

Supporting Psychological Therapy with PDAs

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Abstract

In this article we present an investigation where the main objective is the implementation of tools that support the diagnosis and therapy process in psychological areas. The interaction issues inherent to this type of process are discussed, and solutions for those issues are introduced, as well as for the management and gathering of data concerning the same process, taking advantage of the emerging mobile technologies. New forms of analyzing the results of the diagnosis process, annotation during consultations and creation of the genres used in therapy are also revealed.

This article focuses also on the technology necessary for a system such as this and on an overview of what has been done so far in this field of work.

Keywords

Psychological diagnosis, self-therapy, PDAs, TabletPCs, patient/clinician interaction.

1. INTRODUCTION

In the psychological/psychiatric field, consultations generally occur in the clinician's office, where patients speak about problems and situations, having a conversation guided by the physician. The therapy builds on the conversation itself and the diagnosis emerges promptly or later on from the information exchanged. In the process the clinician often registers data and takes notes (descriptive or interpretative) to be used in deferred analysis. Part of the work, then, is done latter at the office, at home or traveling, without the presence of the patient.

For the particular case of psychological therapy, the patient, most of the times, is also given tasks to accomplish during his daily activities. Those tasks ought to be registered by the patient, along with other reports such as states of mind, thoughts and hours of sleep, among others. Again, tasks and writing are part of the therapy itself. The resulting data complements that gathered in the consultation settings and, of course, is of utmost importance for the diagnosis held by the therapist in the abovementioned scenarios. This patient-centered approach introduces yet another information exchange. In fact, the therapist needs to decide and communicate to the patient the tasks and registers that are relevant and that should be filled and accomplished.

Within the previous scenarios information must flow among actors (patients and clinicians) that move through different settings (e.g. office with and without patient, home; patients' daily work-setting). Data is gathered and registered by both performers and stored, refined,

annotated and analyzed by the therapist, either in face-to-face consultations or separately. This last actor is also responsible by the organization of tasks, forms and its fields specifically for each patient (or group). The process, particularly the data gathering, is mainly supported by paper. This causes coding and organization problems, obstructs co-referencing and annotation and most of all wastes clinician time.

The use of computer support can overcome some of these difficulties. Currently, software is available and used for data gathering, analysis, visualization, etc. [Garrard00]. Specific psychiatric and psychological software allow patients to follow some methods of therapy, including data gathering. Diagnosis programs are also available using statistical, and artificial intelligence and virtual reality approaches [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]. Furthermore, desktop based 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, new applications have emerged. They provide the required mobility allowing patients to use them during daily tasks. Applications exist to measure disease severity and indicate drugs dosage. Therapists and physicians use hand-held devices to get information about drugs or pathologies, or make calculations during patient visits. However, existing applications cover only partial steps of the diagnosis process and no support is

given to the required data flow and refinement of the psychological therapeutic procedures. Integration among actors and settings is hardly offered and clinician adjustment of patient tasks and forms is not even considered. On the consultation strand the device itself becomes clumsy [Barret04], indicating the quest for alternative solutions like Tablet PCs and more ethnographic applications.

This paper presents the design of tools that provide support for the processes of psychological therapy, based on the integration of desktop computers, PDAs and Tablet PCs. The work has been carried on in the context of the project SCOPE (Supporting Cognition Outlines on Psychological Evaluation) and is currently focusing on the data gathering aspects, both for the patient and the therapist. Previous work has been done in the integration of standard psychiatric classifications (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 SCOPE is presented emphasizing the overall architectural approach and the data gathering aspects on the several available settings. 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). 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. 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. It uses HTML as its main language and wireless capabilities in order to send and receive the data [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 to follow-up diabetes patients, using Java technology. This application uses mobile telephones as a mean of data input to the system, although it is planned to expand this functionality to other mobile devices [Lind01]. Other applications cover specific treatments, like smoking, or simple psychiatric diagnosis tools that reach a recommendation by asking the user simple questions. A good example of a psychological treatment tool is Mood Monitor [Monitor 04]. The tool, running on a desktop computer, allows the patient to store his thoughts and state of mind, not only to provide this information for the therapist, but as a form of therapy itself.

However, these applications miss most of the needs of psychological therapy process. Even Mood Monitor, although closer to SCOPE objectives, does not consider the task customization required by the therapy process, or its integration with a clinician's annotation and analysis tool. Finally its desktop approach is inadequate to the situations of registry inherent to some patients' tasks.

3. SCOPE

SCOPE aims at helping and supporting psychologists and psychiatrists in their daily function. Since the patient has a major role in the process of diagnosis, SCOPE is directed to patients as well. The role of the therapist is to analyze the data given by the patient, and to determine a way to help or guide him in his own process of self therapy.

This can be done by providing support for the most common tasks in this process. Among these tasks, the most important are:

- At the office, during a consultation, the gathering of the patient's information, by both patient and clinician.
- The process of annotation that the clinician does during the consultation, creating notes and data about the consultation or the patient.
- The information gathered in such events, will be studied, and manipulated by the clinician

independently of his whereabouts, at home, at the office or even traveling between them.

- After the data is analyzed, the clinician needs to achieve a diagnosis and define a therapy process for the patient to follow. The definition of a therapy is composed by a set of steps that the patient needs to take. These steps are, in most cases, the filling of forms (Figure 1) with the objective of self-diagnosis and self-therapy.
- The clinician needs, besides deciding the therapy for the patient to follow, to create forms specifically for each patient, adapting the standard forms to the patient's needs.
- The filling of the forms, by the patient, that the clinician has prescribed. This may also be done in any location.

Doente	Terapeuta	Avaliação	Data
Este questionário é constituído por vários grupos de afirmações. Sublinhe a resposta que melhor <u>descreva a forma como hoje se sente.</u>			
A-0. Não me sinto triste.			
1. Ando neura ou triste.			
2. Sinto-me "neura" ou triste todo o tempo e não consigo evitá-lo.			
2. Estou tão triste ou infeliz que se torna penoso para mim.			
3. Sinto-me tão triste ou infeliz que não consigo mais suportar.			
d-0. Não estou demasiado pessimista, nem me sinto desencorajada em relação ao futuro.			
1. Sinto-me com medo do futuro.			

Figure 1: Multiple choices forms used for psychological diagnosis and therapy.

A common use case would be: after the first appointment, where most of the information is gathered by the clinician, he goes home and analyzes the information provided by the patient, and the information that he created himself during the consultation. Afterwards, he designs or chooses the forms for the patient at home and synchronizes his computer with the mobile device. Then, he arrives at his office at the appointment hour and transfers the form to his patient. 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 consultation or at home.

3.1 Overall system architecture

The system is constituted by an application designed for a desktop computer, where the main data-base is stored, and where most of the analysis and home work can be done. The advantage of including a desktop computer in the system, besides the amount of memory and working space is the possibility of distributing information among clinicians.

The centralized data-base permits to distribute the same information through many PDAs giving the system great scalability (Figure 2). The security or privacy issues can be solved in various ways, for example by including a login and password protecting the information of certain patients or clinicians.

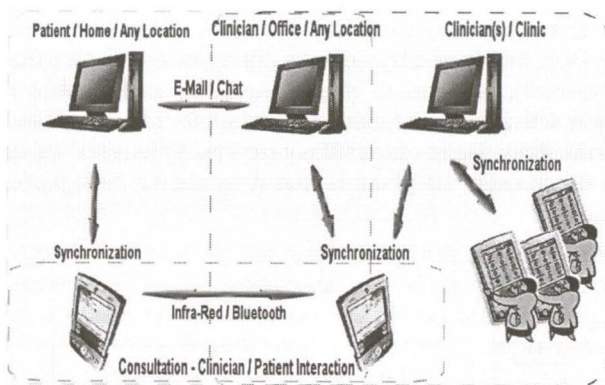


Figure 2: System Architecture.

The synchronicity itself is a mechanism of security, whereas the information synchronized to each clinician is the information that he is allowed to access. The main functionality of the system, will be given by the rest of the architecture, where the mobile devices are the complementing part. Each PDA will have an interface that gives the user, patient or clinician, the ability to insert or remove data, fill forms and access information that is originated both in the mobile device itself, or in the desktop computer from where it was copied during the last synchronization (Figure 2).

However, the appearance of Tablet PCs brings a new perspective to this type of architecture. With a Tablet PC, both the PDA mobility and the PC power are brought together, reducing the number of devices involved in this case study. Although removing the need to synchronize or use to different platforms is an advantage, the size of a Tablet PC is quite different from the size of a PDA. Although this may seem a disadvantage for some users, particularly patients, the larger size of a TabletPC can be useful for the therapist. The great advantage in each case is that all these functionalities can be accessed wherever the user is.

4. PATIENT ARTIFACTS

Due to the type of persons who will be using the application, many aspects must be considered in order to enhance the interaction and provide a useful application for them.

Most of the attention regarding interaction aspects is directed to the patient's side, since they are the users whose symptoms may interfere with the interaction.

The main reasons for a patient to use such a system are the need of depression or anxiety self-diagnosis and therapy. With this in mind, the complexity of the issues inherent to the interface design is quite larger than it is normally. Depression patients tend to have no will to do what so ever. They deny having pleasure in accomplishing any tasks and often refuse to take any action, even if prescribed by the therapist. Besides their condition, the forms that they need to fill are, many times, extensive and boring. Most of them are multiple choices (Figure 1), however, there are some that the patient has liberty to write whatever he wishes to, synthesizing his thoughts or activities in short sentences.

Planning his activities in advance is also a way of therapy, and is usually done by filling tables such as the one shown in Figure 3. The patient is induced to write a short activity for each hour of the day, for all of the days of the week. He needs to fill not only the activity he plans to do, but also the pleasure that such activity brought to him.

Therefore, the filling of forms or activity plans by this type of patients is rare and must be, in some way, appealing to the patient in order to have some results.

DIA DA SEMANA HORAS	ATIVIDADES		ATIVIDADES		ATIVIDADES
8-9		P _a M _a		P _a M _a	P _a M _a
9-10		P _a M _a		P _a M _a	P _a M _a
10-11		P _a M _a		P _a M _a	P _a M _a

Figure 3: Free writing form: Weekly Activity Planning Table (Short sentences and numeric values).

Considerations like these have to be taken and many ideas are being studied. Forms with limited help possibilities and with points to who completes them without any help are one of the possible solutions to motivate the patient. The possibility of choosing help will be available in most of the options, giving the patient the possibility to choose in which questions he needs aid (Figure 4).

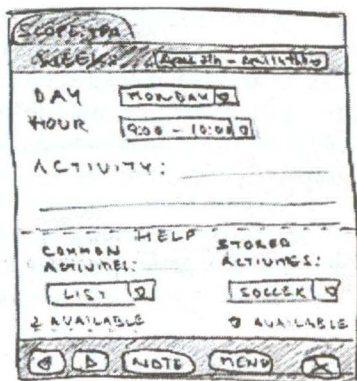


Figure 4: PDA interface sketch for patient application (Weekly Activity Planning Table).

Having in mind, once again, the limitations of mobile devices such as PDAs, and the role that they have in this system, special attentions have to be taken, according as well to the type of users. Patients suffering from anxiety or even depression cannot be faced with a stressful application that requires a great deal of attention or involvement, and have to be given tips or be aided in certain tasks, as mentioned before. The amount of time spent with the interaction has to be minimal as well. The process of interaction has to be as simple as possible so that there is no stress involved in it.

Although help is an option, it is wise to introduce a limit to the amount of help so that the patient does not fill any of the forms without paying attention or mechanizing the process. This has to be done without limiting the patient's freedom. The form needs to be understood by the patients as a challenge or a game, so that the process of filling them is appealing and not an obligation or a boring and demanding task. To accomplish this, providing the

patient with results of his actions towards the software, by giving him points according to his engagement is a possibility.

Other solution that will allow the patient to minimize the amount of time while using the software is, besides using the applications databases, regarding states of mind, common thoughts and activities, as well as other types of information that is needed, is the possibility of storing the patients own common activities or daily tasks. Doing so, the patient does not have to write them every time he uses the software, providing the possibility of choosing them from a list of stored information. This is important not only due to the type of patients but as well to the type of device that is used, and the interaction type that is allowed by it (e.g. PDA with touch screen). As shown in Figure 4, the patient may choose from a list, the value that better represents his choice for a certain question. After responding to all of the questions shown, a new set is presented. When the form ends, results are presented to the patient. These results will be afterwards analyzed by the clinician.

Providing the possibility of choosing, by the patient or by the clinician, a number of options from a list, in order to fill a form or an activity table, the number of input actions is greatly reduced (Figure 4). The user needs to tap the screen only a few times to fill a document that in its paper form takes more time and effort.

Using SCOPE, the patient can go home, synchronize the form given to him by the clinician to his desktop computer, and fill it easily. This will allow the patient to maintain a data-base of the forms he has filled and of the information of previous treatments, on his desktop computer, keeping track of his progress and evolution. Not only is this important in his therapy process, but it will bring the patient the possibility to work without the mobile limitations that the PDA might bring, and in his own environment without the pressure of being in a clinic, hospital or even the clinician's office.

All these details have in mind the location and the interaction that exists between the users and the devices, but also between the users themselves. By reducing the time of interaction with the devices, the users have more time to talk and discuss, directing their attention to the therapy and diagnosis.

5. THERAPIST WORK

As in the patient's application, the type of users has to be considered. Clinicians do not have much time to waste learning how to use or operate the device and the software. They must concentrate in the patient and his words during a consultation, and therefore demand a simple program that allows doing the most common tasks that they usually do, and at the same time doesn't restrain their work and annotation process. The application should support the clinician's work, but not replace the clinician himself or disturb him in its function.

To accomplish these objectives, SCOPE is constituted by an interface that allows the therapist to conceive and

decide which information is relevant to a specific patient. The method to do so is 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 (Figure 5).

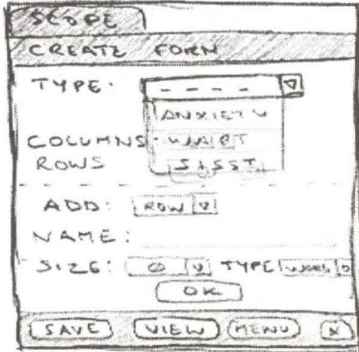


Figure 5: PDA interface sketches for therapist (Creation or customization of forms and tables).

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 is of great relevance. His job and working episodes, that aren't usually a part of any form, and that should be a part of the patient's evaluation are essential. 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. SCOPE provides an easy way to create these specific tables and forms even in the mobile device application. The therapist only needs to decide the fields and size of each form, creating and previewing it, before transferring it to the patient (Figure 5).

As in the patient application, the possibility of choosing stored information, from predefined lists, brings some benefits. The advantages of having stored by the application, a number of usual activities, pathologies, symptoms, and of common forms and inquiries, are many and provide not only a great amount of time saved, but also less effort to control and determine a patient's therapy (Figure 5).

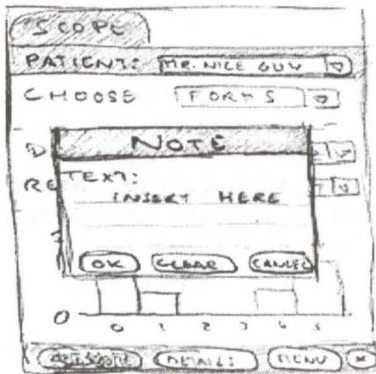


Figure 6: PDA interface sketch for therapist application (Annotation option – add notes to patient forms or results).

Due to the type of interaction that exists in a normal consultation, the annotation process is crucial for the therapist to memorize details from the patient's attitudes or expressions while talking or even filling a form. In each step of the diagnosis process, the therapist has the possibility of taking notes, and storing them together with the rest of the information concerning the consultation or the patient's results, as seen in Figure 6.

With conscience on the limitations of input and screen space inherent to mobile devices such as PDAs, the clinician's application is divided in two interfaces. The main interface, for the desktop computer, where most of the maintenance of the data and creation of forms can be done or analyzed, and the mobile interface. This last one is where the therapist can communicate directly with the patient, allowing him to insert data through the therapist's PDA or through the patient's own PDA. This can be done due to the wireless capabilities of most of the PDAs used today.

Another advantage for the clinician, by dividing the application in two platforms is the overcoming of the reduced amount of memory of mobile devices. Using two platforms and synchronicity between them, the clinician needs to carry on his mobile device information of the patients he's going to attend on that day, leaving the main data-base at home or at his office desktop computer. This way, he may compare cases, patient's symptoms, etc, at home or at his office. This may aid him in the diagnosis process, as well as in the definition of convenient forms and therapy schedules or prescriptions. The clinician continues his work at home without the mobile device's limitations.

A prototype for the clinician's application has been implemented. It follows closely the directions given by DSM-IV. The prototype allows the therapist to store information about his patients, their symptoms, their condition and their current and previous diagnosis. It works in both platforms. The desktop computer interface offers the same functionality as the PDA interface, with the difference of the working space and the amount of information presented per screen. Both allow the insertion and removal of data and search for particular cases or patients. For each patient, the clinician is able to update or create new diagnosis, add symptoms to the patient's condition and maintain a personal data-base of information regarding diseases and common symptoms.

5.1 Visual Data Mining

Thanks to the duality of platforms, and to the new capabilities of mobile devices, the treatment of data resulting from the many forms and inquiries may be handled and presented in different forms. This gives the clinician the ability to analyze the data and information with great ease. Instead of reading paper forms filled by the patient, that sometimes contain thousands of numeric values, the application will introduce the possibility of visualizing the information in a simple chart (Figure 6) or in other ways that are suitable to the type of information that is generated.

Having a desktop PC as part of the architecture allows also the accomplishing of some tasks that are more demanding and need greater viewing space than the available in a PDA. This is noticeable mostly while visualizing great amounts of data from a patient. This way, the clinician may analyze the data, find some results, patterns or similar cases, evaluate the information and choose a form of presentation that may be suitable to present the data to the patient, and show him his progress or symptoms, solutions and most common causes.

6. FUTURE WORK

The next stage of this project is to continue the implementation of the ideas and concepts presented in this article. The following action will be the essential evaluation of the resulting prototypes, through usability tests and research in collaboration with clinicians of the psychological area.

On future analysis, we will try to introduce new functionalities. Functionalities that will allow the usage of voice as a form of interaction with the application, as well as new forms of presenting cognitive maps representing the steps of a diagnosis or therapy process. These features will be helpful in situations of stress and emergency. This brings, in both cases, an easier understanding of the disease and process of cure by the patient, improving the communication and relationship between therapist and patient.

Some researches involving the automatic monitoring of different symptoms are part of the plans, including the appearance of alarms and alerts to the patient, or the clinician responsible for the patient in question.

The inclusion of media, such as videos of procedures or step-by-step diagrams of stress reducing actions is another possibility that may bring a new value to SCOPE in its aiding task.

As in psychology and psychiatry, the parallel of this application may be established in other fields of medicine, where the information provided by the patient is the main input within the process of diagnosis and future therapy. Following the steps and know-how gathered in this project, as an advantage on developing applications for mobile devices, which adapt perfectly to the clinical/medical context, more studies will be conducted.

7. DISCUSSION

The existing work in computer supported medical diagnosis has evolved a lot in the last few years. Many tools, designed for desktop computers or specific medical hardware, are available and have great features. However, the process of psychological diagnosis works differently from the majority of medicine. Here the patient diagnosis himself, and sometimes, treats himself, with the guidance and counseling of the therapist.

From this point of view, the technology available is much underused. The need for applications as the one presented

in this article is great. Taking advantage of the potentialities of mobile devices, and, at the same time, of the indispensable role of the user in the process of diagnosis and therapy is both the main goal and advantage.

In this context, analysis and contextual design is being concluded. This has been done in collaboration with clinicians in order to overcome most of the problems that exist in this field, validating at the same time what is being conceived.

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