

# MOBILE DEVICES FOR ACTIVE PSYCHOTHERAPY

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## ABSTRACT

This paper presents a set of tools that support the construction of personalized therapy applications for psychotherapy. One provides patients the required access to psychotherapy artifacts, enabling an adequate and tailored aid and motivation for fulfillment of common therapy tasks. Another offers therapists the ability to define and refine the artifacts, in order to present, help and react to the patient according to his/her specific needs and therapy status. Two other tools allow the analysis and annotation of the aforementioned artifacts. The tools were designed for several platforms including fixed and mobile devices. This paper focuses on those that run on a PDA base.

## KEYWORDS

Psychotherapy, Active Applications, Building UI, Usability, PDA.

## 1. INTRODUCTION

Cognitive Behavioral Therapy (CBT) is a common form of therapy used in the treatment of anxiety and depression. This constructivist therapy relies on the therapists' ability to understand and induce the patient to gain awareness of problems and distorted cognitions and replace them with adequate ones (Mahoney, 2003). The therapist's work includes the session activities (e.g. conversation and annotation), analysis and definition of patient tasks. On the patient's side, tasks involve the filling of various forms, as therapy, inside or outside sessions. The resulting data contributes to the information that the therapist uses to diagnose and definite therapy procedures, either on or between sessions. The therapist tasks can be summarized as gathering and reasoning on patient's data; defining forms, questionnaires and suitable guidelines for each patient's specific needs; leading patients to perform tasks and register them; and analyze those registers and gathered data.

Currently, therapy usually recurs to paper-based artifact (forms ...) that obstruct the therapist's work. For example, analysis requires previous transcription and cross-referencing and structured annotations are hard to accomplish. On the other hand, the passiveness of paper prevents the therapist from providing incentives and rewards, outside sessions, that could allow patients to pursue therapies in a more efficient way. These and other problems are recurrent throughout the entire process of therapy. Recently, some work emerged on the introduction of technology on the process (Grasso, 2004; Newman, 2004). However, they tend to provide rigid solutions for particular disorders, without therapist control and patient specificity.

In this paper, we present several prototypes which take advantage of emerging mobile technologies. They were designed within the SCOPE project, involving computer engineers and psychologists, and aim to be used during therapy sessions or outside, by patients and therapists. Independently or complementing each other, the tools support the whole CBT psychotherapy process, emphasizing the therapist's role in therapy adjustment and cooperation with patients. All components are available in multiple platforms, although this article focuses on PDAs. The work described focuses one of SCOPE's contributions: the ability to create and refine psychotherapy forms that actively react to the patients' usage behavior.

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## 2. RELATED WORK

Specific software, directed to the psychiatric and psychological use, allows patients to follow particular methods of therapy and even diagnosis (Proudfoot, 2004). Excluding patient solutions that, relying on expedite approaches of diagnosis, have revealed strong human rejection (Das, 2002), studies have demonstrated the effectiveness of the computer role in the process of anxiety and depression therapy (Gega et al, 2004; Herman & Koran, 1998; Otto et al., 2000). However, most of these systems provide either isolated therapist solutions or isolated patient solutions with no therapist control. Moreover, mostly rely on desktop approaches, which are incompatible with most of the real scenarios (Luff & Heath, 1998).

More recently, handheld and overall mobile devices, such as PDAs or TabletPCs, are available, and new applications have appeared. However, they only cover partial steps of the therapy process and do not allow the customization of the patients' tasks or artifacts. The majority is rather simple and allows simple measurements of the severity of pathologies, indicates drug dosage or provides therapists with reference information about diseases or drugs (Grasso, 2004). On the patients' side, some self-control or relaxation procedures are available on hand-held devices (Przeworski & Newman, 2004). Patients carry palmtops at all times and use applications intensively during the initial stages of therapy. But once again, these applications lack the possibility of adapting each step of the procedure to therapists' choices or patients' specific needs.

## 3. SCOPE

SCOPE aims at providing computational support to psychological therapy through all the steps of the process. It ranges from (1) analysis, diagnosis and prescription tools, which the therapist uses without the patients' company; to (2) patients' homework registering tools, used without the therapist presence; through (3) a set of tools that they use in co-presence, and that include all of the above activities. The characteristics of the face-to-face setting tools differ from those used individually, as they should not interfere with the collaborative process.

### **Individual Scenarios:**

A "fixed" therapist scenario is considered, which covers deep analysis of patient data, including the examination of the patient's full history and cross patient studies. Here, SCOPE's main role is to allow therapists to manage large amounts of information, facilitating data gathering and, most of all, providing mechanisms to annotate, correlate data and discover patterns that help the diagnosis process. Used techniques range from semi-automatic ones, based on pattern discovery, to exploratory ones, with particular emphasis on cognitive mapping approaches. The mobile therapist scenario encompasses the activities of the previous one, usually on a lighter perspective, depending on the supporting device. SCOPE targets laptops, but specially TabletPCs and PDAs. These scenarios include tools for prescription that provide to the therapist the ability to easily create and customize questionnaires, thought and activity registration artifacts and to define the rewarding criteria and the messages that will encourage the patient, in the therapist's absence.

On the patient's side, these scenarios basically address the registering activities of the patient. SCOPE's role is to facilitate data registering and to compensate for the absence of the therapist, as much as possible. SCOPE patient tools provide guidelines, alerts and rewards as and when defined by the therapist. As in the therapist counterpart, SCOPE considers a desktop based approach (fixed setting) and a mobile one. The latter, though, is mainly targeted to PDAs, as it is less likely that the patients have access to a TabletPC.

### **Face-to-face Scenarios:**

The face-to-face scenarios cover all the activities of the previous ones, for therapist and patient. However, SCOPE applications, inherited from the mobile settings, are by default stripped of all features that may distract users from the main communication stream of consultation, i.e. therapist-patient conversation. On the patient side, guidelines, rewards and notifications are disabled. On the therapist side, annotations are focused on patients' data and prescription artifacts are usually adjusted and not created. Three basic scenarios are envisaged, that in fact can coexist on a therapy session, or as part of an evolutionary process:

- **Shared scenario** - the therapist works together with the patient on the same device, filling the forms and questionnaires together. This situation is useful when the patient suffers from depression and

each action is accomplished with the intervention/collaboration of the therapist. The human aspect is, of course, determinant. A TabletPC better supports this scenario.

- **Decoupled scenario** - each participant has his own device. Therapist-defined artifacts and patient-filled data are exchanged as needed. The therapist is free to annotate patients' data and make light analysis without the patients' scrutiny. The patient is able to fill records as requested by the therapist in an environment as close as possible to the mobile one. Both can use a PDA or a TabletPC.
- **Tightly-coupled scenario** - each participant has his own device, but a tight communication channel exists between both (wi-fi connections). Apart from the psycho-social aspects of the shared scenario, this one can gather the advantages of the previous two. The therapist can monitor and even control the patient activities, and still reserve his own private space for annotations and general analysis. Clearly, the most adequate device for the therapist is a TabletPC.

## 4. SCOPE TOOLS

This section presents a more detailed description of the tools developed for PDAs, with emphasis on the artifact construction tool. Variants are available for other platforms.

### **ScoNOTES – Annotating**

Using ScoNOTES the therapist is able to gather information and comment on previously gathered one. From the working patient record, the therapist selects ScoNOTES and simply writes text. This necessarily simple process is particularly adequate for consultation settings. On an off-session setting, ScoNOTES enables the (re)organization of annotations and the creation of more detailed and structured ones. These may provide a source of meta-information for every sort of data or artifact that exists in the therapy process. Keywords can be included, themes are reinforced and text entry fields are preferably character-based. New annotations are associated with patients as well, but can be further correlated with every other artifact.

### **ScoFORMS – Composing Artifacts**

ScoFORMS includes three flavors of the same tool: ScoQUE, ScoTIVITY and ScoTHOUGHTS. ScoQUE allows therapists to fetch, change or create questions, and build questionnaires adequate to specific patients and pathologies. A pool of standard questions is always available, as well as all those previously created by the therapist. Different navigation arrangements (e.g. theme, severity) and direct keyword search are supported for question selection. The sequence of questions, or its repetition, is decided when constructing a questionnaire. Standard and stereotyped questionnaires are kept and available for reuse.

Each question has associated an answering type (e.g. keyword, text), a set of help topics and a default interaction element (e.g. gauge, text-box). For each question on a particular questionnaire, the therapist is allowed to change the interaction element or combine it with alternative (compatible) ones. For example, a drop-box instead of a free-text entry or in conjunction with it, as a hint for the patient, is a common choice. The presence or absence of one or more help topics can be adjusted, as well as the total amount of hints and help topics available for a questionnaire. Overall, the therapist is able to customize the questionnaire and the questionnaire's user interface, adapting it to the patient's capabilities.

Finally, the therapist may also decide if and at what points the patient should get synopsis, score feedback, warnings, incentive words or congratulations. The way these are presented and combined with the patient answers is also configurable. For example, after a task completion, an incentive may appear as a sentence, a graphic depicting the patient's evolution or a text composed with the patient's answer.

ScoTIVITY and ScoTHOUGHTS allow the creation of artifacts for registering activities and activity plans and thoughts. In general, these are a subset of ScoQUE, as the units (questions) are usually centered on text-entries, within a simple pre-defined structure (e.g. a classification of thought plus a free-text entry). Nonetheless, ScoTIVITY introduces alarms as an activity reminder or planner, and ScoTHOUGHTS assumes units as templates, i.e. a thoughts-form is often a single unit that will be instantiated every time the patient registers a thought. Therapists may also configure help, reports and rewards.

### **ScoTHERAPY -- The Therapy Artifact**

ScoTHERAPY is the tool that materializes the artifacts to be filled by the patients. Its primary goal is to provide a way to quickly answer questionnaires, register thoughts and activities, or plan activities, as part of a

therapeutic process. Overall, it is driven by a simple, easy to use interface that can provide access to aids, such as supportive hints, choice lists, help, reporting and rewarding. These aids can be disabled on face-to-face setting scenarios, allowing the therapist to actively intervene on the task fulfillment, or enabled on the patient individual scenarios. On the latter, it is up to the therapist to define when, where and what kind of aids are available. For example, after registering three positive thoughts the patient may be presented with a congratulations message, or, at a later therapy stage, the patient may only have access to hint choice-lists on five of the most complex tasks. The artifacts handled by ScoTHERAPY and the data, resulting from its fulfillment are exchanged between therapist and patient devices as needed. Currently the transfer is done using Bluetooth and PalmOS synchronization tools, through a PC or TabletPC.

### **ScopALYSIS -- Analysis**

ScopALYSIS provides a set of components for the analysis of patient data. Its capabilities range from simple scoring analysis on a questionnaire, usually applied during consultation, to more complex ones, more adequate to after sessions. Rearranging the scoring criteria (e.g. based on questions relevance) or determining score evolution over multiple questionnaires are common usage examples. On thought and activity records ScopALYSIS is able to find recurrent themes and keywords or determine word frequency. Its corpus can also be extended to annotations, thus building on meta-information introduced by the therapist. ScopALYSIS is articulated with all the remaining SCOPE tools.

## **5. SYSTEM DESIGN AND EVALUATION**

This project followed a contextual design approach (Beyer & Holtzblatt, 1998). During early stage design, several interviews and meetings with different psychologists were made. Documentation and videos describing the therapy and showing real therapy examples were thoroughly studied. Information flows, activities, artifacts, physical settings and cultural issues along with major breaks (complaints, etc.) were identified, leading to the construction of low-fidelity prototypes.

### **Early Stage Evaluation**

Low-fidelity prototype of both platforms were evaluated under a Wizard of Oz approach. Three psychologists, two of them with clinical know-how and 10 other individuals with different education backgrounds, assessed the prototypes. The first group provided a more thorough, domain oriented, evaluation. The latter group was focused on sequence and screen arrangements, as well as on the use of such artifacts during interview conversations.

Psychologists specially welcomed the ability to exchange forms with the patient in a digital format, still maintaining the facility to share and collaborate in the filling process. The customization of forms was particularly well received. The psychologists suggested some of rearrangements ScoTHERAPY already applied. The requirement of customizing the patient reward subsystem emerged from this design phase. The non-expert group, particularly applied to the patients' tools, triggered the adjustment of some user interface components. Multiple choice questionnaires were very easy to fill whereas free-text forms raised some usage concerns. However, when confronted with the paper original version, users clearly chose the PDA prototypes. In simulated therapy sessions the prototypes were not found more intrusive than paper.

### **Prototype Evaluation**

The software prototypes were tested with the same group of users, plus computer engineering students. The main focus of this last group was directed to interaction and design problems, evaluating qualitatively the ideas and concepts that aim to minimize effort during annotation, artifact building, etc. ScoTHERAPY was actually used during a couple of days to perform specific form filling tasks. Overall the three groups found the software prototypes satisfactory. Although the problems found in early stage evaluation were solved, new ones were found, mainly due to technological limitations (e.g. limited Java API). Even so, most of these problems have already been solved, and improvements are being made at each step of the process.

Apart from the original expert group, another experienced clinical psychotherapist evaluated the improved versions of the software prototypes. He contributed with suggestions of new evolutions and recent therapy practices that can extend SCOPE's coverage. The introduction of a positive/negative classifying field on thought records emerged from this evaluation.

## 6. CONCLUSIONS AND FUTURE WORK

Psychotherapy is a promising area for technology application, especially for its hand-held and collaborative aspects. However, even if some applications exist, they are rigid, focused only on the therapy itself and not considering the actors specificities, not integrated and often missing the context it should serve. The work described here aims to overcome these difficulties and support psychotherapy through all the process. The paper focuses on the PDA versions of a set of components that cover annotation, prescription, therapy and analysis tasks. The central prescription component provides to the therapist the ability to define the artifacts used by patients and the characteristics of his "substitute" as a patient aid, i.e., the therapist is able to define the contents and the look and feel of the forms to be filled by the patient and to establish what, when and how the aids will be available or presented to the patient. Overall the tools cover the activities of the therapeutic process, wherever they take place. This ubiquity and the ability given to the therapist to create and adjust artifacts for psychotherapy are the major contributions of the SCOPE project.

The work done so far has been validated, in its various stages, by a strict collaboration with several professionals and researchers in psychotherapy. They have consistently provided useful input and opinions, guaranteeing the developed prototypes' value, and providing coherent directions for evolution.

New functionalities are planned to be included in SCOPE. Some examples, such as voice interaction with the mobile device, the use of different media like videos or audio files explaining certain procedures; alarms that alert patients or even their therapists of specific situations; are being studied. A new version of SCOPE, that encompasses the scenarios previously described, using real-time message passing and shared/private spaces will also be developed.

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