In-Vivo Therapy Procedures: Design Process of a Geo-Referenced System

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Abstract. This paper presents the design process of a geo-referenced communication system which aims at providing technological support to Cognitive Behavioral Therapy and Social Competences and Skills Training therapeutic procedures. The usage of geo-spatial information while communicating between therapists and patients can be critical, particularly in in-vivo sessions, to identify locations which evoke negative experiences to patients or to encourage the latter to overcome obstacles. We show a high-fidelity prototype multi-iteration design process and complement the discussion with the results from an experimental period which aimed at assessing the system from a usability, user satisfaction and functionality perspectives. Results were positive and led to the revision and ultimately the final design iteration which is reported here. We present the rationale behind these design choices, discuss the advantages over existing similar tools, analyze possible challenges and comment on the fulfillment of providing seamless context to scenarios where such information is paramount.

Keywords: Cognitive Behavioral Therapy, Geo-Referenced Systems, Group Monitoring.

1 Introduction

Exposure to feared, uncomfortable situations is a common and often critical component of success in several forms of therapy, including cognitive-behavioural therapy (CBT) [5] or social competencies and skills training (SCST) [9]. This component, also referred as Exposure Therapy, consists on tentatively taking patients to the entity of distress (e.g. situation, place, person, or object) leading them to deal with situations and thus building their coping mechanisms. Interestingly, many of those entities can be pin-pointed to specific locations (e.g. school, hospital, subway, and the dogs in the neighbours' house).

On a cognitive-behavioural approach patients are usually asked to verbalize or write indicators (e.g., how much fear), thoughts or rationalizations (depending on the therapy stage) towards the situation they were exposed to [17]. This contributes to the patients' cognition restructuring and wellbeing. If possible, these reflexions should be

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expressed at the beginning, during or immediately after the exposing process. This kind of therapy comprehends in-vivo sessions, where the patient works with the therapist, or assignments patients should perform autonomously [18][19]. These in-vivo sessions refer to the activities the patients carry out in determined locations, while being supported by the therapist. Note that geographical co-location may not be required (ensuring face-to-face meetings are not mandatory) since as the therapy process evolves, some of these assignments are carried over as homework, a scenario where the therapist is not physically available. During the sessions, therapists continuously assess the patient status, offering relaxing or encouraging words, as needed. For the off-session assignments, since the therapist is absent, such assessment and support cannot be done. On the other hand, these assignments represent better opportunities to expose the patient to the daily life situations or entities that cause the distress, thus increasing the patient's resilience to these situations.

Solutions for this kind of procedure are scarce. There are various communication systems available, some recurring to geo-referenced cues to provide richer information to individuals monitoring groups, but they are typically too complicated for unspecialized users such as therapists. As such, the research presented in this paper is part of a project – InSiThe – which aims at improving current therapeutic procedures by introducing a set of applications to support the scheduling, and management of in-vivo therapy sessions for therapists and reporting tools for the patients to communicate with the former. The main goal is to create a tool suite capable of supporting therapeutic scenarios by providing therapists and patients alike with seamless contextual data, enriching the knowledge provided to both parties in order to improve the assessment of therapeutic activities. Two teams are actively involved in this project, namely a group of HCI experts from the Faculty of Sciences and a group of clinical therapists and researchers from the Faculty of Psychology, both from the University of Lisbon.

We have developed an application suite comprised by support tools for both therapists and patients which aims at providing technological support to CBT or SCST in-vivo sessions. More particularly, this paper reports the design process of such tools, comprehending three design iterations with appropriate testing and result discussion. We compared the InSiThe application suite to existing and comparable web services based on Google platforms to assess not only the performance of InSiThe's tools, but also if the utilization of an integrated approach would be beneficial to the therapeutic process. We finish our analysis with the discussion of some design aspects we identified to be determinant to the addressed type of systems.

2 Requirements and Related Work

Social competencies and skills training, a sub domain of psychotherapy, promotes in-situ and exposure activities in which they have to complete tasks ranging from talking to someone to being in the vicinity of a specific place. The intrinsic nature of these activities and absence of technological support makes it difficult for therapists to

actively monitor and motivate patients along with proactively intervene in special situations, affecting both the therapy process and results.

With the increasing dissemination of mobile devices and enrichment of smartphones with cutting-edge communication and multimodal features one can identify applications that could be used to mitigate some of these issues [6]. Messaging, voice communication, audio and video recording, etc. can certainly be of assistance. Yet, true support could only be provided by an integrated system that adequately addresses the requirements without precluding the therapy process.

The expertise and knowledge of the therapy domain shared with us by the team of psychotherapy researchers' involved was paramount to identify a set of scenarios and assignments in which these integrated technological solutions would be welcome:

- **In-vivo session support**: Therapeutic processes such as those performed in fear therapy or social competences and skills training involve therapists and patients to interact with each other in the fulfilment of tasks related to the pathology (e.g. being confronted with the fear source, developing social skills in public areas, among other). As the therapeutic process evolves, the therapist often steadily dissipates his / her presence in favour of a more autonomous (yet still with proper support) approach by the patient while carrying out his / her assignments. This support may be given either face-to-face in-between assignments or using remote communication channels when physical co-location is not possible.
- **Transition towards homework assignments**: As the patient progresses throughout the therapeutic sessions, typically some of the aforementioned assignments may start being performed fully autonomously as homework between sessions. In these cases, it is paramount for the data collection mechanisms to retrieve as much contextual data as possible in order for the therapist to assess the validity and truthfulness of the patients' records. In this scenario, the therapist's presence is even less frequent, even as a support entity, since both geographical and temporal availability may be in jeopardy.
- **Offline analysis support with context data**: The final scenario pertains to the analysis of patient data after an in-vivo session. Without technological support, therapists are only able to rely on paper registries performed by the patients and which may not be an accurate depiction of the situations they were involved in. Ideally and with technological support, patient context (e.g. location, time of day, etc.) should be automatically retrieved so that therapists are able to re-enact all assignments the patients performed, enabling a thorough more informed discussion with patients.

Transversely, from these scenarios a set of requirements also emerge to ensure that the traditional therapeutic processes are not severely disrupted and that technology becomes an asset, not a liability, for patients and therapists alike:

- Therapists should be able to monitor and facilitate sessions while, if possible, tracking the patients' progress in co-located or geographically distributed in-session settings.

- Therapists should have the ability to communicate with each patient in-session either on a private or broadcast basis giving encouragement and proactively intervening whenever considered necessary.
- Patients should have an application which allows the timely and multimodal registry of their thoughts for on-session settings.
- Support tools should be an asset in aiding stakeholders to achieve their goals, ensuring their presence does not hinder or disrupt established therapeutic protocols.

Based on these pointers, we investigated current and past group communication platforms which covered these aspects either totally or partially. We will now discuss our findings and the adequacy of such solutions to the CBT and SCST problematic.

2.1 On Group Communication Solutions

Communication platforms and, in particular, instant messaging services have progressively evolved over the last few decades. From the introduction of cartoon elements to provide a more vivid and fun experience [7], to the usage of tri-dimensional virtual rooms [4], this type of services has capitalized on the rapid advances in both hardware and software technologies. The recent introduction of location-based services has prompted yet another set of solutions towards new requirements to provide users with enriched information about their context. In light of this progress, we have witnessed the appearance of tools such as MapMail [11] and MapChat [2]. Both offer geo-referenced information to their users: the former uses this information in an integrated email client, while the latter aims at providing users with a way to arrange meetings online while allowing the possibility of having conversations over special landmarks on a map using their mobile devices.

While some of these solutions present interesting solutions, they fail to provide full geo-referenced support to user conversations. These typically rely on previously pointed landmarks, inhibiting the users from chatting over free locations on a shared map. This leads to another challenge: how to share information between users in the same group working towards the same goal? Managing information that is shared between several devices is the usual goal of a system supporting cooperative work in a spatially distributed environment. The Pebbles project [10] was an interesting research aiming at providing groups of co-located users with means to share data and interact between different devices (e.g. PCs and handheld devices). Following similar lines of research, several authors explored how to share data across communal spaces in order to arrange meetings [14] or simply accomplishing tasks together [3]. Still, location-based support is scarce, and some of these solutions use environments which are not suited for mobile devices (e.g. tri-dimensional virtual worlds). If we delve into more specific domains we conclude that both the technological and user-oriented requirements (e.g. freedom to chat over any spot, unique integrated application, simplicity to use) are far from being achieved by the presented related research and ultimately, fail to cope with the requirements of critical domains such as therapy.

3 The Concept and Low-Fi Prototypes

The InSiThe concept encompasses a set of tools to allow supervision and communication between mobile participants, while allowing in-situ data gathering. The first design iteration [4] was rapidly set using low fidelity prototypes, in a close participatory approach with one teams' therapist. The prototypes showcased the envisioned features for the system. Two main tools were designed: one allowing the therapist to follow and communicate with patients; the other allowing patients to gather different media data and send it to the therapists along with their locations and expressions of anxiety, questions and doubts.

Most importantly, the prototypes gave therapists the opportunity to experiment a concrete, even if paper based, system. A Wizard-of-Oz or shadowing based experiment was setup. Therapists were involved in a simulated CBT and SCST scenario. Actual communication was achieved through a mobile phone connection. The team of therapists working in the project was enthusiastic about the envisioned features, with particular emphasis on the ability to easily access patients' location, time spent at specific points and tasks. A new set of ideas and needs were elicited.

4 The Functional Prototype

In the second design iteration our efforts were channelled towards the development of a high-fidelity prototype of the InSiThe applications. The development period lasted for approximately 8 months and included the implementation of the management, monitoring and reporting tools. All design choices documented in the next subsections reflect the valuable feedback obtained in the previous design iteration. We will now discuss each application in detail.

The Management Tool

The Management Tool is a web application whose scope involves patient record management, the scheduling of therapy sessions and the definition of goals within them. Two forms are provided for the creation of new users or new sessions. Both require mandatory information such as real name, in-system user name or email for the user creation process and session name, theme, date or scheduled starting and conclusion hour for the session creation process. Session scheduling itself involves three steps: addition of new or existing users to the session; definition of the session's date; and the definition (if available) of the session's goals. In the latter, therapists are able to define new goals by positioning a pointer in the map, and then provide information such as goal's description, order and patient assignments, among other.

Monitoring Tool

The Monitoring Tool is shown in Figure 1. The therapist is able to operate it to keep track of the patients in the current session, communicate with them and sanction individual goals. The tool comprehends two main areas: the messaging one, on the left, and the map monitoring area, on the right. Each area has its own filters that enable an independent visualization of the conversations and the locations.

The messaging area (left) corresponds to a chat where each message is labeled with the users' name. The therapist's message includes a destination since they are allowed to select one or all patients. The destination of the therapist's messages is also determined by the vertical users' filter bar (left to the chat). If the "All" option is selected the messages are broadcasted to all the users when the "Send" button is pressed. If a particular user is selected then only his / her messages (as sender or destination) are shown and the therapist's messages are only sent to that particular patient. The panel below the send button shows all the received messages.

The map monitoring area shows the paths of each selected user and his / her goals, shown as pins. The filter (above) the map enables the selection of specific goals by current status goals with a given status (e.g. approved, waiting approval, and in progress) or by patient. Patients' tracks are shown in colors corresponding to the legend on the top right corner of the map. A route checkbox enables or disables the track lines. The map is updated periodically requesting the repository for the new messages since the last update. Objective pins [17] have balloons that provide detailed information about the goals and their status. The pins change color to reflect the status of accomplishment: a red pin corresponds to a rejected accomplishment attempt or a not yet accomplished task, while a green pin relates to an accomplished task.

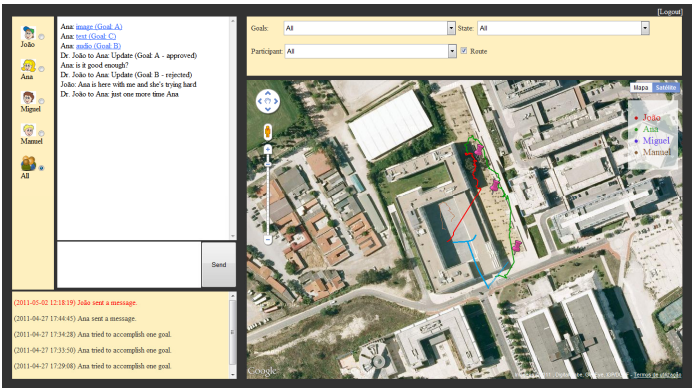

Fig. 1. InSiThe Monitoring Tool

The therapist can also receive multimodal messages (e.g. photographs, audio records). To access it, the therapist must click on the corresponding message in the message area or on a specific area of the balloons that pop over the pins.

Reporting Tool

The Reporting Tool comprises three main panels: map, messages and goals. The bottom bar on all three allows the direct navigation through each panel. Figure 2 (left) shows the vicinity of the patient's current location, along with the goals that he / she has been assigned to accomplish. Goals are depicted as a cup. The balloon that pops on top of the cup (the top one, in the figure) provides some details on the objective and direct access to requesting the approval of that task. Touching the balloon shows

the requesting panel represented Figure 2 (right) which enables the patient to send a text message, an audio recorded message or a photograph. This request is sent to the therapist who will then reject it or accept it. Back on the maps panel on Figure 2 (left), the red and green checks over the cup relate to these states. If rejected the cup goes back to the unchecked state. A similar interface to Figure 2 (right) can be used to send multimodal messages to the therapist whenever the patient needs to communicate with him/her. By performing a swipe gesture on this screen, the user can access the message log and read the entire conversation with the group's members.

Implementation Details

The web services and the managing and monitoring tools were built using web technologies; the reporting tool was implemented in Java for an Android platform; the repository was implemented in MySQL. The option for web technologies is due to portability and the rapid and easy access to communication and remote access protocols. Although several adjustments were done, the tools currently execute adequately in Chrome and Firefox. It has been tested in desktops and laptops, and in two tablets: an IPad 1 and an LG running Windows 7. The choice for the mobile platform was also straightforward. At the beginning of the development is was the best available platform free of charge and providing easy access to the underlying smartphones features. The reporting tool has been tested in a HTC Desire, a Nexus One and a Samsung 550, running Android 2.2 and 2.1. The adoption of a web approach for the mobile platform was considered, yet, at that time the mobile web development technologies were still short of access to some of the smartphone features. The access to maps is done through the Goggle Maps API.

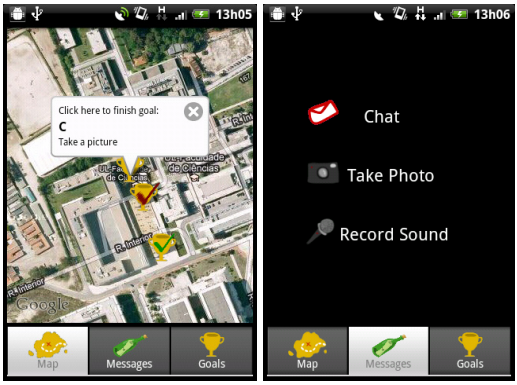

Fig. 2. InSiThe Reporting Tool: map screen (left); messages screen (right)

4.1 Evaluation

We conducted a set of experimental sessions to assess the first design iteration of InSiThe's tool suit from a usability and user satisfaction point-of-view. Since clinical deployments typically require a final version of the applications and testing with individuals undertaking therapy procedures is often not recommended, we opted to

perform a role play experimental period [20], while including individuals from the area to carry out specific roles. We took special care in the recruitment of participants, since we preferred them to have knowledge of therapeutic procedures and tools in order to obtain valuable feedback from individuals from the domain.

Testing took place at our university campus, spanning through the course of two weeks. Four groups composed of three people each participated in the test sessions. Each session lasted for approximately 45 minutes. For each session, one group element would take on the role of a therapist while the remaining subjects would perform the role of a patient.

Goals

The goal of this experimental period was to perform a thorough usability and user satisfaction analysis of the InSiThe toolset. Aspects such as perceived difficulty in taking certain actions, speed to accomplish determined actions or how the user feels while interacting with the tool suite are taken into account in this study. In particular we intend on comparing InSiThe with a set of tools capable of delivering comparable services, namely Google Maps in conjugation with Gmail and Google Talk. The main justification for picking the Google toolset pertains to the applications therapists were mostly used to work with for comparable tasks.

Metrics

The only quantitative metric assessed in this experimental period was the number of messages exchanged by role. We expect InSiThe to present a lower number of messages exchanged – the integration of geo-spatial cues in all applications is expected to make some information users typically send in their messages redundant, thus reducing the amount of data sent to each other. In the context of CBT, the enrichment of information regarding user location is welcomed by therapists, since it allows the patients to focus on the task at hand, instead of the description of their surroundings. In addition to it, we distributed a brief questionnaire to retrieve qualitative responses to features related to each tool and in common between the InSiThe and the Google suite. A Likert-type scale (1 to 5) was used to scale the answers. The therapist questionnaire can be observed in Table 1.

Table 1. Therapist's questionnaire

Tag	Question	Scale
MQ1	Perceived ease of use.	1 – Very Difficult; 5 – Very Easy.
MQ2	Perceived sense of quickness to perform task status management.	1 – Very Slow; 5 – Very Fast.
MQ3	Perceived user satisfaction.	1 – Low Satisfaction; 5 – High Satisfaction.
MQ4	Perceived difficulty during message sending.	1 – Very Difficult; 5 – Very Easy.
MQ5	Perceived difficulty in chat user management.	1 – Very Difficult; 5 – Very Easy.
MQ6	(InSiThe only) Perceived usefulness of the link between goals and map in completing tasks.	1 – Not Useful; 5 – Very Useful.

The patient questionnaire can be consulted in Table 2.

Table 2. Patient's questionnaire

Tag	Question	Scale
Q1	Perceived ease of use.	1 – Very Difficult; 5 – Very Easy.
Q2	Perceived sense of quickness to perform a task completion action.	1 – Very Slow; 5 – Very Fast.
Q3	Perceived user satisfaction.	1 – Low Satisfaction; 5 – High Satisfaction.
Q4	Perceived difficulty in text message sending.	1 – Very Difficult; 5 – Very Easy.
Q5	Perceived difficulty in picture message sending.	1 – Very Difficult; 5 – Very Easy.
Q6	Perceived difficulty in audio message sending.	1 – Very Difficult; 5 – Very Easy.
Q7	(InSiThe only) Perceived usefulness of the link between goals and map in completing tasks.	1 – Not Useful; 5 – Very Useful.

Participants

12 participants (aged 21-35; 8 male, 4 female) volunteered to participate in the experiment, forming 4 groups composed by 3 elements each – one therapist and 2 patients per group. All participants were students of a Psychology course at our university – we picked MSc students to undertake the role of a therapist (since they already undertake on therapist roles during their master's courses), while undergraduate students took the role of patients. None of them were undertaking any therapeutic procedure. They were all familiar with the campus layout and proficient with modern smart phones. Although aware of the existence of tools like the ones they would be using, none of them had previous experience with any kind of monitoring or reporting application for their devices. Individuals in each group did not know each other prior to this test.

Tools & Equipment

Participants undertaking the role of the therapist were handed a tablet (LG XNote c1) previously loaded with InSiThe's Monitoring Tool. Subjects assigned to the patient role were handed Android devices with a 3G connection, namely an HTC Legend and a Google Nexus One, both loaded with InSiThe's Reporting Tool application. The tools used for this test were as follows:

- **InSiThe toolset –** the InSiThe toolset comprised the applications presented in this paper – the monitoring tool and the reporting tool.
- **Google Suite –** the Google Suite was defined as a set of services (e.g. email services, IM services, map services, etc.) available through an Internet connection which could offer the same functionalities present in InSiThe. The proposed services included using Gmail, Google Talk and Google Maps, since all these can be accessed from a tablet or a smartphone, free of charge.

Procedure

Each experimental session consisted of two tests – one with the Google Suite and the other with the InSiThe's toolset. The order was randomly assigned at the beginning of

each session. After the first step, subjects carrying out the patient role were assigned to complete a small set of tasks across the university campus. These tasks were recommended by our therapist team as being representative of the type of assignments typically given to patients in clinical settings (e.g. enter a crowded area, go near a specific location which typically causes fear, etc.). The following list contains an elucidative subset of the tasks available to complete:

- **Task 1 –** write the middle name imprinted in the statue at the front of the campus.
- **Task 2 –** take a photo of the chemical element "Silver" in the Periodic Table on the atrium of the C8 building.
- **Task 3 –** record an audio file nearby the main entrance of the C1 building.
- **Task 4 –** write the name of the street sign near the C8 building.
- **Task 5 –** in the same street as in the previous task, take a photo of the building with door number 7.
- **Task 6 –** go to the bar in the C5 building and record the surrounding sound.

Other tasks consisted in variations of the ones presented (e.g. changing location or the type of content used). For each test within a session, users were randomly assigned 6 tasks, meaning they would not repeat the same ones using the different tool suites.

Results

Results for the experiments can be consulted in Figure 3 and 4. In Figure 3 we can observe the number of messages exchanged between therapists and patients. While the majority of subjects carrying out the therapist role were more active in exchanging messages, the same trend was not witnessed in the patients' case. Overall, there was a substantial decrease in the number of sent messages for participants taking on the patient role. Figure 4 depicts the qualitative results for our experiment (refer to Table 1 and Table 2 for the questions asked). Regarding the Monitoring Tool, subjects perceived it as being generally easy to use, provided quick processes to accomplish their tasks and provided a good sense of satisfaction during their usage experience.

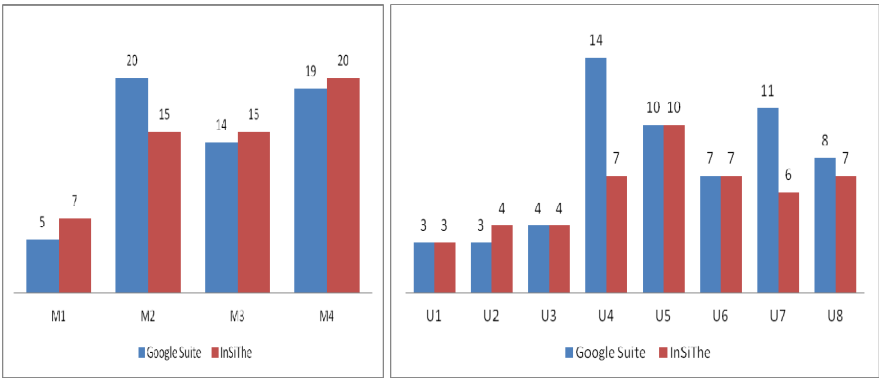

Fig. 3. Number of messages sent from users engaged in the therapist role (left) and in the patient role (right)

As for the chat functionality, users scored the message sending interface as mildly adequate, but the user management features were not positively received. Nevertheless, participants indicated that the coupling between goals and the displayed map was paramount to the task completion assignment they had to carry out.

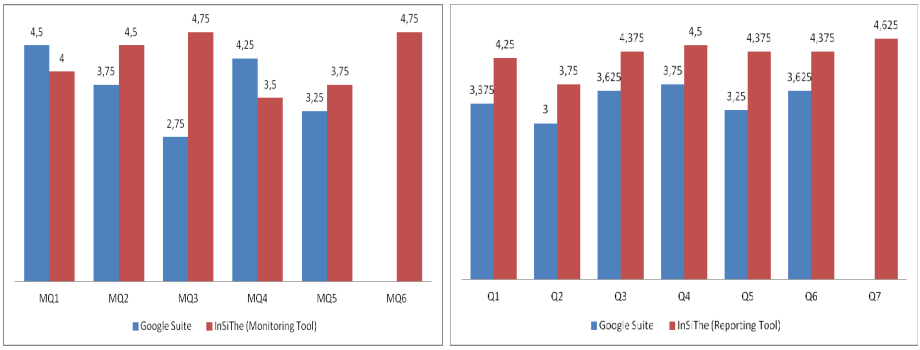

Fig. 4. Qualitative Monitoring (left) and Reporting (right) Tool assessment

Despite InSiThe performing well according to both our quantitative and qualitative metrics, there are a few features, namely user chat management on the monitoring tool and goals screen on the reporting tool, which need further analysis to understand what are the current issues and challenges and how to overcome them.

5 The InSITHE System Revision

Based on the previous results we performed some adjustments to the InSiThe system. Despite an overall positive reception, some issues were raised during that evaluation period. Difficult chat management and poor integration between chat and map visualization areas were the main concerns raised by participants and therapists alike. As such, we proceeded to the idealization and design of a solution which could circumvent the aforementioned issues. After discussing multiple approaches, we agreed that the elimination of the dedicated chat area in favor of design integrated into the map surface would allow all users, but especially therapists, to maintain awareness of the whereabouts of the patients as well as the zones which generated more discussion between them, without the need to divide attention between map and the conversations being kept.

Monitoring Tool – Enriched User Routes

The redesign of the Monitoring Tool capitalizes on a feature already present in the previous iteration to provide a unified area that allows the therapist to track and chat with his / her patients. In this solution, the chat interface is eliminated, allowing the main focus of the tool - the map area - to be maximized to the browser's window. The chat is then integrated into the map itself, in a similar way to that present in MapChat [2] but with a few modifications and a small focus change. In MapChat, conversations are attached to points-of-interest (e.g. restaurants, museums, etc.) preventing users

from freely opening new chat windows. In InSiThe, we intend on marking chat bubbles over user routes so that both they and their peers have spatial knowledge where the messages are sent from and where conversations are taking place.

Figure 5 presents the high fidelity prototype for this solution. As observed, the enriched user routes approach builds on the features already present on InSiThe's Monitoring Tool. Chat bubbles appear over user routes and special filters allow therapists to show / hide messages from determined patients.

The change in the application's main focus to encompass the visualization of a single map, prompted us to rethink the target devices of InSiThe's suite as well as the need for a Reporting Tool. According to the interaction distribution results, users were primarily interacting with the map and chat screens, thus making these two the most important features in the tool. As such, we are keen in testing a new form factor which supports the enriched user routes solution for tablets and to assess user acceptance. However, response from the therapist team was mildly negative. Since CBT and SCST procedures' target demographic may encompass children from 6 years old, the usage of tablets would not be beneficial: size and weight are an impacting factor on their recommendation; such novel device can also prompt socially awkward situations if seen at the hands of children, harnessing unwanted attention and possibly affecting the therapeutic process.

The new interface can be observed in Figure 5. The map area occupies the entire browser window, with additional options being accessed from clicking over the appropriate elements: user routes, user avatar, and user list or message icons over the routes. We can also see two chat bubbles representing conversations between one therapist and two different patients. The user routes contain envelope icons representing the approximate location where a message was sent. By clicking it, the therapist can read the conversation until that point. On the rightmost area of the screen the therapist has access to the list of patients he / she is currently monitoring. By right clicking each one, it is possible to set filters such as toggling user routes on / off or toggling the messages over routes on / off.

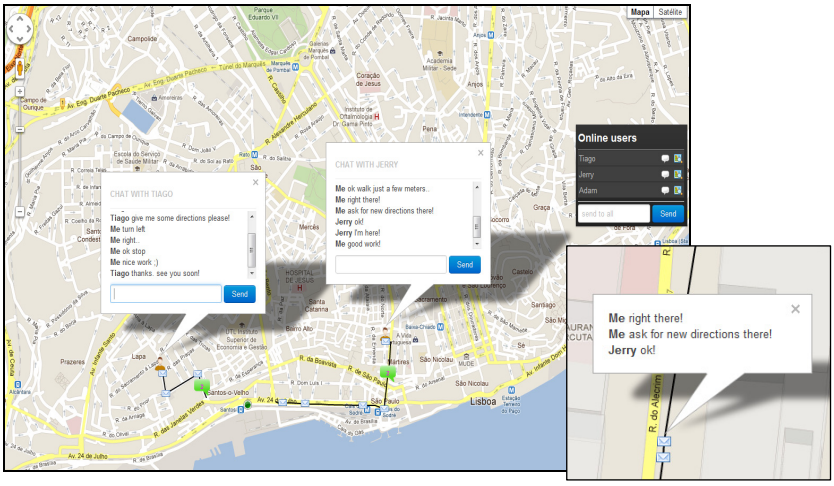

Fig. 5. Enriched User Routes high-fidelity prototype

Reporting Tool
Due to the positive results and comments obtained during the second design iteration experimentation period, no significant changes were envisioned or deployed to the Reporting Tool. The tool, however, will reflect the modifications made to how chat is visualized in the map area, to provide a similar design to therapists and patients alike. Finally, various types of feedback (namely audio and vibratory) were integrated to cater to the patients' preferences and to cope with any situational impairments which might come to fruition given specific therapy scenarios or patient contexts (e.g. crowded areas, etc.).

5.1 Evaluation

We conducted an evaluation period to assess InSiThe's third iteration design. The experimental procedure was in its entirety similar to the one detailed in section 4.1 for the evaluation of previous prototypes. In sum, we carried out 4 trials comprising 3 subjects each (2 patients and 1 therapist). Again, testing took place in our campus. The goal was to perform a usability and satisfaction analysis and, in particular, compare how the latest design iteration fared against the previous ones.

Results. In light of InSiThe's main goals, questionnaire results pointed towards a significant improvement in the message management and exchange processes, whether they involve text, image or sound for the third design iteration. Participants' perception on how quick they were able to accomplish each task also noticeably increased in the mobile application. User satisfaction remained high, leading us to assume that the primary changes performed to the system had no impact in it. Again, the connection between the displayed map and the user goals was determinant for the latter's fulfilment. The goal management mechanism was praised by the subjects. However we do have to mention that this process was significantly altered from the previous version, as this management is now done in run-time settings. We also witnessed a substantial increase in the number of exchanged messages, pointing to the importance of the system changes we carried out on the latest iteration.

6 Discussion

We will now discuss the main findings stemming from InSiThe's design iterations and the main results found in the experimental periods we carried out.

Quantitative Results
The introduction of InSiThe was determinant for a reduction in the amount of messages exchanged. From the comparison between the Google suite to each of the system's versions, we witnessed a steady decrease in message traffic. This was more evident for the participants undertaking the patient role, as the results for the therapist role were not entirely conclusive on this matter. One can discuss these results from two perspectives: on the one hand we could assume this particular group of users had less difficulty accomplishing the tasks. Since task difficulty was significantly low and

we assume it could not influence as much the number of messages exchanged we discard this possibility. On the other hand, we could analyze the messages' content to assess the type of information exchanged. This analysis made us conclude individuals using the Google suite often sent short messages in bursts, with the first one pertaining to the issue they want to discuss, while the subsequent one(s) would provide a description of the situation.

Qualitative Results

Our qualitative analysis discussion will contemplate both the Monitoring Tool's and the Reporting Tool's results. Overall, the response to the Monitoring Tool was positive across all assessed features and user satisfaction was moderately higher when compared with the Google suite (MQ3). Subjects considered the link between goals and the map to provide invaluable help in managing and monitoring their group's members' activities (MQ6). InSiThe's Monitoring Tool second design iteration failed to provide a proper management mechanism for the chat functionality (MQ5). This was solved in the third design iteration with a substantial increase in user satisfaction.

The Reporting Tool was praised for the quick task conclusion process and in overall user satisfaction (Q2 and Q3, respectively). However, it failed to appease to subjects on the ease of use (Q1) and difficulty to send / receive various types of messages (Q4, Q5 and Q6). One of the reasons behind these results is linked to message reception feedback. Google Talk, when running on a smart phone, issues a short vibration when a new message is received, allowing users to carry the device in their pocket and reach it whenever they are notified. This behavior was not present in InSiThe's Reporting Tool's second iteration, forcing users to keep visual contact to check for new messages. This issue was completely addressed in the third iteration, prompting a more positive response from the experiment's subjects.

The Importance of Context

The performed trials were important for the identification of a set of interface design directives for this project and which could easily be generalized for other similar tools as well. Among these directives, we must emphasize the importance of context. Since our initial prototype, our stakeholders have always stated how they wanted the ability to monitor the whereabouts of each patient during a session. This requirement was fulfilled with the addition of patient path tracking via GPS. The trials for the second design iteration presented positive responses from our subjects, praising the ability to see where each patient was going in order for the therapist to proactively intervene if appropriate. Still, subjects pointed it was difficult to which point in the path certain messages pertained (for instance, if they were sent far from an objective pin). This issue was addressed in the third design iteration via the addition of chat bubbles which summarize the exchanged messages within the vicinity of a certain location. As evidenced by the quantitative data, such design choice was responsible for a decrease in the number of exchanged messages. The enrichment of the context in which messages were sent eliminates the necessity of adding redundant information to each message describing the whereabouts of each user. In sum, we achieved our goal of adding seamless contextual information to scenarios in which such data is critical, removing the onus of transmitting such information from the end-users.

Conversation Evolution

Albeit related to context, the ability to track the way conversations evolve during time was another determinant modification employed in InSiThe's latest design. As depicted in Figure 5, the therapist is able to observe conversations in two ways. The first spreads conversation fragments throughout each patient's path. In each location the therapist is able to read the messages exchanged in its vicinity (messages are typically grouped up according to a configurable distance threshold). The second approach pertains to the aggregation of the whole conversation on the patient's current location. This way the therapist is provided with a broader view of the content exchanged with a particular patient without disregarding his / her location's context. During the third design iteration trials, subjects praised both approaches, stating they complement each other well and they provide the therapist with a complete view of the session's and each participant's progress.

7 Conclusion

This paper presented the design process and respective evaluation of a tool-suite which aims at providing therapists and patients with adequate tools for in-vivo therapy sessions. InSiThe is a web-based tool suite which comprehends a therapist's application (Monitoring Tool optimized for laptops and tablets) to monitor patients, registering their conversations, their routes and special markers which contain task assignments, and the Reporting Tool (for smart phones) which users can operate to keep track of their objectives, route and conversation with the therapist.

We presented a three iteration design process, encompassing low to high fidelity prototypes of InSiThe's application set. We complemented the design presentation with the discussion of an evaluation period's results in which we assessed the tool suite from a usability and user satisfaction perspective. We also compared InSiThe to an existing and comparable application suite which reinforced our findings. Results have shown a strong reception from users, based on their opinions. Testing also provided evidence on the importance of geo-spatial cues during conversations, namely awareness of each other's locations. Based on the gathered results, namely user performance and the comments provided by both users and therapists alike, we proceeded to the revision of particular applications within InSiThe, with emphasis on the Monitoring Tool and how therapists are able to keep awareness of a group of users in a session. The solution proposed capitalizes on InSiThe's design to provide a fully integrated geo-referenced chat over user routes on a map. This approach allows the therapist to focus on a single functionality while maintaining awareness of each patient's locations as well as keeping track of their conversation and from where messages were sent. Finally, we presented the early and current prototypes of the third version of this toolset, whose evaluation is currently being finished.

In the near future we will finish the evaluation and respective results analysis for the second design iteration of InSiThe's tool suite. We intend on comparing the new design from a quantitative and qualitative perspective to the suited reported in this paper. We also expect the tool suite to be deployed in real CBT and SCST pilot studies with therapists and patients engaged in in-vivo sessions with these tools.

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