PSYCHOLOGICAL THERAPY ARTIFACTS – USAGE AND EDITING WITH PDAS

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ABSTRACT
We describe, in this article, the design and implementation options that were taken during a research with the main objective of supporting the common process of psychological therapy and diagnosis, using computers. A prototype to be used either in PDAs, Tablet PCs and common desktop computers is presented, discussing the interaction problems that may arise when such devices are introduced in the patient and therapist relationship. Within the spectrum of this prototype, issues such as information management, data gathering, information visualization, annotation or human-computer interaction are also analyzed. The task customization that allows the therapist to treat each patient differently and according to their own problems is one of the main focus areas of the prototype as well. The article points its main attention to the introduction of new tools and techniques that intend to improve patient and therapist communication, minimizing time loss and effort needed in many of the procedures used in anxiety and depression therapy nowadays.

KEYWORDS
Psychological diagnosis, self-therapy, PDAs, task customization, SCOPE.

1. INTRODUCTION

Psychological diagnosis, in particular for the cases of anxiety and depression, is a long process, involving great amount of time and effort by both the therapist and the patient, including the costs relative to the number of consultations involved. It depends greatly on the therapist’s ability to understand the patient’s problems and, on the patient’s self-consciousness of his own problems [Mahoney03]. Besides this mutual comprehension, the patient is also led to participate in the process of diagnosis and mainly in the process of his own therapy [Neimeyer93, Mahoney03]. Self-therapy, or self-help, as designated by some authors [Proudfoot04], is indeed a well know and used therapy method for patients suffering from depression or anxiety disorders. This form of therapy is called cognitive-behavioral therapy and is effective in the treatment of several psychological conditions. It relies on teaching the patients to recognize between cognitions, emotion, behavior and physiology, identify distorted beliefs, attitudes and replace them with more adequate and helpful cognitions. It has well-delineated procedures and it is structured. However, this process takes time and the work is not only confined to the patient since the therapist’s intervention is crucial as well.

The therapists’ work is done by providing guidance to the patient, in his office, by discussing the patients’ problems, life events and thoughts, from which the diagnosis emerges. Afterwards, work continues on the off-consultation hours, either at the office or at home, by analyzing the results. These results may consist of endless forms with hundreds of numeric values, and annotations gathered during the face-to-face time spent with the patient. Besides this analysis work, the therapist is also responsible for providing and defining the steps that each patient should follow, choosing and even creating suitable inquiries and tests that adapt to each case or pathology. During the consultation, the therapists’ work is as important as off it, for he has to annotate and follow each detail of patients’ attitudes, moods, conversations and thoughts. For these reasons, the process of annotation and information gathering is, many times, an obstacle to the therapist-patient relationship, since it removes part of the therapists’ attention from the patient and his problems. Besides, it wastes the therapists’ time during the consultation.
On the patients’ side, great part of the work is done by filling forms and tests, either at home or during the consultations. These forms, multiple choice inquiries or free writing documents, provide the therapist a way of measuring depression and anxiety levels, either by calculating the results on numeric scales or by analyzing the patients thoughts and attitudes.

However, this process is mainly supported by paper. Both the artifacts that the patient uses, and the notes that the therapist produces, exist in paper. This causes coding and organization problems, obstructs co-referencing and annotation, and most of all, wastes both therapist and patients’ time.

Computers can overcome some of these difficulties. Currently, software is available and used for data gathering, analysis, visualization, organizational tasks, etc [Garrard00]. Specific software, directed to psychiatric and psychological use, allows patients to follow some methods of therapy, and even some types of diagnosis [Proudfoot04]. Most of the diagnosis applications that exist rely on statistical, artificial intelligence and virtual reality techniques [Das02]. However, expedite approaches of diagnosis are hardly accepted, and when they are, complementary clinician intervention is required – human acceptance is in fact a major obstacle to computer support on health practice [Das02]. Even so, studies have been taking place which demonstrate the effectiveness of computer introduction in the process of anxiety and depression therapy [Wright97], presenting results where the use of computers is equivalent to the use of antidepressants [Otto00]. However, desktop approaches are incompatible with most of the previously described scenarios, including office consultation [Luff98].

More recently, with the proliferation of mobile devices such as PDAs or TabletPCs, new applications have been emerging. They provide the required mobility that allows patients to use them during the daily tasks. Simple applications exist, to measure disease severity, indicate drug dosage, etc. However, these applications cover only partial steps of the diagnosis and therapy process and no support is given to the required data flow and refinement of the psychological therapeutic procedures. Integration among actors and setting is hardly offered and therapist adjustment of patient tasks and forms is not even considered.

This paper presents a prototype of a tool that provides support for the processes of psychological therapy and diagnosis, based on the integration of desktop computers, PDAs and TabletPCs. This research and consequent prototype are being carried on the context of project SCOPE (Supporting Cognition Outlines on Psychological Evaluation) and are currently focusing on the data gathering aspects, both for the patient and therapist, and on the tasks and artifacts customization by the therapist. Previous work has been done in the integration of standard psychiatric classifications and criteria (DSM-IV) at the diagnosis phase, and explored synchronization and storage issues with PDAs desktop servers. The article begins with a review of the general state of the art. Then the research that took place, the projects’ implementation issues, and some of the results are presented, emphasizing the overall architectural approach, the data gathering aspects and the several interaction questions on the different settings. Finally, the approach is discussed and future work is drawn.

2. RELATED WORK

The integration of computers and information technology in the field of health sciences is evolving quite rapidly [Garrard00; Das02]. Computers are used wherever the clinical related practice occurs (hospitals, clinics, offices and home) and for various purposes (bureaucratic, administrative, clinical and even personal reasons). Psychology and psychiatry are among the medical areas that take great advantage of computers to improve their service and patient life quality. Many studies are taking place on computer-based treatments for diverse psychological problems, focusing on their feasibility and efficacy. Most of them validate the use of computers in self-help and treatment, and mention positive patient acceptability as well as positive treatment results [Proudfoot04]. The concept of e-mental health is gaining momentum [Proudfoot04] and treatments for pathologies such as bulimia are even available through the internet [Lam03]. However, mobility limitations indicate the quest for alternative solutions and more ethnographic applications.

Recently, the advances in hand-held devices open even wider the working settings where computers can be of use [Grasso04]. According to recent studies [Warren00, Barret04] the adoption of PDAs in health communities, particularly for hospital residents in the US, is getting quite high - up to 88% of the respondents use PDAs in clinical practice. The impact of hand-held devices emerges naturally from its portability and consequent adequateness to the requirements of clinicians’ mobility, and their constant need for information.
Those studies point the use of PDAs for medical referring (e.g. drugs) and guidelines, organizers, medical calculations (for prescriptions), patient notes and management. Patients can benefit from the use of hand-held devices as well, since most of the therapies require constant actions and tasks to be accomplished during the day. Using hand-held devices in such cases represents a promising methodology [Herman98]. Although there are many advantages inherent to this type of devices, some negative aspects are relevant. The most pointed ones are the difficulty on data entry (hand writing recognition), size, reliability and memory limitations [Grasso04, Barret04].

On the particular case of SCOPE this is of course a major drawback. However, the introduction of Tablet PC on consultation settings (and recent technologic advances) might solve some of these problems. On the other hand, the type of data usually required to be entered by patients - short sentences and accounting actions - and the objective to provide the clinician the means to customize data entry fields for each patient, definitely open perspectives to overcome those limitations. Even so, and from the current usage panorama, the benefits of allying hand held devices to the medical armamentarium are greater than the disadvantages. For example, at the Columbia-Presbyterian Medical Center, a system for retrieving, accessing and storing clinical data using a PDA has been developed [Wilcox97]. Dalhousie University [Dalhousie01] provides a set of recommendations on the adoption of hardware and software for PalmOs systems. Applications range from image viewers to database, security, patient tracking etc. On the patient side there is also some work available. The Division of Medical Informatics at the Linköping University in Sweden created a pilot application, for mobile telephones, to follow-up diabetes patients, using Java technology [Lind01]. Obsessive-Compulsive disorders can also be evaluated through the use of palmtop computers. With the use of PDAs, patients complete a questionnaire hourly, being reminded to do so by the device that beeps each time the questionnaire has to be completed [Herman98]. Other applications cover specific treatments, like smoking, or simple psychiatric diagnosis tools that reach a recommendation by asking the user simple questions. However, these applications miss most of the needs of the psychological therapy process. Even those that allow patient therapy and some forms of diagnosis, and are closer to SCOPE objectives, do not consider the task customization required by the therapy process, or its integration with a clinician’s annotation and analysis tool.

3. SCOPE

SCOPE is a tool-set that aims at helping and supporting psychologists and psychiatrists in their daily function. Besides supporting the therapists’ role, having in mind the direct intervention and the patient’s importance in his own therapy and diagnosis, SCOPE is directed to patients’ use as well. While the patient acts as the main source of information, the therapist needs to evaluate and analyze this same information generated. However, this is only part of the therapists’ work since he is also responsible for organizing and defining a therapy plan for the patient to follow. Within this therapy layout, the selection of suitable forms, discussions and therapy steps, are this paper’s main focuses.

SCOPE’s primary objectives are to support:

- The gathering of information, either by the patient, with the use of forms and inquiries, or by the therapist, through annotations.

- A simple and effective way to analyze, study and manipulate the different types of information gathered in the abovementioned scenarios.

- The definition of the diagnosis or therapy process, by the therapist. The creation of adequate forms to each patient, deciding the number or type of questions that should exist in a specific form, customizing the therapy for each patient and his own pathologies.

- For the patient, the possibility of filling the forms or creating activity planning tables, reducing time and effort to accomplish their therapies.
A major advantage is that, using SCOPE, the patient may pursue his therapy at any given place or time. A common use-case for SCOPE would be: after an appointment with the patient, where most of the information is gathered by the clinician, the clinician goes home and analyzes the information that was generated. Afterwards, he designs and chooses the forms for the patient at home and synchronizes his computer with the hand-held device. Then, he arrives at his office at the appointment hour and transfers the forms he created to the patient’s device. The patient might go home, and fill the form during the day. The next appointment the patient transfers the filled form to the therapist who analyzes it during the appointment or afterwards at home.

This way, both patient and therapist can use SCOPE wherever they want to; transferring the information between them each time they have an appointment, and storing it wherever it is more useful or easier to manipulate. Allowing patients to fill forms on a mobile device has the advantage of dissimulating his actions. This means that he might be at his office using his PDA, filling his forms without anyone noticing. Privacy is one of the major factors responsible for the low rates of patients that accomplish their homework.

### 3.1 Overall system architecture

The system is composed by an application designed for a desktop or TabletPC computer, where the main database is stored, and by the mobile application, where most of the analysis, form editing, form creation and homework can be done. A desktop computer in the system brings a greater amount of memory, the possibility of distributing information and in some situations extra work space. Distributing information is important if the tracking of a patient and his therapy is followed by more than one clinician at the same time. The same principle applies on sharing information from many patients within the same clinic (Figure 1).

![System Architecture](image)

As shown in the previous figure, the desktop computer can be placed at the clinician’s office or at home, depending on where she works more regularly or, preferably, in both places. The system’s main functionality is given by the mobile components shown in the architecture scheme. Each PDA has an application that gives the users, either therapist or patient, the possibility of inserting information into the system, at any given place or time. The application allows them to access this same information in the same situations or through the desktop computer, to where the information was copied during the last synchronization (Figure 1).

With the appearance of TabletPCs however, a new perspective is brought to this type of architecture. The TabletPC brings together the PDAs’ mobility and the desktop computer power, and, in some cases, the desktop workspace. This might reduce the number of devices that compose the system and discard the need for synchronization between devices. Although TabletPCs may bring these advantages, their use is not as simple as with PDAs, they are heavier, their battery doesn’t last as long, nor does their price resemble the price of a PDA. Even so, the possibility of using Tablet PCs together with PDAs or TabletPCs with desktops is also present, particularly for therapists who might appreciate the extra space while creating or editing forms. The advantage in every case is that the user might perform his activities regardless of his location.
3.2 Patient artifacts

The patients’ work relies mainly on form filling and activity planning. These actions are commonly done during appointments, with the therapist’s supervision, or prescribed for the patient to do at home or any other place, during his spare time, before the next appointment. Anxiety and depression tests are composed, in their majority, by forms with multiple choice questions or free writing tables (Figure 2 and 3). These forms are many times extensive and boring, with questions that have no relation what so ever with the patients’ symptoms.

Figure 2 and 3. Anxiety test and activity planning table.

Adding to the degree of effort that filling a form such as this might imply, the fact that patients suffering from depression have no will to work, or accomplish any action, therapy tasks become a burden, and are avoided at any cost. These factors are a major concern when developing an application that intends to provide these patients with means to pursue therapy or to diagnose themselves. Another relevant factor is the interaction capabilities of mobile devices such as PDAs, where writing is not as simple as it would be desirable. Some ways to achieve these objectives where introduced in SCOPE:

- Allowing patients to choose activities from predefined activity lists, or by introducing common activities to the system’s database. This gives the possibility of choosing, in stead of writing, personal activities when filling a table.

- Present help for each functionality. Help is a crucial aid for patients suffering from anxiety, especially when using the application without the therapist’s guidance.

- Introduce scoring each time a patient fills a form without requesting any help or choosing predefined activities. This prevents patients from filling forms in an automatic way, and, hopefully, might present patients with a challenge while filling forms.

As shown in Figure 4, the patient has the possibility of choosing the value which suits best the answer for the question presented. This prevents the need for the patient to write the date or number. With the use of a PDA, and its touch screen, the filling of a form resembles greatly the normal process, with the great benefit of choosing already stored information whenever possible (Figure 5). Another great advantage is that the user may navigate backwards while filling a form, changing the answers as many times as desired, during its completion. After the form is complete, the patient or the therapist may review the stored form as well.

Figure 4, 5 and 6. Snapshots of SCOPE’s PDA application – Patient options.
Using SCOPE-Forms, patients can store their thoughts whenever they occur and fill forms whenever they have time, patience and feel comfortable, without having the pressure of being in a hospital, clinic or at the therapist’s office (Figure 6). Also, by reducing the time spent filling forms or taking notes, the users have more time to talk and discuss, directing their attention to the therapy and diagnosis, instead of directing it towards the storing and writing of information, making the most out of the time spent during consultations.

3.3 Therapist’s work

Within the filed of psychology and psychiatry, there are many different areas that involve different types of therapy methods. With anxiety and depression, clinicians have to, besides doing their usual work as therapists, counseling and talking with the patients, create and select specific artifacts for each patient. Afterwards they have also the, sometimes complicated, task of analyzing the great amount of information that is generated during consultations, either by their annotations or by the patient, whilst filling the artifacts previously created. For all these reasons, therapists usually have a tight schedule and do not have much time to waste learning how to use or operate new devices and software, and must also concentrate in the patient and on his words during a consultation. Therefore, they demand a simple program that allows doing the most common tasks they usually do, and at the same time doesn’t restrain their work and annotation process. The application must support the clinician’s work, but never replace him or disturbed him in his function.

To accomplish these objectives, the therapist interface allows the therapist to conceive and decide which information is relevant to a specific patient. The method to introduce this functionality was by studying the documents used normally in this process and simulating their use in a digital form. The main idea is to provide this possibility, but to provide also a manner for the therapist to add or remove certain elements of the forms, according to each patient. If a patient has sleeping disorders but doesn’t smoke, it is useless to have as a part of the form for him to fill, a field where he must insert how many cigarettes he has smoked during the day. However, the content of the patient’s dreams might be of great relevance and should be included in such forms. This dynamicity can be achieved by having predefined forms according to the major and most common pathologies, but leaving maneuver space for the therapist to include fields that are specific for one patient only. Also, the option, for the therapist to decide what relevance each question should have in a specific form is also available. This way, the form is adapted not only to the patient but also to the stage of the therapy in question. Figure 7 shows the form creation option for the PDA application. The therapist chooses a name for the form; selects the date and creates the form by adding the desired questions, stored in the application question database (Figure 8).

Since PDAs have limited memory, by dividing the application between two devices, only the relevant information for a specific day or patient needs to be carried in the mobile device. Finally, using SCOPE, the therapist may view form results through charts or tables, and doesn’t need to calculate the final test values manually. Here, non-mobile computers have a relevant role once again. Since they have larger working space, information visualization is facilitated.
3.4 Tools design and implementation

Before SCOPE was implemented, data was gathered and studies were conducted. Interviews with psychologists were made, vast lists of documents about cognitive behavioral therapy were studied and the common artifacts, such as forms and tests, were analyzed in order to create a solid and useful application. After the major part of the analysis work was completed, the system was designed, the results of this process where presented and explained to psychologists, a low-fidelity prototype was conceived.

A few usability and acceptability tests where also conducted together with professionals within the psychology area, using the low-fidelity prototype. This prototype was SCOPE’s starting point. The usability tests revealed that the interface was simple and clear, and the users could accomplish their objectives quickly and without effort. Unfortunately, no patients used the prototype and no patients where interviewed during the design process. The main reason for this limitation involves ethical and privacy issues. However, therapists, who are responsible for assigning and defining patients’ homework and therapy plans, mentioned that this prototype met most of the patients’ demands regarding the effort while getting therapy.

The following step was the implementation of the described prototype using the devices that compose the system. Both applications, for desktop computers and PDAs where created using Java language. This bring platform portability to the applications, since they can run on PalmOS PDAs, Pocket PCs, mobile phones, and any operating system or device that has a Java Virtual Machine installed.

4. CONCLUSION

The existing work in computer supported medical diagnosis is vast and evolving rapidly in the last few years. Tools that work in desktop computers, specific medical hardware and even on mobile devices are available and have great features and indisputable value for the medical community as well as for the patients that are directly affected by their use.

However, the specific process of psychological diagnosis and therapy works differently from the majority of medicine. Besides the long term factor, time wise, the direct intervention of the patient in his therapy and diagnosis, without disregarding the importance of the therapist involved in the process, is a major factor that requires special attention and specific measures. Taking this in consideration, existing technology is underused and may have a decisive role in the near future, allowing new forms of treatment with assured results and facilitating either the process of therapy for the patient and the diagnosis by the therapist.

The application presented in this article introduces the use of different tools, with different advantages, that cover the entire scope of the therapy/diagnosis process, offering, at the same time, the necessary power to customize the process to the needs of each patient or clinician. The work done so far had the close collaboration of specialists in psychology, specifically in the treatment and diagnosis of anxiety and depression, providing useful input and validating it in many ways.

5. FUTURE WORK

The future work within the context of this project relies mainly on continuing the evaluation of the existing prototype and increasing the number and quality of its features. Usability tests and further research, in collaboration with clinicians and researchers on the psychology area, are already drawn in order to validate the current and future prototypes, and options that will follow the already taken, and future paths.

Regarding implementation and communication aspects, a more accurate and profound study on security issues is already being taken as well as wireless communication options, that will allow a better information flow between therapists and patients.

Other functionalities that deserve our interest are the usage of other interaction forms, such as voice commands, the introduction of different media types such as images, videos with certain procedures; audio files with therapeutic sounds; the possibility of presenting cognitive maps representing the steps of a diagnosis or therapy process; alarms that alert the patient or the therapist of a certain situation, among others. Some researches involving the automatic monitoring of different symptoms, such as heartbeat rates, temperature, etc, may be included in our plans.
Finally, as in the psychology and psychiatry, SCOPE may be transported into other fields of medicine, establishing a parallel application of the technology and architecture, in areas where the patient is the main input of information either for diagnosis or therapy. Following the know-how gathered and some of the steps taken within this project, more studies will be conducted, using as an advantage the experience in developing software for medical purposes, which is can be as mobile as the patients themselves.

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