly influenced by this fact.

## 7. Conclusions

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Mental disorders such as Schizophrenia are amongst the 20 leading causes of disability worldwide. There are currently national policies dedicated to address this public health issue, preventing and improving mental health assistance. One of these policies includes the digital provision of mental health information and services through Mental Health Information Systems (MHIS). Such systems are not yet widely accepted by the health professional's community that still has some ICT introduction resistance. The World Health Organization (WHO) provides guidelines for the correct design and implementation of MHIS.

e-Therapy can be seen as a subsystem of an MHIS that enables the electronic provision of a specific health service – therapy. It is a novel mode of delivery for an already existing type of intervention, where both patients and health professionals are involved. There are several computer-assisted approaches available but the act of designing computer-aided systems, like these, can help to clarify what is the actual procedure followed by therapists. These tools will not replace the therapist, but rather will extend their power and avoid time-consuming and less profitable tasks. A framework for measuring the effectiveness of e-Therapy should be used when applying such systems. It should include items such as quality of care, education and empowerment, access, costs and satisfaction.

Continuous monitoring of the patient treatment's outcome and providing feedback to therapists can be used to improve the treatment's success. Regardless of what produces an effective feedback, quite often debated amongst experts in the field, continuous monitoring of the patients' treatment response and provision of the information to the treating clinician, are required. The Learning Progress Monitoring (LPM) model defines a monitoring system as an implementation that supervises a process. It provides a first approach for the type of monitoring that is required in an e-Therapy context.

The best information visualization (InfoVis) is the one that conveys meaning – insight – to its users. Something unexpected that provides a deeper understanding and eureka-like experiences, allows users to discover hidden connections and patterns. The model proposed by Van Wijk (Wijk, 2006) is quite simple and tries to describe the context where visualization occurs. Visualization tools' success is highly dependent on the interaction techniques used and should contain a consistent and usable interface and provide clear feedback to the users.

According to the conceptual framework summarized, a fieldwork was planned recurring to the well-known case study methodology proposed by Yin (R. K. Yin, 2002; R. K. Yin, 2003) and later expanded by Kitchenham (Kitchenham et al., 1995). To accomplish the study planned it was necessary to design, implement and deploy an e-Therapy tool. To accomplish such a product, the research team used the Patient-Centered Design (PCD) approach. PCD is a particular type of User Centered Design (UCD) approach where the end-user is a patient that will use a healthcare solution that should meet his/her expectations (Dabbs et al., 2009; Demiris et al., 2008). This approach is known as human-centered design and focus on needs, wants, skills and preferences of the product's primary user as well as those of the entire organization.

### 7.1. Contributions

After the design and implementation of the e-Therapy tool – eSchi – two distinct sites were chosen for the application of the tool to a real setting and in a true and natural environment. After the deployment and application of the tool under a formerly

planned and conducted case study, the research team collected the data and then analyzed it. This allowed us to deliver some contributions, described next.

The conceptual model for monitoring in e-learning contexts (LPM) was successfully adapted to the specific conditions of e-Therapy sessions. We designed a new visualization model shown in Figure 58. This is the model implemented in eSchi.

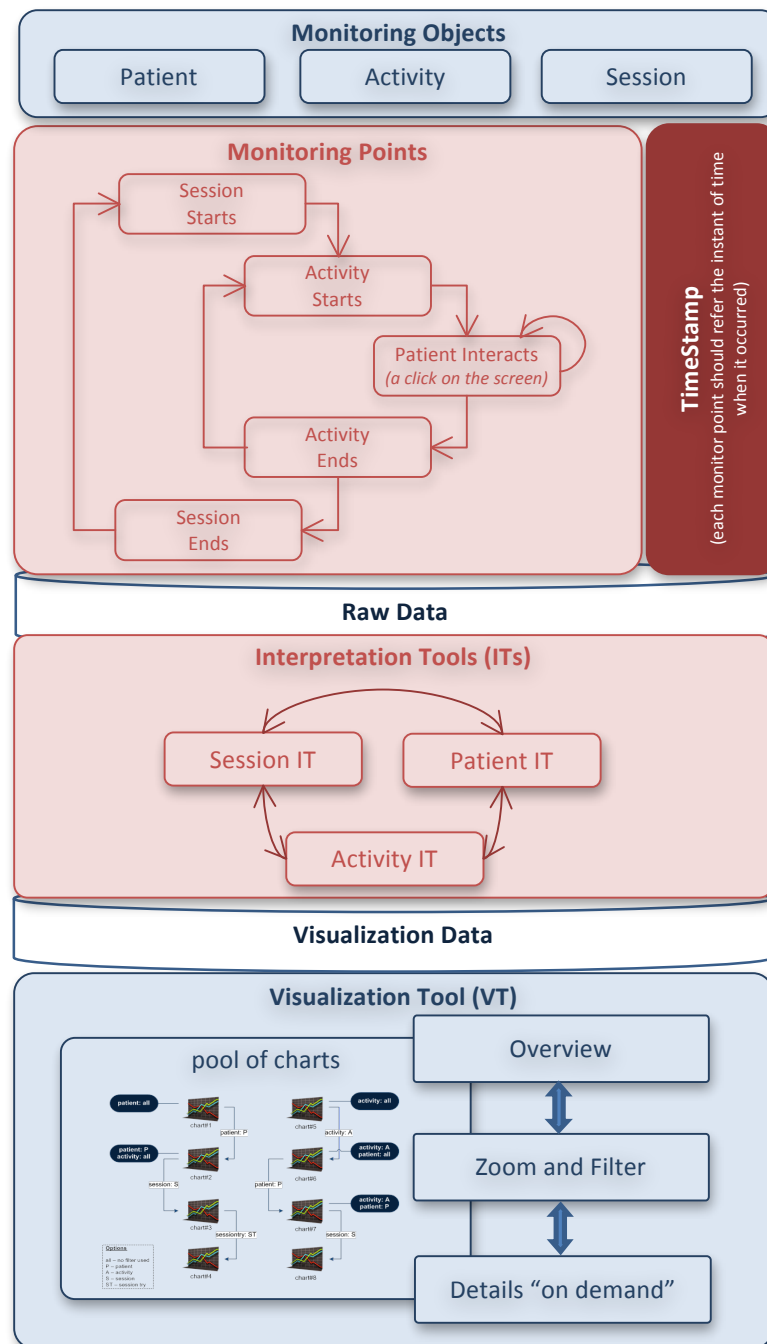


Figure 58 – Conceptual Model for Monitoring and Visualization of Patients' Performance in e-Therapy Contexts



We designed implemented and deployed eSchi, an e-Therapy application used as a complement in traditional therapy sessions. The e-Therapy application was designed and implemented according to the generic guidelines provided by WHO for MHIS systems. eSchi provides a set of multimedia tools that enable the cognitive rehabilitation of Schizophrenia patients, besides allowing therapists to manage their own sessions, patients and define the plan of activities per session. The final system is a simple and transparent structure that enables a fast and flexible integration with new add-ons (activities and additional modules). As far as the user interface is considered: it is clean, easy to learn and comprehend and saves time for its end users.

We successfully deployed eSchi to two distinct real settings, two psychiatric institutions one in Barcelona and the other one in Porto. It was used a Patient Centered Design (PCD) approach that started by listening to the patient's needs and requirements besides considering the social and technical context for the implementation of the product. The method implied the active engagement of end-users in all the design phases starting from early in the lifecycle development process. The conceptual model of eSchi was separated from its implementation model. This is depicted in the plan followed for the empirical work. The PCD approach increased the communication between the health professionals that were involved in the system development.

Through eSchi, we provided support to therapists in the management of their patients' psychotherapy sessions. This improved the effectiveness of the decision-making process while providing some insight into the patient's behavior within a session (single episode) and throughout a sequence of episodes in time (a case) while in e-Therapy settings.

- the indicators chosen and the results of the fieldwork conducted show that patients seem to develop their ability through training. Repetition of the same activities though a certain period seems to improve their outcomes. After some sessions, patients seem to stabilize the amount of time they spend on a session and actually, that effective time seems to decrease over time. Each patient's

results seem to follow the pattern formed by the entire group's results and even the pattern formed by all the users of the system (both sites);

- and it appears to exist a direct relationship between the user ASQ score and the average performance demonstrated in the system's usage. The repeated usage of the tool and the performance improvements in the activities encourage the users' acceptance of the tool, improving their satisfaction level as shown by ASQ scores. There seems to be some redundancy on the information, the ASQ answering could, possibly, be replaced by the data collection analysis provided by the InfoVis features of eSchi.

We propose an evaluation framework to measure the effectiveness of using similar systems to eSchi, in e-Therapy sessions. The framework has a set of guidelines that should be used when designing such systems. As far as eSchi is concerned:

- quality of care – the use of eSchi in a therapy session demonstrates no significant difference from the traditional therapy sessions. Patient's outcome assessment is done using valid tests, scores and scales;
- education and empowerment – all the information available through eSchi was previously validated by the health team, avoiding the ambiguity of that same information. eSchi is prepared to be used online and by patients in an independent way, outside of the sites geographical locations and not only in therapy sessions' periods;
- access – eSchi was a first approach to reduce the resistance to change and technology literacy issue present in mental health contexts. All the legal, privacy, security and ethical issues that are extremely sensible in this type of scenarios were considered and assured;
- costs – this is the most sensible and difficult aspect to measure in the application of such systems and eSchi was not an exception. The only costs that are accountable were the ones associated with the creation of the laboratory of the first site. The desktops and peripherals that were put in the field were given away for charity purposes; and

- satisfaction – eSchi users, both patients and therapists seemed satisfied to use the system, according to the results provided in the questionnaires, the monitoring and visualization of the system's usage data and the informal personal communications that came to our knowledge.

The research team defined no systematic approach to measure the effectiveness of the implementation of eSchi, despite following all of the above guidelines. Nevertheless, we find that there are two aspects extremely relevant for this evaluation. Firstly, all the users that engaged in the study asked for further enhancements of the system, requesting new and improved activities. This reveals their interest in keeping on using the system. Secondly, eSchi is currently in use in a third site of the Sant Joan de Déu Institution by a third group of new users. This application of the system occurred through a professional recommendation of the therapist of the first site. The psychiatrist found eSchi suitable for her professional usage (according to the questionnaires' results) but also worth of recommendation for other professionals in the area.

## 7.2. Limitations of the study

We had the privilege to deploy the application and conduct our study, test it, under real clinical settings. This is something incredible difficult to achieve (Spokoyny & Sharhar, 2004).

Nevertheless, despite the efforts to minimize existing confounding factors that might influence the results collected, the perfect environment could not be achieved. The idea was to provide similar sites in which the system would be implemented but reality is actually quite different. It is almost impossible to ensure the same type of conditions from site to site. Each site has its own unique conditions that include aspects such as including an internment ward or an ICT laboratory, the number of patients to engage in the study and even the diagnosis, the typologies of schizophrenia and schizoaffective conditions. "There are no illnesses, only patients" is a popular saying in the mental health area. Each patient has its own individual and unique condition and cannot, and should not, be grouped into a cluster either in diagnose or treatment. This is the belief of all the health professionals in the mental health field that we had the opportunity to

meet. The patient individuality should be respected and this, sometimes, implies a particular treatment protocol. Further, the fact that schizophrenia is a chronic illness that, at the present, has no scientific evidence on cognition improvements was also a factor that led to distinct sampling conditions.

While all of these concerns prove to be highly considerate for the patients and improve the environment lived in the facilities.

### 7.3. Publications

Most of the work here presented was already published or is in a final step of the publishing process:

- Ferreira, C., Freire, C. S., Reis, C. I., Costa, J., André, N., Gaspar, P., et al. Perspectives of ICT use in nursing in Portugal: A survey. (*submitted December 2009*). Computers, Informatics Nursing,
- Freire, C. S., Reis, C. I., & Monguet, J. M. (2008). eSchi – A multimedia portal for schizophrenia learning and rehabilitation: Work in progress. Paper presented at the Proceedings of World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education, Las Vegas - Nevada - USA. 2175-2180.
- Reis, C. I., Freire, C. S., Fernandez, J., & Monguet, J. M. (2009). eSchi – an e-therapy tool for rehabilitation and training. ED-Media 2009 Proceedings, Honolulu, Hawaii - USA.
- Freire, C. S., Reis, C. I., Monguet, J. M., & Ojeda, J. (2009). eHealth major concepts. 2nd International ICST Conference on Electronic Healthcare for the 21st Century - eHealth'09, Istanbul, Turkey.
- Reis, C. I., Freire, C. S., & Monguet, J. M. (2010). e-therapy. In M. M. Cruz-Cunha, A. J. Tavares & R. Simoes (Eds.), Handbook of research on developments in e-health and telemedicine: Technological and social perspectives (pp. 882-882-903) IGI Global.

## 7.4. Future Work

ICT has many contributions to make in the psychotherapy area (Percevic et al., 2004) and the work here described only adds one small step in this never-ending task. No development work is ever complete and can always be improved. The following list provides a couple of ideas where the work can be improved and extended:

- A clinical validation of the scores used to evaluate the system and discover the user's satisfaction level should be accomplished. This will imply a valid and reliable sample for the study.
- Further applications of the system should be planned and their results published.
- The system should incorporate new and more engaging activities, the users have already asked for them.
- The new ubiquitous world provides new ideas and opportunities to have the same system but under different platforms, namely smartphones (iPhone and Android enabled systems) and tablets (e.g. iPad).
- The visualization module should be improved in a way that the tool could be easily used for future medical research of the clinical staff.
- A clinical valid and statistical valid study should be conducted, in order to evaluate the system and discover the user's satisfaction level.
- The data collected and future data to be collected might be of use in future versions of the system, namely for conducting some type of data mining.

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## 9. Annexes

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This section includes all the annexes that complement the description of our work.

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## 9.1. Meetings and Focus Groups

- ∞ Meeting Minute for 2007/10/08
- ∞ Interview at the HSJD-SSM on the 2008/07/07
- ∞ Meeting Minute for 2008/07/09
- ∞ Initial GUI Prototype Proposal

<p>e-schi</p> <p>Herramientas Multimedia para la mejora de la cognición en esquizofrenia</p>	<p>Estrategia para desarrollar el software</p>	<p>Minuta 8 oct 07</p>
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**Asuntos:** Revisar i validar las propuesta de diseño de las aplicaciones discreta y narrativa

Revisar material propuesto para la aplicación que tiene como objetivo valorar el desempeño del paciente con el ratón

**Asistentes:**

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*Grupo Clínico*

Jaume Autonell

Miquel Bernardo

*Grupo Discreto*

Ana Escanilla

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Motserrat Toribio Prieto

*Grupo de producción UPC*

José María Monguet

Francisca Grimón Mejías

María Luisa Pérez Guerrero (distancia)

Eduardo Huerta Vasquez (distancia)

**Puntos Tratados:**

1. Revisión de las variables a considerar en las aplicaciones del modelo discreto y del modelo narrativo
2. Revisión de las propuestas de la aplicación que valorará el desempeño con el ratón

**Decisiones:**

1. Para valorar el desempeño con el ratón se acordó enfocarse en ejercicios de dos tipos:

Hacer un “click” sobre un objeto

Mover objetos “clickando” y arrastrando el ratón

Se diseñó el estilo del contenido en base a la propuesta de MLP.(vease Power point) limitando al modelo sujeto (bebe) Objeto (chupete). Replicando el modelo a otros objetos-sujetos.

2. Para el modelo narrativo se acordó elaborar un documento que describa 6 ejemplos 2 de cada nivel de dificultad (fácil, medio, difícil) de los productos que habrá de manejar el paciente en los ejercicios
  - Guardar productos en los armarios
  - Elaborar lista de compra de los productos faltantes
3. Para el modelo narrativo se acordó completar la tabla propuesta y concretar las opciones de las variables.
4. Se acordó nombrar dos interlocutores de cada lado que colaboraran con el grupo discreto y con el grupo narrativo.<sup>1</sup>

### **Asignación de actividades:**

1. El grupo discreto definirá las variables necesarias completando la tabla propuesta.
2. El grupo narrativo planteará 6 ejemplos 2 por cada nivel de dificultad de los productos que manejará el paciente en los ejercicios de acomodo en armarios y elaboración de lista de productos faltantes
3. El grupo técnico de producción desarrollará las aplicaciones que valoran el desempeño del usuario con los dos ejercicios que se acordaron.
4. El plazo para disponer de una aplicación que nos permita realizar pruebas alfa con terapeutas i técnicos se establece en el periodo hasta finales de año.
5. El plazo para realizar pruebas beta con enfermos se establece en una primera hipótesis hacia finales del mes de enero.
6. Se trabajara de forma que los interlocutores se encarguen de mantener los contactos.

### **Próxima reunión: ¿?**

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<sup>1</sup> Por parte del grupo técnico los interlocutores serán:

Grupo narrativo: María Luisa Pérez

Grupo discreto: Eduardo Huerta

# Interview

## at the HSJD-SSM on the 2008/07/07

*by Catarina Reis, Carla Freire*

*Leiria, 2<sup>nd</sup> of May of 2008*

The following document presents guidelines to conduct an interview to a psychiatrist or psychotherapist that works with schizophrenia patients. The guidelines were originally prepared with the intention to be conducted in the Hospital San Joan de Déu – Serveis Salut Mental (HSJD-SSM) in Barcelona, Spain.

### Interview Data

Place: **HSJD-SSM**

Date: **2008-05-07**

### Interviewer Identification

Name: **Group of Therapists: Ana Escanilla; Gemma Escartin; Gemma Escuder**

### Patients

### *Demographics*

#### 1. How large is your population of schizophrenia patients?

**Ingressions: Internal patients (within facilities – hospital or others)**

**(Gemma) – Penitentiary Hospital: 60-70% paranoid schizophrenia (60 beds total) – they have several delusional issues and some of them are involved in homicides and other similar situations that lead to their imprisonment.**

**(Anna) 210 – 215 patients in the hospital (90% schizophrenia – paranoid, simple, residual and disorganized) – the hospital is an extended stay facility, so there are many distinct typologies.**

**(Gemma) patients live at their home (community rehabilitation) – 45 places (80% schizophrenia)**

2. Are there any patients that, despite not being schizophrenic, present schizoaffective disorders?

Yes, there are several patients with similar symptoms to the schizophrenia symptoms. Personality disturbances, bipolar disorders, delusional disturbances,

The cognitive symptoms are also found in other mental illnesses such as bipolar disorders, and the eSchi application may also help this kind of patients too, not only the schizophrenic ones.

3. How do you classify your patients? Using DSM-IV?

Yes, they use the DSM-IV to define the schizophrenia but only for the first evaluation. To classify and evaluate the cognitive domains they use test batteries (further ahead in the interview).

4. Is it possible to have access to the demographical data of your patients?

➔ age, schizophrenia subtype (paranoid, disorganized, catatonic), medication type, internment time, relapses,... Is there any other demographic information that should be included?

Yes, upon the ethic committee approval – they would provide us with the data

### *Treatment*

5. Do you use typical and/or atypical antipsychotic drugs?

Yes they use both. Medication is essential. Each case is a specific case and both are used regarding the patient.

6. How often do therapeutic reevaluations occur?

Neuropsychological evaluation (with the batteries) is done every time a patient enters and before starting the treatment, then, after a few months the same evaluation is done again. When the patient achieves a stable state the evaluation process stops. Only if he relapses, then the evaluation is done again. Tests Batteries may be also done according to some of the identified cognitive deficits.

For the planned study (the study will take up at least 3 months – application - to a maximum of 6 months – including study preparation and follow up analysis)

1 – before study (0- basal state)

3 – 3 months after application (2 - last evaluation)

The evaluation made in the usual clinical setting is distinct of the evaluation made for this study. The evaluations are always made in the same way when doing research. When taking into account the clinical setting, each patient is a patient, and there are patients that need weekly evaluation, others only need monthly evaluations.

7. A patient can have more a psychiatrist endorsed to him? Is there a team that is assigned to a patient? Or this relationship is on a one-to-one basis?

1 psychiatrist per patient but there are other elements of the team (experts: psychologist + social workers and nurses). (RULE 1 – 1)

Neuropsychologists deal with cognitive problems.

While the psychiatrist in charge of a patient is defined by geographical location (the goal is to make an effort to enable the patient to return to their home/work as usual), the psychologists are defined by the specific area of treatment (medication issues, self-esteem issues, cognitive problems,...).

8. How many patients do you think you can involve in the eSchi application use?

20/30 patients – eSchi multimedia tool

20/30 patients – usual (standard cognitive therapy)

20/30 patients – without cognitive therapy

9. What inclusion/exclusion criteria do you use for patients that will use the eSchi application?

There is more information in the Meeting Minutes that were completed with the information present in the project guidelines that were made to ask for a scholarship.

Sessions

1. As far as we understand, schizophrenia treatment includes psychotherapy sessions besides medication. Is this true?

Cognitive rehabilitation

IPT - Integrated Psychological Therapy

This is a group therapy that is defined by a model that is a classical model, a standard - but does not offer any evolution to patients and since it is inefficient, they don't use it.

They use the paper and pencil exercises and blackboards that are adapted from other illnesses. There are also some educational programs that can be adapted to achieve this goal.

Example: drawing presented and chosen between distracters

Read them a story and then the patient has to say what he has read or what he heard (therapist asks him).

CRT – Cognitive Remediation Therapy

(the one that is being used nowadays in the world, but there is no translation to spanish yet)

This is an individual therapy. And the training at the HSJD is done as the beginning (the first approach) of this type of theoretical therapy.

2. How many major types of psychotherapies do you know?

Already answered above.

3. Which one(s) do you use in your patients' treatment?

Already answered above.

4. How do you choose a therapy (specific-theoretical one) to a patient? Is it just 1 therapy per patient? Is there a mix of therapies per patient?

Already answered above.

5. How often do these sessions occur? And how long to they take (30-45 minutes)?

At the hospital there are several situations:

1 to 2 per week / 30 -45 minutes

At the penitentiary hospital:

1 per week – 45 minutes

At the community:

2 per week – 50 minutes

1 per week – 50 minutes

6. A session is tailored specifically for a patient? The “tailoring” implies planning and designing the session previously?

A patient has a specific session specially made for him – content is also a preoccupation and sometimes needs to be changed.

Generally they make individual therapy - especially when beginning a therapy - but there are cases where they also do group therapy with, at the maximum, 6 per group. These sessions only work if patients are homogeneous – working in team is very difficult.

Group therapy usually works in the following manner: the therapist explains an activity; each one of the patients completes the activity; and then the results obtained are shown and discussed by everyone in the session.

Social skills – imply other type of concerns and other type of therapies – there is a need to do some more research on this.

7. Can you define the process that is involved in a regular session?

Evaluation

- Clinical information

Individual sessions (patient is supposed to come to the session – it's not mandatory to come to the session – it's not supposed to force patients to come to the session, it's not like the medication that when they don't want it, they are forced to take it - mental effort is different and we cannot force someone to work with their cognitive skills)

- Buenos días. Cómo estás? Como ha pasado la noche?
- Se ha habido algún cambio en los últimos días (de antes, de la última sesión)
- Carpeta con (los ejercicios) todo que hay que hacer (with all the sessions until the end of the therapy)
- Miro el registro del último día para preguntar se ha hecho su trabajo de casa e empiezo por ahí
- Empiezo y concluyo con ejercicios más sencillos (los difíciles quedan en el medio)  
(idea: motivar el paciente)
- No soy capaz de enterarme de una película hasta al final.
- Motivación/Incentivos: no se usan los incentivos con problemas de memoria
- Registrar los datos – notas texto con lo que ha pasado, como ha evolucionado, que tipo de estrategia van a utilizar (al final de la sesión y colocar en el pc para que los otros sepan lo que ha sido hecho y como ha sido hecho)

#### 8. How does a session occur?

- Before
  - A session is scheduled? How do you currently keep track of all your appointments?
  - Frequency? Monthly? Weekly? Daily? More than once a day?

Just one session per day (cognitive therapy related) and the weekly frequency depends on the patient situation.

- Is there any kind of previous work that should be done for the session?  
Are activities prepared? The order of the activities presented to the patient is important?

At the end of the session, doctors register what has happened during it and try to plan for the next session, in a piece of paper.

- During

- How do you start a session? With some kind of informal conversation?  
Do you take notes on this conversation?
- Is there some type of physical test (pulse?)?
- A plan is followed for the activities?

Yes but it might suffer updates, due to the events that occur during the session. The patient might perform more slowly than usual. If there's an exercise that the patient should have done by itself but didn't accomplish it, the exercise is going to be done together (patient + therapist).

- Do you take notes during the session? Before, during or after the activity?

Notes are taken after the session is concluded.

- How is the battery of instruments used? (Skip other questions and go to section 6)
- After
  - Do you make some kind of report with your own personal conclusions/opinions about the patient status?
  - Do you provide some type of feedback to the patient and/or to the patient family or caregivers?

Since patients are insiders in the hospital facilities, the families are non-existing. They know less than the doctors and don't care or don't want to know. There is no connection to the patient. In the field, there are families (they are in a small number, are unstructured and parents are old people). The families that do care are more interested that their family member can live as usual and in a way that they don't feel distressed. They care about how the patients behave and the problems that arise from the schizophrenia patients' cognitive problems. Families have problems with the social inabilities of the patients. Usually they are young patients (25 years) that are diagnosed very early in their life. They are in a stable situation and the family is interested in having the situation resolved. It's a small percentage of cases, but they do exist and should be taken into consideration. They are interested in having a job, a common life for their family members.

The idea is to provide access to useful information.

Feedback to the patient is given in a verbal way.



eSchi is to be used in a stabilized phase

The main worry with this disease is not the cognitive problem, but the hallucinations, delusions, etc that the patient suffers. The therapy only starts after these symptoms are under control.

- Do you provide feedback to your colleagues?

Yes.

- Notes for the next session?

Yes.

9. Do you usually register on video these sessions? Can we have access to these videos?

The sessions are NEVER recorded. There are problems with the patient and with the ethical committee. The social stigma is extremely hard to deal with. It can affect the performance of the patient.

But we can assist to the sessions and can interview them also!!! ☺ - Problem with ethical committee but we can also sign some type of Non Disclosure Agreement - NDA.

#### Activities

1. Motricidad – no babies and pacifiers – what is the alternative?
2. Basic Cognition and Complex Cognition – the content is to be shared (images, sounds and videos) or something different?

We can use real photographs (static content). The photos might have some level of detail, but not too much. It makes sense to also use the images from the other game (complex cognition). Supermarket where there is several products and categories: food; clothing; cleaning; ...

The images content can be made in a more dynamic way, thus allowing therapists to upload their own content for the applications. Deaf and speaking-impaired are also impairments of schizophrenics, but at a small percentage. There are no blind persons amongst the population.

(design the idea of a game of recall using video)

#### Assessment Tests and Tools - Batteries

Type	Scale
Clinical and Functional Assessment	L'Escala dels Síndromes Positius i Negatius (PANSS) (Cuesta y Peralta, 1994)
	C.G.I-Schi (Haro et al, 2003)
	Basic Everyday Living Schedule (O'Driscoll, C. Y Leff, J., 1993)
Cognitive Functioning Assessment	Wechsler Memory Scale-III (Subtests) (The Psychological Corporation, 1997)
	Rivermead Behavioral Memory Test (Wilson, B, 1985)
	Trail Making Test (Partington, J, 1949)

	Wisconsin Card Sorting Test (Berg, E.A., 1948)
	Behavioural Assessment of the Dysexecutive Syndrome (Wilson, B. A., 1996)
	Controlled Word Association (Spreen, O. and Benton, A.L. (1969,1977)
	Subtest de Vocabulario del Wechsler Adult Intelligence Scale third edition (Wechsler, D., 1997)

**2 to 3 hours to apply these scales, at the minimum. These are the scales to be used at the basal moment for a first assessment of the cognitive impairments of the patient and at the end of the study, in order to establish the new scores for each one of the patients. These are exclusion criteria for the study.**

**Only the WCST is on the pc, all the other scales are filled in by hand.**

1. Do you use all of these instruments in a session (or not in a session it might be an evaluation session or re-evaluation)?
2. Are there any other instruments that you use on a daily basis, that are not “official”?  
If yes, which, why and how are they used?
3. Which are the most used scales/tools?
4. Are some scales more adequate or only used in a couple of patients (subtypes considered)?
5. How are these instruments used in conjunction with the activities that we are currently developing (and new ones) for the eSchi project?
6. Do you think that the use of scales and test batteries need to be “learned” to be applied? Therapists should all use the same measures and apply the same rules.

**The scales are extremely easy to use. They are objective. This is what they do on a daily basis and don't need any kind of training on them.**

<p>e-schi</p> <p>Herramientas Multimedia para la mejora de la cognición en esquizofrenia</p>	<p>Revisión de parámetros de las aplicaciones cognitivo básico</p>	<p>Minuta 9 Julio 08</p>
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**Asuntos:** Revisar los parámetros de las aplicaciones que soportan los ejercicios de motricidad y ejercicios cognitivos básicos

**Asistentes:** Grupo San Joan de Deu

*Grupo Discreto*

Ana Escanilla

Gemma Escartin

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José María Monguet

María Luisa Pérez Guerrero

Carla Freire

Catarina Reis

**Herramientas:** Aplicaciones on-line que soportan los ejercicios de motricidad y los ejercicios cognitivo básicos

**Puntos Tratados:**

- ∞ Revisión de los parametros de las aplicaciones que soportan los ejercicios de
  - 3.1. Motricidad
    - a) Tirar objeto visual
    - b) Tirar objeto sonoro
    - c) Dar click y arrastrar
  - 3.2. Cognitivo básico
    - a) Reconocimiento
    - b) Asociación

**Decisiones y observaciones**

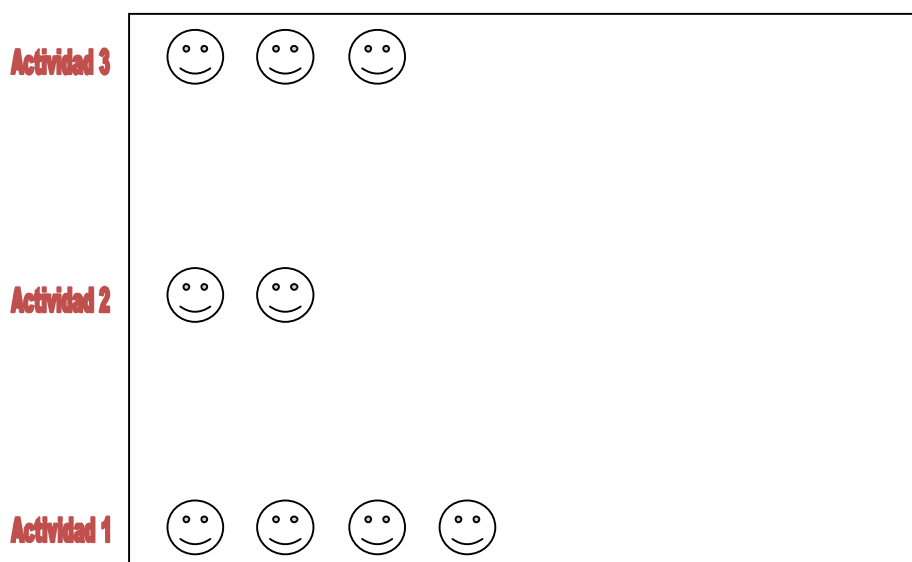
*Observaciones generales:*

- ∞ El ejercicio de asociación es más difícil que el ejercicio de reconocimiento pero menos que el ejercicio de evocación, **que todavía no está hecho y queda saber cómo hacerlo.**
- ∞ No se puede hacer el ejercicio de evocación si no se han hecho los ejercicios de reconocimiento y asociación, **lo que está resuelto porque quien hace la definición de actividades de cada sesión es el terapeuta. Por lo tanto tiene total control sobre la orden de las actividades.**
- ∞ Los estímulos objetos inanimados son de una complejidad básica, los objetos animados son de una complejidad media y las situaciones son de una complejidad alta.
- ∞ El grado de complejidad de los ejercicios depende del número, **de la semejanza entre estímulos** y del tipo de complejidad de los estímulos que se utilicen
- ∞ **Las gráficas que se propusieran son de dos tipos distintos:**

- Por actividad
  - Deberá aparecer al final de cada actividad (opcionalmente disponible para que el paciente la mire)



- Por sesión
  - Deberá estar disponible en el nombre de cada actividad el enlace para la gráfica correspondiente a esa actividad
  - Deberá aparecer el resultado del intento con mejor puntuación



Se recomendaron los siguientes parámetros por tipo de ejercicio:

### **Motricidad**

#### **Clicar (Visual y Sonido)**

Mostrar 3 ejercicios consecutivos considerando la variable tiempo **como el incremento en la complejidad (reduciendo el tiempo entre estímulos en cada ejercicio)**

#### **Clicar y Arrastrar**

Se pueden mostrar los estímulos usando como referencia las esquinas de la pantalla o bien el centro de la pantalla como punto de partida – **siempre de forma aleatoria.**

**Varios estímulos (naranjas) para un solo “target” (cesta) que podrán ir apareciendo con el pasar del tiempo. Los locales en que aparecen los estímulos deberán ser aleatorios.**

### **Reconocimiento**

La complejidad del ejercicio está definida por el número de estímulos **y la semejanza entre los estímulos presentados.**

Ejercicio uno **(se repite 3 veces)**

**Descripción:** 1 estímulo que deberá ser reconocido entre 4 estímulos

Ejercicio dos (condición el primer ejercicio exitoso) **(se repite 3 veces)**

**Descripción:** 2 estímulos que deberán ser reconocidos entre 8 estímulos más

**Ejercicio tres (condición de los dos anteriores exitosos) (se repite 3 veces)**

**Descripción:** 1 estímulos que deberán ser reconocidos entre 4 estímulos más (pero con semejanza elevada y objetos con más detalle – caras y paisajes). En el siguiente 2 estímulos que deberán ser reconocidos entre 8 estímulos más.

Si logró hacer 3 ejercicios que tengan el mismo número de estímulos es decir 1 contra 4 se puede incrementar la dificultad al ejercicio dos.

En caso de que el paciente falle en el primer intento se le darán 12 oportunidades para intentarlo, cada vez se utilizará 1 de los 4 mensajes de ayuda que se repetirá 3 veces de forma aleatoria dentro las 12 oportunidades.

Mensajes de ayuda (distintas para los varios niveles)

“Tienes que prestar más atención”

“Intentalo de nuevo”

“Di el nombre del objeto que buscas en voz alta”

“Por que no pruebas fijarte más en los detalles”

En caso de fallar después de las 12 intentos se le emitirán mensajes de cierre de la actividad como:

“Prueba dentro de un rato”

“Parece que estas un poco cansado”

“Puedes intentarlo más tarde”

### **Asociación**

Se muestran 3 ejercicios de cada nivel, el grado de complejidad será definido por el número de estímulos que se presentan

Nivel básico - 2 parejas de estímulos (4 objetos en pantalla)

Nivel medio - 3 parejas de estímulos (6 objetos en pantalla)

Nivel alto - 4 parejas de estímulos (8 objetos en pantalla)

Nivel máximo - 5 parejas de estímulos (10 objetos en pantalla)

Se recomienda utilizar estímulos como objetos inanimados y animados claramente diferenciables.

### **Asignación de actividades:**

### Grupo Producción UPC

1. Ajustará las aplicaciones con respecto a los parámetros recomendados
2. Se publicará on-line el sitio que contenga las aplicaciones para que los terapeutas puedan probarlo y validen completamente las aplicaciones antes de hacer pruebas piloto con pacientes.

### Próxima reunión:

La próxima reunión queda pendiente de concertar.

### Anexo I – Lista de situaciones pendientes

- ∞ Foto – foto por omisión con la posibilidad de poder hacer *upload* de la foto del terapeuta.
- ∞ Tecla “Enter” a trabajar como el botón del ratón
- ∞ Cambiar todo el texto al castellano.
- ∞ Quitar todas las referencias numéricas en la descripción de las actividades.
- ∞ Verificar los cambios de zoom (permitidos por el IE7) a respecto del zoom.
- ∞ Permitir que más naranjas sean incluidas en la cesta de fruta.
- ∞ Cambiar la imagen para que parezca que tiene una o dos naranjas dentro (imágenes distintas con 1/2/3/4 naranjas).
- ∞ Verificar que se pueda hacer drop (no funciona con el mensaje de alerta)
- ∞ Las gráficas con caritas “emojicons” a la vez de las fotos de las terapeutas
- ∞ La actividad de asociación no lleva mensajes de ayuda
- ∞ Se recomienda utilizar mayor espacio entre los estímulos para no causar confusión (dejar las líneas de asociación más claras)

### Anexo II – A mirar...

- ∞ **Nintendo – Brain Training**
- ∞ **Tetris**



# Initial GUI Prototype Proposal



## **Guião de simulação das aplicações**

### **Motricidade e Discreto**

10 Janeiro 2008

Carla Sofia Freire  
Catarina Reis

#### Tutores

Josep M. Monguet  
Joaquin Fernandez  
Juan José Fábregas



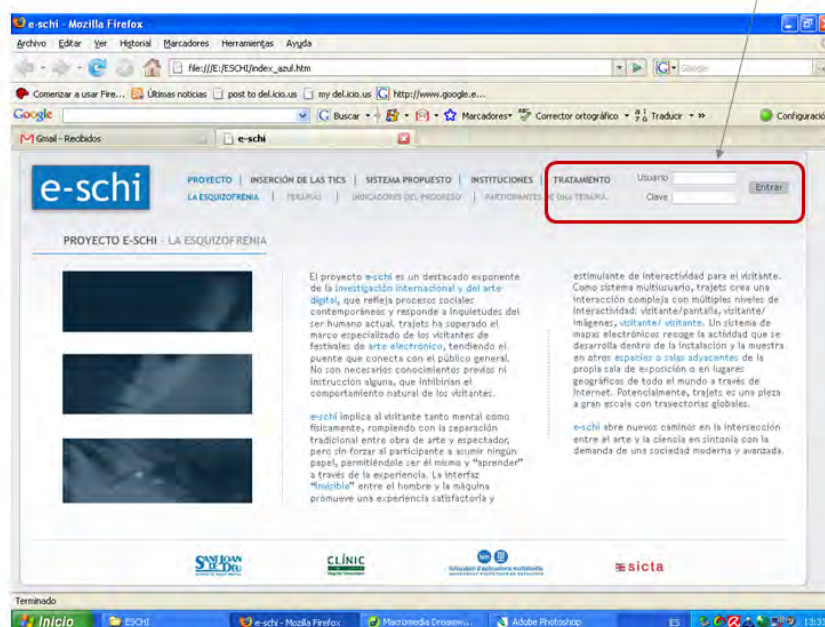
## **Explicações e dúvidas**

- Ver em modo de apresentação
- A partir do próximo diapositivo o **que estiver a vermelho (rojo) é um hiperlink**, para simular a aplicação, assim como os restantes diapositivos estão ocultos, de forma a serem visualizados apenas pelos hiperlinks.
- É **necessário falar com os profissionais da saúde mental**, de forma a ver o que realmente é preciso ser medido, para que se possa fazer a parte do médico (configuração das aplicações) e o acompanhamento do paciente.
- Imagens????  
A parte do discreto foi feito com base em imagens de um hipermercado (continente) ou seja, existe a questão de direitos de autor.  
**Como procedemos relativamente às imagens? Sejam do Motricidade, sejam do Discreto?**



## Entrada na plataforma

O médico entra na Plataforma, mediante um nome de utilizador e uma password



## Área do terapeuta – Em estudo

Saída da área pessoal do médico



## Área do terapeuta – Em estudo

Saída da área pessoal do médico

Logout

e-schi

PROYECTO | INSERCIÓN DE LAS TICs | SISTEMA PROPUESTO | INSTITUCIONES | TRATAMIENTO

Tratamento | Fernando

Ficha pessoal

Actividades a realizar

Evolução

Nome:

Morada:

Telefone:

Diagnóstico:

Medicação:

...

## Área do terapeuta – Em estudo

Saída da área pessoal do médico

Logout

e-schi

PROYECTO | INSERCIÓN DE LAS TICs | SISTEMA PROPUESTO | INSTITUCIONES | TRATAMIENTO

Tratamento | Fernando

Ficha pessoal

Actividades a realizar

Evolução

Motricidade

Discreto

Narrativo

## Área do terapeuta – Em estudo

Saída da área  
pessoal do  
médico

The screenshot shows the 'e-schi' interface for a therapist. The top navigation bar includes 'PROYECTO', 'INSERCIÓN DE LAS TICs', 'SISTEMA PROPUESTO', 'INSTITUCIONES', and 'TRATAMIENTO'. A 'Logout' button is in the top right corner. The main header is 'Tratamento | Fernando'. On the left, under 'Actividades a realizar', there are three options: 'Motricidade', 'Discreto' (highlighted with a red box), and 'Narrativo'. On the right, under the 'Motricidade' section, there are three items: '- Tiro ao alvo visual' (highlighted with a red box), '- Tiro ao alvo sonoro' (highlighted with a red box), and '- Clica e arrasta' (highlighted with a red box).

## Área do terapeuta – Em estudo


Saída da área  
pessoal do  
médico

The screenshot shows the 'e-schi' interface for a therapist. The top navigation bar includes 'PROYECTO', 'INSERCIÓN DE LAS TICs', 'SISTEMA PROPUESTO', 'INSTITUCIONES', and 'TRATAMIENTO'. A 'Logout' button is in the top right corner. The main header is 'Tratamento | Fernando'. On the left, under 'Actividades a realizar', there are three options: 'Motricidade' (highlighted with a red box), 'Discreto', and 'Narrativo'. On the right, under the 'Discreto' section, there are three items: '- Reconhecimento' (highlighted with a red box), '- Associação' (highlighted with a red box), and '- Evocação' (highlighted with a red box).



## Área do terapeuta – Em estudo

Saída da área pessoal do médico


PROYECTO | INSERCIÓN DE LAS TICs | SISTEMA PROPUESTO | INSTITUCIONES | TRATAMIENTO
Logout

Tratamiento | Fernando

Actividades a realizar

Discreto

Adicionar actividade Motricidade

- Tiro ao alvo visual

- Tiro ao alvo sonoro

- Click e arrasta

**Motricidade | Tiro ao alvo visual**

Tempo da actividade  segundos

Número de estímulos a aparecer

Tempo de demora a aparecerem os estímulos  milissegundos

Guardar


Começar

*Possibilidade de guardar as configurações e adicionar novas actividades*

*Iniciar a actividade para o paciente*

## Área do terapeuta – Em estudo

Saída da área pessoal do médico


PROYECTO | INSERCIÓN DE LAS TICs | SISTEMA PROPUESTO | INSTITUCIONES | TRATAMIENTO
Logout

Tratamiento | Fernando

Actividades a realizar

Discreto

Adicionar actividade Motricidade

- Tiro ao alvo visual

- Tiro ao alvo sonoro

- Click e arrasta

**Motricidade | Tiro ao alvo sonoro**

Tempo da actividade  segundos

Número de estímulos a ouvir

Tempo de demora a aparecerem os estímulos  milissegundos

Guardar

Começar

*Possibilidade de guardar as configurações e adicionar novas actividades*

*Iniciar a actividade para o paciente*

## Área do terapeuta – Em estudo

Saída da área pessoal do médico

Logout

e-schi

PROYECTO | INSERCIÓN DE LAS TICs | SISTEMA PROPUESTO | INSTITUCIONES | TRATAMIENTO

Tratamento | Fernando

Actividades a realizar

Discreto

Adicionar actividade Motricidade

- Tiro ao alvo visual

- Tiro ao alvo sonoro

- Clica e arrasta

**Motricidade | Clica e Arrasta**

Tempo da actividade  segundos

Número de crianças

Número de chupetas

Guardar

Começar

Possibilidade de guardar as configurações e adicionar novas actividades

Iniciar a actividade para o paciente

## Área do terapeuta – Em estudo

Saída da área pessoal do médico

Logout

e-schi

PROYECTO | INSERCIÓN DE LAS TICs | SISTEMA PROPUESTO | INSTITUCIONES | TRATAMIENTO

Tratamento | Fernando

Actividades a realizar

Motricidade

Adicionar actividade Discreto

- Reconhecimento

- Associação

- Evocação

**Discreto | Reconhecimento**

Tempo da actividade segundos

Tipo de tarefa distratora

Velocidade da apresentação do alvo

Natureza do estímulo

Número de alvos a memorizar

Frequência

Similitude do alvo com os elementos distractores

Guardar

Começar

Possibilidade de guardar as configurações e adicionar novas actividades

Iniciar a actividade para o paciente

## Área do terapeuta – Em estudo

Saída da área  
pessoal do  
médico

The screenshot shows the 'e-schi' web application interface for a therapist. The top navigation bar includes links for 'PROYECTO', 'INSERCIÓN DE LAS TICs', 'SISTEMA PROPUESTO', 'INSTITUCIONES', and 'TRATAMIENTO'. A 'Logout' button is in the top right corner. The main header reads 'Tratamento | Fernando'. On the left, under 'Actividades a realizar', there is a list of activities: 'Motricidade', 'Adicionar actividade Discreto', '- Reconhecimento', '- Associação', and '- Evocação'. The 'Adicionar actividade Discreto' option is highlighted. The main content area is titled 'Discreto | Associação' and lists several parameters: 'Tempo da actividade segundos', 'Tipo de tarefa distratora', 'Velocidade da apresentação do alvo', 'Natureza do estímulo', 'Número de alvos a memorizar', 'Frequência', and 'Similitude do alvo com os elementos distractores'. At the bottom of this section are 'Guardar' and 'Começar' buttons. A footer note states: 'Possibilidade de guardar as configurações e adicionar novas actividades'.

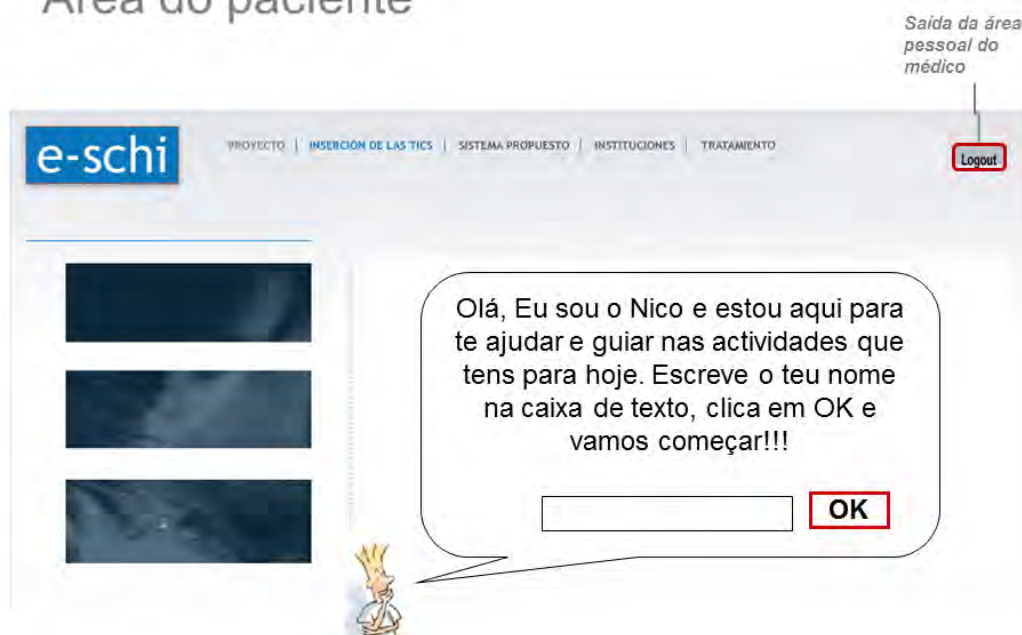
## Área do terapeuta – Em estudo

Saída da área  
pessoal do  
médico

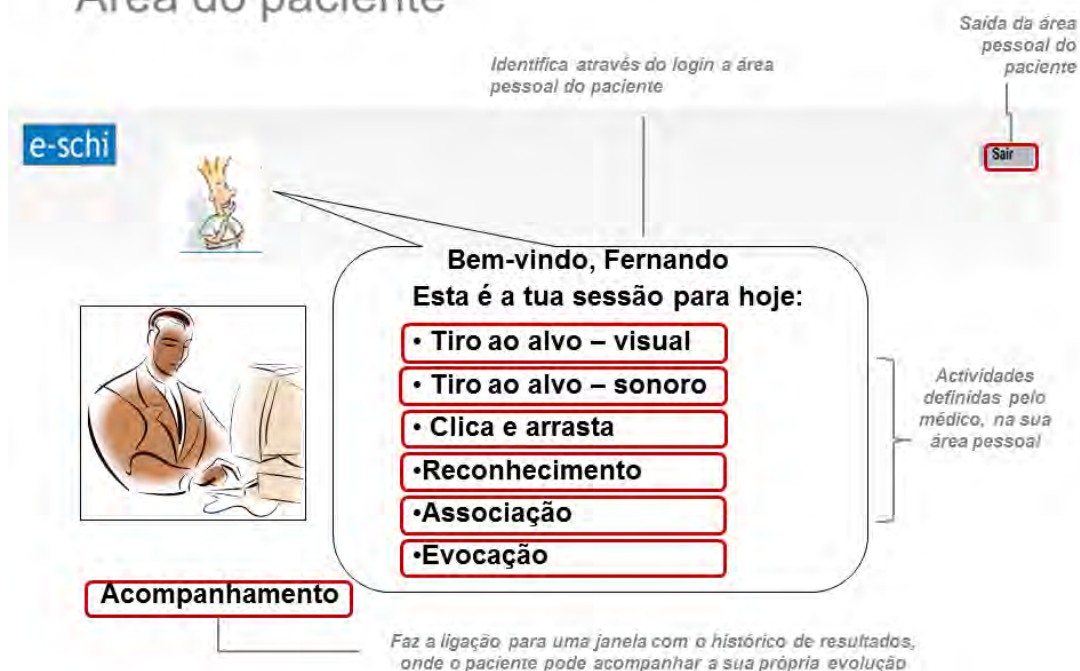
This screenshot shows the same 'e-schi' interface but with the 'Discreto | Evocação' activity selected. The 'Adicionar actividade Discreto' option in the left sidebar is still highlighted. The main content area now lists parameters for the 'Evocação' activity: 'Tempo da actividade segundos', 'Tipo de tarefa distratora', 'Velocidade da apresentação do alvo', 'Natureza do estímulo', 'Número de alvos a memorizar', 'Frequência', and 'Similitude do alvo com os elementos distractores'. The 'Guardar' and 'Começar' buttons remain at the bottom. The same footer note is present: 'Possibilidade de guardar as configurações e adicionar novas actividades'.



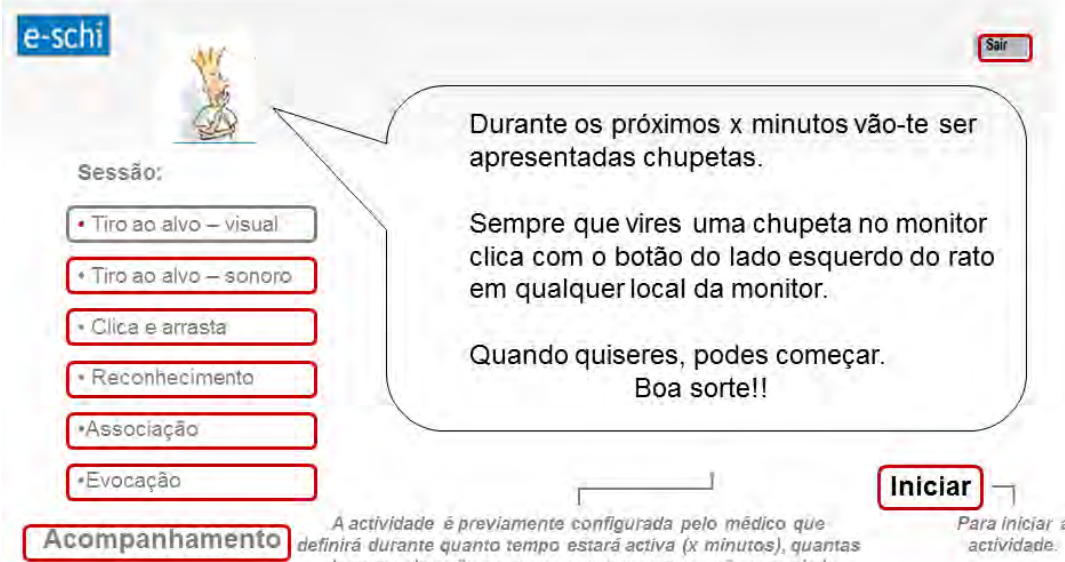
## Área do paciente



## Área do paciente



## Área do paciente – Tiro ao alvo visual



**e-schi** Sair

**Sessão:**

- Tiro ao alvo – visual
- Tiro ao alvo – sonoro
- Clica e arrasta
- Reconhecimento
- Associação
- Evocação

**Acompanhamento**

**Iniciar** Para iniciar a actividade.

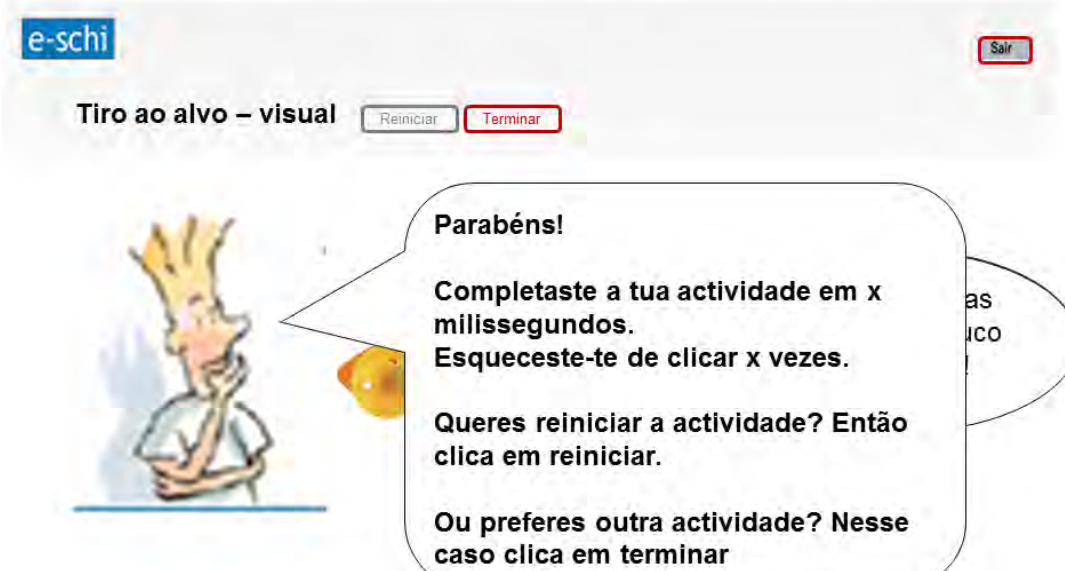
*A actividade é previamente configurada pelo médico que definirá durante quanto tempo estará activa (x minutos), quantas chupetas deverão aparecer e se tem som ou não associado*

Durante os próximos x minutos vão-te ser apresentadas chupetas.

Sempre que vires uma chupeta no monitor clica com o botão do lado esquerdo do rato em qualquer local da monitor.

Quando quiseres, podes começar.  
Boa sorte!!

## Área do paciente – Tiro ao alvo visual



**e-schi** Sair

**Tiro ao alvo – visual** Reiniciar Terminar

**Parabéns!**

**Completaste a tua actividade em x milissegundos.**


**Esqueceste-te de clicar x vezes.**

**Queres reiniciar a actividade? Então clica em reiniciar.**

**Ou preferes outra actividade? Nesse caso clica em terminar**

## Área do paciente – Tiro ao alvo sonoro

**e-schi** Sair



Sessão:

- Tiro ao alvo – visual
- Tiro ao alvo – sonoro
- Clica e arrasta
- Reconhecimento
- Associação
- Evocação

**Acompanhamento**

**Iniciar**

Para iniciar a actividade:

Durante os próximos x minutos vais ouvir sons.

Sempre que ouvires um som, clica com o botão do lado esquerdo do rato em qualquer local da monitor.


Quando quiseres, podes começar.  
Boa sorte!!

A actividade é previamente configurada pelo médico que definirá durante quanto tempo estará activa (x minutos), quantas chupetas deverão aparecer e se tem som ou não associado

## Área do paciente – Tiro ao alvo sonoro

**e-schi** Sair

**Tiro ao alvo – sonoro** Reiniciar Terminar



**Parabéns!**

**Completaste a tua actividade em x milissegundos.**

**Esqueceste-te de clicar x vezes.**

**Queres reiniciar a actividade? Então clica em reiniciar.**

**Ou preferes outra actividade? Nesse caso clica em terminar**

## Área do paciente – Clica e arrasta

**e-schi** Sair

**Sessão:**

- Tiro ao alvo – visual
- Tiro ao alvo – sonoro
- Clica e arrasta
- Reconhecimento
- Associação
- Evocação

**Acompanhamento**

**Iniciar**

Vão-te ser apresentados bebés e chupetas.

Objectivo: Clica e arrasta cada chupeta para cima de um bebé.

Quando quiseres, podes começar.  
**Boa sorte!!**

*A actividade é previamente configurada pelo médico que definirá durante quanto tempo estará activa (x minutos), quantas chupetas deverão aparecer e se tem som ou não associado*

*Para iniciar a actividade.*

## Área do paciente – Clica e arrasta

**e-schi** Sair

**Clica e arrasta** Reiniciar Terminar

**Parabéns!**

Completa Muito bem, foste em x milissegundos muito rápido!

Queres reiniciar a actividade? Então a em reiniciar.

Ou preferes outra actividade? Nesse caso clica em terminar



## Área do paciente – Acompanhamento

**e-schi**

Menu Inicial

Acompanhamento:

- Sessão 5 – 30/10/2007
- Sessão 4 – 26/10/2007
- Sessão 3 – 25/10/2007
- Sessão 2 – 21/10/2007
- Sessão 1 – 20/10/2007
- Anteriores

Ver evolução

Sair

Fernando, estes são os teus resultados da sessão 5, se quiseres ver os anteriores, escolhe a sessão que pretendes, se preferes ver o gráfico de evolução, clica em Ver evolução

Actividade	Tempo Total	Tempo médio execução	Número de enganos
Tiro ao alvo – visual	123	23	1
Tiro ao alvo – sonoro	100	10	0
Clica e arrasta	400	45	2

## Área do paciente – Evolução (tempo)

**e-schi**

Menu Inicial

Evolução:

- Tempo
- Número de enganos

Acompanhamento

Sair

Aqui podes ver o tempo que estiveste em cada sessão, se quiseres ver o gráfico de quantas vezes te enganaste clica em Número de enganos. Se preferes ver o acompanhamento por sessão, clica em Acompanhamento

Sessão	Tempo
Sessão 1	150
Sessão 2	200
Sessão 3	140
Sessão 4	130
Sessão 5	120

## Área do paciente – Evolução



## Área do paciente – Reconhecimento

**e-schi**

Sair

Sessão:

- Tiro ao alvo – visual
- Tiro ao alvo – sonoro
- Clica e arrasta
- Reconhecimento
- Associação
- Evocação

Acompanhamento

Iniciar

Durante os próximos x segundos vai ser apresentada uma imagem.

Depois dela desaparecer, vão aparecer várias imagens, identifica aquela que viste antes!

Quando quiseres, podes começar.  
Boa sorte!!

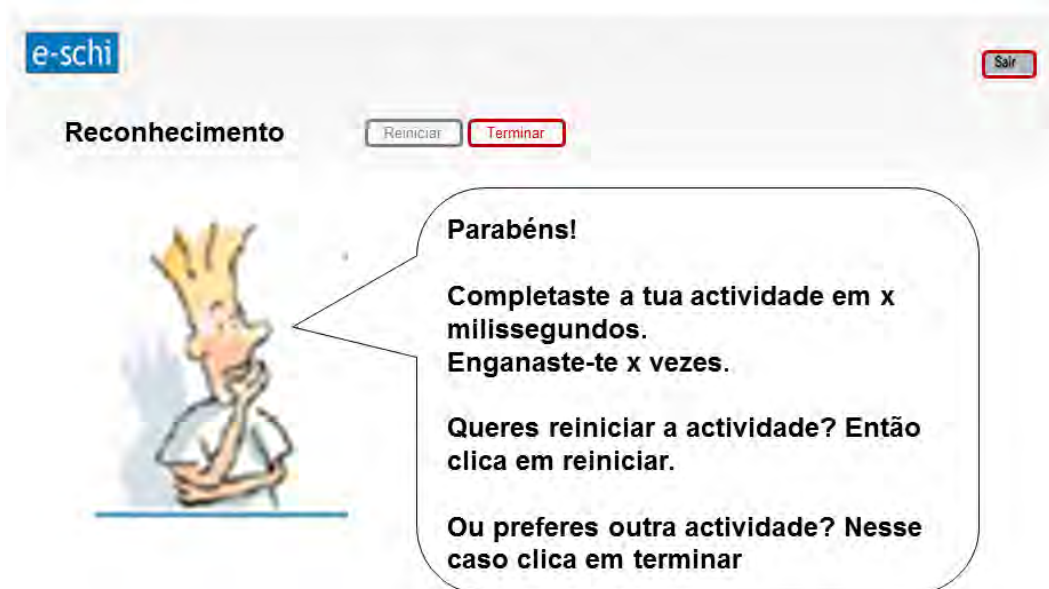
A actividade é previamente configurada pelo médico que definirá durante quanto tempo estará activa (x minutos) e quantas imagens deverão aparecer no processo de reconhecimento.

Para iniciar a actividade.

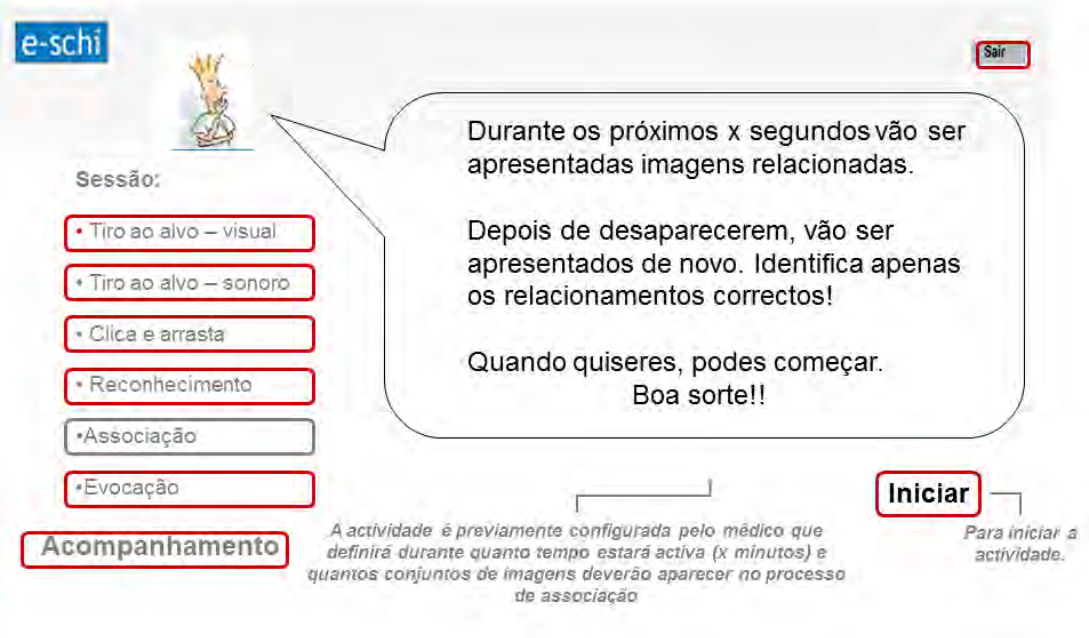
## Área do paciente – Reconhecimento



## Área do paciente – Reconhecimento



## Área do paciente – Associação



**e-schi** Sair

**Sessão:**

- Tiro ao alvo – visual
- Tiro ao alvo – sonoro
- Clica e arrasta
- Reconhecimento
- Associação
- Evocação

**Acompanhamento**

**Iniciar**

Para iniciar a actividade.

Durante os próximos x segundos vão ser apresentadas imagens relacionadas.

Depois de desaparecerem, vão ser apresentados de novo. Identifica apenas os relacionamentos correctos!

Quando quiseres, podes começar.  
Boa sorte!!

A actividade é previamente configurada pelo médico que definirá durante quanto tempo estará activa (x minutos) e quantos conjuntos de imagens deverão aparecer no processo de associação

## Área do paciente – Associação



**e-schi** Sair

**Associação** Reiniciar Terminar


O paciente deverá arrastar o objecto para o seu correspondente. Neste guião esta parte não está demonstrada, devido à impossibilidade de fazê-lo no powerPoint



## Área do paciente – Associação

**e-schi** Sair

**Associação** Reiniciar Terminar



**Parabéns!**


Completaste a tua actividade em x milissegundos.  
Enganaste-te x vezes.

Queres reiniciar a actividade? Então clica em reiniciar.

Ou preferes outra actividade? Nesse caso clica em terminar

## Área do paciente – Evocação

**e-schi** Sair



Sessão:

- Tiro ao alvo – visual
- Tiro ao alvo – sonoro
- Clica e arrasta
- Reconhecimento
- Associação
- Evocação

**Acompanhamento**

**Iniciar**

Para iniciar a actividade.

Durante os próximos x segundos vão ser apresentadas imagens e palavras relacionadas.

Depois de desaparecerem, escreve as palavras que memorizaste

Quando quiseres, podes começar.  
Boa sorte!!

A actividade é previamente configurada pelo médico que definirá durante quanto tempo estará activa (x minutos) e quantas imagens deverão aparecer no processo de evocação.

## Área do paciente – Evocação

**e-schi** Sair

**Evocação** Reiniciar Terminar

Quais as palavras que memorizaste?

Labuta

Caneca

Frigideira

O paciente deverá escrever as palavras que memorizou anteriormente. Neste guião esta parte não está demonstrada, devido à impossibilidade de fazê-lo no PowerPoint

## Área do paciente – Evocação

**e-schi** Sair

**Evocação** Reiniciar Terminar

**Parabéns!**

**Completaste a tua actividade em x milissegundos.**

**Eganaste-te x vezes.**

**Queres reiniciar a actividade? Então clica em reiniciar.**

**Ou preferes outra actividade? Nesse caso clica em terminar**

## 9.2. Requirements Specification

ID	Requirement
1	Every operation on the eschi app will only be available to authenticated users.
2	Every user should provide a valid username and a password pair to access the application.
3	A therapist will have a list of patients to take care of.
4	A patient will have a known therapist.
5	The patient will have access to distinct activities that are scheduled by the therapist(s).
6	The therapist will be able to manage (add, update or delete) the list of existing activities.
7	The therapist will be able to schedule a session for a patient.
8	A session includes a list of activities to be conducted and the data to be gathered.
9	Activity 1 - Clicking on an object: The patient will have to click on a specific object (the target).
10	Activity 1 - Should measure data concerning the procedure context such as the latency time, the type of distracting activity and the speed of the target presentation.
11	Activity 1 - Should measure data concerning the stimulus of the procedure such as the complexity of the stimulus, the number of targets to memorize and the target abstraction vs the frequency.
12	Activity 2 - Clicking and dragging an object: The patient will have to click and drag object(s) to a specific (target) location.
13	Activity 2 - Should measure data concerning the procedure context such as the latency time, the type of distracting activity and the speed of the target presentation.
14	Activity 2 - Should measure data concerning the stimulus of the procedure such as the complexity of the stimulus, the number of targets to memorize and the target abstraction vs the frequency.
15	Activity 3 - Objects-subjects: The patient will have to click and drag object(s) to a specific (target) location.
16	Activity 3 - Should measure data concerning the procedure context such as the latency time, the type of distracting activity and the speed of the target presentation.
17	Activity 3 - Should measure data concerning the stimulus of the procedure such as the complexity of the stimulus, the number of targets to memorize and the target abstraction vs the frequency.

Annexes

### 9.3. eSchi Users' Manual

## eSchi

## Manual de Utilizador - PT



## Introdução

O portal eSchi pretende ser um portal acessível e cómodo de utilizar. No entanto existem sempre dúvidas que facilmente podem ser clarificadas com uma explicação mais aprofundada.

Este manual de utilizador agrega toda a informação sobre as funcionalidades que estão disponíveis no sistema. Além de que tenta fazer uma descrição mais ou menos minuciosa sobre as funcionalidades que se podem desenvolver no portal eSchi.

O portal é utilizado por distintos perfis de utilizadores (administrador, médico/terapeuta e utente) e, como é habitual, existem funcionalidades específicas disponíveis para os diferentes perfis. O acesso e a saída do portal fazem-se do mesmo modo, qualquer que seja o perfil. Neste momento as funcionalidades descritas são apenas as do perfil do utente.

## Funcionalidades

De seguida descrevem-se as funcionalidades disponíveis no portal mediante o acesso de um utilizador autenticado com o perfil de utente.

### Acesso

O acesso ao sistema só é possível por parte de um utilizador autenticado, ou seja, tem que ter credenciais (um nome de utilizador e uma palavra-passe) válidas para que seja reconhecido pelo sistema.

Na página web inicial do portal existe uma zona dedicada para que os utilizadores possam preencher as suas informações pessoais. Assim, ao ter um nome de utilizador e uma palavra-passe há que preencher o espaço apropriado e pressionar o botão “entrar”.

Imagem 1 – Acesso ao Portal

O sistema conduzirá o utilizador para a primeira página pós-autenticação.

Imagem 2 – Página Principal do Utilizador Utente

Quando os dados não estão correctos o sistema apresenta uma mensagem a indicar que deve repetir a acção, mas com os dados correctos.

Imagem 3 – Erro de Acesso



## Sair

Para sair do sistema e encerrar uma sessão deve-se pressionar o botão “Sair” que está sempre disponível em qualquer página do portal.

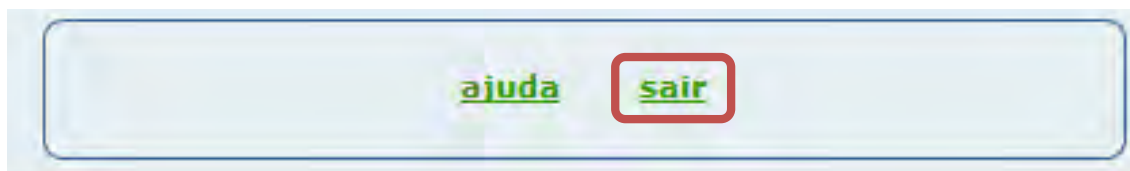


Imagem 4 – Saída do Portal

A saída e encerramento correcto de uma sessão conduz o utilizador à página principal do portal.



Imagem 5 – Página Principal do Portal

## Identificação

Antes de começar a sessão, o sistema apresenta uma página de saudação onde o utilizador tem que escrever o seu nome. O sistema aceita qualquer nome (sequência de caracteres).

Na caixa de texto deve-se escrever o nome pelo qual o sistema passará a tratar o utilizador e fazer um click do rato ou pressionar qualquer tecla.



Imagem 6 – Identificação do Utilizador

O portal direcciona o utilizador para a página da sessão do dia de hoje.

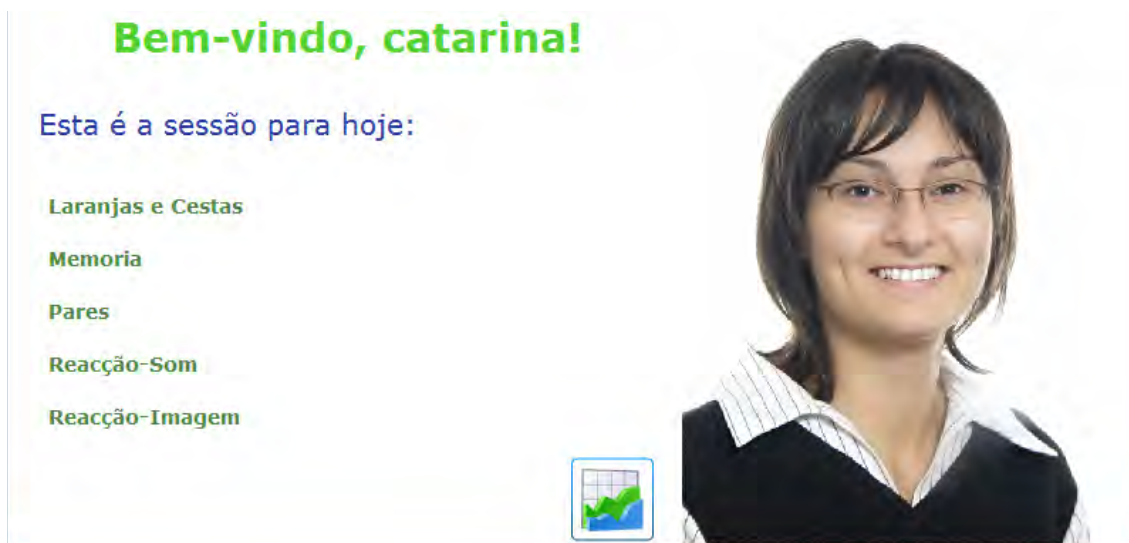




Imagem 7 – Página com a Sessão Actual

### Actividades

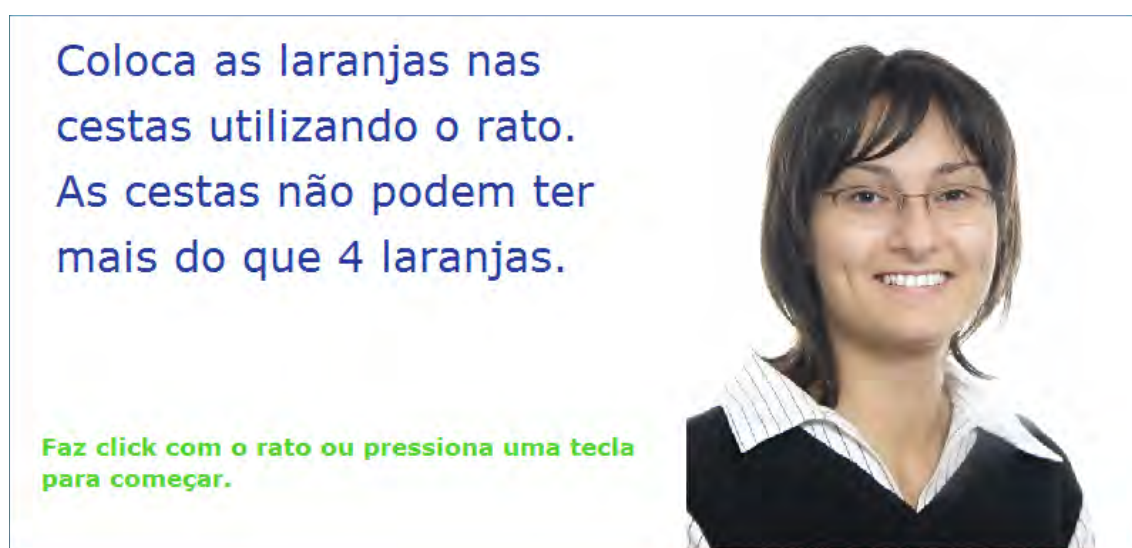
Todas as actividades começam da mesma forma: com uma descrição dos desafios a alcançar.

Para começar uma actividade deve pressionar-se o botão da actividade desejada (botão de ligação com o nome da actividade).



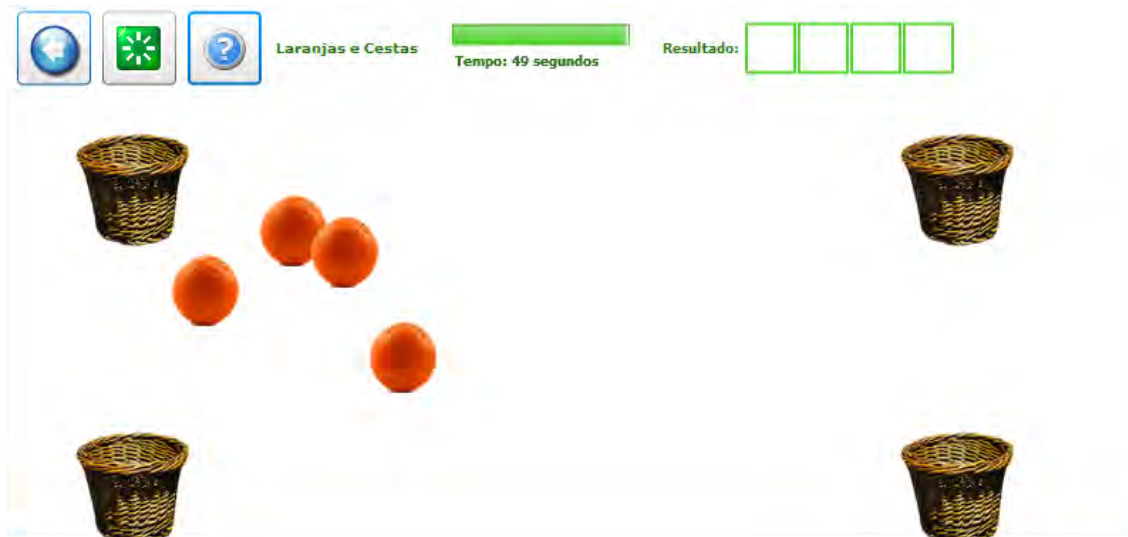
Imagem 8 – Seleccionar uma Actividade

O sistema apresenta uma mensagem com a descrição inicial dos objectivos e do modo de alcançar o final da actividade.






**Imagem 9 – Desafios da Actividade**

Depois de ler o texto descritivo deve fazer-se um click com o rato ou pressionar qualquer tecla. O sistema apresenta uma área destinada à realização da actividade e esta começa.



**Imagem 10 – Área da Actividade Seleccionada**

Todas as actividades têm um menu de opções (e botões) persistentes:

-  regressar – botão para voltar à lista de actividades para a sessão de hoje.
-  reiniciar – botão para começar de novo a actividade actual.
-  ajuda – botão que apresenta uma janela com as instruções necessárias para completar a actividade.
- Tempo de Actividade – informação sobre o tempo restante para completar a actividade com uma barra de progresso.
- Resultado – Informação sobre o resultado do utilizador na actividade.



**Imagem 11 – Opções Persistentes das Actividades**

## Pares

Apresentam-se 8 imagens ao utilizador, juntas em duas colunas de 4. Estas imagens têm uma correspondência directa com o objecto que está na mesma linha. Dizem-se associadas (aos pares).

Memoriza os pares que  
surtem no ecrã e depois  
faz tu os pares arrastando  
as imagens com o rato.

Faz click com o rato ou pressiona uma tecla  
para começar.



Imagem 12 – Mensagem Inicial da Actividade

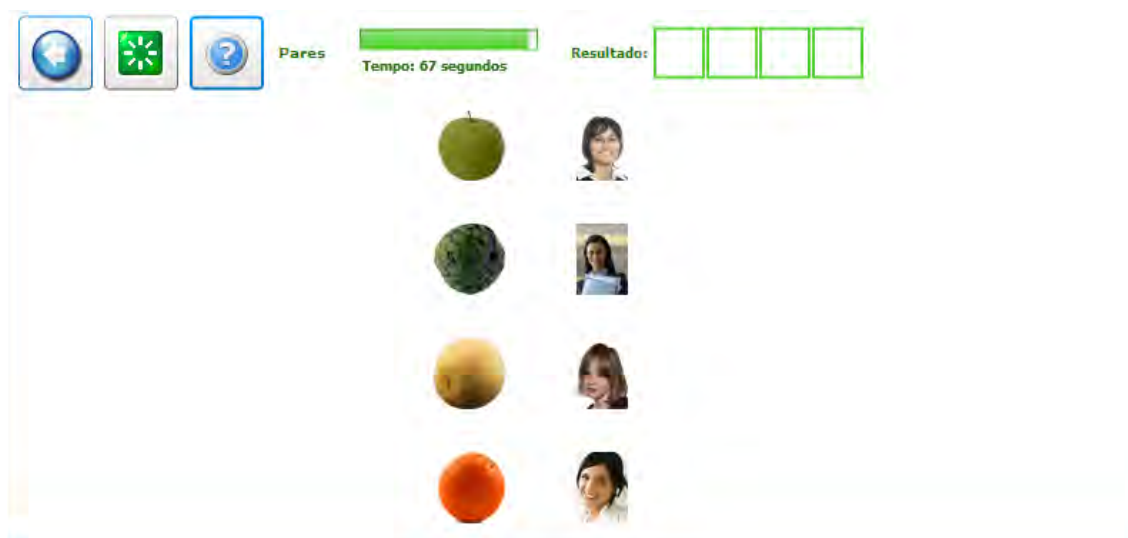
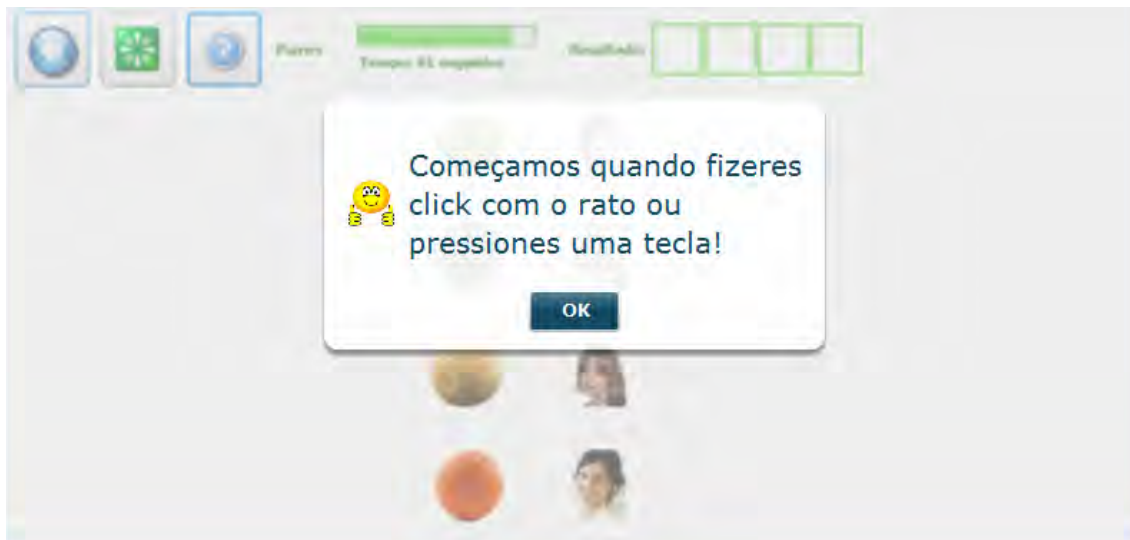


Imagem 13 – Página Inicial da Actividade

Passado algum tempo, o sistema apresenta uma mensagem ao utilizador, perguntando se está preparado para começar.



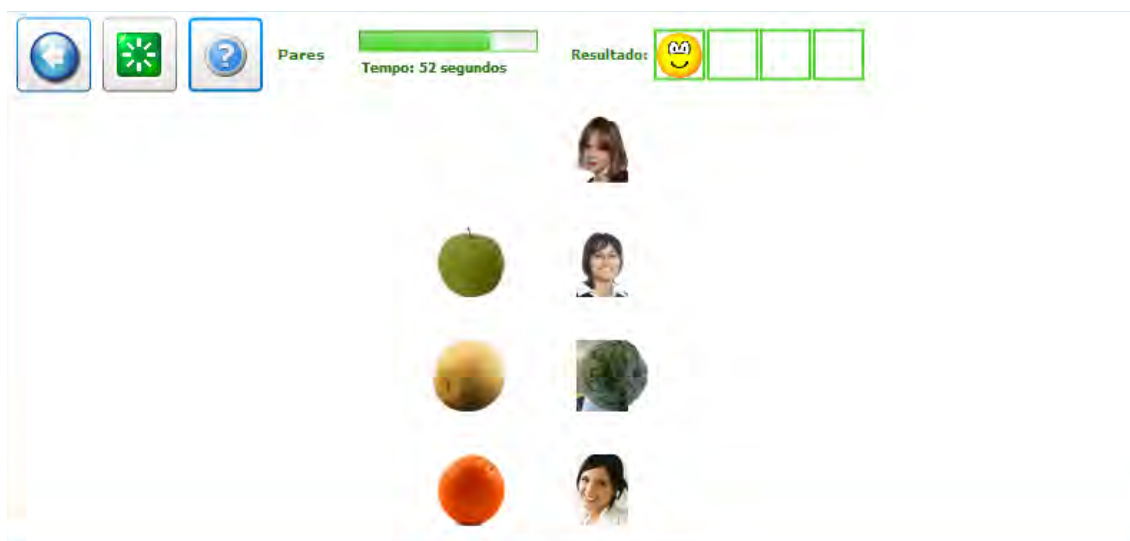
**Imagem 14 – Mensagem para Começar a Associação**

O utilizador aceita o desafio para iniciar, pressionando o botão “OK”. O sistema mistura as 4 imagens da coluna esquerda, apresentando uma nova disposição.



**Imagem 15 – Imagens Misturadas e Preparadas para Associar**

O utilizador tem que arrastar cada uma destas 4 imagens, que foram misturadas, e soltá-las no objecto previamente associado.



**Imagem 16 – Estímulo Correctamente Associado**

A actividade termina quando o tempo chega ao final ou quando o utilizador termina a associação das 4 imagens.



**Imagem 17 – Três de Quatro Imagens Correctamente Associadas**



Imagem 18 – Página Final da Actividade Terminada

Pôr laranjas nos cestos de frutas

Apresentam-se ao utilizador 4 laranjas no centro da página e 4 cestos vazios.

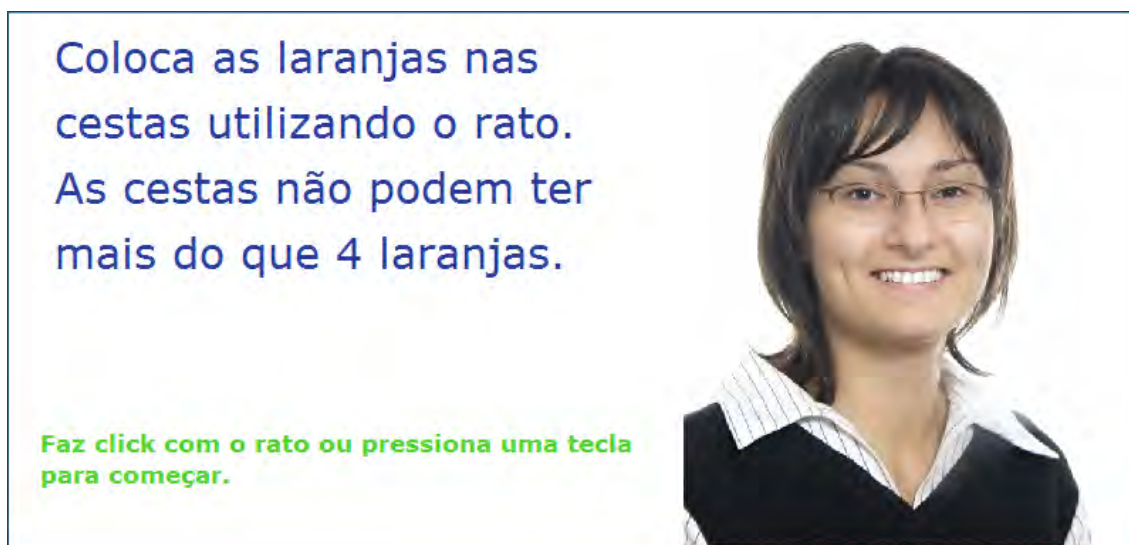


Imagem 19 – Mensagem Inicial da Actividade



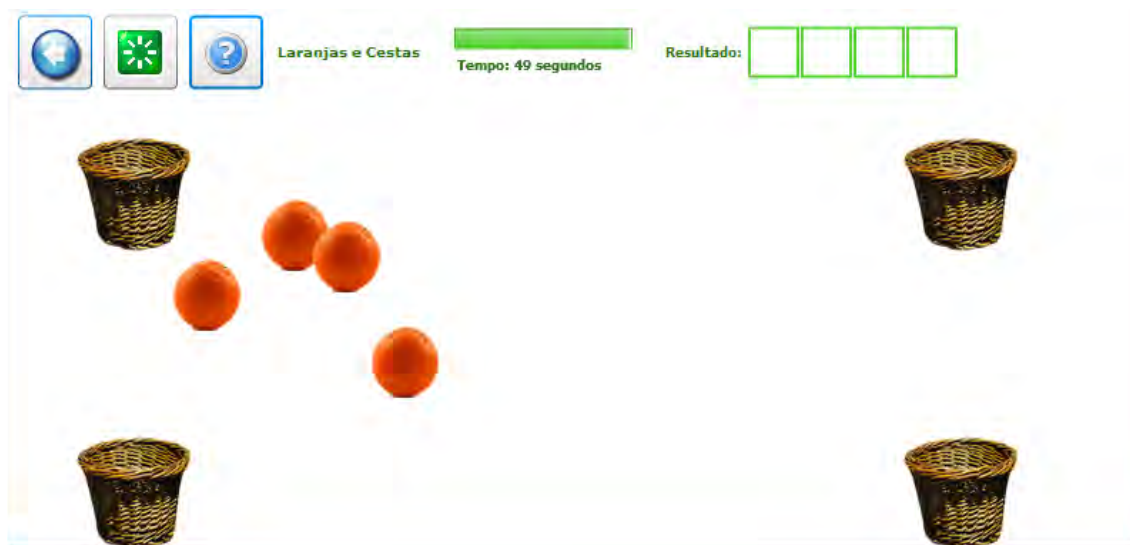


Imagem 20 – Página Inicial da Actividade

O utilizador deve arrastar cada laranja para um cesto. Cada cesto pode levar até 4 laranjas.

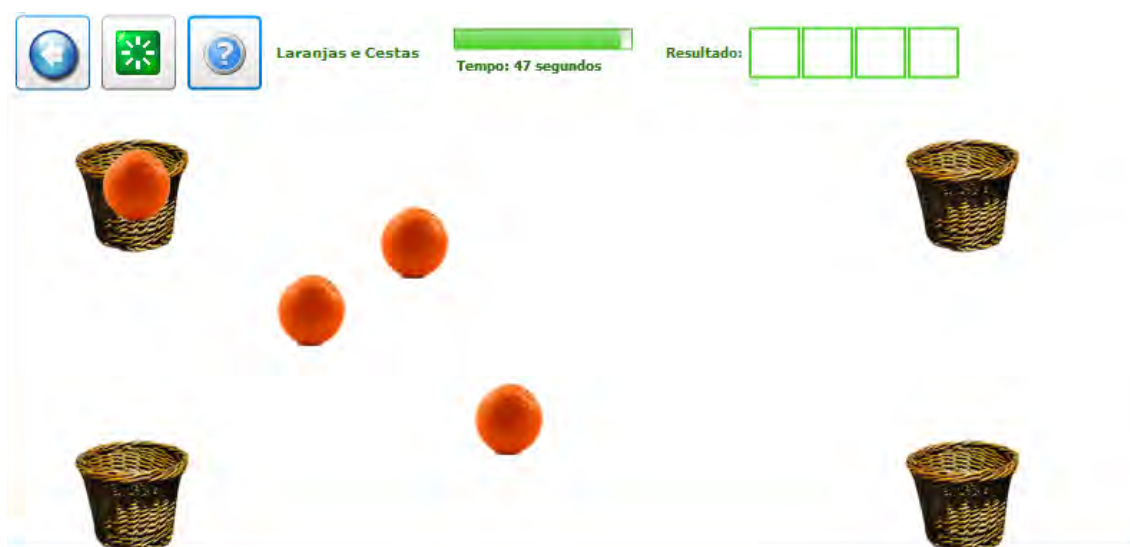
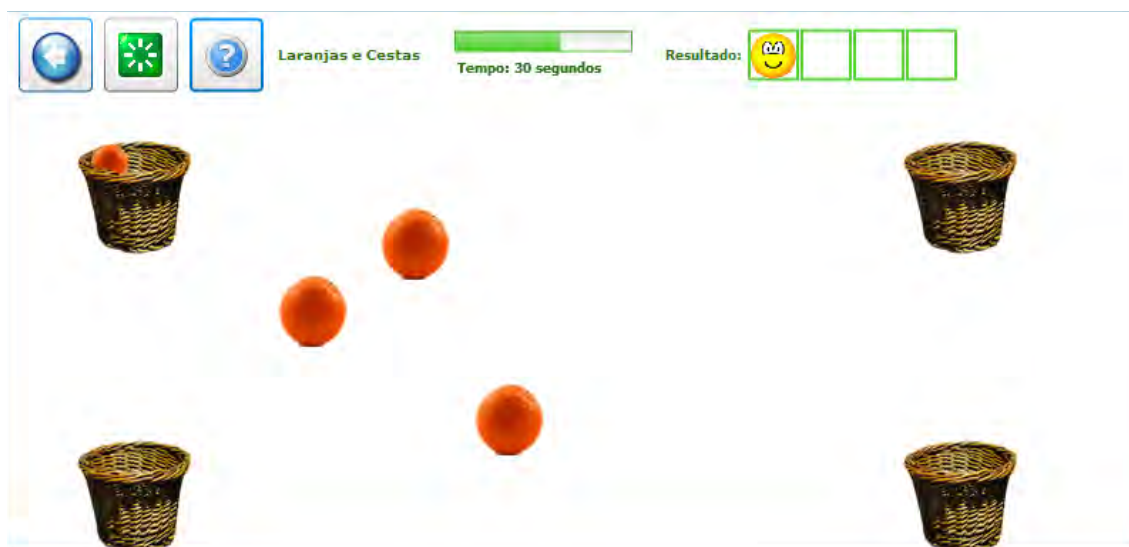


Imagem 21 – Tentativa de Completar a Acção



**Imagem 22 – Laranja Correcta no Cesto**

Sempre que uma laranja não seja totalmente arrastada para o cesto, retorna à sua posição inicial na página.



**Imagem 23 – Laranjas Correctas no Cesto**

A actividade termina quando o tempo chegar ao final ou quando o utilizador não tenha mais laranjas para arrastar.





Imagem 24 – Página Final da Actividade Terminada

## Memória

Apresenta-se uma imagem ao utilizador.

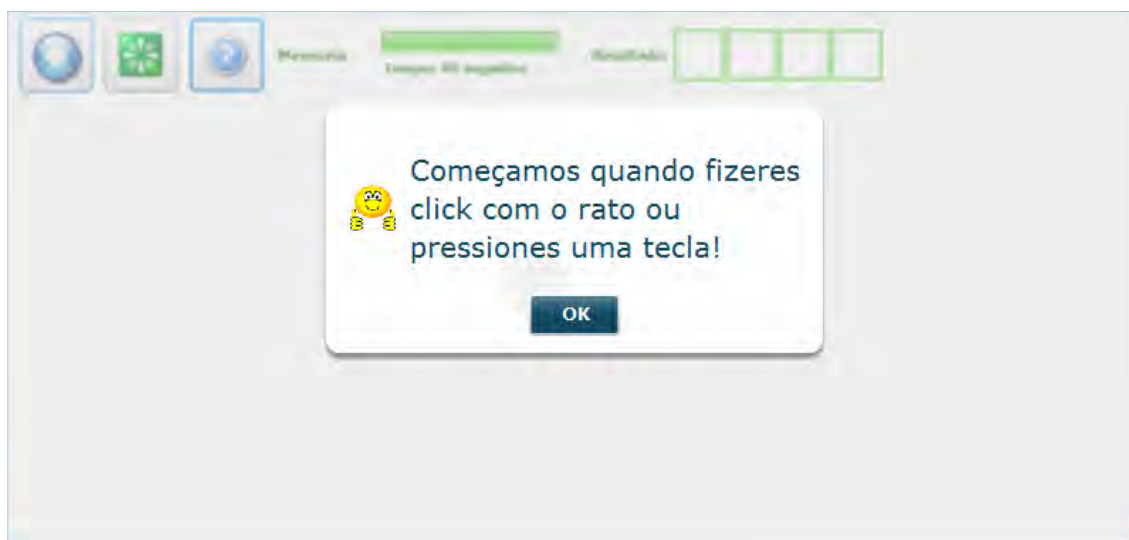


Imagem 25 – Mensagem Inicial da Actividade



**Imagem 26 – Página Inicial da Actividade**

Depois de um período de tempo apresenta-se uma mensagem ao utilizador, perguntando se está preparado para começar.



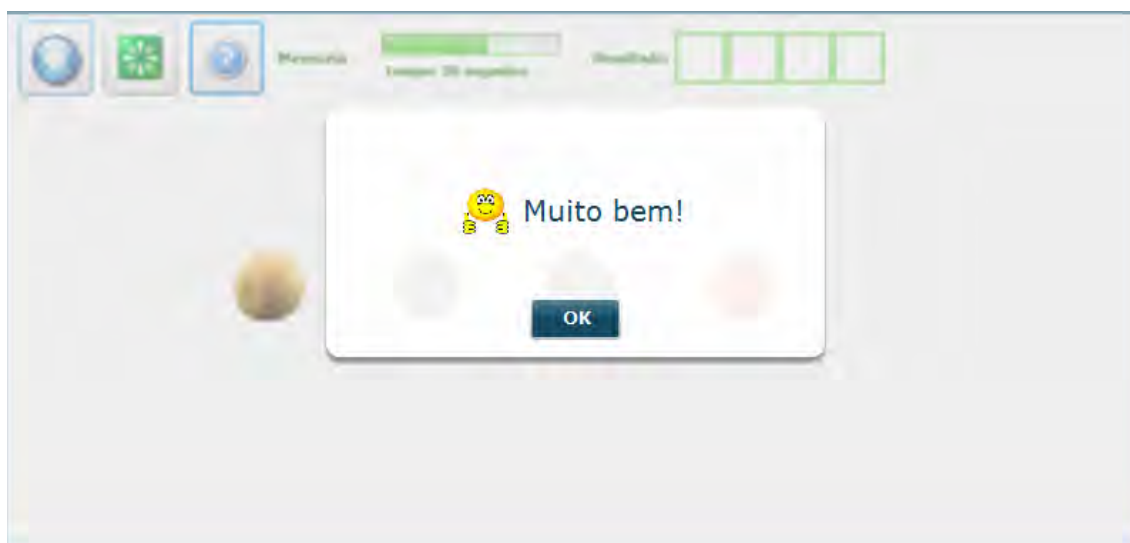
**Imagem 27 – Mensagem para Começar o Reconhecimento**

O utilizador aceita o desafio para iniciar e escolhe a imagem correcta a partir de uma lista de 4 imagens distintas.



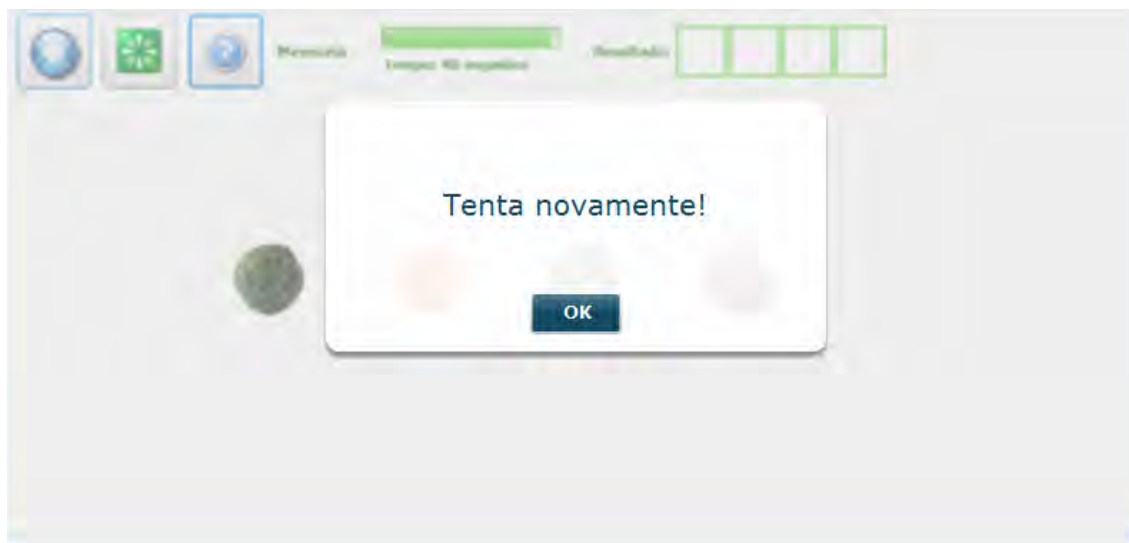
**Imagem 28 – Imagens para Reconhecer**

A actividade termina quando o tempo chegar ao limite ou quando o utilizador reconheça o estímulo.



**Imagem 29 – Imagem Correcta Reconhecida**

Sempre que o utilizador não escolha a imagem correcta, apresenta-se uma mensagem de erro ao utilizador.



**Imagem 30 – Imagem Não Correcta**

Enquanto a actividade decorre, o utilizador pode receber mensagens de apoio para que se recorde da imagem vista no início da actividade.

Reacção-Imagem (Lento, Médio e Rápido)

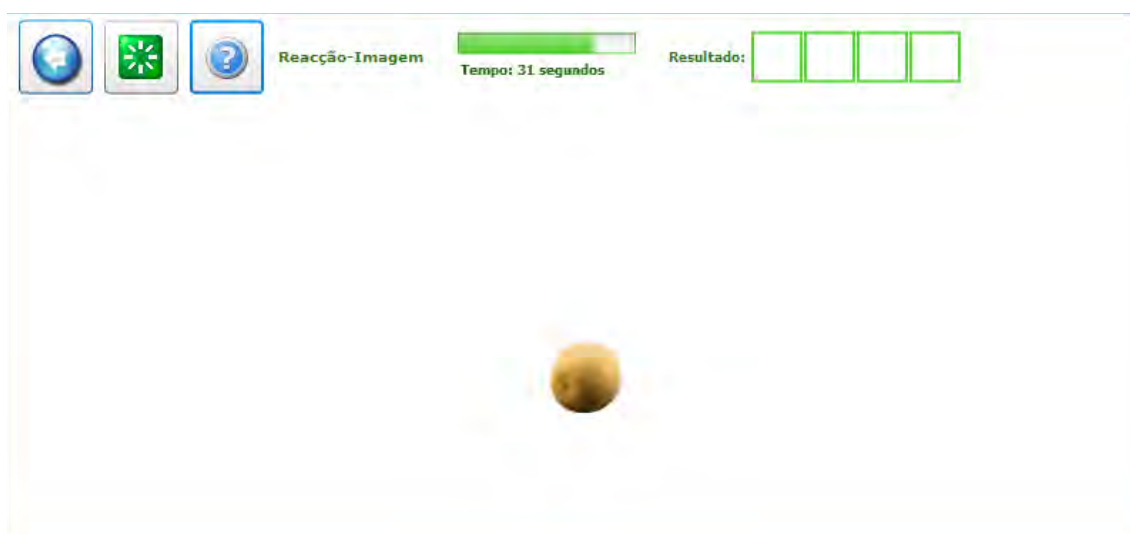


**Imagem 31 - Mensagem Inicial da Actividade**



**Imagem 32 – Página Inicial da Actividade**

Depois de um período de tempo apresenta-se uma imagem ao utilizador.

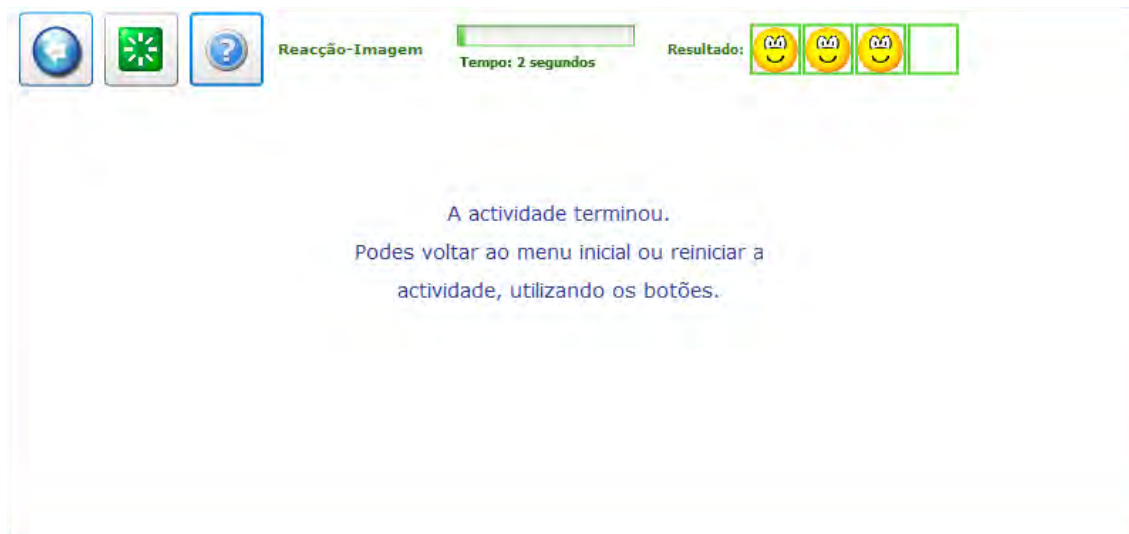


**Imagem 33 – Primeira Imagem Apresentada**

O utilizador deve reagir face à imagem, pressionando o botão do rato ou qualquer tecla, em qualquer local da página.

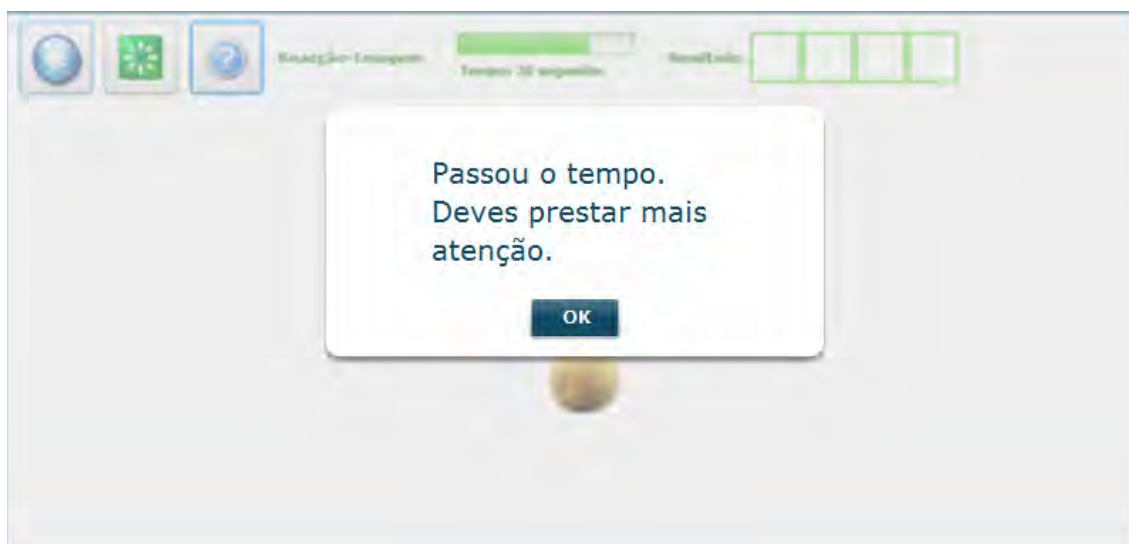
O sistema apresenta outra imagem e o tempo entre a apresentação das imagens é que define os 3 tipos de actividades: lento, rápido e médio.

A actividade termina quando o tempo chega ao final ou quando o utilizador reage face às 3 imagens disponíveis.



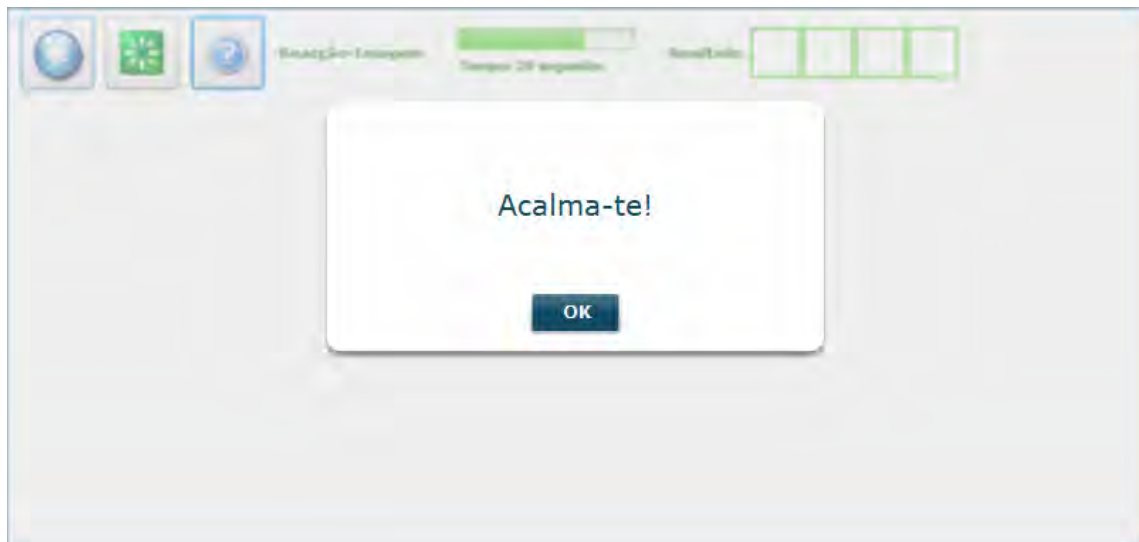
**Imagem 34 – Término de Actividade**

Sempre que o utilizador não reage à imagem no período de tempo determinado, o sistema apresenta uma mensagem de aviso indicando que o tempo de reacção passou.



**Imagem 35 – Mensagem de Atenção**

Sempre que o utilizador reage, pressionando o botão do rato sem que haja uma imagem, o sistema apresenta uma mensagem de aviso indicando que o utilizador deve ter mais calma.



**Imagem 36 – Mensagem de Calma**

### Reacção-Imagem – Completo

*(para ver uma sequência de imagens consultar o ponto 0)*

Depois de um período de tempo apresenta-se uma imagem ao utilizador.

O utilizador deve reagir face à imagem e deve pressionar o botão do rato ou qualquer tecla, em qualquer local da página.

Para começar, apresentam-se 3 imagens lentamente, depois 3 imagens a tempo médio e finalmente mais 3 imagens são apresentadas rapidamente.

A actividade termina quando o tempo chega ao final ou quando o utilizador reage às 9 imagens disponíveis.

Sempre que o utilizador não reage à imagem no período de tempo determinado, o sistema apresenta uma mensagem de aviso indicando que o tempo de reacção passou.

Sempre que o utilizador reage, pressionando o botão do rato, sem que haja imagem, o sistema apresenta uma mensagem de aviso indicando que o utilizador deve ter mais calma.

Reacção-Som (Lento, Médio e Rápido)

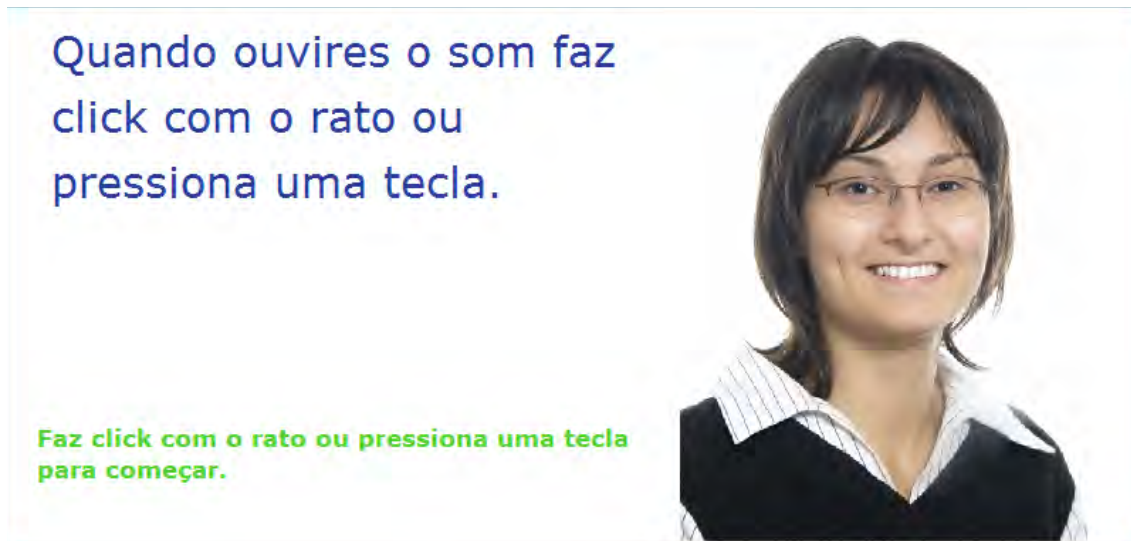


Imagem 37 - Mensagem Inicial da Actividade



Imagem 38 – Página Inicial da Actividade



Depois de um período de tempo apresenta-se um estímulo sonoro ao utilizador.



Imagem 39 – Primeiro Som Apresentado

O utilizador deve reagir face ao som e deve pressionar o botão do rato ou uma tecla, em qualquer local da página.

O sistema apresenta outro estímulo sonoro e o tempo entre os estímulos é que define 3 tipos de actividades: lento, rápido e médio.

A actividade termina quando o tempo chega ao final ou quando o utilizador reage face aos 3 estímulos disponíveis.

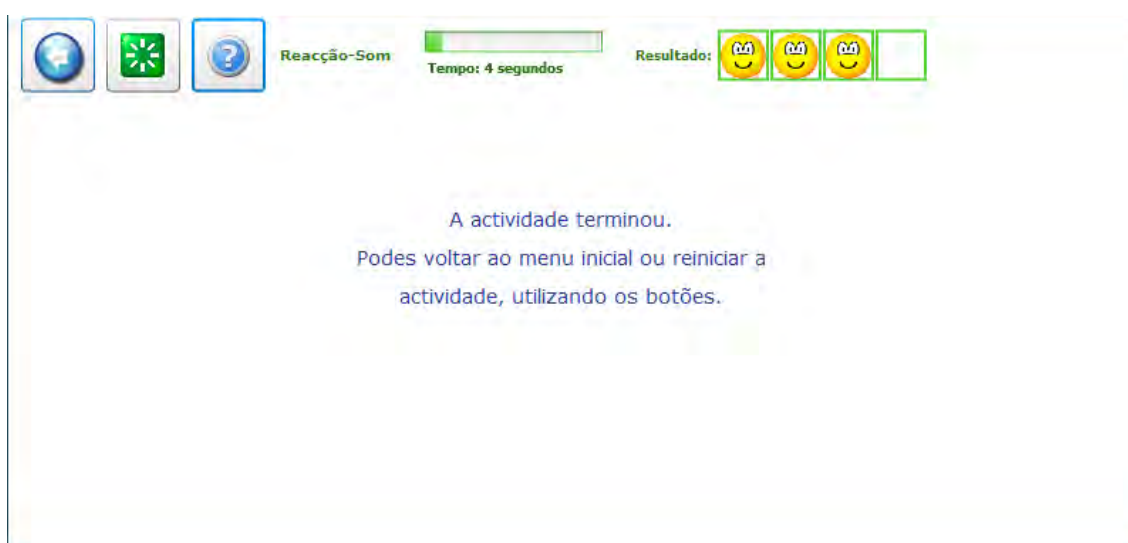
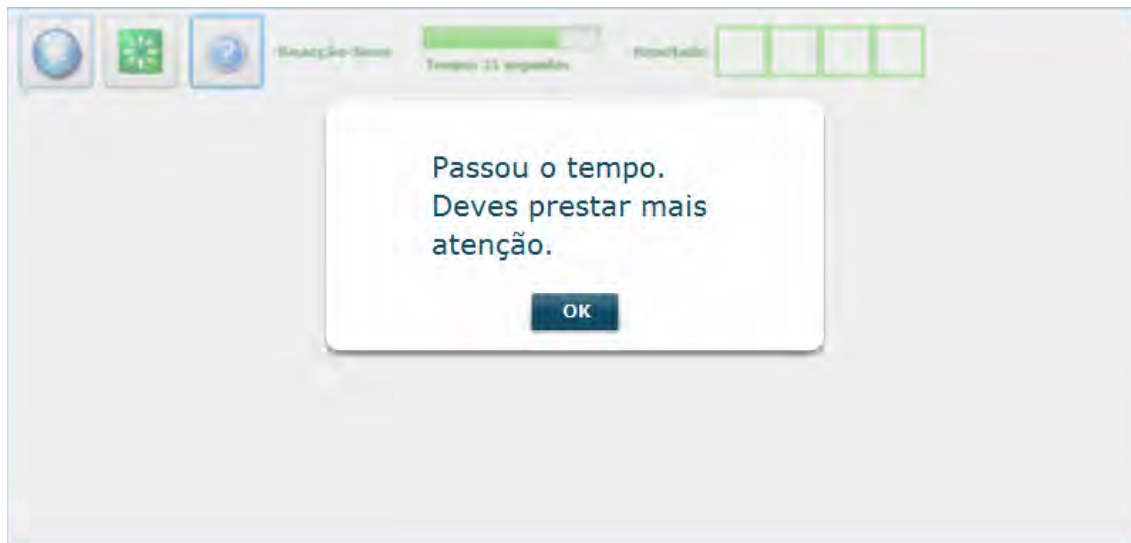


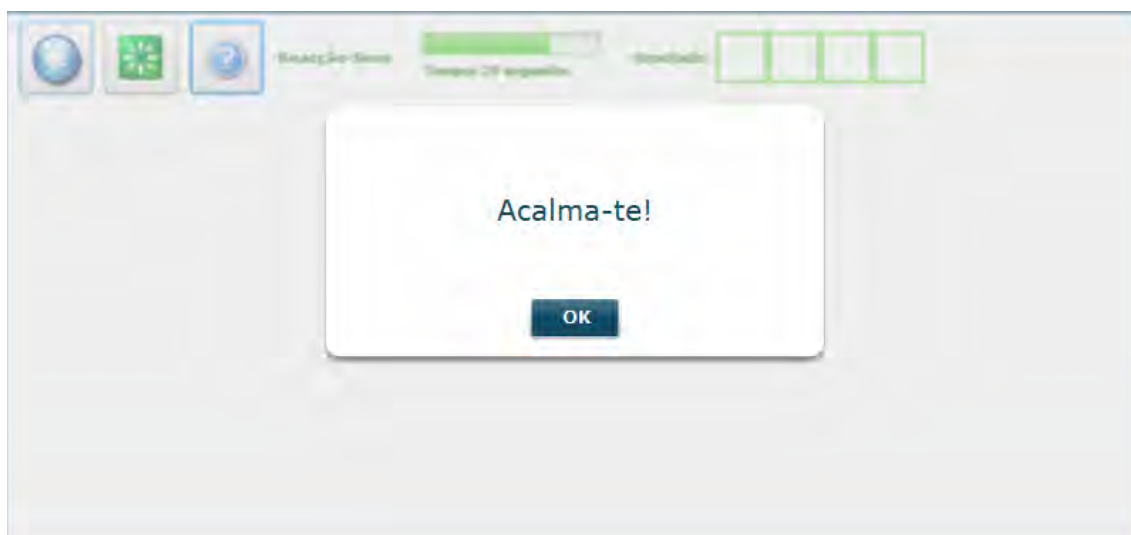
Imagem 40 – Término da Actividade

Sempre que o utilizador não reage ao estímulo no período de tempo determinado, o sistema apresenta uma mensagem de aviso indicando que o tempo de reacção passou.



**Imagem 41 – Mensagem de Atenção**

Sempre que o utilizador reage, pressionando o botão do rato sem que haja estímulo, o sistema apresenta uma mensagem de aviso indicando que o utilizador deve ter mais calma.



**Imagem 42 – Mensagem de Calma**

### Reacção-Som – Completo

*(para ver uma sequência de imagens consultar o ponto 0)*

Depois de um período de tempo apresenta-se um estímulo sonoro ao utilizador.

O utilizador deve reagir face ao som e deve pressionar o botão do rato, em qualquer local da página.

Para começar apresentam-se 3 estímulos sonoros lentamente, depois 3 estímulos sonoros a tempo médio e finalmente mais 3 estímulos sonoros são apresentados rapidamente.

A actividade termina quando o tempo chega ao final ou quando o utilizador reage aos 9 estímulos sonoros disponíveis.

Sempre que o utilizador não reage ao estímulo sonoro no período de tempo determinado, o sistema apresenta uma mensagem de aviso indicando que o tempo de reacção passou.

Sempre que o utilizador reage, pressionando o botão do rato sem que haja estímulo, o sistema apresenta uma mensagem de aviso indicando que o utilizador deve ter mais calma.

### Estatística

Há vários tipos de estatística disponíveis que se distinguem a dois níveis: actividade e sessão.

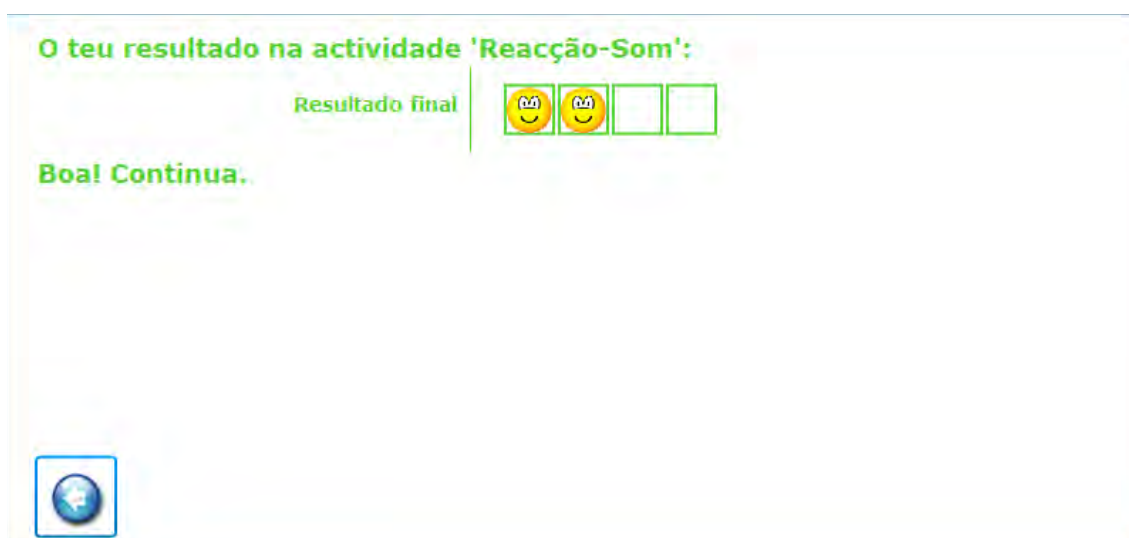
#### Estatística da Última Actividade

Enquanto está a realizar a actividade, a qualquer momento, o utilizador sabe sempre o seu resultado (Imagem 11 – Opções Persistentes das Actividades). Ao regressar à lista de actividades para a sessão, e após terminar a actividade, o utilizador tem a opção de ver o resultado final da actividade.



**Imagem 43 – Mensagem com Opção de Ver Resultado da Actividade**

O sistema apresenta uma nova página com os resultados para o perfil do utente.



**Imagem 44 – Página com os Resultados da Actividade**

De acordo com o resultado, 1 de 3 mensagens distintas é apresentado ao utilizador: “Muito bem! Continua assim.”, “Boa! Continua.” e “Continua a tentar! Da próxima vez vai correr melhor!”.

A página contém um botão para regressar à lista de actividades para a sessão actual.

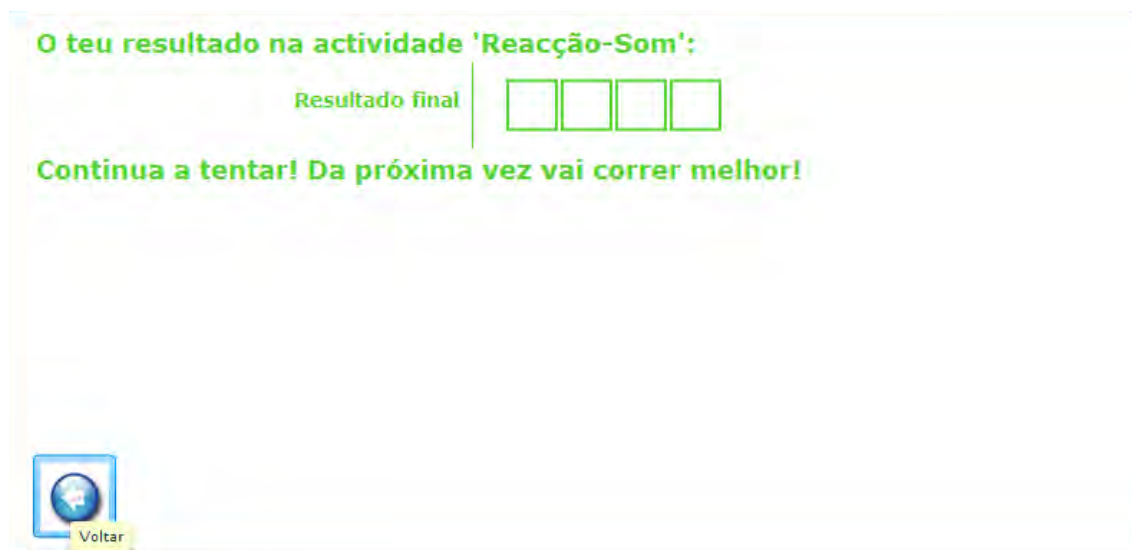


Imagem 45 – Botão para Regressar à Lista de Actividades

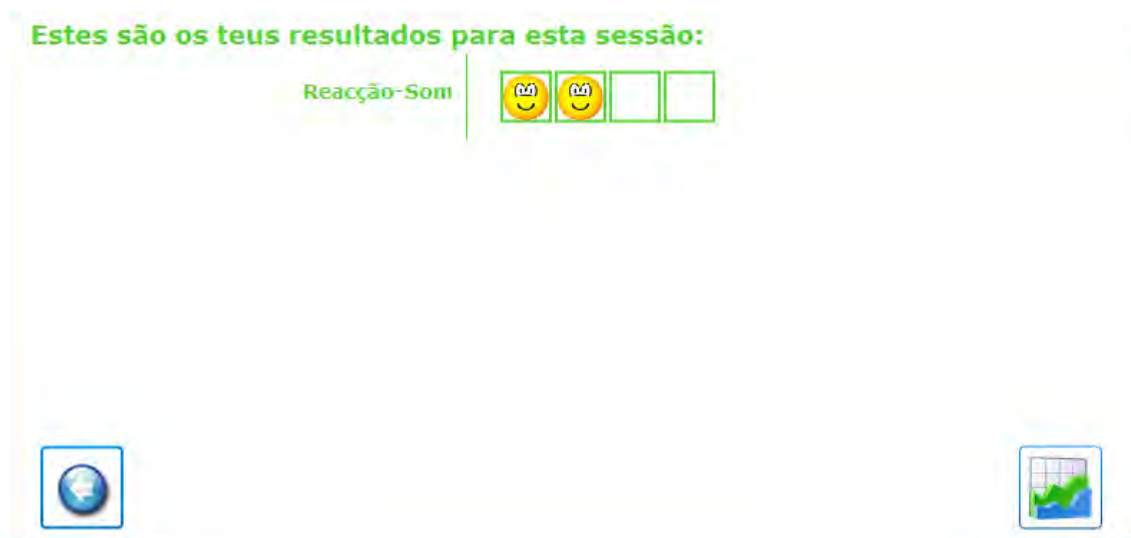
### Estatística da Sessão

A qualquer momento o utilizador pode visualizar os seus resultados para a sessão que está a decorrer ou aceder ao histórico de repetições desta mesma sessão. Repetições essas que terão sido realizadas anteriormente, ao longo do dia.



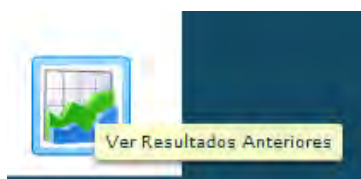
Imagem 46 – Botão para Ver Evolução da Sessão

O sistema apresenta uma lista com as actividades realizadas durante a sessão que está a decorrer e os respectivos resultados.



**Imagem 47 – Resultados da Sessão Actual**

Para obter informação histórica sobre repetições anteriores desta mesma sessão, o utilizador pode seleccionar o botão adequado.



**Imagem 48 – Botão para Ver Resultados Anteriores**

O sistema apresentará uma lista com todas as actividades que o utilizador já realizou e respectivos resultados.

**Resultados anteriores para esta sessão:**

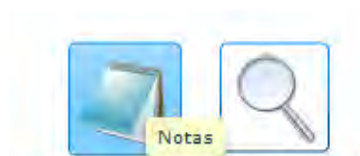
Reacção-Imagem	😊😊😊	
Reacção-Som	😊😊😊	
Laranjas e Cestas	😊😊😊😊	





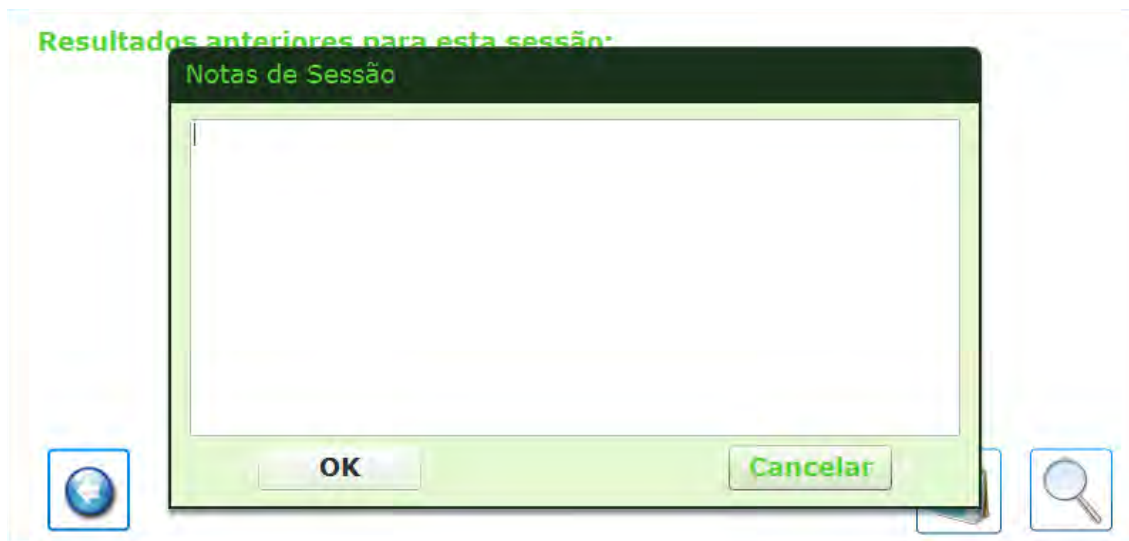
**Imagem 49 – Histórico dos Resultados**

A partir desta página estão disponíveis duas opções especialmente dedicadas aos terapeutas que acompanham a sessão de terapia. O utilizador pode optar por tomar algumas notas em relação ao modo como decorreu a sessão ou visualizar os dados históricos com maior detalhe.



**Imagem 50 – Botão para Tomar Notas da Sessão**

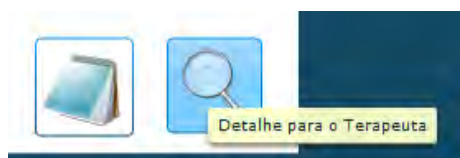
Ao pressionar o botão de tomar notas, uma nova janela surge com um campo de texto livre para preencher e registar a informação (“OK”).



**Imagem 51 – Janela de Notas**

Após efectuar o registo das notas, pressionando o botão “Ok” ou cancelando a operação, a janela desaparece e o sistema retorna à janela anterior.

Caso o utilizador opte por ver o histórico de resultados com maior detalhe, após pressionar o botão indicado:



**Imagem 52 – Botão para Ver Detalhe do Histórico de Resultados**

O sistema apresenta uma página com um gráfico resumo da actividade do utente para a sessão do dia.





Imagem 53 – Gráfico Sumário de Todas as Actividades da Sessão

No gráfico resumo é possível fazer um zoom-in aos dados e obter ainda mais detalhe. Assim, ao clicar sobre um dos pontos do gráfico relativos a uma determinada actividade é possível ver um gráfico com informação específica sobre cada repetição dessa mesma actividade.

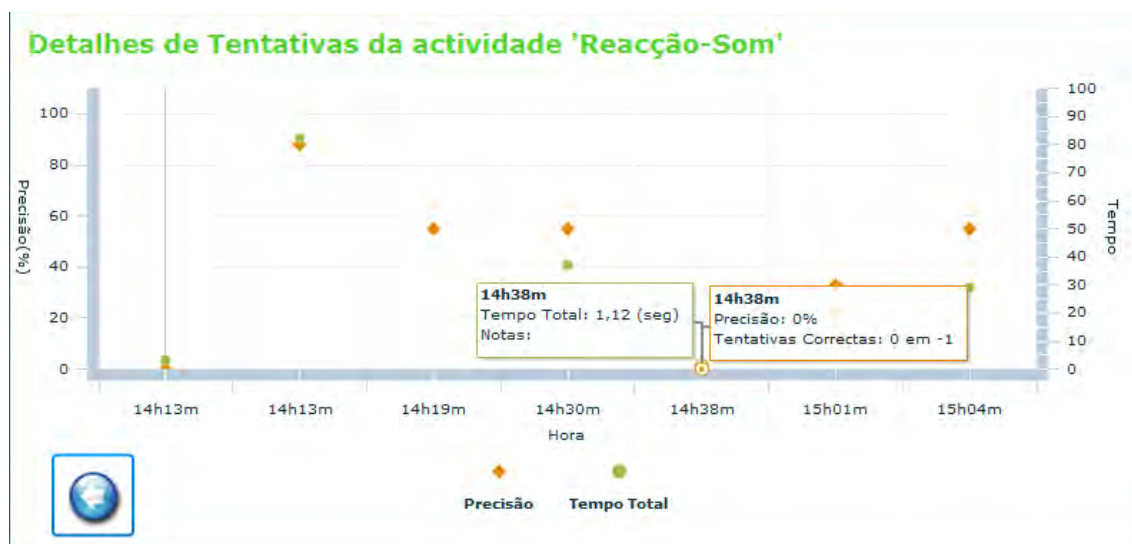
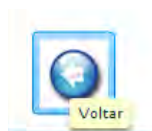


Imagem 54 – Gráfico Detalhe de uma Actividade

A qualquer momento o utilizador pode retornar à página anterior usando o botão de “Voltar”.



**Imagem 55 – Botão para Voltar à Lista de Actividades da Sessão**

## eSchi

### *Mini Guía de Acciones-Perfil Terapeuta<sup>2</sup>*

1. [Datos Personales](#)  
Cambiar la información personal con respecto al terapeuta.
2. [Pacientes](#)  
Visualizar, alterar y añadir nuevos pacientes.
3. [Actividades](#)  
Visualizar y crear nuevas actividades.
4. [Sesiones](#)  
Visualizar y crear nuevas sesiones.
5. [Estadísticas](#)  
Visualizar datos estadísticos sobre el desempeño de los pacientes en las sesiones.
6. [Preguntas Frecuentes](#)  
Cómo debo proceder para hacer una tarea específica?

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<sup>2</sup> El perfil de Terapeuta solo está disponible en la lengua inglesa, por lo tanto, todas las imágenes están de acuerdo con el aspecto exacto del sistema.

## Personal Info

Click the button “Personal Info” of the main menu to access the form ([Figure 2](#)) with your personal information.



Figure 1 – Main menu with the option “Personal Info” selected

The form presented enables you to update all your personal data, except the username<sup>3</sup>. All the data is available in a text field that can be updated and all the fields are mandatory, except for the email field. A photo can be added by clicking in the “add photo” button or changed by clicking in the existing photo.

---

<sup>3</sup> for this feature, contact the system administrator.

rs\eSchiApp\_HS\ID\_Survivor\bin\eSchiApp.html - Windows Internet Explorer

ayuda salir

search

**Personal Information**

(\*) fullname: Doutora Catarina Reis

(\*) username: doc

(\*) password: \*\*\*

(\*) confirm password: \*\*\*

email: doc@mail.pt

save

Figure 2 – “Personal Info” area

Press the “save” button to submit the updates and the system will provide a success message if all goes as expected.

## Patients

Click the button “Patients List” of the main menu to access the list of patients (Figure 4).



Figure 3 – Main menu with the option “Patients List” selected

The system provides the list of the patients that are attributed to the logged in therapist. It is possible to filter the list, using the text field and the “search” button<sup>4</sup>.

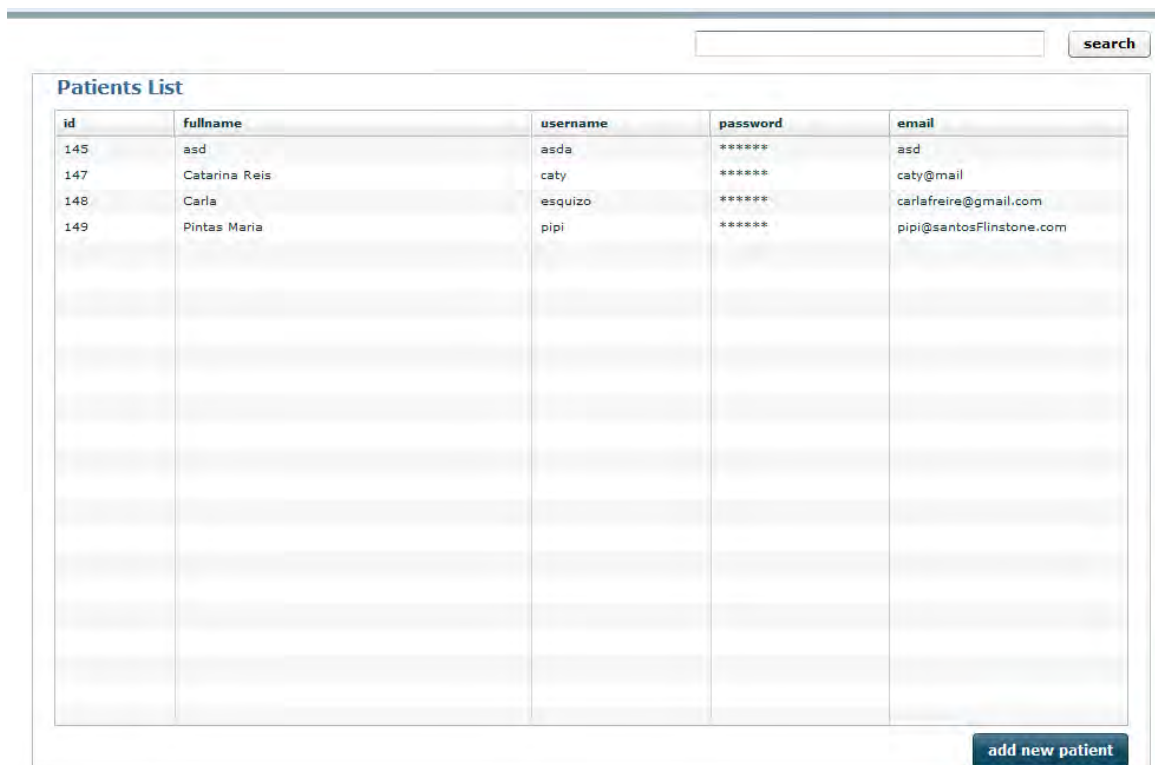
---

Generic Functions Available

To edit and update the information of a patient, simply select one in the list and double click it. A form with the existing information will appear (similar to the one presented in Figure 2) where you can change the information as desired.

By pressing the “add new patient” button you will be able to access a form with the required data to add a new patient to the system.

Whether to edit or add a new patient you should always guarantee that your changes have been correctly submitted, by the system response<sup>5</sup>.

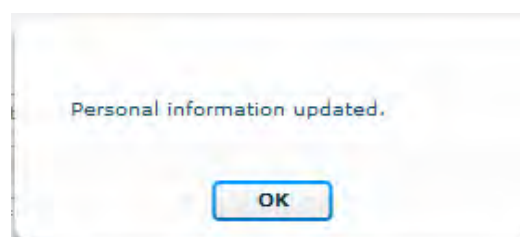


id	fullname	username	password	email
145	asd	asda	*****	asd
147	Catarina Reis	caty	*****	caty@mail
148	Carla	esquizo	*****	carlafreire@gmail.com
149	Pintas Maria	pipi	*****	pipi@santosFlinstone.com

Figure 4 – “Patients List”

<sup>4</sup> **“search” button general functioning:** enter the specific text in the text field and then press enter or the “search” button. The text entered will be searched in every column of the datagrid (bellow), that will be filtered and presented to you according to the results found. To present all the results, without any type of filter, simply clear the text field and hit enter or press the “search button”.

<sup>5</sup> **success update messages** provided by the system: everytime the user performs an update or creates a new element, the system reacts with a success message similar to the one bellow:



## Activities

Click the “Activity List” button to access the list of available activities in the system (Figure 6).



Figure 5 - Main menu with the option “Activity List” selected

The system provides the list of all the activities that are available. It is possible to filter the list, using the text field and the “search” button<sup>4</sup>.

Activities List					
id	name	description	type	stimulus complexity	duration
11	Tiro al Blanco - Lento	Algunos estímulos visuales te serán	Visual Target Shooting	high	12
12	Tiro al Blanco - Median	Algunos estímulos visuales te serán	Visual Target Shooting	medium	8
13	Tiro al Blanco - Rápido	Algunos estímulos visuales te serán	Visual Target Shooting	high	4
14	Tiro al Blanco Sonido -	Algunos estímulos sonoros te serán	Sound Target Shooting	low	12
15	Tiro al Blanco Sonido -	Algunos estímulos sonoros te serán	Sound Target Shooting	medium	8
16	Tiro al Blanco Sonido -	Algunos estímulos sonoros te serán	Sound Target Shooting	high	4
17	Naranjas y Cestas	Coloca las naranjas en las cestas u	Drag and Drop	low	50
18	Memoria	Recuerda la imagen que saldrá en l	Recognition	low	50
19	Parejas	Recuerda las parejas que saldrán e	Association	medium	70
20	Reacción-sonido	Cuando oigas el sonido haz click co	Sound Target Shooting	low	40
21	Reacción-imagen	Cuando veas la imagen en la pant	Visual Target Shooting	low	40
22	acerta no objecto	ao aparecer um objecto clica num lc	Visual Target Shooting	medium	30
23	Apanha a fruta	coloca a fruta no sitio correcto	Drag and Drop	low	40
24	Qual é a coisa, qual é	Identifica o objecto que viste anteri	Recognition	medium	40
25	Pares	coloca os pares correctamente de a	Association	medium	30
31	TesteCatarina	esta e daquelas de drag and drop	Drag and Drop	low	20
32	TesteCatarina2	esta é a primeira...	Visual Target Shooting	low	12
33	TesteCatarina3	esta é a nivel de sons	Sound Target Shooting	low	40
34	TesteCatarina4	reconheces?	Recognition	low	10
35	TesteCatarina5	associa...	Association	low	10
36	TesteCatarina6	completo	Sound Target Shooting	low	30
37	TesteCatarina7	este é a nivel visual	Visual Target Shooting	low	20
38	aa	aa	Visual Target Shooting	low	1

Figure 6 – “Activity List”

In order to configure a new activity the user can click on the “add new activity” or on the “duplicate activity” button. The system presents a new activity form (Figure 7) with the basic activity information. Every activity should have a unique name or the system will deny its creation as an activity configuration.

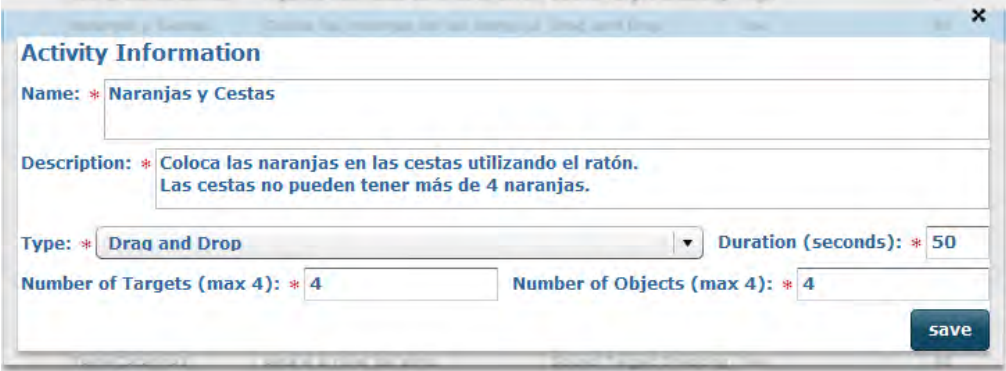


Figure 7 – Activity Form

In a new activity configuration, the system provides the default values for the type of activity chosen.

To duplicate an existing activity, the user should select an existing activity configuration to copy from the list. When presenting the form, the system provides the values that are defined for the initially selected configuration and the new activity is called by default the “Copy of “ + the name of the initial activity.

Whether to add a new activity or duplicate an existing one, you should always guarantee that your changes have been correctly submitted, by the system response<sup>5</sup>.

There are 7 distinct types of activities implemented in the system that can be customized. Next we will present each of the existing types, the default values provided and the values allowed in their customization.

### **Activity Types and Configuration**

Every activity has a time duration that represents its enabled period. The total amount of seconds since the user starts the activity until the point where the system terminates the activity, if the user hasn’t completed it yet.

#### **1. Visual Target Shooting**

This activity’s chief goal is to train the user reaction to the presentation of visual stimuli. The user should click somewhere in the screen after the system has presented an image (stimulus).

Thus, it is possible to customize some of the parameters that have a direct impact in the activity such as the time between stimuli and the number of stimuli.



The time between stimuli is the interval from one stimulus presentation up until the next one. And the number of stimuli is the total amount of images that will be presented to the user. The default values that are presented to the user are the following:

- ∞ time between stimuli – 3 seconds
- ∞ number of stimuli – 3
- ∞ duration<sup>6</sup> – 12 seconds

**attention:** the time between stimuli should always be a smaller value than the duration time of the activity and the number of stimuli must be a positive integer higher than 1.

## 2. Sound Target Shooting

This activity's chief goal is to train the user reaction to the presentation of audio stimuli. The user should click somewhere in the screen after the system has started playing a sound (stimulus).

Thus, it is possible to customize some of the parameters that have a direct impact in the activity such as the time between stimuli and the number of stimuli.

The time between stimuli is the interval from one stimulus presentation up until the next one. And the number of stimuli is the total amount of sounds that will be presented to the user. The default values that are presented to the user are the following:

- ∞ time between stimuli – 3 seconds
- ∞ number of stimuli – 3
- ∞ duration<sup>6</sup> – 12 seconds

**attention:** the time between stimuli should always be a smaller value than the duration time of the activity and the number of stimuli must be a positive integer higher than 1.

## 3. Sound Target Shooting Complete

This activity's chief goal is to train the user reaction to the presentation of audio stimuli according to an increase of three levels of complexity – three stimuli blocks. The activity will play a block of stimuli with the indicated time between stimuli and then will proceed to the next, decreasing the time between stimuli presentation and increasing the complexity of the activity. This will occur up until three blocks of stimuli are played. The user should click somewhere in the screen after the system has started playing a sound (stimulus).

---

<sup>6</sup> **tip:** the time duration for an activity could be calculated using rounded (approximate) values of the following formula:

$$\text{duration} = \text{number of stimuli} * \text{time between stimuli} + 4 \text{ seconds}$$

In order to customize the activity, some of the parameters that have a direct impact in the activity such as the time between stimuli and the number of stimuli might be set.

The time between stimuli is the initial time interval from one stimulus presentation up until the next one. This value will only be used for the first block of stimuli presentation. The number of stimuli is the total amount of sounds that will be presented to the user on the whole activity. The default values that are presented to the user are the following:

- ∞ time between stimuli – 5 seconds
- ∞ number of stimuli – 9
- ∞ duration<sup>6</sup> – 50 seconds

**attention:** the time between stimuli should always be a smaller value than the duration time of the activity and the number of stimuli must be a positive integer higher than 1.

#### 4. Visual Target Shooting Complete

This activity's chief goal is to train the user reaction to the presentation of visual stimuli according to an increase of three levels of complexity – three stimuli blocks. The activity will present a block of stimuli with the indicated time between stimuli and then will proceed to the next, decreasing the time between stimuli presentation and increasing the complexity of the activity. This will occur up until three blocks of stimuli are presented. The user should click somewhere in the screen after the system has presented an image (stimulus).

In order to customize the activity, some of the parameters that have a direct impact in the activity such as the time between stimuli and the number of stimuli might be set.

The time between stimuli is the initial time interval from one stimulus presentation up until the next one. This value will only be used for the first block of stimuli presentation. The number of stimuli is the total amount of images that will be presented to the user on the whole activity. The default values that are presented to the user are the following:

- ∞ time between stimuli – 5 seconds
- ∞ number of stimuli – 9
- ∞ duration<sup>6</sup> – 50 seconds

**attention:** the time between stimuli should always be a smaller value than the duration time of the activity and the number of stimuli must be a positive integer higher than 1.

#### 5. Drag and Drop

This activity's chief goal is to train the user ability to select (by clicking), drag and drop a specific visual element over a specified visual target, for instance dragging oranges into baskets.

Thus, it is possible to customize some of the parameters that have a direct impact in the activity such as the number of objects to drag and the number of target objects. The default values that are presented to the user are the following:

- ∞ number of objects (to drag) – 4
- ∞ number of targets – 4
- ∞ duration – 50 seconds

**attention:** the number of objects to drag and the number of targets must be positive integers between 1 and 4.

## 6. Recognition

This activity's chief goal is to train the user ability to memorize a specific visual element and then recognize it amongst a set of distinct visual elements.

Thus, it is possible to customize some of the parameters that have a direct impact in the activity such as the time that is given to the user to memorize the visual elements and the number of visual elements in the discovery set. The default values that are presented to the user are the following:

- ∞ memory time – 5
- ∞ number of visual elements in the final set – 4
- ∞ duration – 50 seconds

**attention:** the time to memorize should always be a smaller value than the duration time of the activity and the number of visual elements in the final set should be a positive integer between 1 and 5.

## 7. Association

This activity's chief goal is to train the user ability to memorize pairs of visual elements and then recreate the initial pairs after they have been scrambled.

Thus, it is possible to customize some of the parameters that have a direct impact in the activity such as the time that is given to the user to memorize the pairs and the number of pairs. The default values that are presented to the user are the following:

- ∞ memory time – 10
- ∞ number of visual elements in the final set – 4
- ∞ duration – 70 seconds

**attention:** the time to memorize should always be a smaller value than the duration time of the activity and the number of visual elements in the final set should be a positive integer between 1 and 4.

# Sessions



In order to configure a new session the user can click on the “add new session” or on the “duplicate session” button. The system presents a new session form (Figure 10) with the session information.

Figure 10 – Session Form

In a new session configuration, the system provides a clean form. At the top of the form there is a list with the available patients (left corner) and a date field that specifies the date for the session to occur. There is also the list of the available activities on the left and a column for the session activities on the right.

To duplicate an existing session, the user should select an existing session to copy from the list. When presenting the form, the system provides the values that are defined for the initially selected session.

Special consideration should be taken to this: there can be only one session established per patient per day.

Therefore, there is also the possibility to remove sessions that are on the list. In order to delete an existing session the user should select it (or them, if the action is desired for more than one session) and click on the “remove sessions” button. In order to keep the system safe, this action is only allowed in sessions that haven’t occurred yet, so they must be in the “created” status to be removed.

Whether to add a new session, duplicate an existing one or remove sessions, you should always guarantee that your changes have been correctly submitted, by the system response<sup>5</sup>.

## Statistics

Click the “Statistics” button to access to the statistics module where the information regarding the current therapist’s patients’ performance during the sessions is available (Figure 12).



Figure 11 – Main menu with the option “Statistics” selected

The statistics module appears in a popup window where a small set of charts is presented.

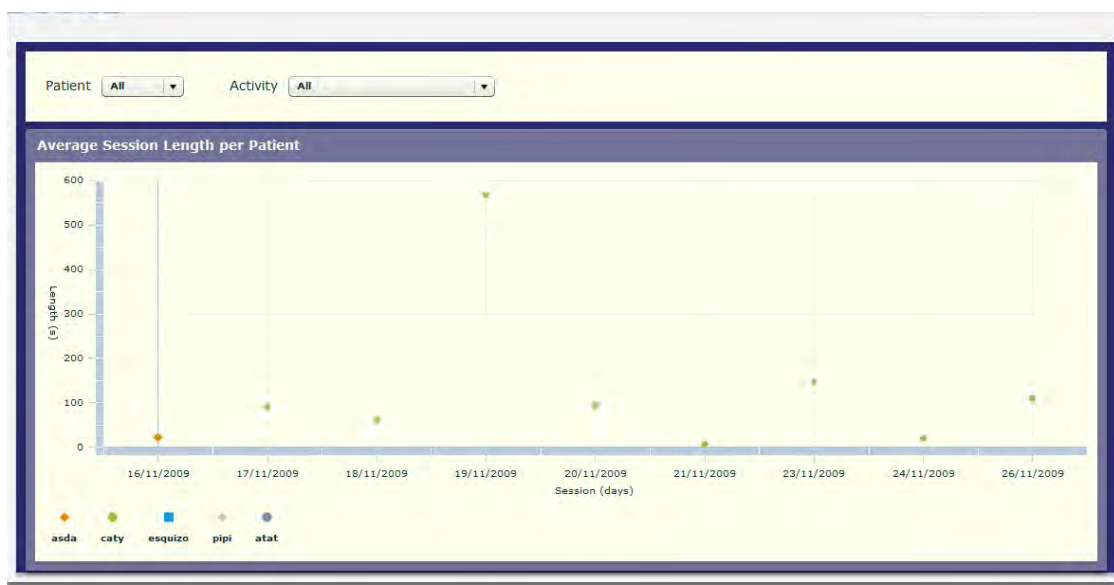


Figure 12 – Statistics Module

The first chart that is presented to the user represents the **average session length (duration)** that a patient takes when taking a session. The information provided refers to all the therapist’s patients and the days where the sessions took place.

When drilling down or zooming in the chart, and this can be done by selecting a data point in the current chart, the system will present the **average session length (duration)** for the chosen patient and for every session he took.

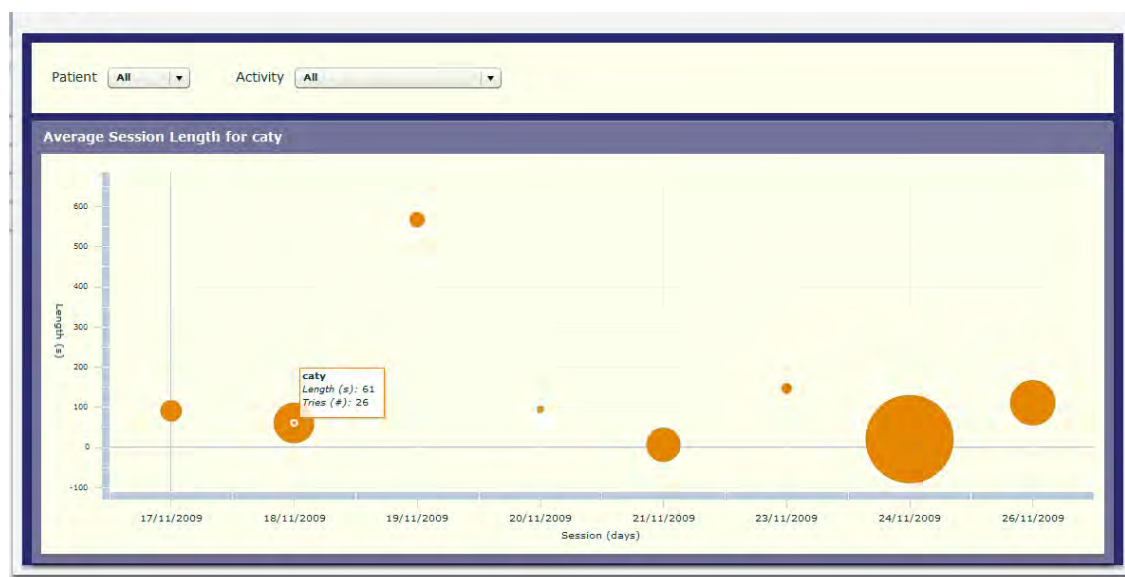


Figure 13 – Average Session Length per Patient

Each data point indicates the number of tries (attempts) that were conducted in a specific day as well as the average duration of these sessions.

Another click in an existing data point leads the way to the next chart where all **session lengths for a specific patient on a specific day** are depicted. This includes every try that was made using the system, indicated by starting time (hour).

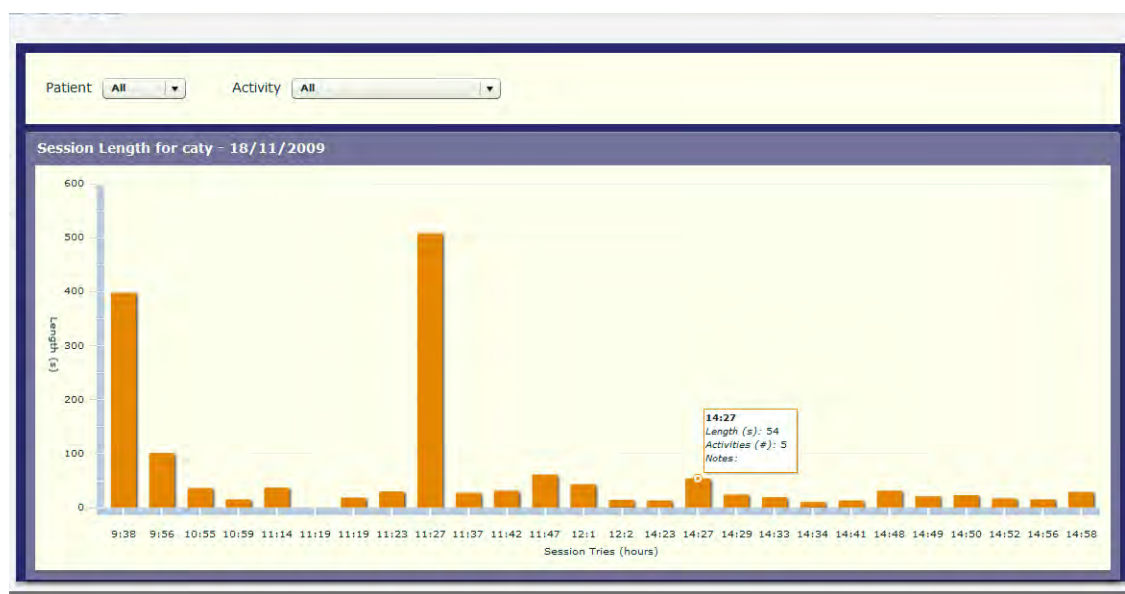


Figure 14 – Session Length for a specific patient and a specific session day



Each data point shows information regarding a specific session try length, the number of activities conducted and the notes taken when using the system.

The last zoom-in that is allowed in this set of charts shows the user the **performance for the chosen patient, on a specific session day and try, presenting each activity data.**

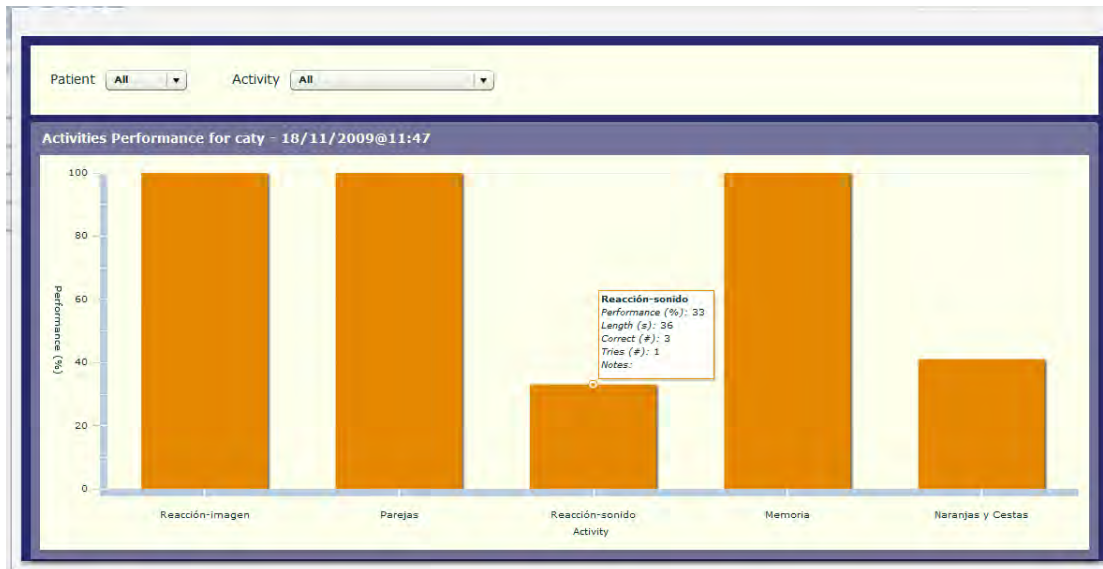


Figure 15 – Activities Performance for a specific patient on a specific session try

Each data point provides information regarding a specific activity performance, length, number of correct stimuli, number of attempts the patient took to conduct the activity and the notes taken when using the system.

When the user uses the ***filter options*** that are available in this module, such as the patient filter or the activity filter there are other charts available.

When the user selects a patient from the existing top left drop down, the system presents the **average session length (duration)** for the chosen patient and for every session he took.





Figure 16 – Average Session Length using the patient filter

If the user selects an activity from the existing top right drop down, the system presents the **average performance for the chosen activity per patient**.

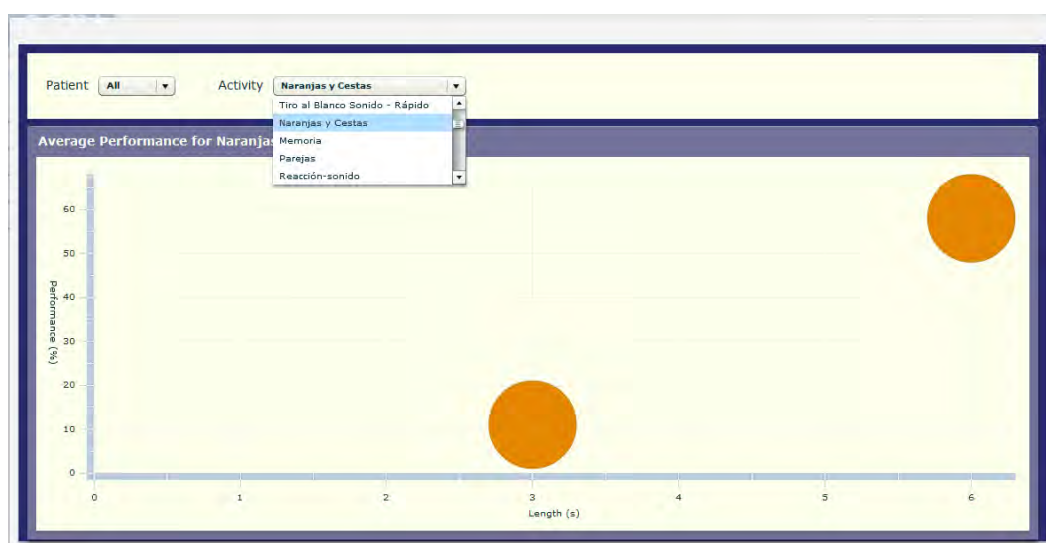


Figure 17 – Average Performance for a specific activity

Each data point provides information regarding the patient, length, number of tries, correct stimuli, performance and number of sessions involved in the averages.

When zooming-in this chart leads to another one where it is possible to see the **performance of a specific patient on every activity try** he has made.

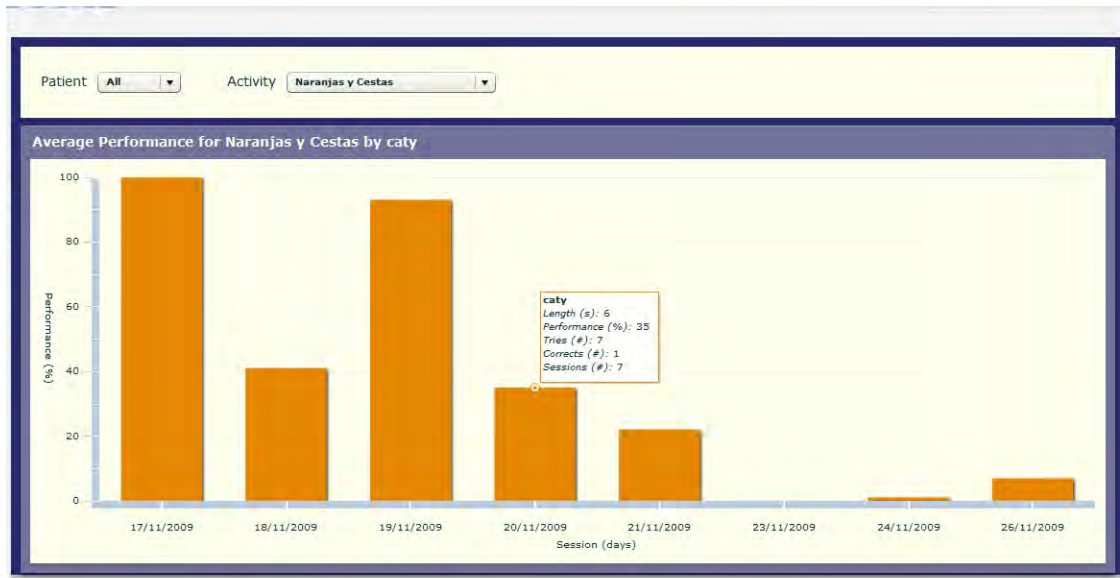


Figure 18 – Performance for a specific patient on every try for the chosen activity

Each data point has information regarding the average length, performance, number of correct stimuli, number of activity attempts for each session (day) the activity was taken.

A further drill down on the data gives access to the **performance for the chosen activity by the specific patient on a chosen session day**.



Figure 19 – Performance for the chosen activity for a specific patient and session try

Each data point provides information regarding the patients behaviour when conducting the activity attempt. Namely, the length, performance, number of tries and number of correct stimuli achieved.

When the user unselects a specific activity and the filters return to their initial state: patient-all and activity-all, the system provides the following chart.



Figure 20 – Average Activity Performance per Patient

This chart presents the **average information grouped by activity attempts** conducted by all the patients in the system. Each data point refers to an activity and provides information regarding the activity average length and performance.

## FAQs - Preguntas Frecuentes

### 1. Cómo debo hacer para añadir una nueva actividad?

Seguir las instrucciones del capítulo 0 de acuerdo con “add new activity”. El resultado será una actividad nueva para el sistema.

### 2. Cómo debo hacer para modificar una actividad existente?

No se puede hacer.

### 3. Cómo debo hacer se quiero una actividad similar a una que ya tengo definida?

Seguir las instrucciones del capítulo 0 de acuerdo con “duplicate activity”. El resultado será una actividad nueva para el sistema.

### 4. Cómo interpreto los parámetros que debo configurar para las actividades?

Seguir las indicaciones providenciadas aquí: **Activity Types and Configuration**

**5. Cómo debo hacer para añadir una nueva sesión?**

Seguir las instrucciones del capítulo 0 de acuerdo con “add new session”. El resultado será una sesión nueva para el sistema.

**6. Cómo debo hacer para modificar una sesión existente?**

No se puede hacer.

**7. Cómo debo hacer se quiero una nueva sesión similar a una existente?**

Seguir las instrucciones del capítulo 0 de acuerdo con “duplicate session”. El resultado será una sesión nueva para el sistema.

**8. Me he equivocado y he definido más de una sesión para el mismo paciente, para el mismo día, que debo hacer?**

Seguir las instrucciones del capítulo 0 de acuerdo con “remove sessions”. Las sesiones no podrán estar consideradas terminadas y el sistema eliminará de modo a que el paciente solo tenga una sesión para el día pretendido.

## Manual de Usuario - ES



## Introducción

El portal eSchi intenta ser un portal accesible y cómodo de usar. Pero hay siempre algunas dudas que fácilmente se pueden aclarar con una explicación más profundizada.

Este manual de usuario agrega toda la información sobre las tareas que están disponibles en el sistema. Además se intenta hacer una descripción más o menos escrupulosa sobre las tareas que se pueden desarrollar en el portal eSchi.

El portal es usado por distintos perfiles de usuarios (administrador, terapeuta/médico y paciente) y como es normal hay tareas distintas disponibles para los distintos perfiles. El acceso y la salida del portal se hace del mismo modo cualquier que sea el perfil. Para ya las tareas descritas son justo las del perfil de paciente.

Mientras se añade nuevas tareas, las que estén aquí ya descritas se mejoran.

## Tareas

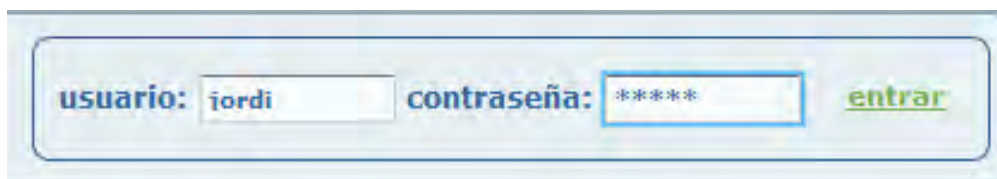
A continuación se describen las tareas disponibles en el portal.

### Acceso

Para entrar en el sistema hay que ser un usuario autenticado, o sea, hay que tener un nombre de usuario y una contraseña para que se sea reconocido por el sistema.

En la página web inicial del portal hay una zona dedicada para que los usuarios puedan rellenar su información personal.

Así, cuando tengan un usuario y una contraseña hay que rellenarlos en lo espacio apropiado y presionar el botón “entrar”.

El formulario de acceso al portal está contenido en un recuadro rectangular con una sombra suave. Dentro, a la izquierda, se encuentra el texto "usuario:" en azul, seguido de un campo de texto que contiene el nombre "jordi". A la derecha de este, se encuentra el texto "contraseña:" en azul, seguido de un campo de texto que contiene cinco asteriscos "\*\*\*\*\*". A la derecha de estos campos, hay un botón rectangular con el texto "entrar" en verde.

**Imagen 56 – Acceso al Portal**

El sistema conducirá el usuario para la primera página del sistema pós-autenticación.



Imagen 57 – Página Principal del Usuario Paciente

Cuando los datos no son los correctos el sistema presenta un mensaje indicando que hay que repetir la acción, pero con los datos correctos.

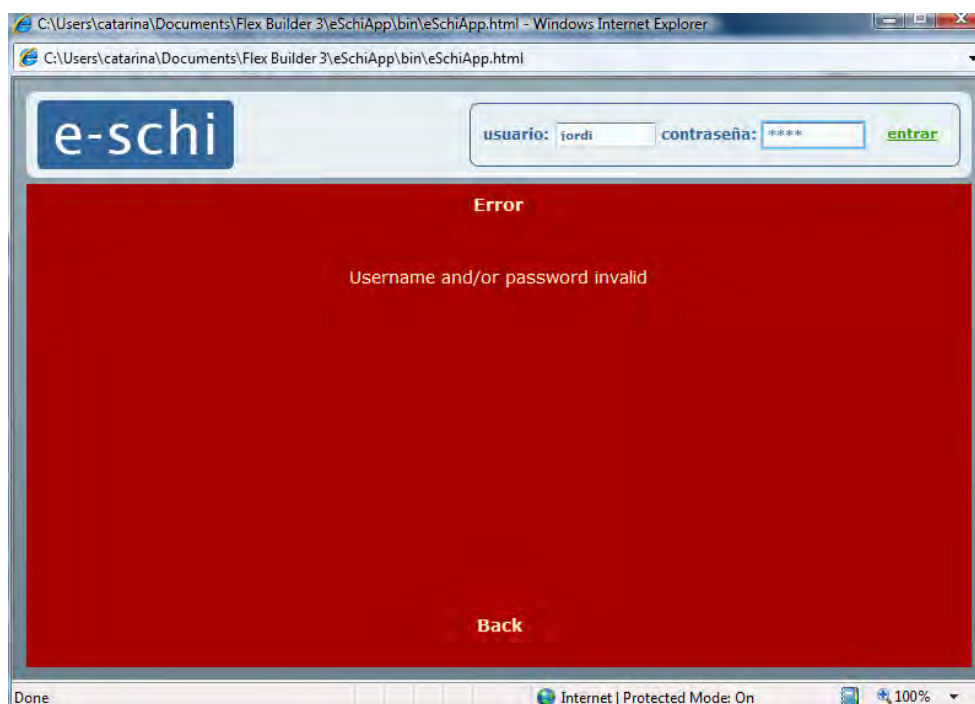


Imagen 58 – Error de Acceso



## Salir

Para salir del sistema y cerrar una sesión hay que presionar el botón “salir” que está siempre disponible en cualquier página del portal.

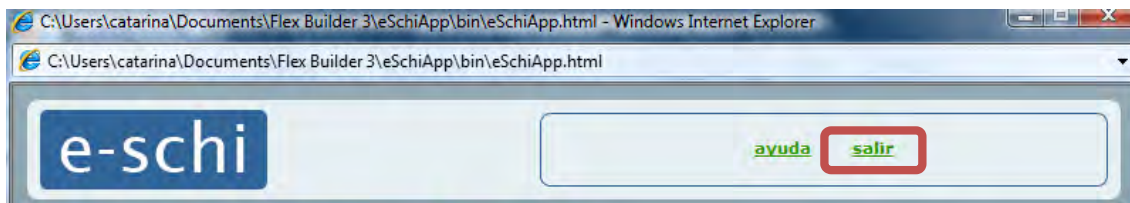


Imagen 59 – Salida del Portal

La salida y cierre correcto de una sesión conduce el usuario hasta la página principal del portal.



Imagen 60 – Página Principal del Portal



## Identificación

Antes de empezar la sesión, el sistema presenta una página de salutación donde el usuario tiene que contestar su nombre. El sistema acepta cualquier parte del nombre completo del usuario, letras mayúsculas y minúsculas.

En la caja de texto hay que escribir el nombre del usuario y presionar el botón “empezar”.



Imagen 61 – Identificación del Usuario

El portal direcciona el usuario para la página de la sesión del día de hoy.



Imagen 62 – Página con la Sesión Actual

### Actividades

Todas las actividades empiezan de la misma manera: con una descripción de los rectos que hay que alcanzar.

Para empezar una actividad hay que presionar el botón de la actividad deseada (botón de enlace con el nombre de la actividad).



Imagen 63 – Elegir una Actividad

El sistema presenta un mensaje con la descripción inicial de los objetivos y del modo de alcanzar el final de la actividad.



Imagen 64 – Retos para la Actividad

Después de leer el texto con la descripción hay que presionar el botón “empezar”. El sistema presenta el área elegida y empieza la actividad.





Imagen 65 – Área de la Actividad Elegida

Todas las actividades tienen un menú de opciones persistentes:

- Regresar – botón para retornar al listado de actividades para la sesión de hoy.
- Reiniciar – botón para empezar de nuevo la actividad actual.
- Tiempo de Actividad – información sobre el tiempo restante para completar la actividad. Tiene una barra de progreso
- Resultado – información sobre el resultado del usuario en la actividad.



Imagen 66 – Opciones Persistentes de las Actividades

### Asociación

Se presentan al usuario 8 estímulos juntos en dos columnas de 4. Estos estímulos tienen una correspondencia directa con el objeto que está en la misma línea. Se dicen asociados.

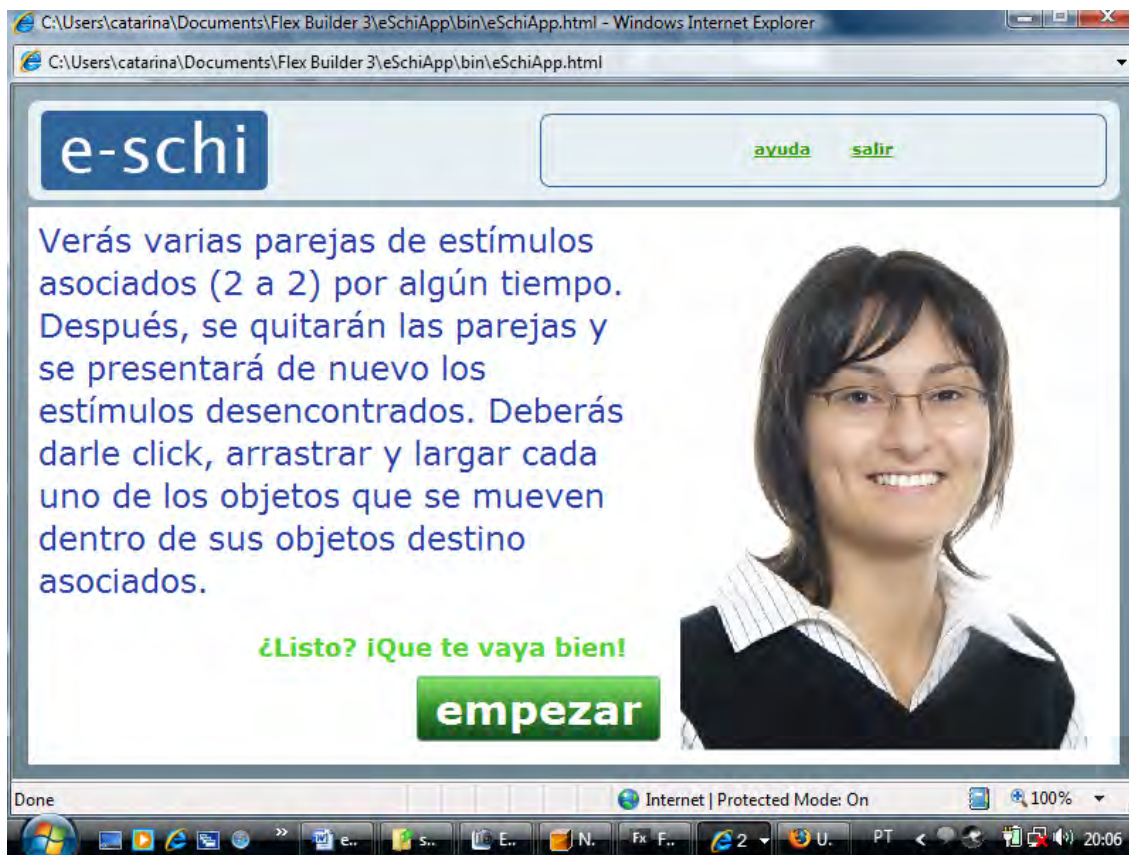
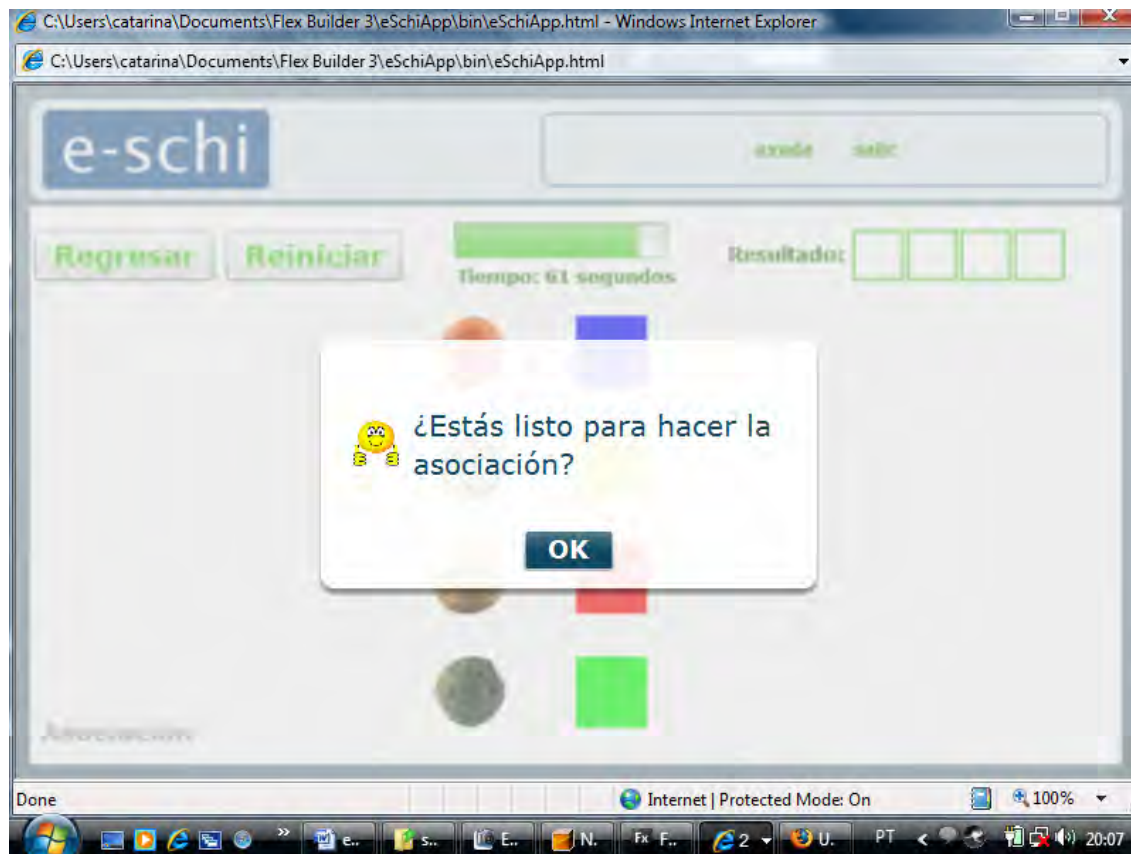


Imagen 67 – Mensaje Inicial de la Actividad



Imagen 68 – Página Inicial de la Actividad

Pasado algún tiempo, el sistema presenta un mensaje al usuario, preguntando si él está listo para comenzar.



**Imagen 69 – Mensaje para Empezar la Asociación**

El usuario acepta el reto para iniciar, presionando el botón “OK”. El sistema mezcla y dispone de una nueva forma los 4 estímulos de la columna más a izquierda.





**Imagen 70 – Estímulos Mezclados y Listos para Asociar**

El usuario tiene que arrastrar cada uno de estos 4 estímulos, que fueron mezclados, y soltar en el correspondiente objeto asociado.



Imagen 71 – Intento de Asociación de un Estímulo



Imagen 72 – Estímulo Correctamente Asociado

La actividad termina cuando el tiempo llega al término o cuando el usuario termine la asociación de los 4 estímulos.



Imagen 73 – Tres de Cuatro Estímulos Correctamente Asociados



Imagen 74 – Actividad Terminada



Imagen 75 – Pantalla Final de la Actividad Terminada



Poner naranjas en cestas de frutas

Se presentan al usuario 4 naranjas en el centro de la pantalla y 4 cestas vacías.



Imagen 76 – Mensaje Inicial de la Actividad



Imagen 77 – Página Inicial de la Actividad

El usuario debe arrastrar cada naranja en una cesta. Cada cesta puede tomar hasta 4 naranjas.



Imagen 78 – Intento de Completar la Acción



Imagen 79 – Naranja Correcta en la Cesta

Siempre que una naranja no sea totalmente arrastrada hasta la cesta, retorna a su posición inicial en la pantalla.



Imagen 80 – Intento de Completar la Acción



Imagen 81 – Naranjas Correctas en la Cesta



La actividad termina cuando el tiempo llega al término o cuando el usuario no tenga más naranjas para arrastrar.

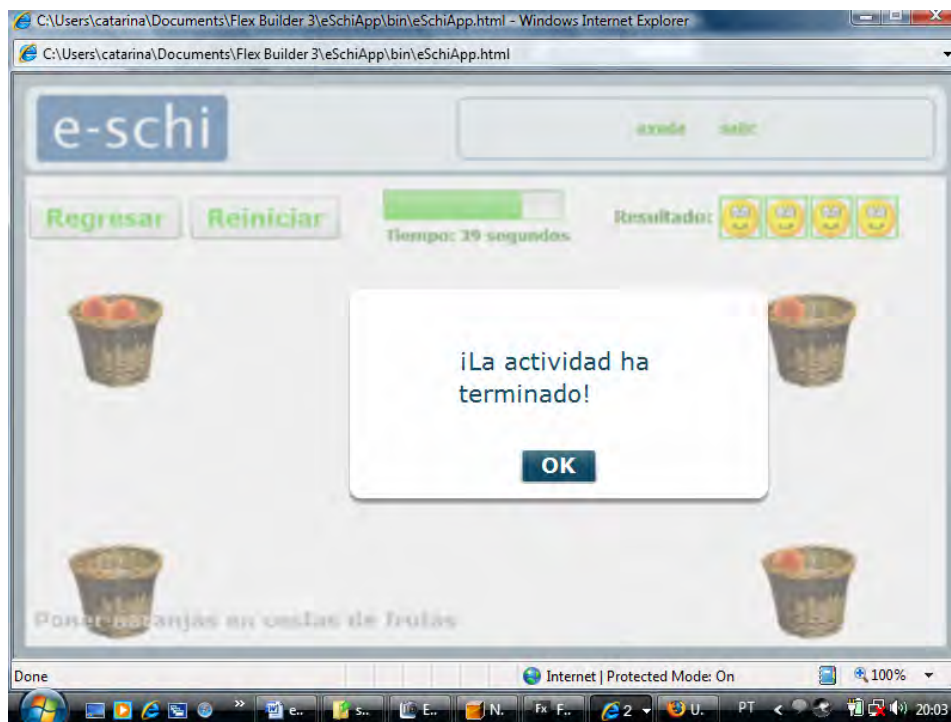


Imagen 82 – Actividad Terminada



Imagen 83 – Pantalla Final de la Actividad Terminada



## Reconocimiento

Se presenta un estímulo al usuario.



Imagen 84 – Mensaje Inicial de la Actividad



Imagen 85 – Página Inicial de la Actividad

Después de un periodo de tiempo se presenta un mensaje al usuario, preguntando si él está listo para comenzar.



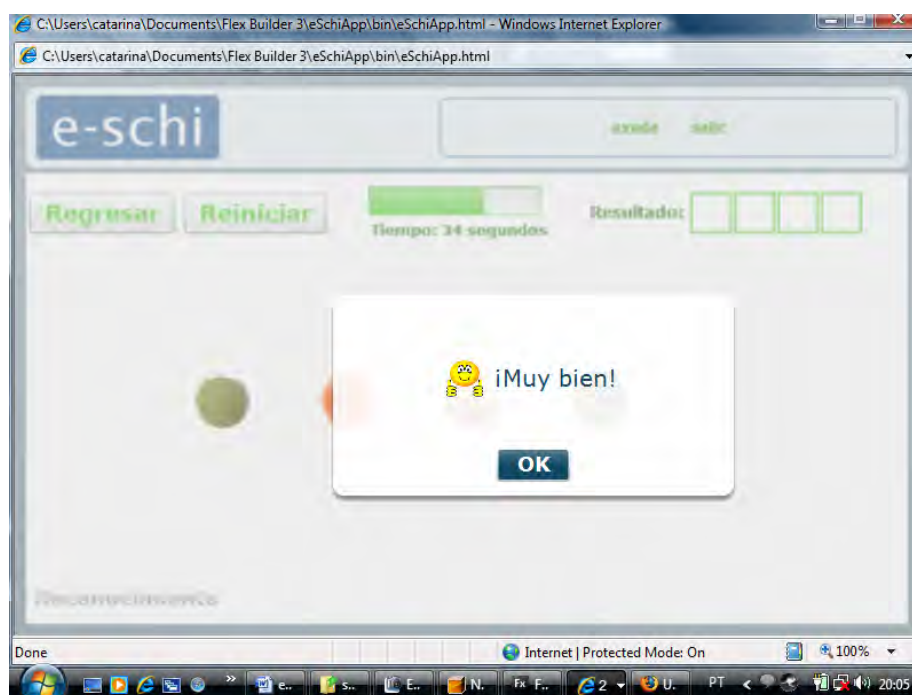
Imagen 86 – Mensaje para Empezar la Asociación

El usuario acepta el reto para iniciar y escoge el estímulo correcto a partir de una lista de 4 estímulos distintos.



Imagen 87 – Estímulos para Reconocer

La actividad termina cuando el tiempo llega al límite o cuando el usuario reconozca el estímulo.



**Imagen 88 – Estímulo Correcto Reconocido**

Siempre que el usuario no elige el estímulo correcto, se presenta un mensaje de error al usuario.



**Imagen 89 – Estímulo No Correcto**

Mientras la actividad pasa, el usuario podrá recibir mensajes de apoyo para que se acuerde del estímulo que ha visto en el inicio de la actividad.

#### Tiro al Blanco (Lento, Mediano y Rápido)



Imagen 90 - Mensaje Inicial de la Actividad



Imagen 91 – Página Inicial de la Actividad



Después de un periodo de tiempo se presenta un estímulo al usuario.



Imagen 92 – Primero Estímulo Presentado

El usuario debe reaccionar ante el estímulo y debe hacer clic en el botón del ratón, en algún lugar de la pantalla. La actividad felicita el usuario por su hecho.

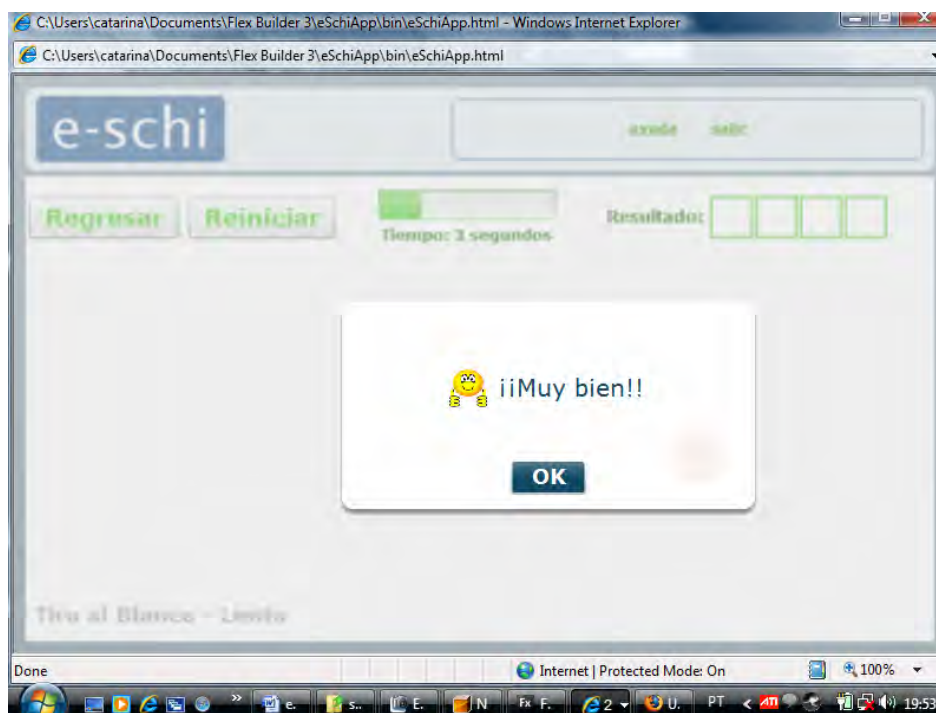
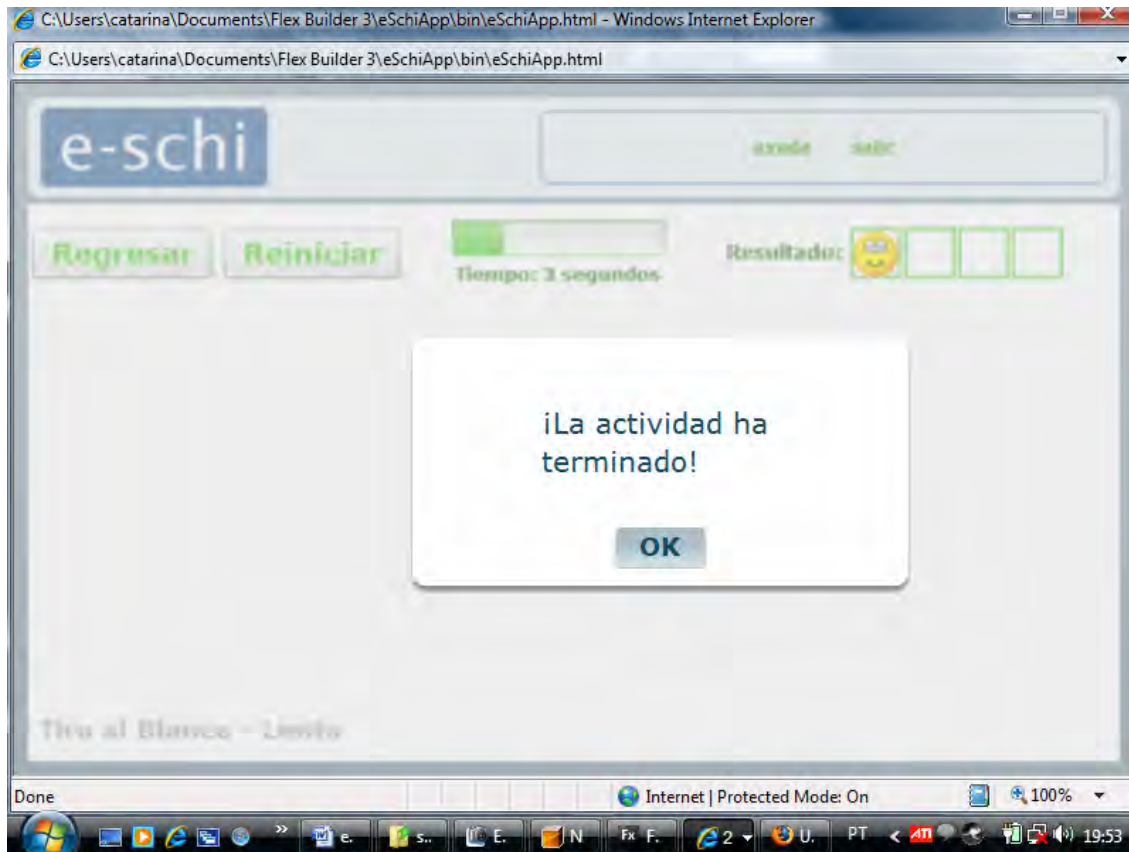


Imagen 93 – Felicitación de Suceso

El sistema facilita otro estímulo y el tiempo entre los estímulos define 3 tipos de actividades: lento, rápido y mediano.

La actividad termina cuando el tiempo llega al término o cuando el usuario reaccione ante los 3 estímulos disponibles.



**Imagen 94 – Término de Actividad**

Siempre que el usuario no reacciona al estímulo en el período de tiempo determinado, el sistema presenta un mensaje de aviso indicando que el tiempo para reaccionar ha pasado.

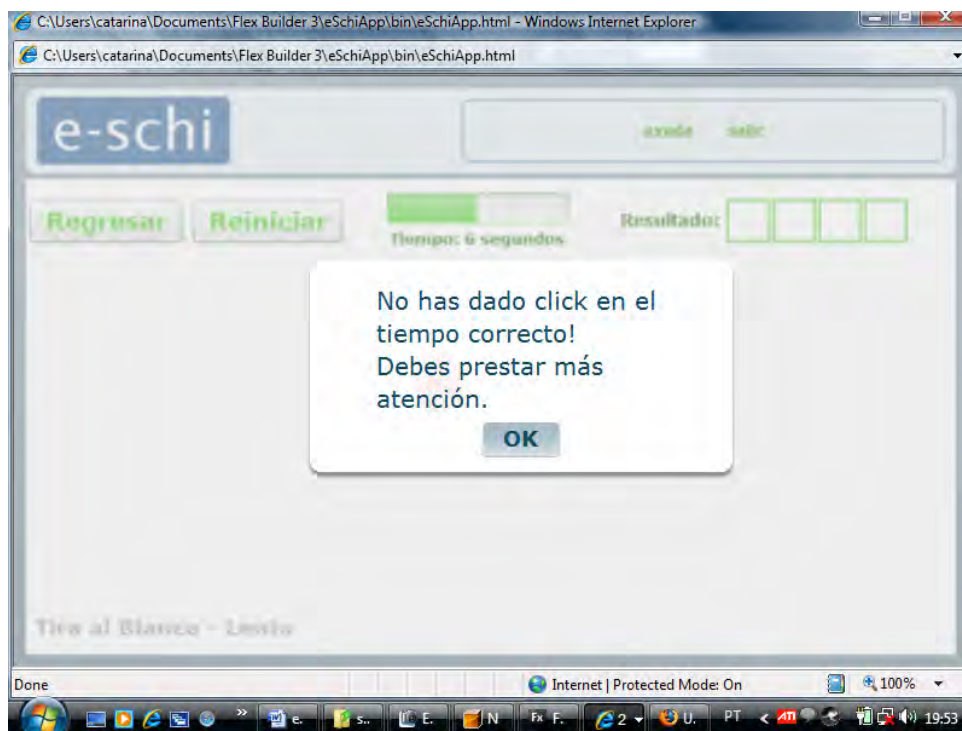


Imagen 95 – Mensaje de Atención

Siempre que el usuario reacciona, clicando el botón del ratón aún que no haya un estímulo, el sistema presenta un mensaje de aviso indicando que el usuario tiene que tener más calma.



Imagen 96 – Mensaje de Calma

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### Tiro al Blanco – Completo

Después de un periodo de tiempo se presenta un estímulo al usuario.

El usuario debe reaccionar ante el estímulo y debe hacer clic en el botón del ratón, en algún lugar de la pantalla.

La actividad felicita el usuario por su hecho.

Para principiar se presentan 3 estímulos lentamente, después 3 estímulos a tempo mediano y, por último, 3 más son presentados rápidamente.

La actividad termina cuando el tiempo llega al término o cuando el usuario reaccione ante los 9 estímulos disponibles.

Siempre que el usuario no reacciona al estímulo en el período de tiempo determinado, el sistema presenta un mensaje de aviso indicando que el tiempo para reaccionar ha pasado.

Siempre que el usuario reacciona, clicando el botón del ratón aún que no haya un estímulo, el sistema presenta un mensaje de aviso indicando que el usuario tiene que tener más calma.

## Tiro al Blanco Sonido (Lento, Mediano y Rápido)



Imagen 97 - Mensaje Inicial de la Actividad



**Imagen 98 – Página Inicial de la Actividad**

Después de un periodo de tiempo se presenta un estímulo sonoro al usuario.

**Imagen 99 – Primero Estímulo Presentado**

El usuario debe reaccionar ante el estímulo y debe hacer clic en el botón del ratón, en algún lugar de la pantalla. La actividad felicita el usuario por su hecho.



**Imagen 100 – Felicitación de Suceso**

El sistema facilita otro estímulo sonoro y el tiempo entre los estímulos define 3 tipos de actividades: lento, rápido y mediano.

La actividad termina cuando el tiempo llega al término o cuando el usuario reaccione ante los 3 estímulos disponibles.



**Imagen 101 – Término de Actividad**

Siempre que el usuario no reacciona al estímulo en el período de tiempo determinado, el sistema presenta un mensaje de aviso indicando que el tiempo para reaccionar ha pasado.

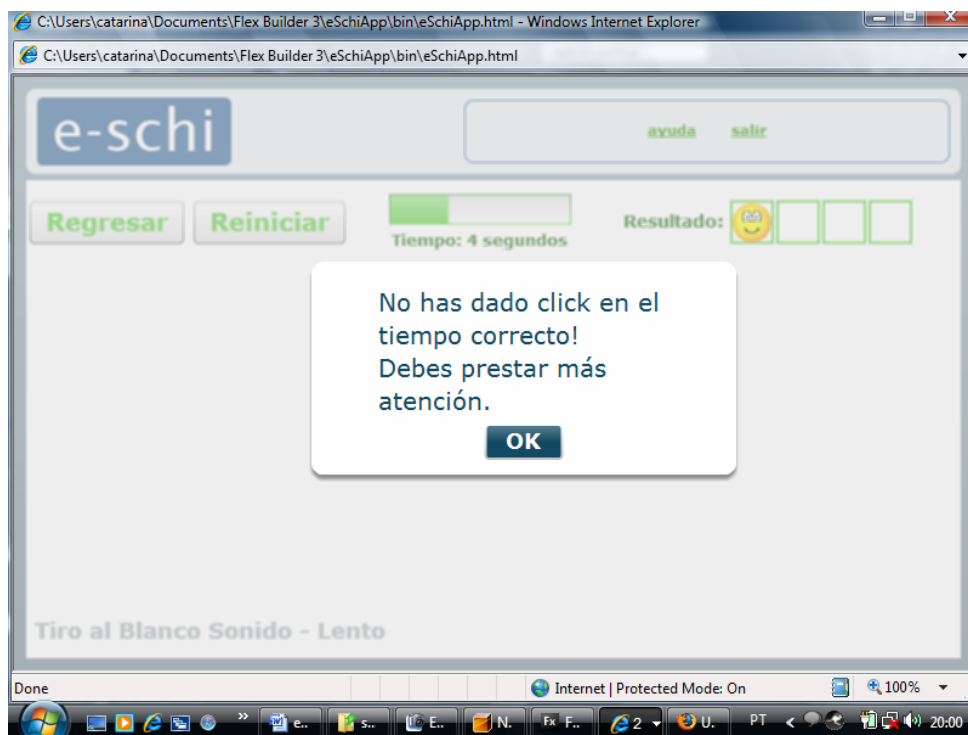


Imagen 102 – Mensaje de Atención

Siempre que el usuario reacciona, clicando el botón del ratón aún que no haya un estímulo, el sistema presenta un mensaje de aviso indicando que el usuario tiene que tener más calma.



Imagen 103 – Mensaje de Calma

### Tiro al Blanco Sonido - Completo

Después de un periodo de tiempo se presenta un estímulo sonoro al usuario.

El usuario debe reaccionar ante el estímulo y debe hacer clic en el botón del ratón, en algún lugar de la pantalla.

La actividad felicita al usuario por su hecho.

Para principiar se presentan 3 estímulos sonoros lentamente, después 3 estímulos sonoros a tempo mediano y, por último, 3 más son presentados rápidamente.

La actividad termina cuando el tiempo llega al término o cuando el usuario reaccione ante los 9 estímulos sonoros disponibles.

Siempre que el usuario no reacciona al estímulo sonoro en el período de tiempo determinado, el sistema presenta un mensaje de aviso indicando que el tiempo para reaccionar ha pasado.

Siempre que el usuario reacciona, clicando el botón del ratón aún que no haya un estímulo, el sistema presenta un mensaje de aviso indicando que el usuario tiene que tener más calma.

## Estadísticas

Hay varios tipos de estadísticas disponibles y además se distinguen por dos niveles: actividad y sesión.

### Estadística de la última Actividad

Cuando está desarrollando su actividad y a cualquier momento, el usuario sabe siempre su resultado. Además, cuando termine la actividad, el usuario tiene la opción de ver su resultado final en la actividad.



**Imagen 104 – Mensaje con Opción de Ver Resultados de la Actividad**

El sistema presenta una nueva página con los resultados para el perfil paciente.





Imagen 105 – Página con los Resultados de la Actividad

De acuerdo con el resultado, 1 de 3 mensajes distintos es presentada al usuario:

La página contiene un botón de “Detalle para el Terapeuta” (en futuro solo estará disponible para el perfil terapeuta) que da acceso a resultados más pormenorizados sobre el desempeño del paciente en su última actividad.



Imagen 106 – Botón de acceso para Detalle para Terapeuta

La página contiene también un botón para regresar al listado de actividades para la sesión actual.



Imagen 107 – Botón para Regresar Lista de Actividades

## Detalle para el Terapeuta



Imagen 108 – Página con Detalles para Terapeutas

En la página con los detalles, el terapeuta podrá ver varios resultados con respecto a la última actividad desarrollada por el paciente.

Explicar los resultados obtenidos.... Cálculos... como se hacen

La página contiene un botón para imprimir los resultados presentados en la página. Incluso se puede exportar para el formato PDF (*Portable Document Format*).



Imagen 109 – Botón para Imprimir los Resultados

La página contiene un botón para exportar los resultados presentados en la página.



Imagen 110 – Botón para Exportar los Resultados para CSV

El sistema abre una ventana donde se puede elegir si se abre la hoja de cálculo CSV (*Comma Separated Value*) o si se escoge el sitio donde se graba el archivo.

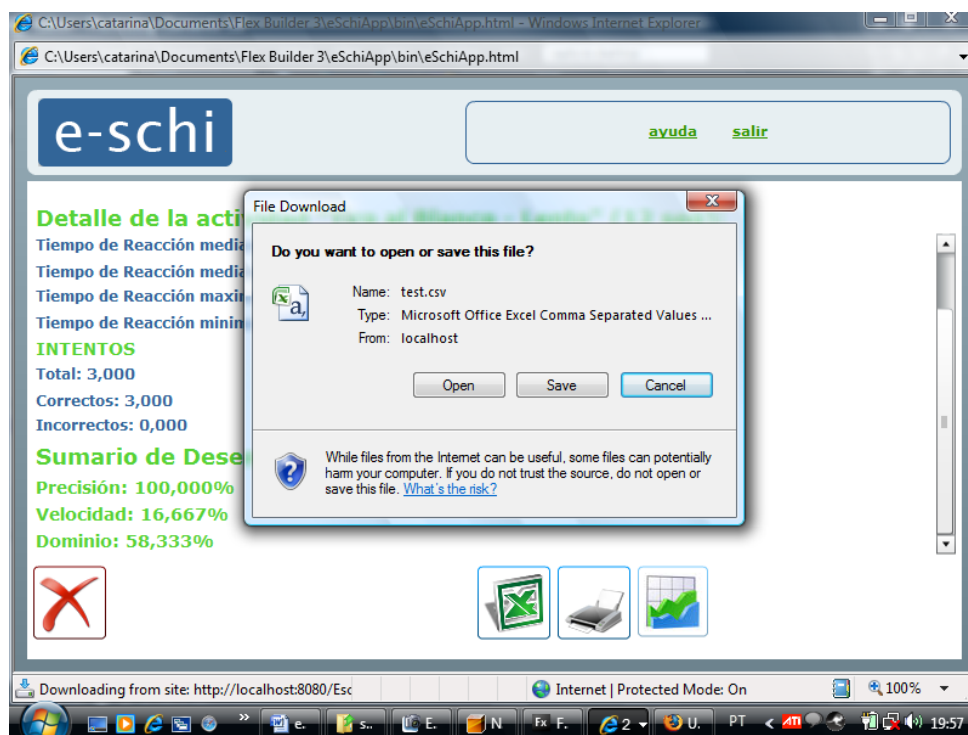


Imagen 111 – Mensaje para Guardar/Abrir el Archivo CSV

El archivo se puede ver en la mayoría de las aplicaciones de hojas de cálculo.

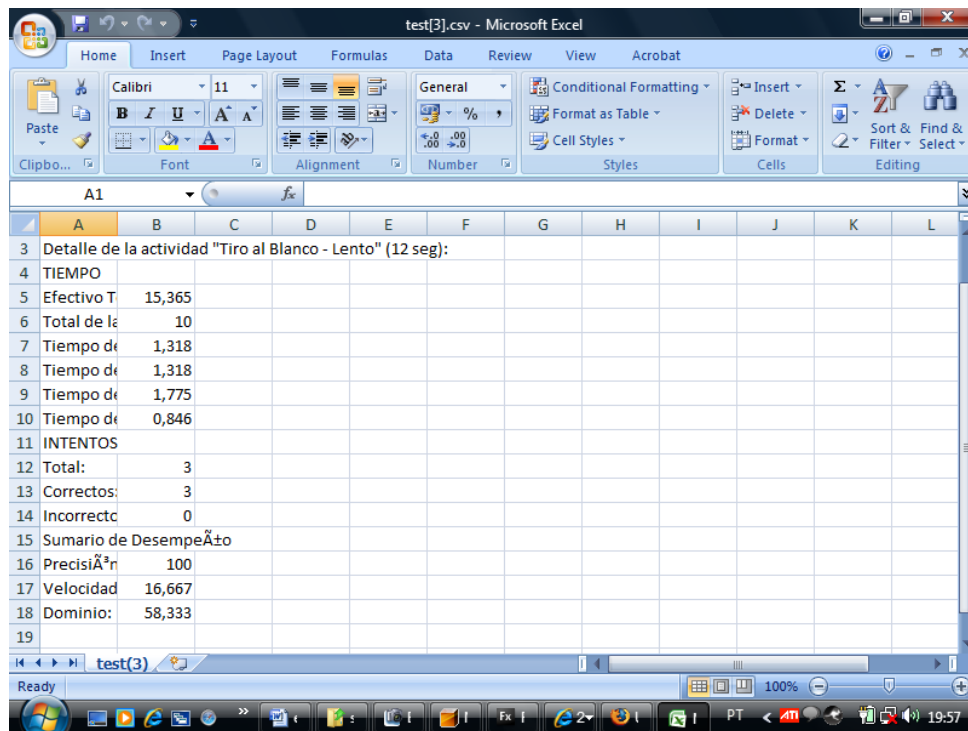


Imagen 112 – Archivo CSV en el Excel

La página contiene también un botón para regresar al listado de actividades para la sesión actual.



Imagen 113 – Botón para Regresar al Listado de Actividades

Perfil	Acción	Descripción	Comportamiento alternativo - a considerar correcto se sucede
Todos	Acceso	1 - Introducir su nombre de usuario / contraseña y pulsar "entrar" o la tecla ENTER.	Una página de error si se presenta el par usuario / contraseña no es correcta.
		2 - El acceso de los usuarios a la zona (de acuerdo con el perfil)	
Paciente	Identificación	1 - Introducir su nombre de usuario y pulsar "empezar". 2 - Acceso a la sesión del paciente planeada para el día de hoy.	Un mensaje de error emerge, si el nombre introducido no es correcto.
Actividades			
Todas las actividades empiezan de la misma manera: con una descripción de los retos que hay que alcanzar.			
<i>Empezar Actividad</i>			
1 - Hacer clic en el botón de la actividad deseada (botón de enlace con el nombre de la actividad).			
2 - Se presenta una mensaje con la descripción inicial.			
3 - Leer el texto de la descripción y hacer clic en el botón "empezar".			
4 - Acceso a la zona de la actividad elegida.			

## 9.4. eSchi System Architecture

The following picture presents ESCHI as a modular system, with the different profiles a user may assume before it and the macro modules that encapsulate the system's functionalities.

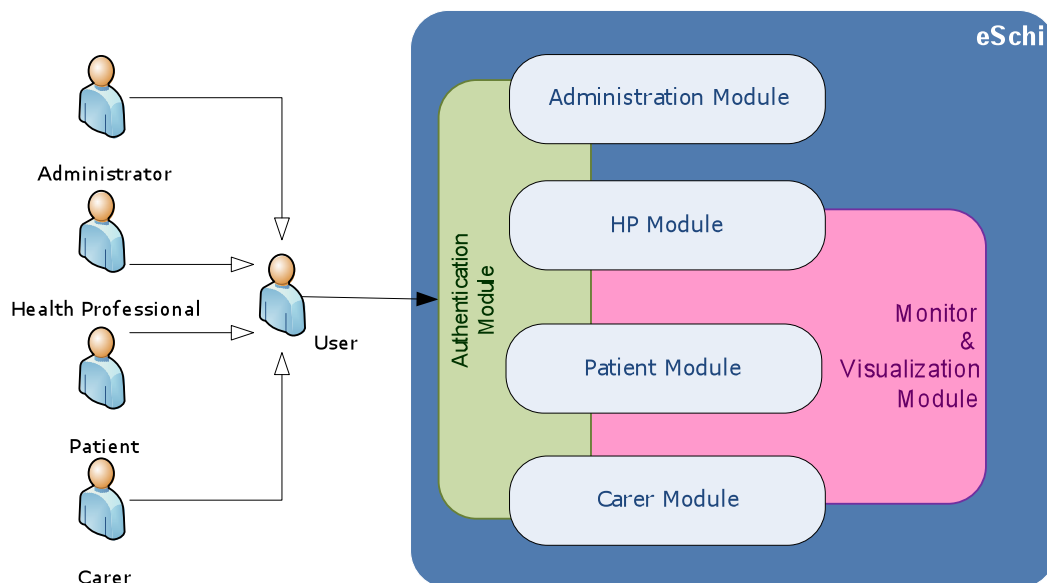


Figure 21 – ESCHI Architecture

### Authentication Module

Every user can access the system through the use of the Authentication Module. This module is responsible for verifying the user credentials (username and password) and then providing her with access to a personal area.

### User Profiles

ESCHI will allow the access to the following four distinct user profiles described according to their basic characteristics:

- Administrator – will manage the health professionals' access to the system and perform all the administration tasks of the system.



- Health Professional (HP) – will configure therapy activities; manage its patients (including system access), their therapy sessions and visualize results' information. They will be able to share their results and comment on the results of their health professional colleagues. They will also be able to send reports to the patient's families and caregivers with the results of their relatives.
- Patient – will carry out sessions, conducting the list of available activities for a day and visualize the results obtained in the activities.
- Caretaker – will be able to visualize the performance of their relative/patient. They will also be able to check the reports and additional treatment information provided by the health professionals.

The Authentication Module will be able to redirect the user according to its profile and thus enable access to user specific features and data. For instance, a health professional will be able to manage sessions for its patients, but will not be able to manage its colleagues sessions. A patient will be able to conduct its sessions but not other patients' sessions. Forward access to personal areas will be made applying a one-to-one mapping between profile and corresponding module: Administrator → Administrator Module; Health Professional → Health Professional Module; Patient → Patient Module and Caretaker → Caretaker Module.

### Administration Module (AM)

The system has one built-in administrator user (admin) that is responsible for the initial creation of other system users, specifically health professionals. This is the only profile with access to this module.

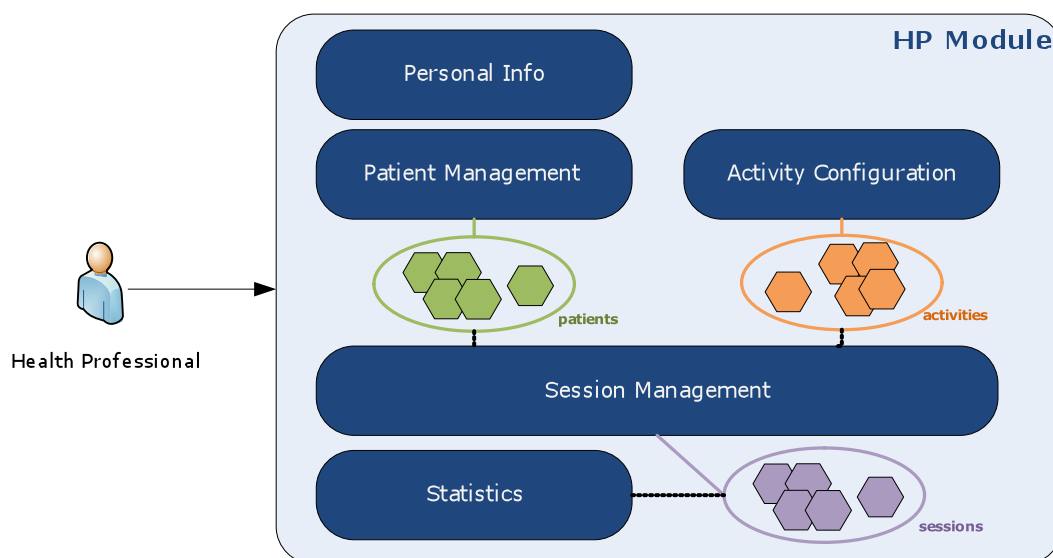
The module contains all the administrative tasks that allow a user to manage accounts for other users of the system. Each account has the authentication credentials (a username and a password) for a user.

The administrator has access to a list of the existing HP users and can add new ones or remove any of them. As far as editing user information, the administrator is only able to change the users' password. Since the username must be unique for the entire

system, updating usernames is not allowed. If a username update is required, a new user must be created with the new username.

### Health Professional Module (HPM)

This module provides configuration, planning and basic management features to the health professionals. This module can only be accessed by a Health Professional (HP) profile user.



**Figure 22 – Health Professional Module Architecture**

In this module, the HP will be able to create new and manage existing patients (green pool of items shown as patients), as well as activities (orange pool of items shown as activities) and sessions (purple pool of items shown as sessions). The HP will have access to the pool of patients and to the pool of activities that will allow him to use them when performing sessions' management, whether by creating new or updating existing ones.

### Personal Info

The HP can update its information including its password, its full name, email address and a photo image. The username appears as read-only and the user is unable to change it.

### Patient Management

The HP can create new system users, enabling system access to patients. Besides, it is also possible to update and remove existing patients, disabling their access to the system.

To create a new patient, the HP must fill a personal information form. It is necessary to provide the patient's full name, email address and choose its credentials (username and password). It is optional to attach a photo image to the form. After this step, the patient will be able to access the system using its credentials.

A list of patients is available where the most relevant data (username, full name and email address) is shown. All the personal information of a patient can be changed except its username.

Upon selection of one or more of the existing patients, it is possible to remove them and disable their access to the system.

### Activities Configuration

There are several activities that were defined in the initial focus group and implemented for the first milestone of the project (a list and description of the implemented therapy activities is available in annex C).

There are two types of activities implemented: motion training activities and simple cognition activities. Motion training activities were the first ones to be included in the system in order to provide users with a first approach to the system, besides improving their usage of the computer, sound system, mouse and keyboard. These include sound target shooting, visual target shooting and drag and drop activities. Simple cognition

activities are actually cognitive domain training related tasks to recalling stimulus (recognition) and matching up pairs of stimuli (association).

For each of the available activities in the system there is a small set of parameters that can be configured. Name, description, activity type, stimulus complexity and length (duration) are the parameters common to all activities.

Based on the type of the activity, the specific parameters that can be configured are different and are presented in the following table:

**Table 1 – Configuration Parameters per Activity Type**

Activity Type	Parameters
Sound Target Shooting	number of stimuli time between stimulus
Visual Target Shooting	number of stimuli time between stimulus
Drag and Drop	number of moving stimuli number of target stimuli
Recognition Association	number of stimuli number of stimuli pairs

The sessions' activities that are performed by the patients are in fact specific configurations based on the existing activity types.

The configuration of parameters is done by the health professional that will try to adapt an existing exercise to the actual needs of a single patient. A patient could have more difficulties completing an activity on time and that could jeopardize her engagement in the therapy process. If the length (duration) of the activity is altered to comply with her needs, she would probably feel more cared, secure and understood.

A new activity (with a distinct name) is actually created, whenever a configuration occurs. Specific values for these parameters are responsible for defining a unique environment for the end user/patient.

Likewise, the user can also modify any one of the configurations created and eliminate one or more configurations.

### Session Management

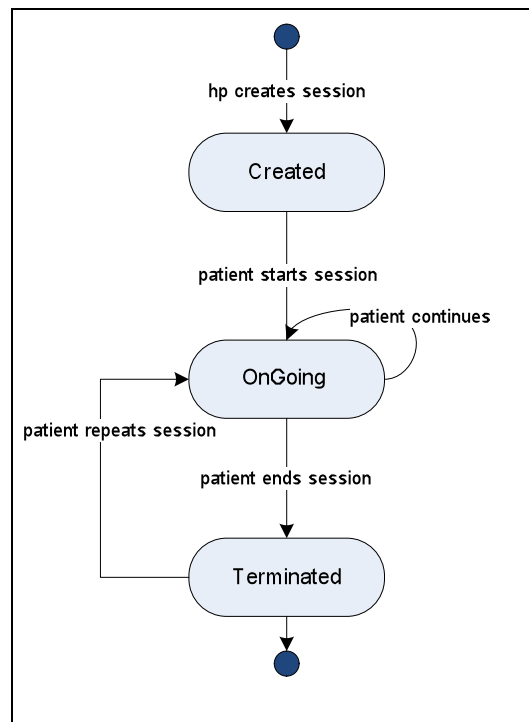
A therapy session is usually a meeting between a health professional and a patient on a specific date and time. Throughout the meeting, the health professional proposes a set of distinct activities to the patient. These activities are cognitive training activities similar to the ones previously referred above.

A HP is able to create new therapy sessions, update and remove existing ones. In order to create a new therapy session it is necessary to choose the patient it is intended to, the date when the session will be held and the activities that will be undertaken during the session. The HP will have access to the list of the available patients and to a list of all the activities previously configured in the system.

Sessions occur on a daily basis, thus, there should be only one session configured per day. Nevertheless, a patient will be able to repeat its daily session every time she desires.

In order to improve the module's usability, an additional feature that allows the duplication of sessions was enabled. Most times, patients share the therapy session's structure and such a feature is useful for the HP.

Every session has a status that changes automatically according to the usage of the system. Both HP users and patients have a direct influence on a session state, as can be seen in the following diagram:



**Figure 23 – Session state chart**

Upon its creation, a session enters the “Created” state. When the patient starts taking a session, the session automatically enters the “OnGoing” state, where it remains up until the instant the patient ends the session. At this point, the session is considered as being “Terminated”.

Nevertheless, a patient can repeat his daily session countless times, so the session can enter the “OnGoing” state after being “Terminated”.

A session can only be updated while it is still in the “Created” state. Once the session starts for the first time and then ends (being both in the “OnGoing” or “Terminated” state) it cannot be updated.

### Statistics

This section is also a part of the Visualization Module (Monitor&Visualization Module). In this section, the user will be able to see the statistical information that was gathered when patients took their sessions and completed the activities.

Based on the data available in the system – the “usage data” – (further description of the module of monitor & visualization can be seen in chapter XX) the following items were considered relevant to filter the data:

- patient;
- activity;
- session (day of) and
- session try (time of).

Patients are referred by their unique usernames. Activities are referred by their unique names (provided upon their configuration). Sessions are referred by dates, since they occur on a daily basis, there can only be one per day. Session Tries are referred by hours, the time of the day when the patient starts or restarts the session.

The visualization process follows the major guidelines of conduct to provide useful information: overview, zoom-in and interactivity (data drill). An initial set of 8 charts were defined to comply with these guidelines.

**Table 2 – Chart List with Name and Type**

ID#	Name	Type
1	Average Session Length per Patient	overview
2	Average Session Length for + <i>chosenPatient</i>	zoom-in
3	Session Length for Patient + <i>chosenPatient</i> + on the + <i>chosenDay</i>	zoom-in
4	Activities Performance for + <i>chosenPatient</i> + on the + <i>chosenDay</i> + @ + <i>chosenSessionTry</i>	zoom-in
5	Average Activity Performance	overview
6	Average Performance for + <i>chosenActivity</i>	zoom-in
7	Average Performance for + <i>chosenActivity</i> + by + <i>chosenPatient</i>	zoom-in
8	Performance for activity + <i>chosenActivity</i> + for patient + <i>chosenPatient</i> + for session + <i>chosenSession</i>	zoom-in

Both chart#1 and chart#5 were designed on an overview perspective, where context information is presented. All other charts are the outcome of the data drill (down)

process accomplished when users filter the available data and, interacting with the chart, ask for a zoom in on the data.

From this point forward the charts will be referred by their identification numbers (ID#). The next table presents the indicators and calculus involved in the creation of the charts. For instance, in order to present chart number 5, the “Average Activity Performance”, the system must:

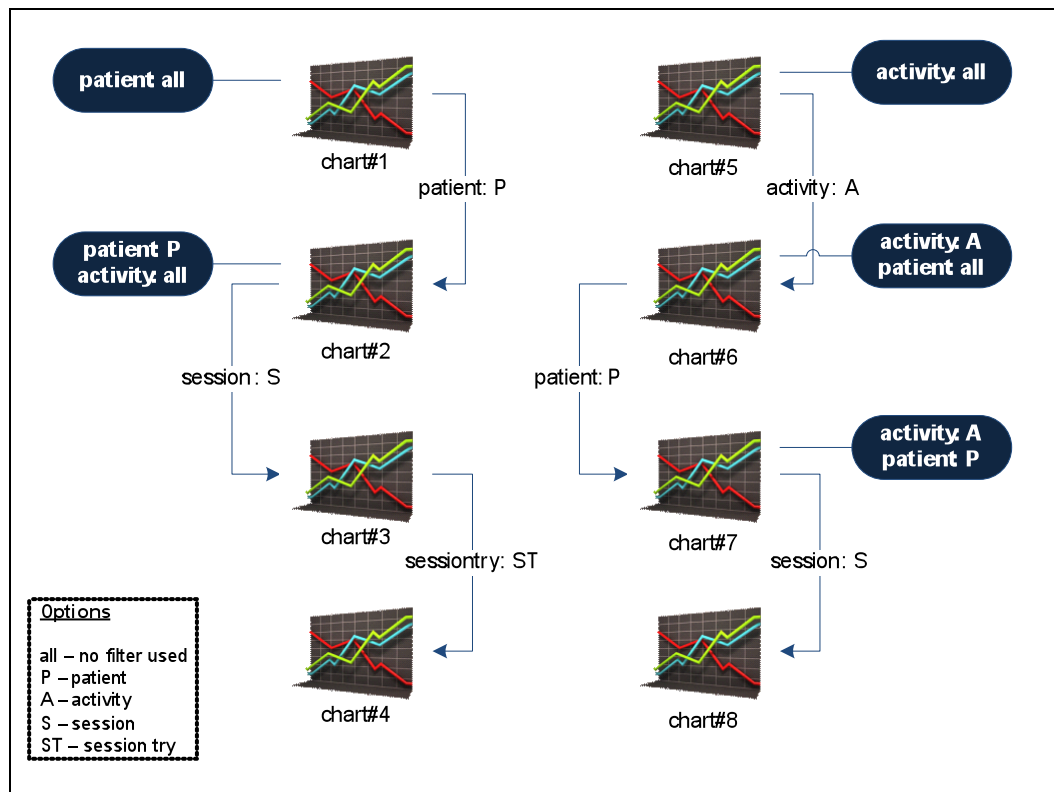
- for every patient in the system, check its session tries and average its performance for every try of a specific activity and
- average the results for all the patients in the system.

**Table 3 – Description of available charts**

ID#	Indicators
1	An overview chart that presents the average duration of sessions (all the sessions, including tries, from all the patients) grouped by the day of the session.
2	A data drill chart that presents the average duration of the sessions (including tries) for a specific patient, grouped by the day of the session.
3	A data drill chart that presents the duration of the sessions tries on a specific day, for a specific patient.
4	A data drill chart that presents the performance accomplished by a specific patient on a specific day on a specific session try.
5	An overview chart that presents the average performance and duration of activities (all the activities, including tries, from all patients).
6	A data drill chart that presents the average performance and duration for a specific activity (including all the tries from all the patients)
7	A data drill chart that presents the average performance for a specific activity for a specific patient, grouped by session days.
8	A data drill chart that presents the performance for a specific activity, for a specific patient on a specific day, grouped by session tries.

Next, the usage flow available in the system that enables the navigation between distinct charts is shown.





**Figure 24 – Flow between charts with the indication of the filters used**

The user has two options to interact with the data: using what was considered as major filters (round rectangles in the figure above) or by selecting the desired information on the chart (data drill/zoom-in signalled in the arrows).

Two major filters are available for selection in the statistics module: Patient and Activity. Thus, it is possible to choose all or one of the available patients and all or one of the available activities. Upon the combined usage of the major filters, the module presents one of 5 charts: chart#1, chart#5, chart#2, chart#6 or chart#7. For instance, to see the statistical information for all the patients that completed a specific activity, it's necessary to choose the filters “all patients” and the desired activity. The statistics module will present chart#6.

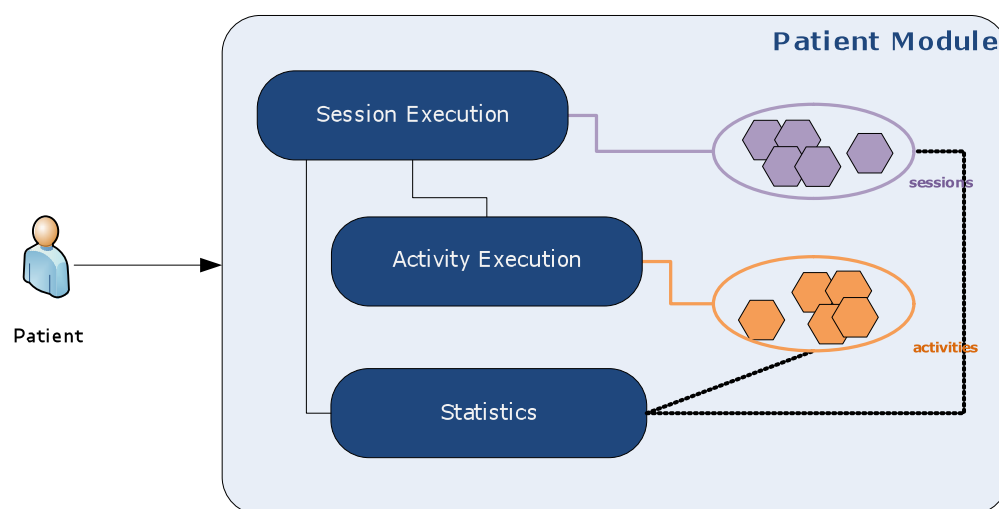
The interaction with the currently displayed chart data is done using a data drill process. The HP selects and clicks in the data to drill, on the chart. For instance, when chart#1 is available with information regarding all the patients of the HP (1 patient == 1

data point), by selecting (clicking) one of the data points, chart#2 will be presented with specific information for the chosen patient.

The Figure presents the filters used in the chart flow when data-drilling. Thus, when the system presents chart#4 the data has been filtered by patient, session and sessiontry.

### Patient Module

This module enables patients to carry out therapy sessions, completing cognitive activities, and to visualize their results. This module is accessed by patient users only. Both HP users and Caretaker users might also access it for therapy matters but they must do it using patient credentials (they assume the session therapy assistant role). For the system's sake, when someone uses valid credentials to access the PM, it is always a patient profile user.



**Figure 25 – Patient Module Architecture**

Basically there is only one module, the “Session Execution” that provides access to the activity execution and to the statistics sub-modules.

### Session Execution

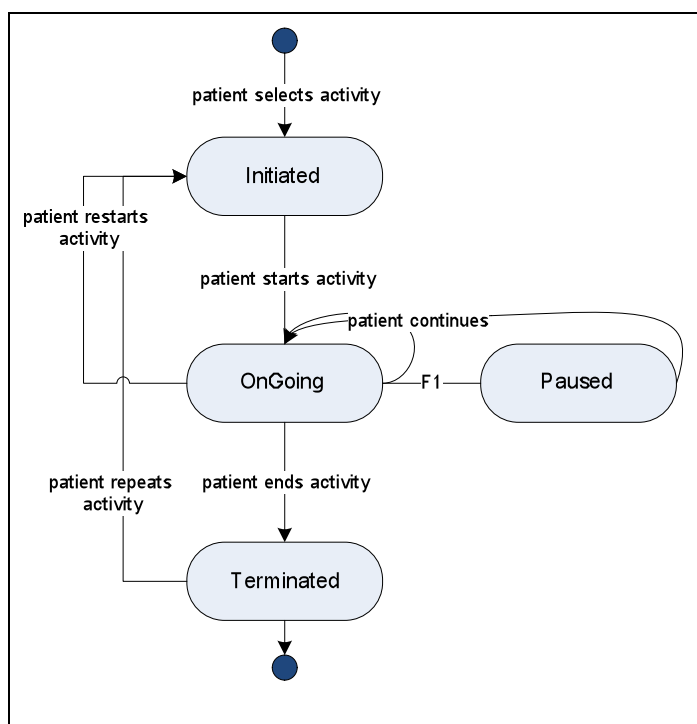
When the patient accesses the system, the list of activities that were scheduled for the current day is shown and, what the system considers a “session execution” starts. On the subject of sessions’ scheduling please refer to the previous section.

Besides the list of available activities, the patient will also have the option to visualize statistics from previous tries of this same session, conducted earlier in the day – statistics module.

The list of the available activities does not mean a specific order of completion. Thus, the patient has the liberty to choose the activity he wants to conduct first. Upon selecting an activity, she accesses the activity execution module.

### Activity Execution

There are several types of activities implemented in the system but they all comply with the same rules (interface) that easily allows them to be integrated in the existing system. All the activities follow the same sequence of steps shown in the figure.



**Figure 26 - Activity state chart**

The execution of an activity starts when the patient selects/chooses the activity to carry out.

After that, the activity is said to be “Initiated” and an initial message with instructions for the activity is presented, together with a “start” button. At this point, the patient must actually start the activity.

Only after the patient presses the “start” button will the activity really start. The patient is presented with two distinct areas: a status area and the actual activity area. The status area contains the general buttons “stop”, “restart”, “help”, the timer with the activity’s duration and the current performance outcome (results). The activity area is a work area where the actions will really take place. At this time, the actions to take depend on the activity being completed. For instance, in a typical drag-n-drop activity, the patient must select an object, drag and drop it into a specific target (check annex C and see the description of “The oranges and baskets” activity).

During the execution of an activity the patient can ask for help using the corresponding button. The system will present a new window with the activity instructions.

The patient can end the activity by accomplishing its goals and thus, taking all the steps and actions to successfully complete the activity or, the activity can reach its maximum duration time and end without success.

Either way, when the activity ends, the patient is prompted to visualize the results for the activity. A section of the statistics modules presents the performance result for that activity. This result is based on the ratio between number of goals achieved and the total number of goals for the activity. After this information is displayed, the patient will be able to return to the initial list of activities or repeat the activity (“restart” button).

At any time throughout the activity the patient will be able to “restart” or actually “stop” the activity. When the activity is restarted, the initial message is presented again and the activity proceeds as usual. When the activity is stopped, the patient is taken to the initial list of available activities for the session.

### Statistics

This section enables the patient to see the statistical information that was gathered by the Monitor&Visualization module (chapter XX).

The Monitor&Visualization module only considers the information of the patient whose credentials were used to access the system. By information it is meant the data gathered in the execution of the activities.

In this section the patient is able to see a summary chart with the best results achieved in the activities in the current session try. But there is also a data-drill option available to check the performance achieved in the same set of activities in previous tries of the session.

An optional note taking system is available for the patient (or the session therapy assistant) to add additional information regarding the session (e.g. activity difficulties, extra or medication issues...) that will be kept in the system for later reference.

### Caretaker Module

This module allows the development and strengthens the relationship between health professionals and the families and caretakers of the patients. This module can only be accessed by caretaker users.

The module consists on a report area where caretakers are given access to the last reports made by the health professionals regarding their patient's performance in therapy.

The reports can be accompanied by indications of medical interest, whether it would be therapy sessions repetitions or medication updates.

## 9.5. eSchi Heuristics Evaluation Report



*eSchi*

*Usability Heuristics Evaluation*

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Date: 24<sup>th</sup> April 2009

## Introduction

In order to get eSchi's patient module ready for the specific public that it is intended to serve, several informal tests were conducted, but the authors believed that further testing was required. Thus, in order to obtain some adequate and formal feedback for issues regarding the module, a Heuristic Evaluation (HE) was conducted.

Despite several usability techniques have been scientifically proven to be more adequate and better as far as results are concerned, they are also more time and money consuming (J. Nielsen, 1994a) than the "discount usability engineering" approach. It tries to solve the referred issues, providing a more agile method to keep track of usability problems. This agile method can be used in practical design situations; in iterative development projects and is based in early user-focus. The number of usability standards available nowadays is outrageous and intimidates developers. The HE method uses only a small subset of heuristics known as the 10 basic usability principles. A small subset of different people should perform a heuristic evaluation, since different people usually locate distinct usability problems. Nielsen's (J. Nielsen, 1994b) 10 basic principles of usability – the heuristics – are: 1-Visibility of system status; 2-Match between system and the real world; 3-User control and freedom; 4-Consistency and standards; 5-Error prevention; 6-Recognition rather than recall; 7-Flexibility and efficiency of use; 8-Aesthetic and minimalist design; 9-Help users recognize, diagnose, and recover from errors; 10-Help and documentation.

In HE a small subset of evaluators (3 to 5) examines the interface and judges its compliance to the 10 basic principles (the "heuristics"). The number of evaluators should be kept small since there isn't much gain in information by using a large number. The interface examination session implies that each evaluator will conduct its evaluation alone, in order to ensure independent evaluations. The evaluator goes through the interface several times and checks the compliance of the various elements with the list of general rules. She is also allowed to take notes on something else additional that comes into mind. For each issue found in the examination, a severity degree can be assigned using a rating scale from 0 (less serious problems) to 4 (more serious problems). This severity estimates can help in the prioritization of solving the usability issues, in the development process. The results can be presented as written reports (one per evaluator) or as verbal comments to an outside observer as they go along the interface.

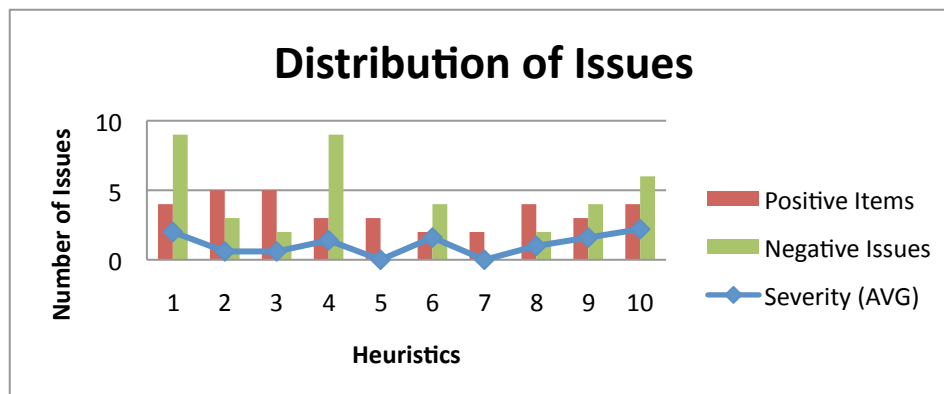
## Field work

According to this, a test scenario was created to evaluate eSchi's patient module usability. A total of 7 evaluators were asked to conduct a heuristic evaluation to the module and the theoretical information was sent to each one. Each evaluator was also asked to provide a written report with the issues examined, severity levels and some observations they considered useful.

## Results

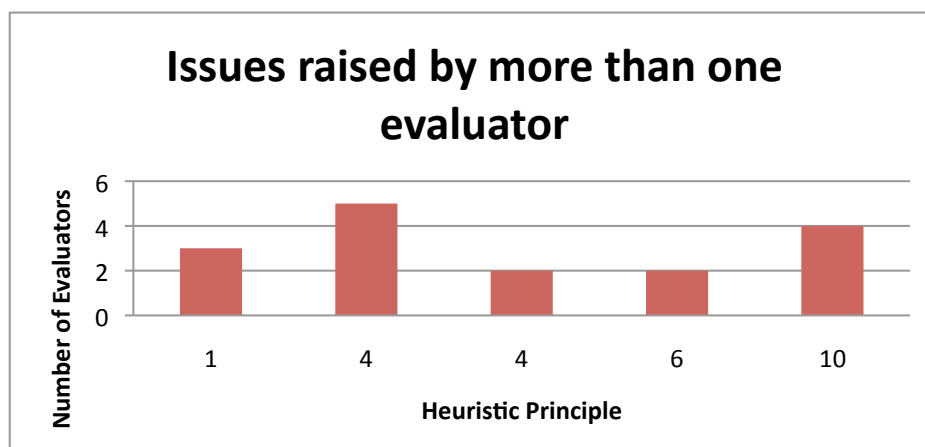
A total of 5 evaluators completed the evaluation process and presented a written report with the list of issues grouped by heuristic principle. A total amount of 39 issues were raised besides having 35 items assigned as positive aspects of the interface that respected the heuristic principles. The severity assigned to the negative issues ranged from 0 to 4.





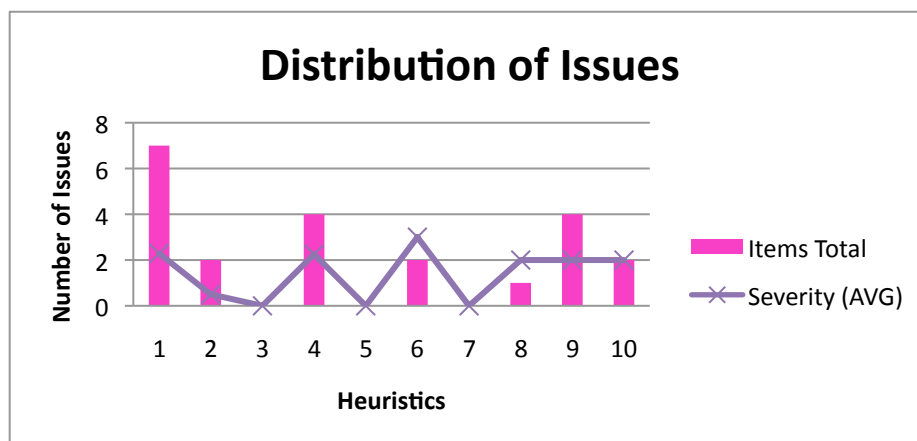
**Figure 1:** Original Distribution of Items (Positive and Negative) and the average of severity assigned to the issues

From the initial list of issues, the positive items were archived and only the negative items received statistical treatment. The first technique used consisted in the filtering of the items in order to eliminate duplicate items. Since the same 5 issues were raised by distinct evaluators, the original list was reduced to a total of 28 unique issues. A special attention was paid to the issues that were found by distinct evaluators, including one that was identified by all the evaluators.



**Figure 2:** Issues (Negative) raised by more than one evaluator

The second filtering technique used consisted in eliminating all the items that referred to functionalities that are only a part of the prototype and will not be available in the real setting. A total of 22 issues remained. Finally, one of the items was shifted to another heuristic to comply with the rules and the final distribution of the issues was the following:



**Figure 3:** Final Distribution of Issues (Negative) and the average of severity assigned to the issues

### Discussion

After having the final distribution of issues per heuristic principle they were scheduled to be solved in a new release of the application. The list of items was ordered by the severity assigned to an issue and the major issues were the ones that were first revised and solved in the development of the application.

Annex A provides the final list of the issues raised and their current status and solution provided.

Besides the heuristics evaluation that was made, a brief example of the charting regarding the user's behaviour using the system during a session is shown in annex B.

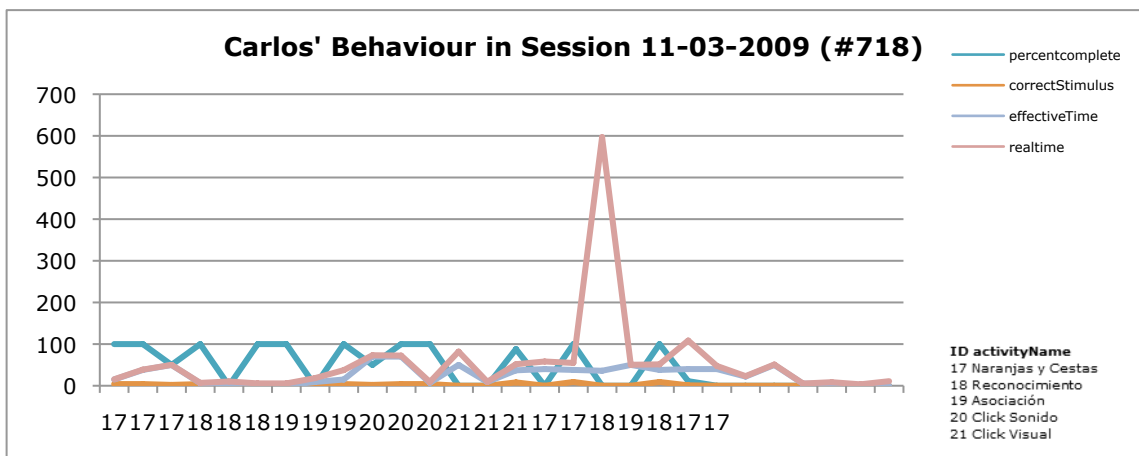
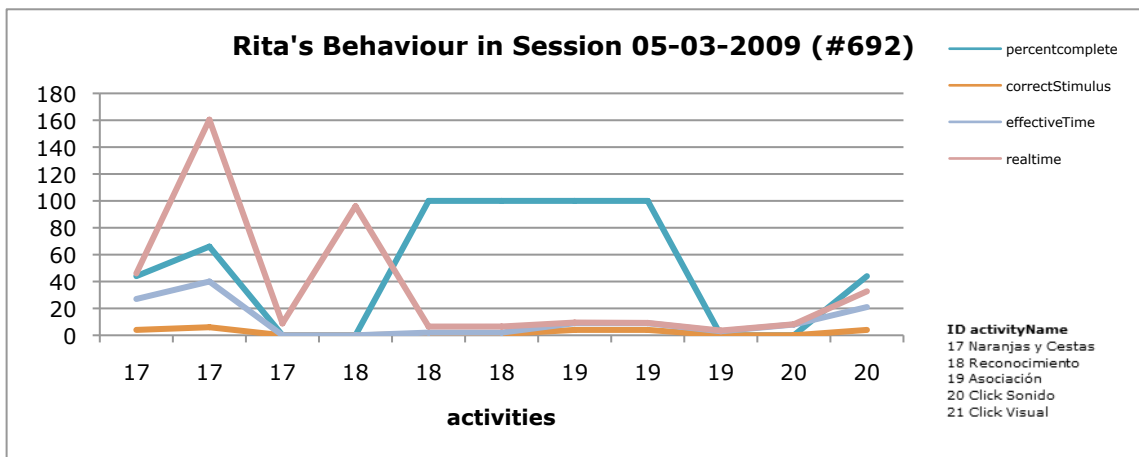
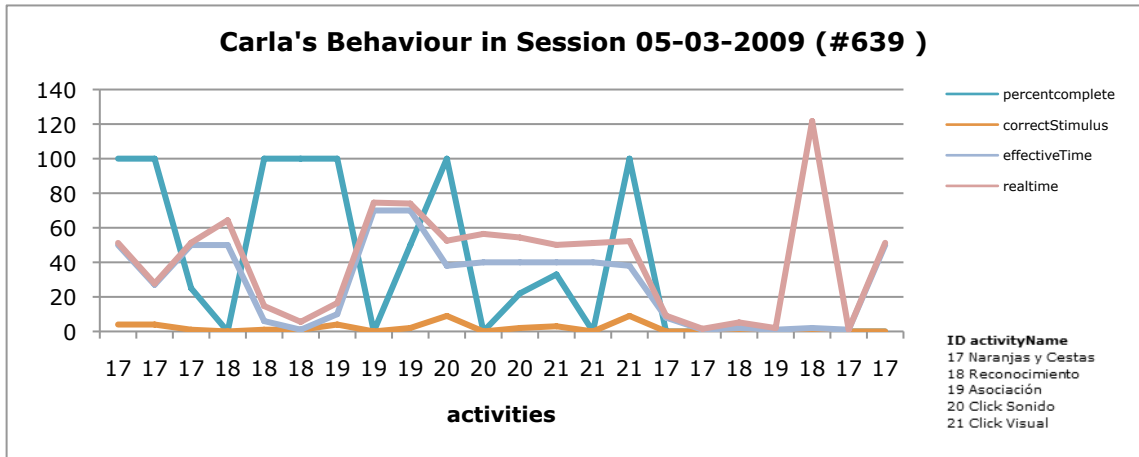
A new release was published and the patient module is now available to start the beta testing phase, in a real setting.

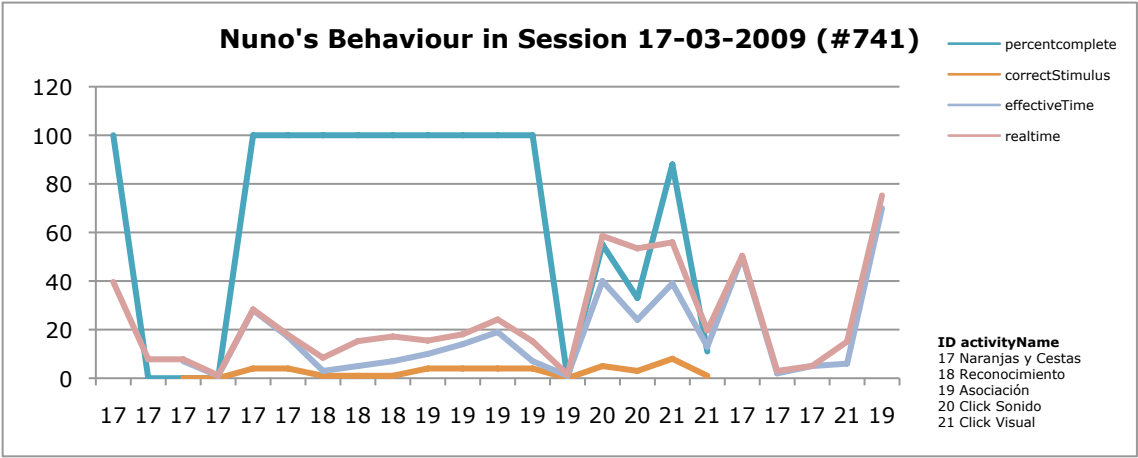
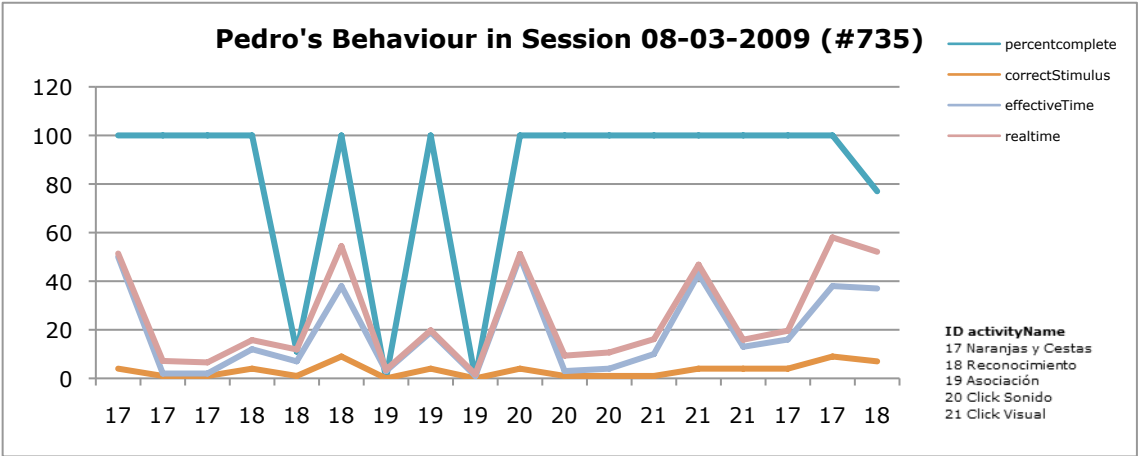






## Annex B – User's Behaviour in a Session





## 9.6. Case Studies Implementation Protocol Plans

- Protocol Plan for HSJD – Serveis de Salut Mental
- Protocol Plan for HML



# eSchi

## Protocolo para Testes - ES



## Introducción

Con este documento **se explica** el protocolo a adoptar para hacer los testes iniciales a la aplicación eSchi.

En primero lugar presentamos un plan con los recursos (temporales y humanos) pretendidos para hacer las pruebas y después explicamos, con más detalle, las acciones necesarias a los testes.

## Plan

Las pruebas de eSchi están divididas en 4 fases: el Pre, el Mientras, el Pos Inmediato y el Pos (2 semanas después de terminar). En cada una de las etapas, tanto pacientes como profesionales de salud estarán involucrados.

Previese que la duración de los testes sea de 17 días laborales.

Con respecto a los recursos humanos están disponibles, en el sistema, cerca de 30 usuarios para hacer los testes. Cada usuario tendrá 1 sesión ubicada por día, con actividades para realizar. Cada sesión puede ser repetida cuantas veces lo quieran.

En los primeros 5 días de pruebas, las sesiones serán compuestas por las actividades de motricidad para que el usuario pueda entrenar el uso del ratón y adaptarse a la aplicación (visual, opciones de menú, ...). Por lo tanto, las primeras 5 sesiones serán apenas de entrenamiento de las capacidades motrices.

En los restantes (10) días de pruebas, cada sesión tendrá 5 actividades. Estas serán de la tipología motricidad, además de las actividades de reconocimiento y asociación.

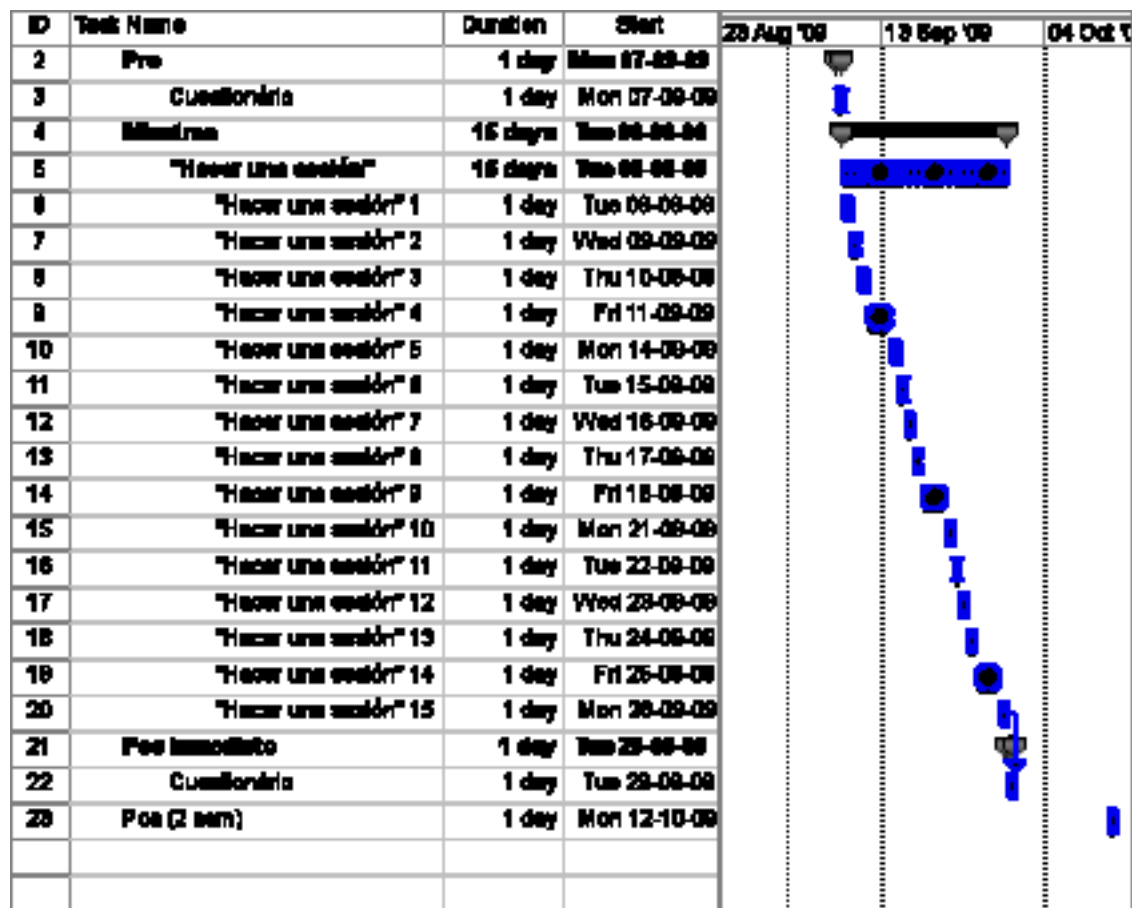


Imagen 114 – Plan de Testes

## Personas

Las pruebas de utilización de eSchi contarán con dos tipos distintos de intervinientes: los pacientes (usuarios) y los profesionales de salud.

Los pacientes como usuarios de las actividades de eSchi: motricidad, reconocimiento e asociación; los profesionales de salud como responsables por la gestión de las actividades.

Todas las personas involucradas deberán contestar a algunas preguntas que hacen parte del trabajo de campo.

Además, el equipo técnico se encontrará disponible, mismo a la distancia, y se compone de Catarina Reis ([catarina.isabel.reis@gmail.com](mailto:catarina.isabel.reis@gmail.com)) – ayuda con la aplicación – y Carla Freire ([carlafreire@gmail.com](mailto:carlafreire@gmail.com)) – ayuda con los cuestionarios.

## Etapas

Las pruebas de eSchi se dividen en 4 fases: el Pre, el Mientras, el Pos Inmediato y el Pos (2 semanas).

A continuación se describen las fases.

### Pre

Antes de hacer las pruebas a la aplicación hay que responder a un cuestionario.

El objetivo del cuestionario es buscar las percepciones de aceptación de la tecnología en el entorno de salud, en específico en una terapia. Todos involucrados en la terapia deben contestar al cuestionario, desde los pacientes, doctores, enfermeros, cuidadores, familiares, etc. Este cuestionario deberá pasar antes de cualquier contacto con el eSchi, para que no haya respuestas influenciadas por la aplicación eSchi.

Los ítems a considerar en esta etapa pueden ser consultadas en el anexo A.

El papel que el profesional de salud toma en esta fase es determinante para el suceso de las pruebas.

Cada profesional de salud deberá asignar un par usuario+contraseña a cada paciente, para que lo use siempre que ejecute la aplicación.

Junto se envía una hoja de cálculo con los pares usuario+contraseña que están disponibles. Una buena práctica sería identificar el paciente que usa cada par usuario+contraseña para que el mismo par no sea usado por más de un paciente.

Por ejemplo:

usuario	contraseña	paciente
usuario 1	usuario 1	Mario Nunes

**Imagen 115 – Ejemplo de la hoja de cálculo para garantizar 1 paciente – 1 usuario**

Las respuestas al cuestionario ya deberán tener la indicación de usuario para que se pueda contrastar las respuestas antes, mientras y después.

#### Mientras

En esta fase, el papel del paciente consiste en “hacer una sesión”:

1. Entrar en la aplicación (usando el usuario+contraseña);
2. Introducir su nombre (el nombre por lo cual será conocido por la aplicación);
3. Hacer las actividades que están programadas para la sesión.
4. Al terminar, contestar a las cuestiones del ASQ (3 preguntas) – anexo B

Está disponible una sesión por día y el paciente puede repetirla cuantas veces quiera. Todos los días él tendrá las mismas actividades para hacer.

Para saber más sobre cada actividad propuesta remetiese el lector para el Manual de Usuario de eSchi (documento anexo).

El cuestionario ASQ (anexo B) es un cuestionario de usabilidad que solo tiene 3 preguntas y intenta medir la usabilidad percibida por los usuarios de la aplicación mientras la utilizan. La aplicación del cuestionario se deberá hacer después de cada escenario de teste, o sea, después de cada sesión.

#### Pos Inmediato

Después de hacer las pruebas a la aplicación hay que responder a un cuestionario.

El objetivo del cuestionario es medir el grado de aceptación de la tecnología. Todos los involucrados en la terapia deben contestar al cuestionario, desde los pacientes, doctores, enfermeros, cuidadores, familiares, etc. Este cuestionario deberá pasar al

final de los testes con eSchi para que sea posible tener respuestas fiables sobre la utilización del eSchi

Los ítems a considerar para esta etapa pueden ser consultados en el anexo C.

Pos (2 semanas)

La intención de hacer un cuestionario final 2 semanas después de utilizar la aplicación es obtener *feedback* sobre la sensación de usabilidad que permanece en la comunidad que ha utilizado a eschi.

El cuestionario a usar será el CSUQ (anexo D) que es un instrumento válido para obtener la usabilidad de una aplicación y que debe ser aplicado después del contacto con la aplicación.

## Anexos

### Anexo A:

#### **Items a considerar para análisis de percepciones sobre la utilización de la tecnología en la terapia.**

Los ítems serán contestados en una escala de Likert de 5 puntos, siendo que 1 corresponde “Completamente en desacuerdo” e 5 a “Completamente de acuerdo”. En el final habrá un campo abierto para que caso el usuario quería, pueda escribir algo sobre el cuestionario o la aplicación eSchi.

1. Yo dudaría usar una herramienta de eTerapia porque no me es familiar
2. Creo que iba a conseguir completar una tarea de eTerapia sin ayuda complementar (manuales, personas, etc.)
3. Si tuviera la oportunidad me gustaría de experimentar una herramienta de eTerapia
4. Yo usaría una herramienta de eTerapia si vira otras personas a usaren
5. Creo que hacer terapia fuera del local clínico de costumbre (en casa u otro local deseado) iba a traer beneficios para el proceso de terapia
6. Usar una herramienta de eTerapia mejorará el proceso de Terapia
7. Usar una herramienta de eTerapia seria sencillo para mi
8. Creo que la aprendizaje pueda influenciar la adherencia a una herramienta de eTerapia
9. Si me dieran los recursos y las condiciones necesarias yo usaría una herramienta eTerapia
10. Usar una herramienta de eTerapia es una buena idea para el proceso de terapia
11. Si yo estuviera en un entorno de terapia quedaría ansioso por actividades con una herramienta de eTerapia

### Anexo B:

*(in the next annex)*

**Anexo C:****Ítems a considerar para análisis de aceptación de la tecnología en la terapia.**

Los ítems serán contestados en una escala de Likert de 5 puntos, siendo que 1 corresponde “Completamente en desacuerdo” e 5 a “Completamente de acuerdo”. En el final habrá un campo abierto para que caso el usuario quería, pueda escribir algo sobre el cuestionario o la aplicación eSchi.

1. Al usar eSchi temo cometer errores que no pueda corregir
2. Me siento confortable a usar eSchi
3. Resultaría difícil trabajar con eSchi si como ayuda sólo tuviera manuales de software
4. Resultaría fácil trabajar con eSchi si viera a alguien a utilizar antes que yo
5. He utilizado eSchi sólo porque me han pedido
6. He utilizado eSchi porque me gusta intentar nuevas experiencias
7. Personas importantes para mí creen que debo usar eSchi
8. Uso eSchi porque todos lo utilizan
9. Si pudiera utilizaría eSchi con frecuencia en casa
10. Sólo utilizo eSchi cuando tengo alguien cerca (médico, terapeuta, cuidador, etc.)
11. Usar eSchi facilita el proceso de terapia
12. Usar eSchi permite realizar tareas más rápido
13. El ambiente de usuario eSchi es amigable
14. Usar eSchi es sencillo para mí
15. El contenido de la formación en eSchi fue satisfactorio para mí
16. La duración de la formación eSchi fue satisfactoria para mí
17. Me resulta sencillo usar eSchi porque me han dado los recursos y formación necesarios
18. Trabajar con eSchi encaja bien con la forma como me gusta trabajar
19. Usar eSchi es una buena idea para hacer terapia
20. Usar eSchi hace las actividades más interesantes
21. Yo volvería a usar eSchi en el futuro
22. Yo experimentaría nuevas funcionalidades de eSchi en el futuro

**Anexo D:**



***(in the next annex)***



# e-schi

## Plan de pruebas- septiembre-octubre 2009

semanas/ turnos		21-09-2009		22-09-2009		23-09-2009		24-09-2009		25-09-2009			
S1	DIA 1		DIA 2		DIA 3		DIA 4		DIA 5				
	G1	G2	G1	G2	G1	G2	G1	G2	G1	G2			
	turno 1	A-B			A-B	B1			B1	B2			
	turno 2	A-B			A-B	B1			B1	B2			
	turno 3	A-B			A-B	B1			B1	B2			
	turno 4	A-B			A-B	B1			B1	B2			
28-09-2009		29-09-2009		30-09-2009		01-10-2009		02-10-2009					
S2	DIA 6		DIA 7		DIA 8		DIA 9		DIA 10				
	G1	G2	G1	G2	G1	G2	G1	G2	G1	G2			
	turno 1		B2	B3		B3	B4			B4			
	turno 2		B2	B3		B3	B4			B4			
	turno 3		B2	B3		B3	B4			B4			
	turno 4		B2	B3		B3	B4			B4			
03-10-2009		06-10-2009		07-10-2009		08-10-2009		09-10-2009					
S3	DIA 11		DIA 12		DIA 13		DIA 14		DIA 15				
	G1	G2	G1	G2	G1	G2	G1	G2	G1	G2			
	turno 1	B5			B5	B6			B6	B7			
	turno 2	B5			B5	B6			B6	B7			
	turno 3	B5			B5	B6			B6	B7			
	turno 4	B5			B5	B6			B6	B7			
12-10-2009		13-10-2009		14-10-2009		15-10-2009		16-10-2009					
S4	DIA 16		DIA 17		DIA 18		DIA 19						
	G1	G2	G1	G2	G1	G2	G1	G2	G1	G2			
	turno 1				B7	B8			B8	B9			
	turno 2				B7	B8			B8	B9			
	turno 3				B7	B8			B8	B9			
	turno 4				B7	B8			B8	B9			
19-10-2009		20-10-2009		21-10-2009		22-10-2009		23-10-2009					
S5	DIA 20		DIA 22		DIA 23		DIA 24		DIA 25				
	G1	G2	G1	G2	G1	G2	G1	G2	G1	G2			
	turno 1		B9	B10		B10	B11			B11			
	turno 2		B9	B10		B10	B11			B11			
	turno 3		B9	B10		B10	B11			B11			
	turno 4		B9	B10		B10	B11			B11			
26-10-2009		27-10-2009		28-10-2009		29-10-2009		30-10-2009					
S6	DIA 26		DIA 27		DIA 28		DIA 29		DIA 30				
	G1	G2	G1	G2	G1	G2	G1	G2	G1	G2			
	turno 1	B12			B12	B13			B13	B14			
	turno 2	B12			B12	B13			B13	B14			
	turno 3	B12			B12	B13			B13	B14			
	turno 4	B12			B12	B13			B13	B14			
02-11-2009		03-11-2009		04-11-2009									
S7	DIA 26		DIA 27		DIA 28								
	G1	G2	G1	G2	G1	G2							
	turno 1		B14	B15		B15							
	turno 2		B14	B15		B15							
	turno 3		B14	B15		B15							
	turno 4		B14	B15		B15							
18-11-2009		19-11-2009											
S9	DIA 31		DIA 32										
	G1	G2	G1	G2									
	turno 1	C2			C2								
	turno 2	C2			C2								
	turno 3	C2			C2								
	turno 4	C2			C2								

	T1	T2	T3	T4
G1	us uario 1	us uario 4	us uario 7	us uario 10
	us uario 2	us uario 5	us uario 8	us uario 11
	us uario 3	us uario 6	us uario 9	us uario 12
	T1	T2	T3	T4
G2	us uario 13	us uario 16	us uario 19	us uario 22
	us uario 14	us uario 17	us uario 20	us uario 23
	us uario 15	us uario 18	us uario 21	us uario 24

# eSchi

## Protocolo de Testes - PT



## Introdução

O objectivo deste documento é explicar o protocolo a adoptar para realizar os testes iniciais à aplicação eSchi.

Em primeiro lugar apresentamos o plano com os recursos (temporais e humanos) para realizar as provas e depois explicamos, com maior detalhe, as acções necessárias para os testes.

## Plano

O trabalho de campo está dividido em 4 etapas: o Pré, o Durante, o Pós Imediato e o Pós (2 semanas após terminar a utilização do eSchi). Em cada uma das etapas, tanto os doentes como os profissionais de saúde estão envolvidos.

No que diz respeito a recursos humanos, estão disponíveis, no sistema, cerca de 30 utilizadores para realizar os testes. Cada utilizador terá uma sessão disponível por dia e com actividades para realizar. Cada sessão pode ser repetida quantas vezes quiserem, ao longo do dia.

Nos primeiros 5 dias de provas, as sessões serão compostas por actividades de motricidade, para que o utilizador possa treinar o uso do rato e adaptar-se à aplicação (visual, opções de menu, ...). Portanto, as primeiras 5 sessões são apenas de treino das capacidades motoras.

Nos restantes (25) dias de provas, cada sessão terá 5 actividades que incluirão a tipologia motricidade, para além das actividades de reconhecimento e associação.

A ideia é alternar os doentes/sessões por cada 2 dias. Fazendo 4 turnos de 3 doentes por dia pode-se ter 12 doentes por dia. No primeiro dia, um grupo de doentes (G1)

utilizará a aplicação durante esse dia e depois terá um dia de descanso. No segundo dia, outros 12 doentes (G2) usarão a aplicação enquanto os primeiros descansam.

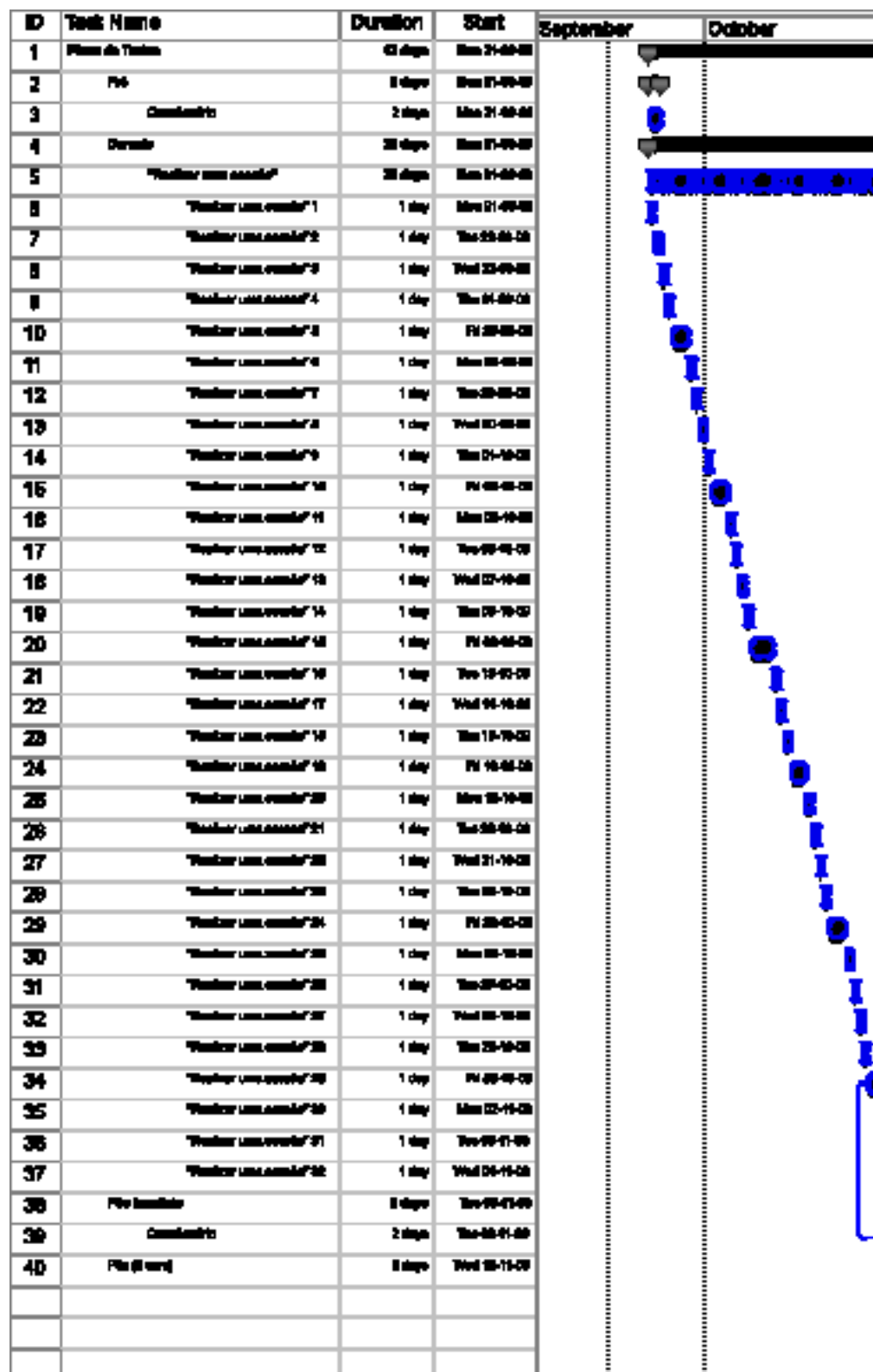


Figura 1 – Plano de Testes

Prevê-se que a duração dos testes seja de 43 dias laborais.

**Grupos**

G1 – 12 doentes: 4 turnos de 3 doentes

G2 – 12 doentes: 4 turnos de 3 doentes

**Dias de provas**

Dia 1 – G1 realiza as suas sessões

Dia 2 – G2 realiza as suas sessões

Dia 3 – G1 realiza as suas sessões

Dia 4 – G2 realiza as suas sessões

...

**Tipologia de actividades disponíveis por sessão**

Dia 1 – Dia 10 – actividades de motricidade (azul na imagem)

Dia 11 – Dia 32 – todas as actividades (motricidade, reconhecimento e associação)  
(rosa na imagem)



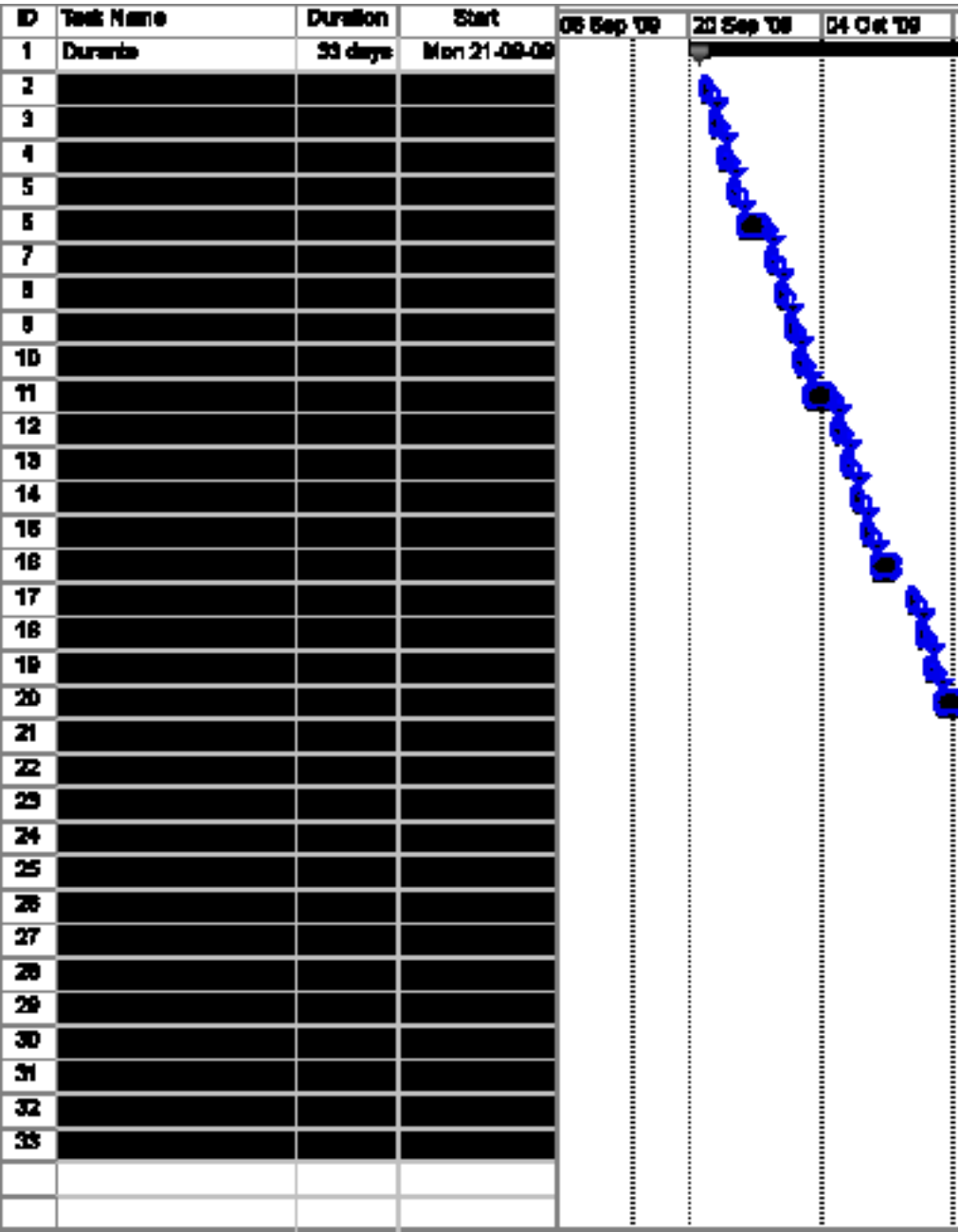


Figura 2 – Detalhe do Plano de Testes

## Pessoas

As provas de utilização do eSchi contarão com dois tipos distintos de intervenientes: os doentes e os profissionais de saúde.

Os doentes, como utilizadores das actividades do eSchi: motricidade, reconhecimento e associação; os profissionais de saúde como responsáveis pela gestão das actividades.

Todas as pessoas envolvidas deverão responder a algumas perguntas que fazem parte do trabalho de campo.

Para além disso, a equipa técnica estará disponível, mesmo que à distância, e compõe-se por Catarina Reis ([catarina.isabel.reis@gmail.com](mailto:catarina.isabel.reis@gmail.com)) – ajuda com a aplicação – e Carla Freire ([carlafreire@gmail.com](mailto:carlafreire@gmail.com)) – ajuda com os questionários.

## Etapas

As provas do eSchi dividem-se em 4 fases: o Pré, o Durante, o Pós Imediato e o Pós (2 semanas).

De seguida, descreve-se cada uma das fases com maior detalhe.

### Pré

Antes de fazer as provas à aplicação deverá responder-se a um questionário.

O objectivo do questionário é procurar as percepções de aceitação da tecnologia no contexto da saúde e mais especificamente de uma terapia. Todos os envolvidos na terapia deverão responder ao questionário, desde os doentes, doutores, enfermeiros, tratadores, familiares, etc. Este questionário deverá ser respondido antes de qualquer contacto com o eSchi para que não haja respostas influenciadas pela aplicação eSchi.

Os itens a considerar nesta etapa podem ser consultados no anexo A.

O papel que o profissional de saúde assume nesta fase é determinante para o sucesso das provas.

Cada profissional de saúde deverá atribuir um par utilizador+password a cada doente, para que o use sempre que execute a aplicação.

Segue uma folha de cálculo com os pares utilizador+password que estão disponíveis. Uma boa prática seria identificar o doente que usa cada par utilizador+password para que o mesmo par não seja usado por mais do que um doente.

Por exemplo:

utilizador	password	doente
utilizador1	utilizador1	Mario Nunes

**Figura 3 – Exemplo da folha de cálculo para garantir 1 doente – 1 utilizador**

As respostas do questionário deverão ter a indicação do utilizador para que se possa mapear/interligar as respostas antes, durante e após a utilização da aplicação.

### Durante

Nesta fase, o papel do doente consiste em “realizar uma sessão”:

5. Entrar na aplicação (usando o utilizador+password);
6. Introduzir o seu nome (o nome pelo qual será conhecido pela aplicação);
7. Realizar as actividades que estão programadas para a sessão.
8. No final, responder às perguntas do questionário ASQ (3 perguntas) – anexo B

Está disponível uma sessão por dia e o doente pode repeti-la quantas vezes quiser. Todos os dias terá as mesmas actividades para realizar.

Para saber mais sobre cada actividade proposta remete-se o leitor para o Manual de Utilizador do eSchi (documento anexo).

O questionário ASQ (anexo B) é um questionário de usabilidade que só tem 3 perguntas e tenta medir a usabilidade percebida pelos utilizadores da aplicação

enquanto a utilizam. A aplicação do questionário deverá ser feita depois de cada cenário de teste, ou seja, depois de cada sessão.

#### Pós Imediato

Depois de realizar as provas à aplicação deverá responder-se a um outro questionário.

O objectivo do questionário é medir o grau de aceitação da tecnologia. Todos os envolvidos na terapia deverão responder ao questionário, desde os doentes, doutores, enfermeiros, tratadores, familiares, etc. Este questionário deverá ser respondido depois dos testes ao eSchi terminarem para que seja possível obter respostas sobre a utilização da aplicação.

Os itens a considerar para esta etapa podem ser consultados no anexo C.

#### Pós (2 semanas)

O objectivo de aplicar um questionário duas semanas depois de terminarem os testes com a aplicação é obter um feedback sobre a sensação de usabilidade que permanece na comunidade que utilizou o eSchi.

O questionário a usar deverá ser o CSUQ (anexo D) que é um válido para obter a usabilidade de uma aplicação e que deve ser aplicado depois do contacto com a aplicação em causa.

## Anexos

### Anexo A:

#### **Itens a considerar para a análise de precepções sobre a utilização da tecnologia na terapia.**

Os itens serão respondidos numa escala de Likert de 5 pontos, sendo que 1 corresponde “Discordo Completamente” e 5 a “Concordo Completamente”. No final haverá uma resposta aberta para que, caso o utilizador queira, possa escrever algo sobre o questionário ou a aplicação eSchi.

12. Eu hesitaria utilizar uma ferramenta de eTerapia porque não me é familiar
13. Acredito que seria capaz de completar uma tarefa de eTerapia sem ajuda complementar (manuais, pessoas, etc)
14. Se tivesse oportunidade gostaria de experimentar uma ferramenta de eTerapia
15. Eu utilizaria uma ferramenta de eTerapia se visse outras pessoas a utilizarem
16. Acredito que fazer Terapia fora do local clínico habitual (em casa ou outro local desejado) traria benefícios para o processo de Terapia
17. Utilizar uma ferramenta de eTerapia irá melhorar o processo de Terapia
18. Utilizar uma ferramenta de eTerapia seria fácil para mim
19. Acredito que a aprendizagem possa influenciar a aderência a uma ferramenta de eTerapia
20. Se me dessem os recursos e condições necessários eu utilizaria uma ferramenta de eTerapia
21. Utilizar uma ferramenta de eTerapia é uma boa ideia para o processo de Terapia
22. Se eu estivesse num contexto de Terapia ficaria ansioso por actividades por actividades com uma ferramenta de eTerapia

### Anexo B:

*(in the next annex)*

**Anexo C:****Itens a considerar para a análise de aceitação da tecnologia na terapia.**

Os itens serão respondidos numa escala de Likert de 5 pontos, sendo que 1 corresponde “Discordo Completamente” e 5 a “Concordo Completamente”. No final haverá uma resposta aberta para que, caso o utilizador queira, possa escrever algo sobre o questionário ou a aplicação eSchi.

1. Ao utilizar eSchi temo cometer erros que não possa corrigir
2. Sinto-me confortável a utilizar eSchi
3. Seria difícil trabalhar com eSchi se apenas tivesse como ajuda manuais de software
4. Seria fácil trabalhar com eSchi se eu visse alguém a utilizar antes de mim
5. Utilizei eSchi apenas porque me pediram
6. Utilizei eSchi porque gosto de tentar novas experiências
7. Pessoas importantes para mim pensam que deveria utilizar eSchi
8. Utilizo eSchi porque todos utilizam
9. Se pudesse utilizaria eSchi frequentemente em casa
10. Apenas utilizo eSchi quando tenho alguém perto (médico, terapeuta, cuidador, etc)
11. Utilizar eSchi facilita o processo de terapia
12. Utilizar eSchi permite realizar tarefas mais rapidamente
13. O ambiente de utilizador eSchi é amigável
14. Utilizar eSchi é fácil para mim
15. O conteúdo da formação em eSchi foi satisfatório para mim
16. A duração da formação em eSchi foi satisfatória para mim
17. É fácil para mim utilizar eSchi porque me deram os recursos e formação necessários
18. Trabalhar com eSchi encaixa bem com forma como gosto de trabalhar
19. Utilizar eSchi é uma boa ideia para fazer terapia
20. Utilizar eSchi torna as actividades mais interessantes
21. Eu voltaria a utilizar eSchi no futuro
22. Eu experimentaria novas funcionalidades eSchi no futuro

**Anexo D:**

*(in the next annex)*





# e-schi

## Plano de provas - setembro-novembro 2009

semanas/ turnos		21-09-2009		22-09-2009		23-09-2009		24-09-2009		25-09-2009	
S1	DIA 1		DIA 2		DIA 3		DIA 4		DIA 5		
	G1	G2	G1	G2	G1	G2	G1	G2	G1	G2	
	turno 1	A-B		A-B	B1			B1	B2		
	turno 2	A-B		A-B	B1			B1	B2		
	turno 3	A-B		A-B	B1			B1	B2		
turno 4	A-B		A-B	B1			B1	B2			
28-09-2009		29-09-2009		30-09-2009		01-10-2009		02-10-2009			
S2	DIA 6		DIA 7		DIA 8		DIA 9		DIA 10		
	G1	G2	G1	G2	G1	G2	G1	G2	G1	G2	
	turno 1		B2	B3		B3	B4			B4	
	turno 2		B2	B3		B3	B4			B4	
	turno 3		B2	B3		B3	B4			B4	
turno 4		B2	B3		B3	B4			B4		
03-10-2009		06-10-2009		07-10-2009		08-10-2009		09-10-2009			
S3	DIA 11		DIA 12		DIA 13		DIA 14		DIA 15		
	G1	G2	G1	G2	G1	G2	G1	G2	G1	G2	
	turno 1	B5		B5	B6			B6	B7		
	turno 2	B5		B5	B6			B6	B7		
	turno 3	B5		B5	B6			B6	B7		
turno 4	B5		B5	B6			B6	B7			
12-10-2009		13-10-2009		14-10-2009		15-10-2009		16-10-2009			
S4	DIA 16		DIA 17		DIA 18		DIA 19		DIA 20		
	G1	G2	G1	G2	G1	G2	G1	G2	G1	G2	
	turno 1		B7	B8		B8	B9			B9	
	turno 2		B7	B8		B8	B9			B9	
	turno 3		B7	B8		B8	B9			B9	
turno 4		B7	B8		B8	B9			B9		
19-10-2009		20-10-2009		21-10-2009		22-10-2009		23-10-2009			
S5	DIA 21		DIA 22		DIA 23		DIA 24		DIA 25		
	G1	G2	G1	G2	G1	G2	G1	G2	G1	G2	
	turno 1	B10		B10	B11			B11		B12	
	turno 2	B10		B10	B11			B11		B12	
	turno 3	B10		B10	B11			B11		B12	
turno 4	B10		B10	B11			B11		B12		
26-10-2009		27-10-2009		28-10-2009		29-10-2009		30-10-2009			
S6	DIA 26		DIA 27		DIA 28		DIA 29		DIA 30		
	G1	G2	G1	G2	G1	G2	G1	G2	G1	G2	
	turno 1		B12	B13		B13	B14			B14	
	turno 2		B12	B13		B13	B14			B14	
	turno 3		B12	B13		B13	B14			B14	
turno 4		B12	B13		B13	B14			B14		
02-11-2009		03-11-2009									
S7	DIA 26		DIA 27								
	G1	G2	G1	G2							
	turno 1	B15		B15							
	turno 2	B15		B15							
	turno 3	B15		B15							
turno 4	B15		B15								
18-11-2009		15-01-1900									
S9	DIA 31		DIA 32								
	G1	G2	G1	G2							
	turno 1	C2		C2							
	turno 2	C2		C2							
	turno 3	C2		C2							
turno 4	C2		C2								

	T1	T2	T3	T4
G1	utilizador 1	utilizador 4	utilizador 7	utilizador 10
	utilizador 2	utilizador 5	utilizador 8	utilizador 11
	utilizador 3	utilizador 6	utilizador 9	utilizador 12
	T1	T2	T3	T4
G2	utilizador 13	utilizador 16	utilizador 19	utilizador 22
	utilizador 14	utilizador 17	utilizador 20	utilizador 23
	utilizador 15	utilizador 18	utilizador 21	utilizador 24

## 9.7. Questionnaires

- ASQ – Spanish
- CSUQ – Spanish
- ASQ – Portuguese
- CSUQ – Portuguese
- Administration and Scoring Rules for the Questionnaires
- Custom Questionnaires

## Cuestionario después del escenario (ASQ)

Asigne un valor a cada frase según su grado de acuerdo o desacuerdo. Si la frase no es aplicable a su caso deje la respuesta en blanco. Al finalizar pulse el botón y el cuestionario se enviará.

\* Required

usuario \*

En general, estoy satisfecho con lo fácil que me ha sido acabar esta tarea.

1 2 3 4 5 6 7

---

Completamente de Acuerdo ☐ ☐ ☐ ☐ ☐ ☐ ☐ Totalmente en Desacuerdo

---

En general, estoy satisfecho con el tiempo que he tardado en acabar esta tarea.

1 2 3 4 5 6 7

---

Completamente de Acuerdo ☐ ☐ ☐ ☐ ☐ ☐ ☐ Totalmente en Desacuerdo

---

En general, estoy satisfecho con la información de apoyo (ayuda en línea, mensajes, documentación) para acabar esta tarea.

1 2 3 4 5 6 7

---

Completamente de Acuerdo ☐ ☐ ☐ ☐ ☐ ☐ ☐ Totalmente en Desacuerdo

---

## Cuestionario de Usabilidad del Sistema de Ordenador (CSUQ)

Este cuestionario es para que usted pueda expresar la satisfacción con el uso del programa. Sus respuestas nos ayudarán a entender que aspectos del programa le preocupan en particular y que aspectos le satisfacen. En la medida de lo posible, piense en todos los ejercicios que ha realizado en el programa cuando responda a las preguntas. Por favor lea cada frase y responda según el grado de acuerdo o de desacuerdo con la frase. Si una frase no es aplicable a su caso, deje la respuesta en blanco. Siempre que lo desee, por favor escriba comentarios para explicar sus respuestas.

\* Required

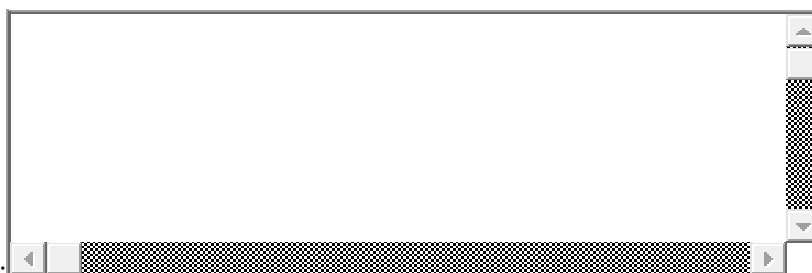
usuario \*

En general, estoy satisfecho con lo fácil que es utilizar este programa.

1 2 3 4 5 6 7

Completamente de Acuerdo ☐ ☐ ☐ ☐ ☐ ☐ ☐ Totalmente en Desacuerdo

Comentarios:




Es sencillo utilizar este programa.

1 2 3 4 5 6 7

Completamente de Acuerdo ☐ ☐ ☐ ☐ ☐ ☐ ☐ Totalmente en Desacuerdo

Comentarios:



Puedo acabar los ejercicios correctamente utilizando este programa.


1 2 3 4 5 6 7

---

Completamente de Acuerdo ☐ ☐ ☐ ☐ ☐ ☐ ☐ Totalmente en Desacuerdo

---

Comentarios:



Soy capaz de acabar los ejercicios más rápidamente utilizando este programa.

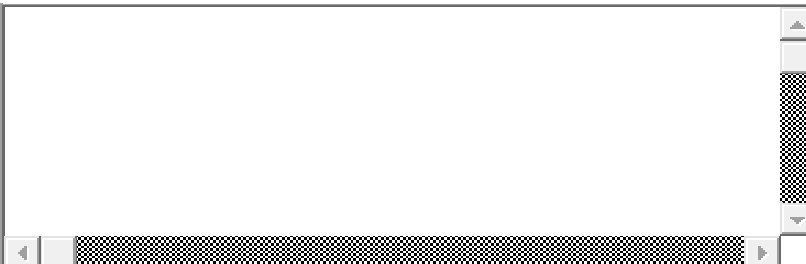
1 2 3 4 5 6 7

---

Completamente de Acuerdo ☐ ☐ ☐ ☐ ☐ ☐ ☐ Totalmente en Desacuerdo

---

Comentarios:



Soy capaz de acabar los ejercicios a tiempo utilizando este sistema.

1 2 3 4 5 6 7

Completamente de Acuerdo ☐ ☐ ☐ ☐ ☐ ☐ ☐ Totalmente en Desacuerdo

Comentarios:

Me siento cómodo utilizando este programa.

1 2 3 4 5 6 7

Completamente de Acuerdo ☐ ☐ ☐ ☐ ☐ ☐ ☐ Totalmente en Desacuerdo


Comentarios:

Ha sido sencillo aprender a utilizar este programa.

1 2 3 4 5 6 7

Completamente de Acuerdo ☐ ☐ ☐ ☐ ☐ ☐ ☐ Totalmente en Desacuerdo

Comentarios:



Creo que me torné productivo rápidamente utilizando este programa.


1 2 3 4 5 6 7

---

Completamente de Acuerdo ☐ ☐ ☐ ☐ ☐ ☐ ☐ Totalmente en Desacuerdo

---

Comentarios:



Este programa proporciona mensajes de error que me dicen claramente cómo solucionar los problemas.


1 2 3 4 5 6 7

---

Completamente de Acuerdo ☐ ☐ ☐ ☐ ☐ ☐ ☐ Totalmente en Desacuerdo

---

Comentarios:



Siempre que hago un error al usar el programa, vuelvo a empezar sencilla y rápidamente.

1 2 3 4 5 6 7

Completamente de Acuerdo ☐ ☐ ☐ ☐ ☐ ☐ ☐ Totalmente en Desacuerdo

Comentarios:

La información (como ayuda en red, mensajes de pantalla y otra documentación) ofrecida con el programa es clara.

1 2 3 4 5 6 7

Completamente de Acuerdo ☐ ☐ ☐ ☐ ☐ ☐ ☐ Totalmente en Desacuerdo

Comentarios:


Es sencillo encontrar la información que necesito.

1 2 3 4 5 6 7

Completamente de Acuerdo ☐ ☐ ☐ ☐ ☐ ☐ ☐ Totalmente en Desacuerdo



Comentarios:



La información ofrecida por el programa es fácil de entender.

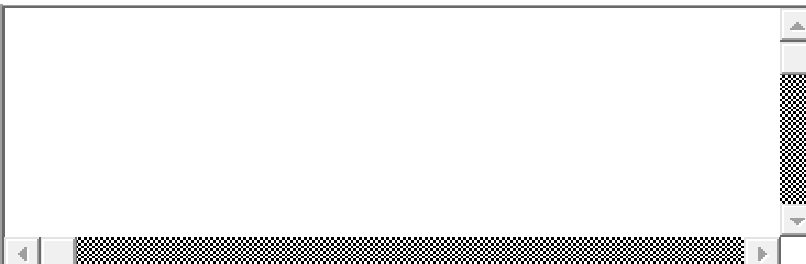
1 2 3 4 5 6 7

---

Completamente de Acuerdo ☐ ☐ ☐ ☐ ☐ ☐ ☐ Totalmente en Desacuerdo

---

Comentarios:



La información me resulta útil para acabar mis ejercicios.

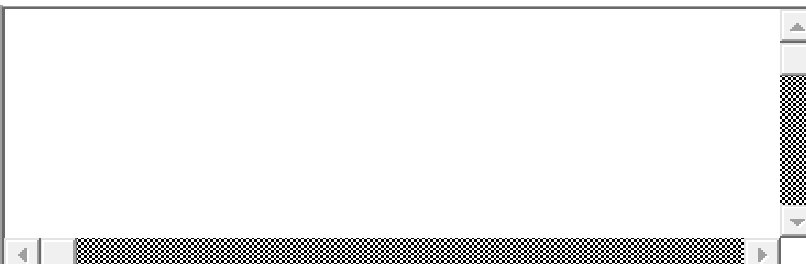
1 2 3 4 5 6 7

---

Completamente de Acuerdo ☐ ☐ ☐ ☐ ☐ ☐ ☐ Totalmente en Desacuerdo

---

Comentarios:



La organización de la información en las pantallas del programa es clara.

1 2 3 4 5 6 7

Completamente de Acuerdo ☐ ☐ ☐ ☐ ☐ ☐ ☐ Totalmente en Desacuerdo

Comentarios:

El teclado, el ratón, las pantallas y las gráficas y lenguaje utilizado por el programa es agradable.

1 2 3 4 5 6 7

Completamente de Acuerdo ☐ ☐ ☐ ☐ ☐ ☐ ☐ Totalmente en Desacuerdo


Comentarios:

Me gusta utilizar el teclado, el ratón, las pantallas...etc de este programa.

1 2 3 4 5 6 7

Completamente de Acuerdo ☐ ☐ ☐ ☐ ☐ ☐ ☐ Totalmente en Desacuerdo

Comentarios:



El programa tiene todas las funciones y capacidades que esperaba que tuviera.


1 2 3 4 5 6 7

---

Completamente de Acuerdo ☐ ☐ ☐ ☐ ☐ ☐ ☐ Totalmente en Desacuerdo

---

Comentarios:



En general, estoy satisfecho con este programa.


1 2 3 4 5 6 7

---

Completamente de Acuerdo ☐ ☐ ☐ ☐ ☐ ☐ ☐ Totalmente en Desacuerdo

---

Comentarios:



## The After-Scenario Questionnaire (ASQ) \_ Português

Para cada uma das frases abaixo, assinale o seu nível de acordo ou desacordo. Se a frase não se aplicar no seu caso, deixe a resposta em branco. Para terminar carregue no botão e as suas respostas serão submetidas.

\* Required

utilizador \*

No geral, estou satisfeito com a facilidade de completar esta tarefa.

1 2 3 4 5 6 7

Concordo Totalmente ☐ ☐ ☐ ☐ ☐ ☐ ☐ Discordo Totalmente

No geral, estou satisfeito com o tempo que demorei a realizar esta tarefa.

1 2 3 4 5 6 7

Concordo Totalmente ☐ ☐ ☐ ☐ ☐ ☐ ☐ Discordo Totalmente

No geral, estou satisfeito com a informação de apoio (ajuda, mensagens, documentação) para completar esta tarefa.

1 2 3 4 5 6 7

Concordo Totalmente ☐ ☐ ☐ ☐ ☐ ☐ ☐ Discordo Totalmente

## The Computer System Usability Questionnaire (CSUQ)\_Português

Este questionário dá-lhe uma oportunidade para expressar a sua satisfação com a usabilidade do seu sistema de computador primário. As suas respostas irão ajudar-nos a perceber os aspectos do sistema com os quais está particularmente preocupado e os aspectos que o satisfazem. Na medida do possível, pense em todas as tarefas que realizou no sistema enquanto responde a estas questões. Por favor leia cada frase e indique o quão concorda ou discorda com a frase assinalando o valor na escala. Se uma frase não se aplica ao seu caso, deixe a resposta em branco (corresponde a NA). Sempre que apropriado, por favor escreva comentários que expliquem as suas respostas. Obrigada!

**\* Required**

utilizador \*

No geral, estou satisfeito com a facilidade de usar o sistema.

1   2   3   4   5   6   7


Concordo Totalmente ☐ ☐ ☐ ☐ ☐ ☐ ☐ Discordo Totalmente

Comentários:

É simples usar este sistema.

1   2   3   4   5   6   7


Concordo Totalmente ☐ ☐ ☐ ☐ ☐ ☐ ☐ Discordo Totalmente

Comentários: 

Eu posso completar o meu trabalho eficazmente usando este sistema.

1 2 3 4 5 6 7


Concordo Totalmente ☐ ☐ ☐ ☐ ☐ ☐ ☐ Discordo Totalmente

Comentários: 

Eu sou capaz de completar o meu trabalho rapidamente usando este sistema.

1 2 3 4 5 6 7

Concordo Totalmente ☐ ☐ ☐ ☐ ☐ ☐ ☐ Discordo Totalmente

Comments: 

Eu sou capaz de completar o meu trabalho eficientemente usando este sistema.

1 2 3 4 5 6 7

---

Strongly Agree ☐ ☐ ☐ ☐ ☐ ☐ ☐ Strongly Disagree

---

Comentários:



Eu sinto-me confortável usando este sistema.

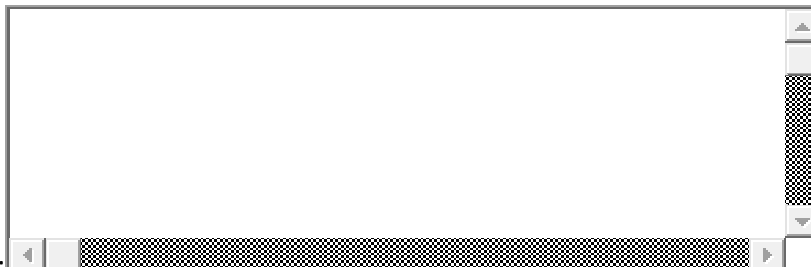
1 2 3 4 5 6 7

---

Concordo Totalmente ☐ ☐ ☐ ☐ ☐ ☐ ☐ Discordo Totalmente

---

Comentários:




Foi fácil aprender a usar este sistema.

1 2 3 4 5 6 7

---

Concordo Totalmente ☐ ☐ ☐ ☐ ☐ ☐ ☐ Discordo Totalmente


---

Comentários: 

Eu acredito que me tornei produtivo rapidamente usando este sistema.

1 2 3 4 5 6 7


Concordo Totalmente ☐ ☐ ☐ ☐ ☐ ☐ ☐ Discordo Totalmente

Comentários: 

O sistema fornece mensagens de erro que me indicam claramente como resolver os problemas.

1 2 3 4 5 6 7

Concordo Totalmente ☐ ☐ ☐ ☐ ☐ ☐ ☐ Discordo Totalmente

Comentários: 



Sempre que cometo um erro ao usar o sistema, recupero de forma fácil e rápida.

1 2 3 4 5 6 7

Concordo Totalmente ☐ ☐ ☐ ☐ ☐ ☐ ☐ Discordo Totalmente

Comentários:

A informação (ajuda em linha, mensagens de ecrã e outra documentação) fornecida com este sistema é clara.

1 2 3 4 5 6 7


Concordo Totalmente ☐ ☐ ☐ ☐ ☐ ☐ ☐ Discordo Totalmente

Comentários:

É fácil encontrar a informação que necessito.

1 2 3 4 5 6 7


Concordo Totalmente ☐ ☐ ☐ ☐ ☐ ☐ ☐ Discordo Totalmente

Comentários: 

A informação fornecida com o sistema é fácil de entender.

1 2 3 4 5 6 7


Concordo Totalmente ☐ ☐ ☐ ☐ ☐ ☐ ☐ Discordo Totalmente

Comentários: 

A informação é eficaz na ajuda para completar o meu trabalho.

1 2 3 4 5 6 7

Concordo Totalmente ☐ ☐ ☐ ☐ ☐ ☐ ☐ Discordo Totalmente

Comentários: 

A organização da informação nos ecrãs do sistema é clara.

1 2 3 4 5 6 7

Concordo Totalmente ☐ ☐ ☐ ☐ ☐ ☐ ☐ Discordo Totalmente

Comentários:

A interface do sistema é agradável.

1 2 3 4 5 6 7


Concordo Totalmente ☐ ☐ ☐ ☐ ☐ ☐ ☐ Discordo Totalmente

Comentários:

Eu gosto de usar a interface deste sistema.

1 2 3 4 5 6 7


Concordo Totalmente ☐ ☐ ☐ ☐ ☐ ☐ ☐ Discordo Totalmente

Comentários: 

Este sistema tem todas as funcionalidades e capacidades que esperava que tivesse.

1 2 3 4 5 6 7


Concordo Totalmente ☐ ☐ ☐ ☐ ☐ ☐ ☐ Discordo Totalmente

Comentários: 

No geral, eu estou satisfeito com este sistema.

1 2 3 4 5 6 7

Concordo Totalmente ☐ ☐ ☐ ☐ ☐ ☐ ☐ Discordo Totalmente

Comentários: 

# ASQ

**Administration and Scoring.** Give the questionnaire to a participant after he or she has completed a scenario during a usability evaluation. Average (with the arithmetic mean) the scores from the three items to obtain the ASQ score for a participant's satisfaction with the system for a given scenario. Low scores are better than high scores due to the anchors used in the 7-point scales. If a participant does not answer an item or marks N/A, average the remaining items to obtain the ASQ score.

# CSUQ

**Administration and Scoring.** Use the CSUQ rather than the PSSUQ when the usability study is in a non-laboratory setting. Appendix Table 1 contains the rules for calculating the CSUQ and PSSUQ scores.

Table 1. Rules for Calculating CSUQ/PSSUQ Scores

Score Name	Average the Responses to:
OVERALL	Items 1 through 19
SYSUSE	Items 1 through 8
INFOQUAL	Items 9 through 15
INTERQUAL	Items 16 through 18

Average the scores from the appropriate items to obtain the scale and subscale scores. Low scores are better than high scores due to the anchors used in the 7-point scales. If a participant does not answer an item or marks "N/A," then average the remaining item scores.

## 9.8. Personal Communications

- Hospital Sant Joan de Déu
- Hospital Magalhães de Lemos

## Hospital Sant Joan de Déu

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### Confirmacion de cita en SJD proyecto eschi

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aescanilla@sjd-ssm.com <aescanilla@sjd-ssm.com>

Thu, Jul 10, 2008 at 3:09 PM

To: "Catarina I. Reis" <catarina.isabel.reis@gmail.com>

Cc: María Luisa Pérez Guerrero <mlpg20@gmail.com>, "@hoslin022.sjd-ssm.com, Carla\_Freire@hoslin022.sjd-ssm.com, " <carlafreire@gmail.com/@sjd-ssm.com, gescuder@sjd-ssm.com, gescartin\_upps@sjd-ssm.com"@hoslin022.sjd-ssm.com

La segunda versión de la "minuta" resume bastante bien lo discudtido ayer.

Sólo quería hacer un comentario sobre los mensajes de Ayuda que se dan al paciente cuando fracasa en el ejercicio. Estos mensajes deben tratar de mejorar las estrategias internas de la persona cuando procesa la información y/o cuando debe memorizarla. Creo que debemos pensar muy bien como deben ser y posiblemente tendrán que individualizarse por tipo de ejercicio. Algunos ejemplos que se me ocurren son: "Dime para que sirve esto que ves" , "De qué color es este objeto?", "¿Recuerdas haberlo usado/comido/visitado alguna vez?", "Describeme brevemente cómo es (edad, características particulares, sugerencias...)", "Repite el nombre del objeto/lugar cinco veces en voz alta".

Seguro que entre todas se nos ocurren más y mejores.

Un saludo,

Ana Escanilla Casal

Neuropsicóloga

Servicio de Rehabilitación Psiquiátrica Intensiva (SERPI)

Sant Joan de Déu-Serveis de Salut Mental

93.640.63.50 ext.2508

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## eSchi - prueba 0

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aescanilla@sjd-ssm.com <aescanilla@sjd-ssm.com>

Fri, Dec 19, 2008 at 9:52 AM

To: "Catarina I. Reis" <catarina.isabel.reis@gmail.com>

Cc: gescuder@sjd-ssm.com, gescartin\_upps@sjd-ssm.com

Hola Catarina,

He entrado en eSchi. Mis comentarios son los siguientes:

1- Para empezar creo que deberíamos corregir el texto (sobretudo la forma más que el contenido) pues hay varios errores: uso de palabras no castellanas, otras poco frecuentes... Por ejemplo en la ventana de bienvenida pone "...sobreviviendo a la *schizophrenia*" y creo que se debería cambiar, por ejemplo "...*afrontando* la *esquizofrenia*"

2- No puedo hacer los ejercicios porque al entrar (por ejemplo tiro al blanco) el texto sale cortado y no me permite seguir adelante clicando al ratón. Me ha pasado en todos los ejercicios.

Un saludo,

Ana Escanilla Casal

Neuropsicóloga

Servicio de Rehabilitación Psiquiátrica Intensiva (SERPI)

Sant Joan de Déu-Serveis de Salut Mental

93.640.63.50 ext.2508

-----"Catarina I. Reis" <[catarina.isabel.reis@gmail.com](mailto:catarina.isabel.reis@gmail.com)> escribió: -----

Para: [aescanilla@sjd-ssm.com](mailto:aescanilla@sjd-ssm.com)

De: "Catarina I. Reis" <[catarina.isabel.reis@gmail.com](mailto:catarina.isabel.reis@gmail.com)>

Fecha: 18/12/2008 22:33

Asunto: eSchi - prueba 0

[Quoted text hidden]



Catarina Reis <catarina.isabel.reis@gmail.com>

---

## Aula para laboratorio eSchi

---

aescanilla@sjd-ssm.com <aescanilla@sjd-ssm.com>

Thu, Feb 5, 2009 at 2:50 PM

To: "Catarina I. Reis" <catarina.isabel.reis@gmail.com>

Cc: aescanilla@sjd-ssm.com, Gemma Escartin <gemma.escartin@gmail.com>, Gemma Escuder Romeva <gemmaescuder@hotmail.com>, jmmf <jm.monguet@gmail.com>, Carla Freire <carlafreire@gmail.com>, Eduardo Huerta <eduardohuertavasquez@gmail.com>, joaquin.lam.upc@gmail.com, jautonell@sjd-ssm.com

El aula está disponible en la Clínica St.Carlos (dentro del programa de Alta Contención).

Lo que no hay son ordenadores, que si mal no recuerdo los iba a proporcionar la UPC, y yo no he recibido ningún tipo de información al respecto.

Quedamos a la espera..

Un saludo,

Ana Escanilla Casal

Neuropsicóloga

Servicio de Rehabilitación Psiquiátrica Intensiva (SERPI)

Sant Joan de Déu-Serveis de Salut Mental

93.640.63.50 ext.2508

-----"Catarina I. Reis" <catarina.isabel.reis@gmail.com> escribió: -----

Para: aescanilla@sjd-ssm.com, Gemma Escartin <gemma.escartin@gmail.com>, Gemma Escuder Romeva <gemmaescuder@hotmail.com>

De: "Catarina I. Reis" <catarina.isabel.reis@gmail.com>

Fecha: 05/02/2009 14:51

cc: jmmf <jm.monguet@gmail.com>, Carla Freire <carlafreire@gmail.com>,

Eduardo Huerta

<eduardohuertavasquez@gmail.com>, joaquin.lam.upc@gmail.com, jautonell@sjd-ssm.com

Asunto: Aula para laboratorio eSchi

Hola a todas.

Espero que se encuentren bien.

Tengo que preguntaros se sabéis de algo con respecto a la aula que estaba pensada para montar el laboratorio de eSchi.

Ya tenéis una aula dedicada a eso?

Saludos

Catarina Reis

## incidencias

Catarina I. Reis <[catarina.isabel.reis@gmail.com](mailto:catarina.isabel.reis@gmail.com)>

Fri, Nov 13, 2009 at 1:41 AM

To: [aescanilla@sjd-ssm.com](mailto:aescanilla@sjd-ssm.com)

Cc: [jfernandezupclam@gmail.com](mailto:jfernandezupclam@gmail.com), Carla Freire <[carlafreire@gmail.com](mailto:carlafreire@gmail.com)>

Buenas tardes,

con respecto a las llamadas estoy también disponible por aquí (el google talk/google mail tiene una opción de conversa por voz) en [catarina.isabel.reis@gmail.com](mailto:catarina.isabel.reis@gmail.com) ("chat" incluido).

Con respecto a las incidencias estuve intentando dañar el sistema pero no lo he conseguido. O sea, no he conseguido repetir los errores indicados.

Pero estube calculando información estadística con base en los datos que el sistema ha monitorado y son los siguientes:

- \* el sistema ha sido accedido por 5 usuarios (usuario1, usuario3, usuario4, usuario5 y más tarde por el usuario2)
- \* todos los pacientes han cumplido (bien o mal) todas las 5 actividades
- \* solo una sesión ha sido considerada como terminada correctamente (usuario3 - por azar ha sido el primero a completar la sesión)

Por lo que he visto en los datos monitorados y con el hecho de que aquí lo que tengo funciona, me parece que se si pudieran arreglar lo siguiente que se quedaria más fácil usar el sistema:

- 1 - el lector de FLASH (flash player) es la versión 10 - la más reciente (como verificar? en cima del sistema, darle click con el ratón - menu - About Adobe Flash Player 10)
- 2 - es necesario aguardar respuesta del sistema, por veces tarda (voy intentar verificar esto en el final de semana)
- 3 - siempre que el sistema tenga un comportamiento no esperado, hay que garantizar que se retorna a uno estado estable - hacer refresh - F5 en el browser es una manera de hacerlo.

Además de esto y con respecto a las observaciones del castellano y de lo que está en las actividades, solo necesito saber el nuevo texto y lo cambio en 1 minuto.

Saludos  
Catarina Reis

2009/11/12 <[aescanilla@sjd-ssm.com](mailto:aescanilla@sjd-ssm.com)>

Hola a los dos!

Primero de todo no puedo hacer llamadas internacionales desde el despacho.

Primero de todo no puedo hacer llamadas internacionales desde el despacho. Así que la comunicación con Caterina por teléfono queda desechada.

Sigo con incidencias en algunos casos:

- Hoy con el usuario1 el tercer ensayo de naranjas y cestas no se podía hacer porque las naranjas no se quedaban metidas en las cestas.
- Con el usuario3 hemos intentado ver el evolutivo de las sesiones para ver si mejoraba y el sistema se ha quedado colgado.
- Nuevamente con el usuario5 he tenido problemas "error tipo#1009" y no hemos podido hacer los ejercicios de asociación.

Otra cosa, es muy difícil entender la explicación de los ejercicios. Yo debo "traducir" a cada momento a los pacientes pues no lo entienden. Debería ser más sencillo, sin tecnicismos (ej: no saben lo que es un "estímulo", ni "largar"... ) y bien traducido.

Seguimos en ello.

Hasta pronto!

Ana Escanilla Casal

Neuropsicóloga

Servicio de Rehabilitación Psiquiátrica Intensiva (SERPI)

Parc Sanitari Sant Joan de Déu

93.640.63.50 ext.2508

## incidencias

---

aescanilla@sjd-ssm.com <aescanilla@sjd-ssm.com>

Mon, Nov 23, 2009 at 2:24 PM

To: "Catarina I. Reis" <catarina.isabel.reis@gmail.com>

Cc: jfernandezupclam@gmail.com

Buenas tardes. Me gusta mucho el nuevo "look", es más fácil y comprensible para los pacientes.

Deciros que la propuesta de usar teclas o ratón está muy bien, pero parece que no está activo. Sólo hemos podido dar a tecla en la primera pantalla (bienvenida) a partir de las siguientes (ejercicios) no hemos podido.

Un saludo,

Ana Escanilla Casal

Neuropsicóloga

Servicio de Rehabilitación Psiquiátrica Intensiva (SERPI)

Parc Sanitari Sant Joan de Déu

93.640.63.50 ext.2508

## activar sesiones

---

Catarina I. Reis <catarina.isabel.reis@gmail.com>

Fri, Jan 8, 2010 at 3:08 PM

To: Ana Escanilla Casal <aescanilla@pssjd.org>  
Cc: Joaquin Fernandez <jfernandezupclam@gmail.com>  
Bcc: Carla Freire <carlafreire@gmail.com>

Hola,

muchas gracias y feliz año nuevo! :)

Las sesiones para los usuarios (8, 9 y 10) están disponibles hasta el 12 de marzo.  
Cualquier cosa más, es solo decir.

Saludos  
Catarina Reis

2010/1/8 Ana Escanilla Casal <[aescanilla@pssjd.org](mailto:aescanilla@pssjd.org)>

Buenos días Catarina y feliz año nuevo!

Ayer recluté a un nuevo paciente (usuario8) y no puedo acceder a los ejercicios. Podrías activarme las sesiones de este nuevo usuario? Si quieres también las sesiones de los usuario 9 y 10, pues a lo mejor consigo otros dos pacientes.

Muchas gracias y hasta pronto,

--

Ana Escanilla Casal  
Neuropsicóloga  
Servicio de Rehabilitación Psiquiátrica Intensiva (SERPI)  
Parc Sanitari Sant Joan de Déu  
93.640.63.50 ext.2508

# Hospital Magalhães de Lemos

## Fw: eschi

---

Catarina I. Reis <catarina.isabel.reis@gmail.com>

Tue, Jan 26, 2010 at  
10:29 AM

To: Patrícia Cruz <patriciafacruz@hotmail.com>

Cc: Carla Freire <carlafreire@gmail.com>

Bom dia,

sim e espero que aí por cima também esteja tudo a correr pelo melhor.

### Ponto 1 - Notas

Em relação às notas dos utentes transcrevo as registadas pelo sistema:

utilizador3 - "com ajuda de terapoutica ' pode correr melhor."

utilizador4 - "1 - vaisse tornando mais simples á medida que se faz mais vezes  
2 - não sei se as bolinhas sorridentes são o total ou percentagem?"

utilizador1 - "A Reacção-Som é uma actividade que me exige com que eu ouça e preste atenção a sons que eu não estou habituado a ouvir."

### Comentários

As carinhas sorridentes indicam a percentagem do objectivo final que já foi cumprido. Por exemplo, se houver 4 laranjas para colocar em 4 cestos, cada laranja dentro do cesto corresponde a 25% do objectivo final cumprido. Portanto, de cada vez que 1 laranja vai para dentro do cesto, o resultado é actualizado em +25% (uma carinha).

Em relação aos sons da actividade "Reacção-Som", há alguma coisa que se possa mudar? Ou eliminar alguns sons?

### Ponto 2 - Dificuldade e Novas Actividades

Em relação a aumentar o nível de dificuldade. não sei o que mais se pode fazer

Em relação a aumentar o nível de dificuldade, não sei o que mais se pode fazer atendendo às actividades que temos neste momento...

Mas sim, concordo que é preciso mantê-los motivados....

Estou neste momento a trabalhar numa proposta de actividades novas que vou organizar pelo nível de trabalho requerido a nível de implementação. Depois ia-lhe pedir que as ordenasse por interesse/utilidade para os seus utentes. Que lhe parece? Assim conseguiríamos agendar o lançamento de novas actividades.

um abraço  
Catarina Reis

2010/1/25 Patrícia Cruz <[patriciafacruz@hotmail.com](mailto:patriciafacruz@hotmail.com)>  
Olá Boa tarde:

Tudo bem? Gostaria de saber se já teve oportunidade de lêr o que os utentes têm escrito no bloco de notas? Tenho sentido que eles estão um pouco desmotivados relativamente à repetição das actividades, uma vez que elas não apresentam um grau de dificuldade crescente. Gostaria de saber tb a sua opinião e o que podemos fazer. Quanto aos problemas que falei relativamente ao jogos da laranjas, seriam daqueles mais básicos que fazíamos na escola primária que envolvem noções de adição e subtracção mas podemos esperar pela reacção dos utentes. Entretanto mal possa experimentar com mais alguns.

Obrigada

Um abraço

Patricia Cruz

---

Date: Wed, 20 Jan 2010 09:54:02 +0000  
Subject: Re: Fw: eschi  
From: [catarina.isabel.reis@gmail.com](mailto:catarina.isabel.reis@gmail.com)  
To: [patriciafacruz@hotmail.com](mailto:patriciafacruz@hotmail.com)  
CC: [carlafreire@gmail.com](mailto:carlafreire@gmail.com)

Bom dia,

em relação aos pontos apresentados devo dizer que há alguns que são relativamente fáceis de resolver e vou tentar que fiquem resolvidos até ao fim do dia de hoje.

O único ponto que envolve maior dedicação de tempo é a parte de "poderia-se tentar complicar um pouco mais talvez com problemas por exemplo.". Pelo que entendi estaríamos a falar de uma nova actividade, ou tipo de actividades. Correcto? Assim sendo, sim, concordo que faz falta, mas penso que primeiro deveríamos pensar o tipo de actividade que nos interessa... ou melhor.. que interesse aos utentes.

Obrigada pelo feedback.

Darei notícias ainda hoje sobre o estado das alterações.

Um abraço  
Catarina Reis

2010/1/19 Catarina Reis <creis@estg.ipleiria.pt>

----- Original Message -----

**From:** Patrícia Cruz

**To:** catarina reis

**Sent:** Tuesday, January 19, 2010 2:33 PM

**Subject:** eschi

Olá Boa tarde:

Mais um parecer sobre o eschi e algumas sugestões e pedidos:

- Será que era possível colocar mais imagens na actividade da memória, é que para os nossos utentes é bastante básico bem como a actividade das laranjas, poderia-se tentar complicar um pouco mais talvez com problemas por exemplo.
- Na actividade dos pares também sugeria aumentar o tempo que é dado para fixarem as imagens.
- Penso que devem tb ter acesso ao bloco de notas dos utentes para verem o que eles acham.
- Uma outra sugestão que não ficou registada no bloco de notas do utente foi o seguinte, quando surge a palavra "Acalma-te" ele considera isto quase como uma ordem e sugere antes "Presta mais atenção", penso que é uma achega importante.

Vou dando mais novidades e vou tentar introduzir mais utentes esta semana.

Um abraço

Patricia Cruz

---

## actividades

Patrícia Cruz <patriciafacruz@hotmail.com>

Tue, Feb 9, 2010 at 2:48 PM

To: catarina reis eschi <catarina.isabel.reis@gmail.com>

Olá Dra. Catarina:

Desculpe só enviar agora a sugestão das actividades mas só tive um tempinho disponível esta semana.

Envio em anexo o documento que me enviou com as minhas sugestões.

Em relação às actividades que do som e imagem reacção tenho notado que alguns utentes têm mais dificuldade na resposta a esta actividade será possível dificultarmos um bocdinho, talvez com mmaior fluência de sons e imagens ou então associar uma imagem a um som?

A semana passada como já deve ter reparado paramos na implementação do programa pois o nosso utilizador 2 teve alta do serviço e os restantes solicitam um nível mais difícil de concretização daí a implementação destas novas actividades.

Agradeço desde já a atenção e aguardo resposta.

Um abraço

Patricia Cruz

---

Fique protegido enquanto navega na Internet. [Instale o Internet Explorer 8.](#)



**PropostaNovasActividades.docx**  
301K



## 9.9. New Activities for eSchi



# Hospital Magalhães de Lemos

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*Proposta de Actividades*

**Versão:** 1º rascunho

### Histórico do Documento

Data	Autores	Estado
27/01/2010	Catarina Reis, Carla Freire	1º rascunho versão português

## Introdução

Este documento é um conjunto de propostas de novas actividades que se podem introduzir no sistema eschi para que os utentes possam desfrutar de uma maior variedade de actividades, bem como de novos níveis de dificuldade.

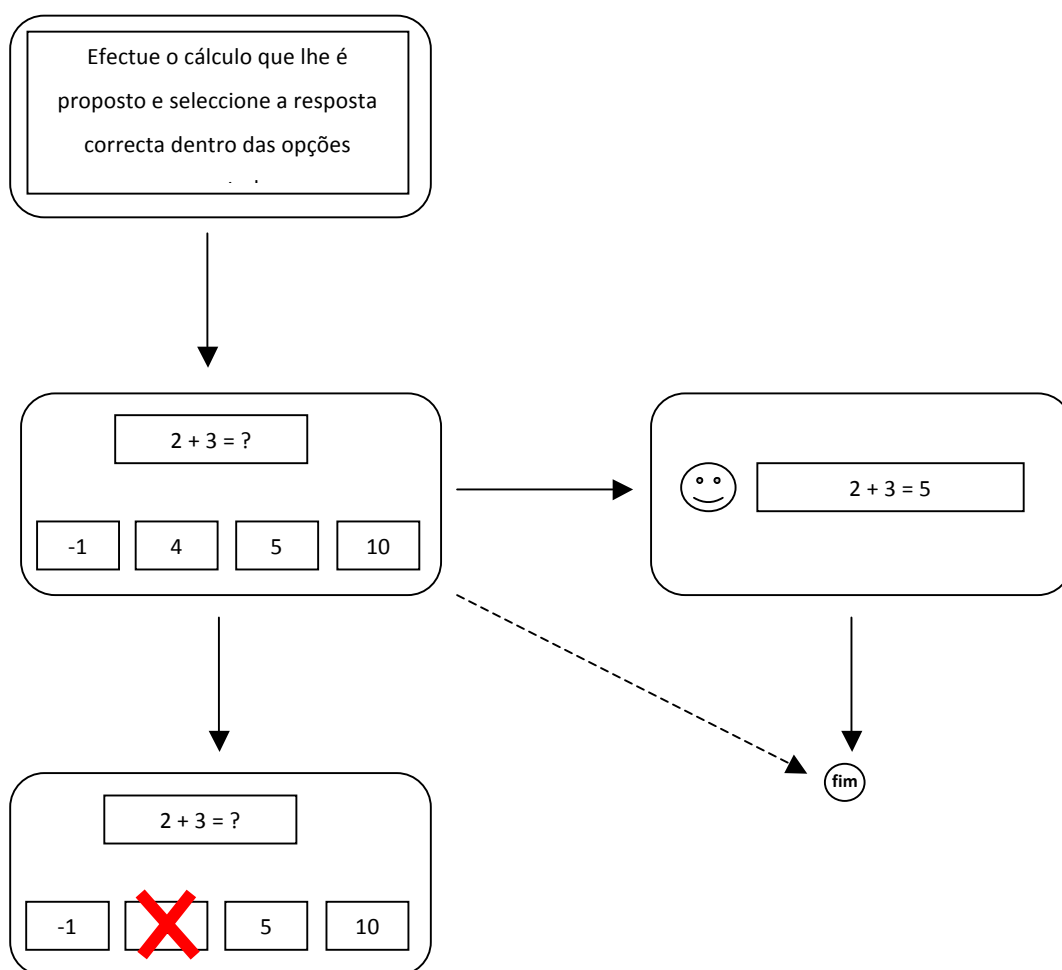
Nesta versão do documento são apresentadas 5 novas actividades, sendo que algumas (actividades 2 e 3) são apenas variantes das actividades que já existem actualmente. Para cada actividade são apresentados uma pequena descrição bem como o *storyboard* que se pensou para o desenrolar da actividade.

No final resume-se, sob a forma de tabela, a informação presente no documento bem como o tempo de implementação (primeira aproximação) que se considera adequado para desenvolver as actividades.

## Actividade 1 – Problemas de Matemática

A ideia desta nova actividade é realizar alguns cálculos básicos que envolvem as 4 operações aritméticas simples: adição, subtracção, multiplicação e divisão.

### Storyboard



#### Variáveis

- Operação (soma, subtracção, multiplicação, divisão)
- Valores (inteiros – positivos e negativos, reais?)
- Resultado

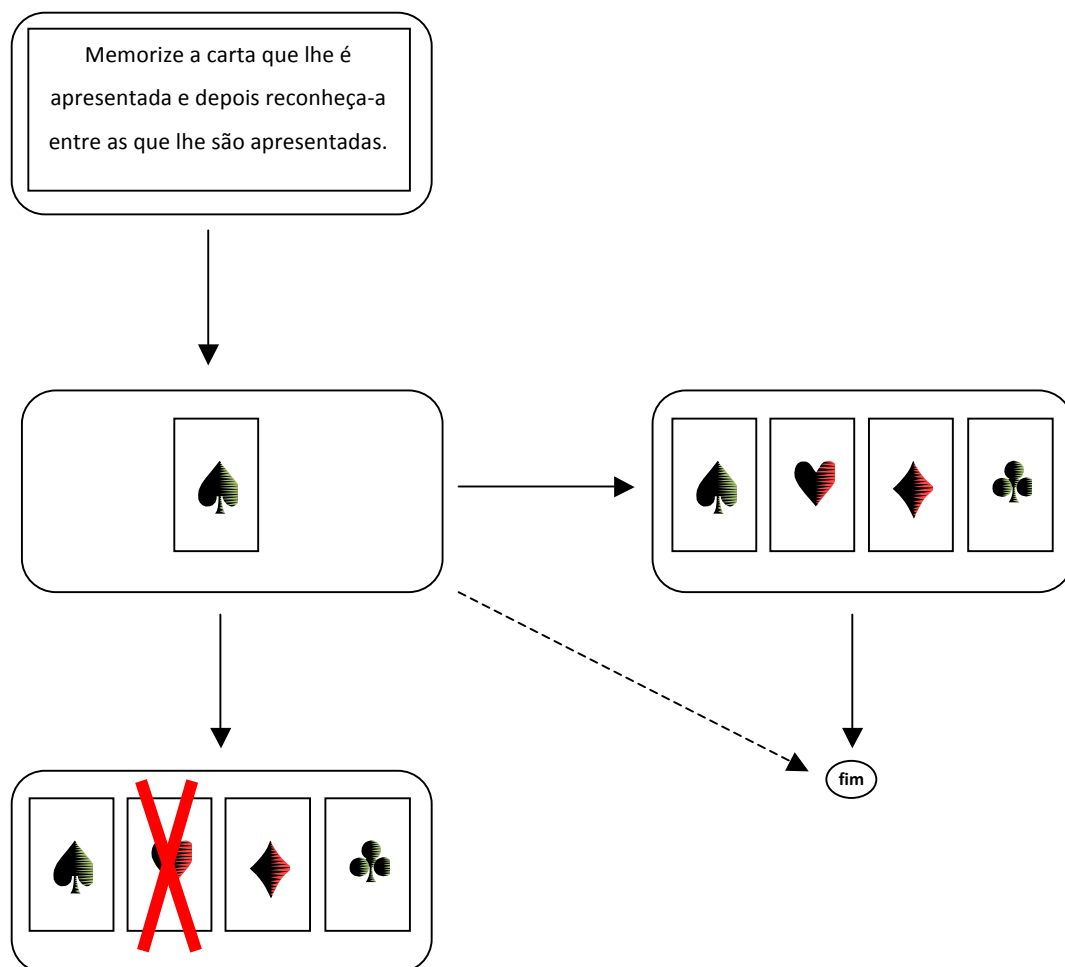
- 3 resultados alternativos (valores calculados aleatoriamente excepto o correcto)

PENSO QUE ESTA ACTIVIDADE SERIA SIMPLES PARA ELES, O QUE SUGERIA ERA ALGO PARECIDO COM PROBLEMAS EM QUE PODERIAM SER UTILIZADOS NA MESMA A LÓGICA DOS CESTOS, POR EXEMPLO EXISTEM X LARANJAS QUE TÊM QUE SER DISTIRBUIDAS PELOS CESTOS MAS O CESTO A E B JÁ TÊM X LARANJAS QUANTAS FALTAM EM CADA CESTO?

## Actividade 2 – Memorizar Cartas

A ideia desta actividade é fornecer uma variante de uma actividade já existente: "Memória". Nesta versão, há que memorizar e reconhecer uma carta entre várias possíveis do baralho.

### Storyboard



Variante para aumento de dificuldade – reconhecimento dentro da mesma cor (naipes vermelhos, naipes pretos)

ESTA ACTIVIDADE PARECE-ME BEM

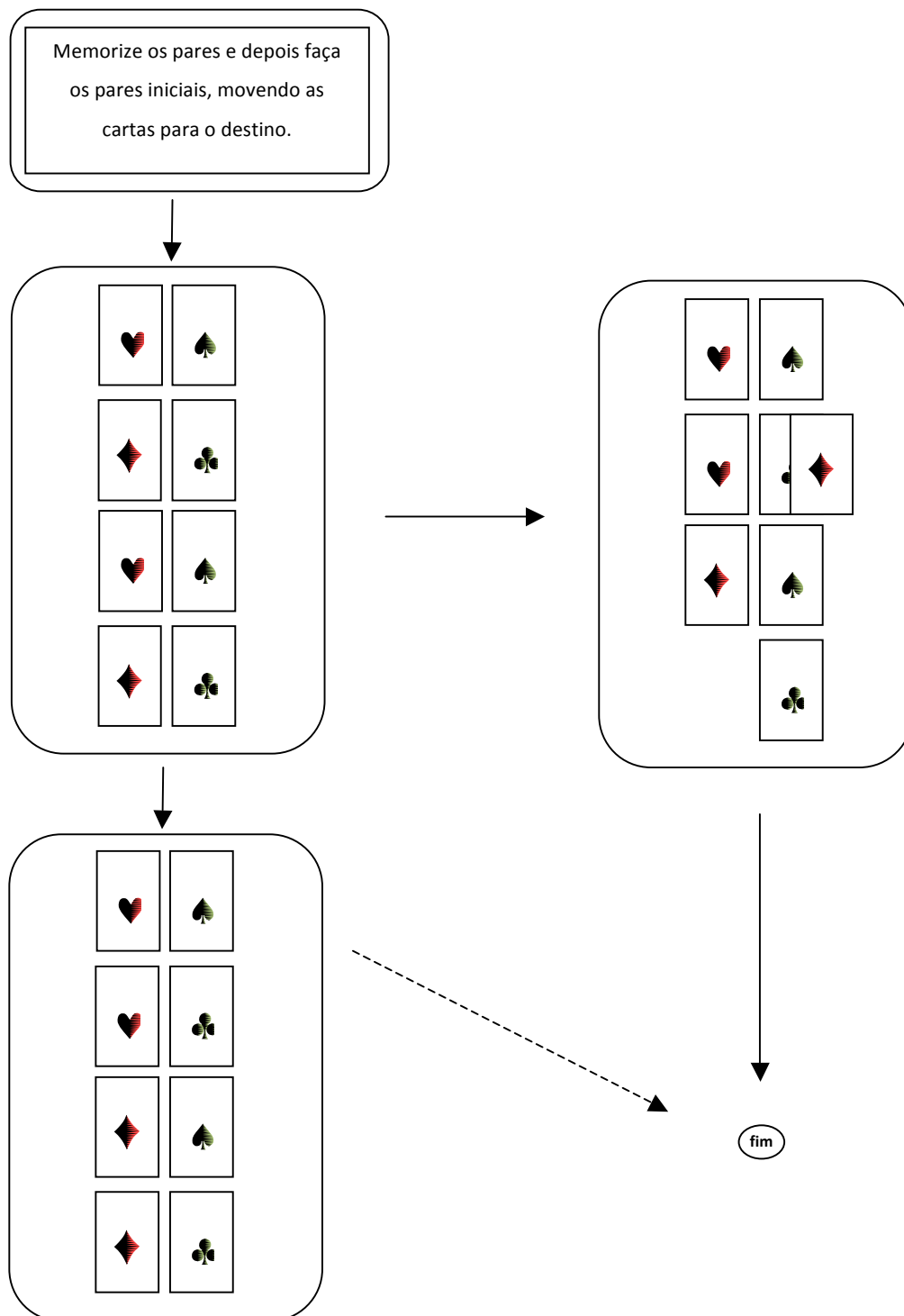
## Actividade 3 – Pares de cartas

A ideia desta actividade é fornecer uma variante de uma actividade já existente: “Pares”. Nesta versão, há que memorizar e, mais tarde reagrupar, 4 pares de cartas.

Obs: Não sei se não será de um nível de dificuldade excessivo e que tipo de benefícios trará... OS BENEFÍCIOS SÃO SEMPRE SOB O PONTO DE VISTA DAS COMPETÊNCIAS COGNITIVAS (MEMÓRIA, ATENÇÃO...)

ACHO A ACTIVIDADE INTERESSANTE AS IMAGENS POR SEREM MUITO PARECIDAS  
PODEM SER CONFUSAS, PODEMOS RECORRER POR EXEMPLO A IMAGENS DE ANIMAIS OU FRUTOS E NUMA FASE MAIS AVANÇADA RECORRER A ESTAS.

## Storyboard

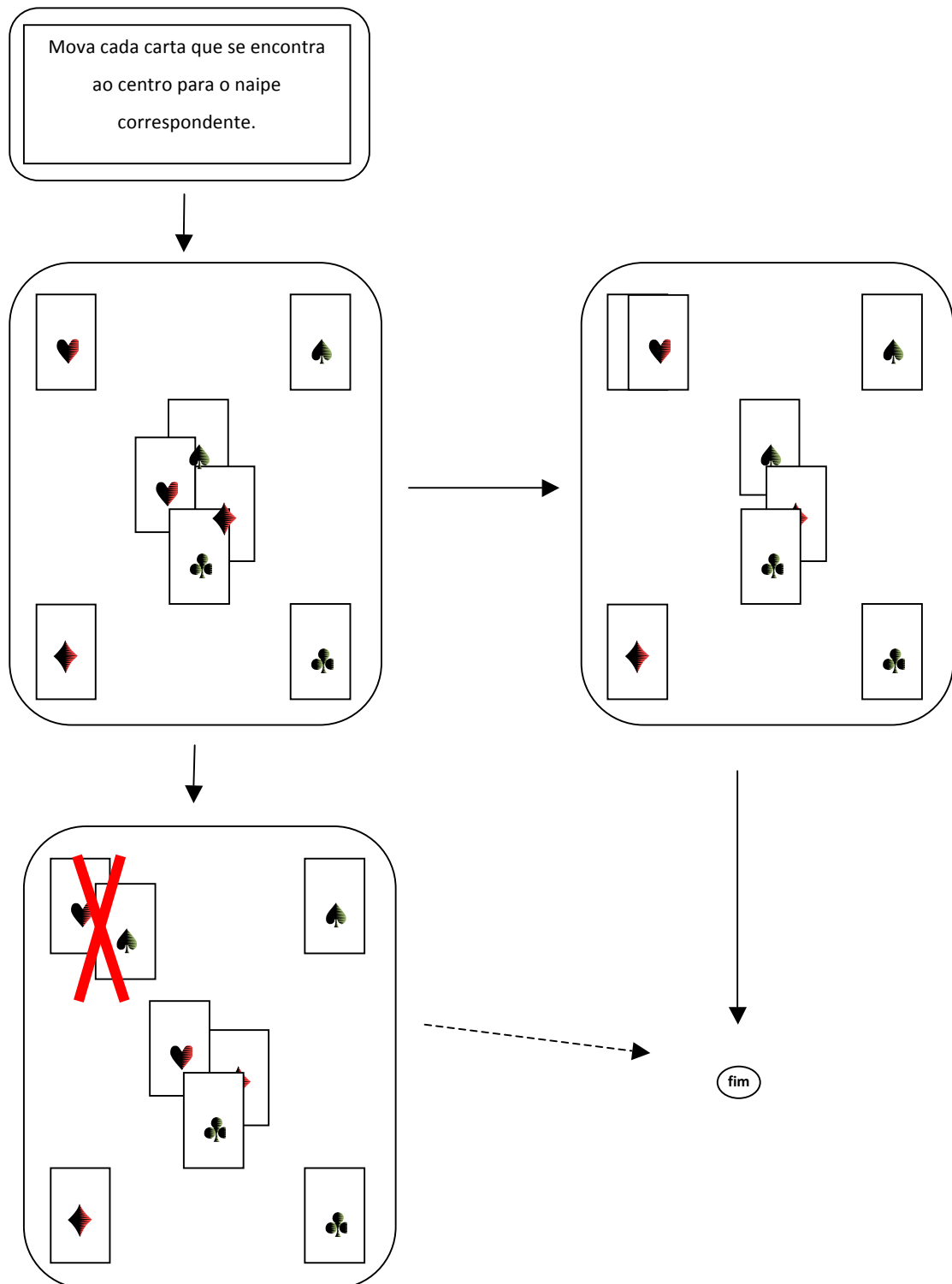


## Actividade 4 – Paciência

A ideia desta nova actividade é fornecer uma variante de uma actividade já existente: “Laranjas e Cestas”. Nesta versão, há que fazer chegar cada carta que esteja no centro do ecrã (n cartas) ao seu naipe correspondente (1 dos 4 cantos). Aqui irá haver o reconhecimento do naipe, portanto, as cartas quando não fazem parte do naipe para onde estão a ser deslocadas, voltam ao centro.

PENSO QUE ESTA SERÁ DEMASIADO SIMPLES...

## Storyboard





## Actividade 5 – Formar Pares de Cartas

Nesta nova actividade, irá ser apresentado um tabuleiro 4x4 com cartas tapadas. Existem 6 pares de cartas iguais 2 a 2, distribuídas aleatoriamente. A ideia consiste em ir destapando as cartas 2 a 2 e verificar se compõem um par. Caso isso aconteça, elas permanecem viradas para cima (destapadas). Caso contrário, voltam ao seu estado inicial de tapadas.

ESTA ACTIVIDADE TAMBÉM CONSIDERO UTIL...

## Storyboard

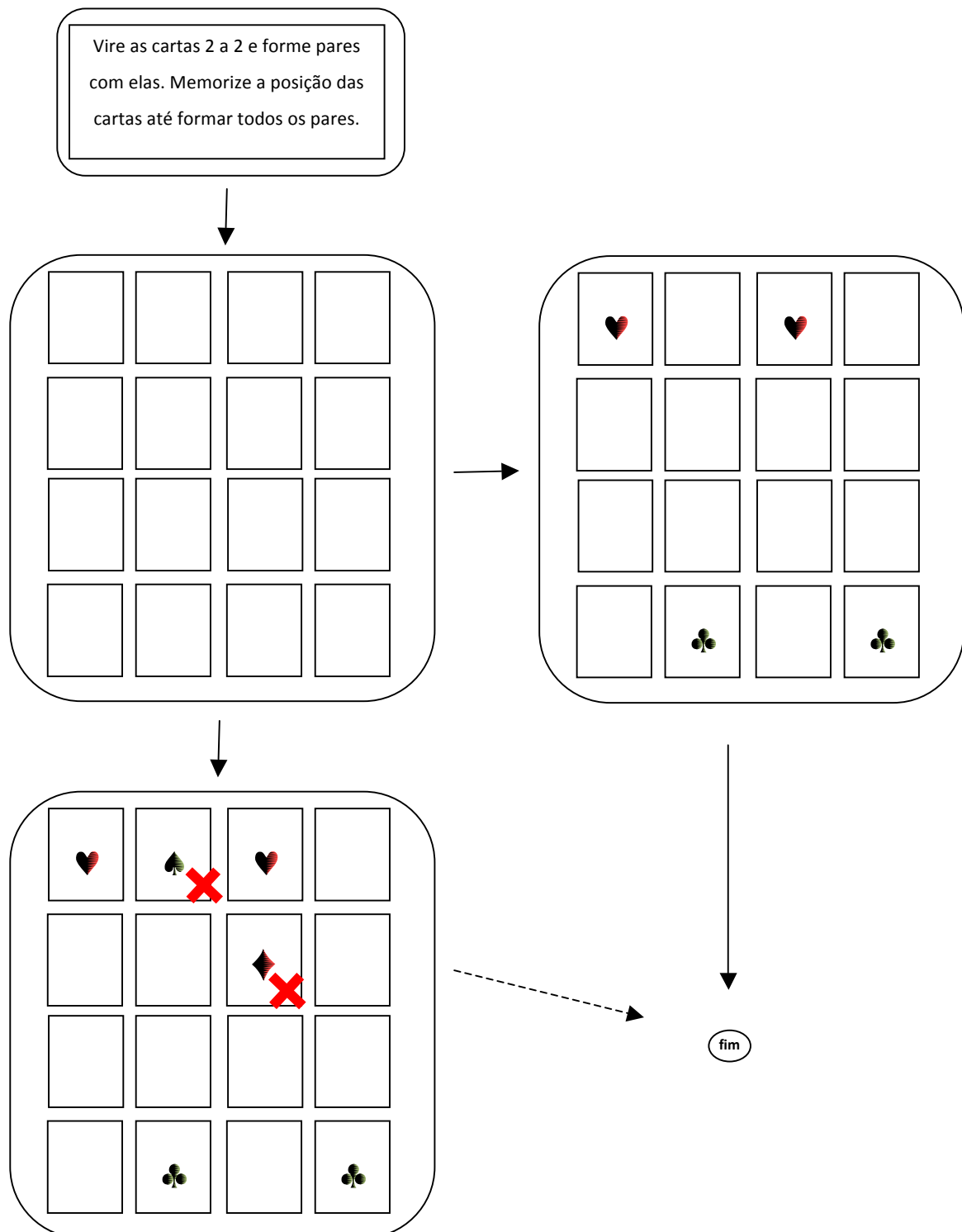


Tabela Resumo Actividades-Tempo Implementação

ID	Nome	Tempo Implementação	Observações
1	Problemas de Matemática	1 semana?	Definir variáveis
2	Memorizar Cartas	1 dia?	Definir variáveis
3	Pares de Cartas	1 dia?	Difícil. Compensa?
4	Paciência	1 semana?	Compensa?
5	Formar Pares de Cartas	2 semanas?	Definir variáveis