Cooperative Note-Taking in Psychotherapy Sessions: An Evaluation of the Therapist's User Experience with Tele-Board MED

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Abstract—In the course of patient treatments, psychotherapists aim to meet the challenges of being both a trusted, knowledgeable conversation partner and a diligent documentalist. We are developing the digital whiteboard system Tele-Board MED (TBM), which allows the therapist to take digital notes during the session together with the patient. This study investigates what therapists are experiencing when they document with TBM in patient sessions for the first time and whether this documentation saves them time when writing official clinical documents. As the core of this study, we conducted four anamnesis session dialogues with behavior psychotherapists and volunteers acting in the role of patients. Following a mixed-method approach, the data collection and analysis involved self-reported emotion samples, user experience curves and questionnaires. We found that even in the very first patient session with TBM, therapists come to feel comfortable, develop a positive feeling and can concentrate on the patient. Regarding administrative documentation tasks, we found with the TBM report generation feature the therapists save 60% of the time they normally spend on writing case reports to the health insurance.

Keywords—user experience; emotion measurement; computer-mediated therapy; behavior psychotherapy; human-computer interaction; medical documentation; note-taking

I. INTRODUCTION

In the course of patient treatments, psychotherapists aim to meet the challenges of both being a trusted, knowledgeable conversation partner and a diligent documentalist. Treatment session documentation is part of a psychotherapist’s professional duties and serves as a memory aid and for administrative purposes. In earlier feedback studies, we learned that behavior psychotherapists take handwritten notes during or after patient sessions [1] and that fulfilling administrative documentation tasks is a highly time-consuming and troublesome activity [2]. After the initial anamnesis interview and up to a further five trial sessions, therapists send a case report to the health insurance company to request treatment funding. Creating these reports is usually done by transferring handwritten notes into a digital format.

We are developing the digital whiteboard system Tele-Board MED (TBM), which allows the therapist to take digital notes during the session together with the patient (fig. 1). TBM is designed to address two major goals: to yield faster high-quality documentation, and to support doctor-patient collaboration. Past studies show that TBM has great potential for more efficient documentation [2] and increased doctor-patient collaboration, including patient empowerment and a positive doctor-patient relationship [3]. This study illuminates the interference of both goals and aims to answer the questions: What are therapists experiencing when documenting with TBM in patient sessions for the first time and does this way of documenting save them time when writing official clinical documents?

The following study was conducted at a university in Germany with four behavior psychotherapists.

II. RELATED WORK

Our research into Tele-Board MED touches upon different related works, such as the activity of note-taking and computer supported collaboration in talk-based mental health care. Note-taking and technology support is the subject of research in various domains, most notably in education, but also in business, legal and healthcare contexts [4]. The shared whiteboard system and educational practice ‘Livenotes’ was introduced in lectures to facilitate cooperative and augmented note-taking [5]. With TBM, note-taking in the healthcare context becomes cooperative because doctor and patient document their conversation...
jointly in real-time. Note-taking is augmented in the sense that TBM provides flexible documentation templates with headlines and visuals.

When we look at the use of technology in talk-based mental health care, we first and foremost find tools which focus on improving the patients’ access to services, such as electronic contact means, online information sources or electronic questionnaires. However, there is strong and largely untapped potential in improving the patients’ personal engagement in the treatment by means of technology [6]. While there is a noticeable body of work on computerized therapy, Knowles et al. [7] call for more research on computer-mediated therapy (i.e., the integration of computer-delivered content in the health professional’s input). Just like TBM, the following software application fall into the category of computer-mediated therapy. The roleplaying computer game ‘Personal Investigator’ is designed to be played by an adolescent patient together with a therapist in a treatment session [6]. While in this game, a digital notebook supports the player’s personal reflection, TBM offers an interface for collaborative note-taking with the therapist. The application ‘My Mobile Story’ is designed to trigger a patient’s self-reflection by allowing them to visually capturing case information [8]. This application seems to support asynchronous and remote collaboration between therapist and patient while the TBM user scenario is characterized by synchronous and face-to-face collaboration. There is further research on related topics, such as digital tools for collaborative health tracking [9], automated generation of textual summaries in healthcare [10] and patient access to electronic health records in mental health care [11]. However, to our knowledge, there is no system similar to TBM and its collection of functions.

III. THE TBM SYSTEM

Tele-Board MED (TBM) is a software system to support doctor-patient collaboration by means of joint documentation. TBM builds on the web-based application Tele-Board, which was designed for supporting creative teamwork over distances [12]. The system is usable on a variety of hardware devices, such as laptop, desktop computer, tablet computer or digital whiteboard.

A. Note-Taking in Patient Sessions with Tele-Board MED

The core feature of TBM is a whiteboard-inspired graphical user interface, which allows the users to edit documentation panels freely as they fill them with sticky notes, scribbles, and pictures. Therapists and patients can work on blank panels, use prepared templates or create their own ones. As an alternative to entering notes via keyboard, therapists can use the TBM sticky pad app [13] with a tablet computer (or other mobile devices) and a digital pen. The app provides handwriting recognition, based on the Microsoft.Ink API (application programming interface) for the German and English language. The digital notes can be sent from the app to the whiteboard interface.

B. Medical Report Generation with Tele-Board MED

Furthermore, TBM offers a feature to create clinical documents out of the digital notes taken during the session. The sticky notes in TBM are designed for short sentences or key points written in a colloquial language. Official clinical documents, on the other hand, are written in a professional jargon, partly in subjunctive tense, and follow certain text standards. As a first step to bridge both documentation formats, we implemented the medical report generation feature that allows for automatic sorting of the TBM content into the corresponding sections of a text document. While this feature works with any structured text document, we are taking the clinical case report as an example for this study. The case report is a document in the German health care system therapists send to insurance companies to apply for treatment funding. Based on the guidelines for case report creation [14], we created an MS Word document, which contains header, footer and section headings. Next to these standard text segments, our template contains placeholders characterized by a dollar sign and curly brackets (e.g. ‘${Therapy goals}’). Figure 2 (right) shows a schematic representation of such a text file. When the file is uploaded to TBM, the placeholders are recognized via regular expression detection. They allow the transfer of text from the TBM documentation panels to the Word file. The report generation feature is not limited to German notes. The user simply has to create whiteboard panels and a text template in the desired language, for example, English.

We prepared a collection of seven TBM documentation templates that help therapists cover all relevant information needed for the case report, namely concerns and symptoms, patient history (cf. fig. 2), behavior analysis, therapy plan, psychological finding, somatic finding and diagnosis. On top of the whiteboard layer with the sticky notes is a second layer, which represents the linkage between panel areas and the sections of the medical report (cf. labeled bars in fig. 2, left). By moving sticky notes to certain areas on the documentation panel, the sorting for the report creation is prepared. After the patient session, it takes just the click of a button to create the case report.

Figure 2. The concept behind the TBM report generation feature. The whiteboard panel content (left) is sorted automatically into sections of a text file (basic structure of a report template on the right) based on their spatial arrangement. The whiteboard panel (left) contains information about the patient’s life history. The grey rectangle (left) indicates that all information positioned in this area will appear in the section “Training and job” (right) in the automatically created case report later on.
IV. METHODS

We designed a study, which takes into account the evaluation of two aspects of the therapist’s user experience with Tele-Board MED, namely the note-taking in patient sessions and the case report generation. The core of the study is an anamnesis session dialogue between a behavior psychotherapist and a volunteer who acts as a patient with a particular mental health problem. The study was conducted in Germany with four therapists and four volunteers. For each of the four study runs, we scheduled two dates: one to introduce the therapist to TBM and one for the therapist-patient session and evaluation.

A. Study Participants and Preparation

We included behavior psychotherapists (N=4) who are either practicing or in training to become approved therapists. They received a written study description with a call for participation. Participation was on a voluntarily basis, and participants received a small expense allowance. We conducted individual, moderated 2-hour introductory sessions with the therapists. Here, they were able to try out the TBM whiteboard interface and the prepared documentation templates (cf. section II B). They adapted them, based on personal preferences, to be well prepared for the anamnesis session. Additionally, we invited them to try the handwriting recognition with the TBM sticky pad app.

In order to acquire volunteers for acting out the patient role we asked university staff. The inclusion criteria were the willingness to participate voluntarily and fluent German skills. The volunteers were asked to memorize a patient case stemming from an educational book on clinical psychology [15]. The case describes biographical information, a mental health problem including symptoms and unpleasant situations the person had experienced. Two male volunteers acted out the role of a 27-year old man suffering from obsessive-compulsive disorder. Two female volunteers played the role of a 32-year old woman suffering from social phobia. To keep the therapy session as authentic as possible, the therapists were familiar neither with the patient actors nor with the case they would present.

B. Study Setup and Data Collection

Once the therapist and the patient actor were prepared, the anamnesis session and the therapist experience evaluation took place. A refurnished meeting room served as location. It resembled a therapy room and allowed for recording (fig. 3, setup cf. fig. 1). We used the SMART Board Interactive Display 6052i as touch screen. We provided a wireless keyboard with trackpad (Logitech k400 Plus) and a tablet computer with a stylus pen (Samsung Galaxy Tab S3). The 3-hour slot was subdivided into three parts. For the first 50 minutes – which is the common duration of a therapy session in Germany – therapist and patient conducted the anamnesis interview with TBM. This interview was recorded with a digital video camera mounted onto a tripod.

Directly after the anamnesis interview, we sent off the patient and conducted the therapist’s experience evaluation. Here, we used the approach of self-confrontation [16] to measure dynamically the therapist’s emotions while interacting with the system and the patient. We asked the therapists to watch the video of the session and to report about their experience. Every two minutes, we paused the video and asked the therapist to assess three verbal semantic differential items in a very short questionnaire using pen and paper. The first two items relate to the therapist’s feeling (pleasant vs. unpleasant, calm vs. excited). Both are dimensions commonly used for self-reporting the emotional response to human-computer interaction [16, 17]. Item three asked where the therapist’s attention was directed at this moment (patient vs. TBM). Afterwards, we asked the therapists to draw and annotate a user experience (UX) curve [18] of their feeling over time.

After the therapist’s emotion assessment, we moved on to testing the report generation feature. Here, the therapists got the task to generate a case report with TBM and to revise it in a way so that it would be suitable to submit for insurance purposes. We encouraged them to think aloud so that the moderator could write a protocol on their thoughts and observations. We recorded the time needed by the therapist to turn the generated file into a revised document. Finally, we asked them to fill out a questionnaire covering their just-experienced report writing with TBM, general report writing habits, therapy experience and sociodemographic data.

C. Data Analysis Methods

Per therapist, we collected 25 serially numbered samples of the described three dimensions (pleasantness, calmness, and attention). The analysis of this quantitative data collected via paper questionnaires involved several steps. First, the handwritten crosses on the semantic differentials were read with a ruler and converted to numerical values between 0 and 7. For better comprehension, the value range was transformed to -1 (unpleasant, excited, attention towards TBM) to 1 (pleasant, calm, attention towards patient). We applied descriptive statistics and a regression analysis using SPSS 25.
We compared the hand-drawn UX curves qualitatively by scanning the paper sheets and overlapping the diagrams (fig. 5). The therapists’ curve annotations were translated from German to English.

V. RESULTS

We gained insights into the therapist’s experience of note-taking in the anamnesis sessions, as well as in the case report creation with Tele-Board MED – based on both quantitative and qualitative data. Table 1 shows the characteristics of the study participants (N=4).

A. Findings on the Note-Taking Experience with TBM

Based on the time-related emotion samples we computed a linear regression model, predicting the therapists’ perceived pleasantness based on time. The dependent variable ranges between -1 (unpleasant) and 1 (pleasant). The independent variable ranges between 1 (first assessment after 2 minutes) and 25 (last assessment after 50 minutes). When we permitted the calculation of a regression constant, a constant was suggested that did not achieve statistical significance. We therefore computed the final regression model without permitting a constant. The resulting model is represented in (1) and visualized in fig. 4. It is statistically highly significant at a level of p<=0.01 and explains 55% of the overall data variance (R=0.741). The regression coefficient b amounts to 0.025, indicating that the feeling of the therapist becomes increasingly positive over time. We did linear regressions for the other two outcome variables of calmness (-1 [excited] to 1 [calm]) and attention (-1 [TBM] to 1 [patient]) as well. The results are very similar as b amounts to .023 for both calmness and attention.

\[
\text{pleasantness} = b \times \text{time} = 0.025 \times \text{time}
\]

![Figure 4. The regression model illustrates the relationship between time (y-axis, 25 samples in 50 minutes) and pleasantness (x-axis, -1 to 1). Per time point there are four samples by the four therapists.](image)

We also did a statistical analysis on how the three variables relate to each other by filtering the samples according to the lower and upper quartiles of one variable and calculating the statistical means for the respective other two variables. This shows that, if the therapists do not feel good (all time points with pleasantness below 0.200), they have their attention on the TBM system (attention Ø -0.312) and they are moderately excited (calmness Ø -0.113). If they feel good (all time points of pleasantness above 0.600), they are calm (calmness Ø 0.593) and they can pay close attention to their patient while the system interaction just happens along the way (attention Ø 0.641).

The hand-drawn user experience curves of all therapists (T1, T2, T3, and T4) were combined in one diagram (fig. 5). The curves T1 and T2 start in the area of negative emotions, whereas T3 and T4 start in the area of neutral emotions. After roughly the first quarter of time, all of them rise towards the positive range. In the central ~25 minutes, T3 rises continuously, while T1, T2 and T4 oscillate around the zero line. In the final quarter of time, all curves are in the positive emotion range at a medium to high level. Therapist 1 (T1) comments that in the beginning he had “difficulties with technology (key combination for a line break on sticky note)”. In the middle, his feeling “got better as soon as technology problem was solved”, after which it “got worse through uncertainty of which symptoms are illness-related and relevant to note”. Finally, “after the many diagnostic questions, [his] feeling got better because the attention was largely on the patient.” Therapist 2 (T2) comments that she was “insecure in the beginning and often looked at the whiteboard”. In the interim of the conversation, when she typed text on sticky notes, there was “confusion between adding a line break (keys Shift + Enter) and closing the sticky note editing view (key Enter)”. She had a “secure feeling when working on one documentation panel at a time”. However, whenever the conversation required switching panels, her uncertainty rose. Towards the end, her feeling of “security and control increased when she could wrap up the session using the collected notes.” Therapists 1 and 2 refrained from using the touch option of the digital whiteboard. Instead, they used the trackpad on the keyboard for navigation. For therapist 2 it would have been confusing to handle two devices and moreover she found that reaching....

<table>
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<th>Therapy experience</th>
<th>Number of written reports</th>
<th>Time to draft (min)</th>
<th>Further time needed (min)</th>
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<td>4</td>
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<td>27</td>
<td>therapist in training year 2</td>
<td>11-20</td>
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We gained insights into the therapist’s experience of note-taking in the anamnesis sessions, as well as in the case report creation with Tele-Board MED – based on both quantitative and qualitative data. Table 1 shows the characteristics of the study participants (N=4).
Figure 5. Comparison of UX curves drawn by the four therapists.

towards or standing up at the whiteboard would cause restlessness in the session. Therapists 3 and 4, on the other hand, decided to use the whiteboard touch option for all pointing inputs (e.g. navigation between documentation panels and moving sticky notes). Here we observed, that the double click on the whiteboard screen, which is supposed to start the sticky note editing mode, was defective. Often it took the therapists several attempts of finger tapping before they could finally enter text. The annotations of therapist 3 say that she felt “greater insecurity in the beginning, especially due to the missing response of her finger tapping”. Later on, she felt “more and more secure” and could “manage better when something did not work immediately”.

Therapists 1, 2 and 3 decided against using the tablet, because the possibility of wrong handwriting recognition would make them nervous. Therapist 4, on the other hand, favored the tablet instead of the keyboard. She took notes with the stylus pen and used handwriting recognition throughout the session. Only when the conversation came to the patient’s life history, she switched to the keyboard to fill the prepared sticky notes (cf. panel in fig. 2). This is due to the fact, that the handwriting recognition feature works when sticky notes are newly created, but not when existing ones are edited. The slump in the middle of T4 reflects the switch to the keyboard along with the whiteboard touch input and its usability flaws described above. While therapist 4 describes a solid positive feeling when working with the tablet, she comments the slight drop towards the end of the curve (T4) as follows: “I became nervous when I realized I had only little time left. Thus, I sent notes to the wrong panel and lost even more time.” When the destination panel changes, this has to be adapted in the settings of the sticky pad app.

B. Findings on the Report Creation with Tele-Board MED

Following the anamnesis interview, it took the therapists two clicks and a few seconds waiting time until TBM generated the initial version of the case report. The therapists revised the Word file by paraphrasing notes, formulating sentences, changing the inflection of words, formatting text, removing text, and adding text that was not noted in the session. The notes were complemented at times (e.g. when the therapists’ perception differed from the patient-reported information). Furthermore, the therapists highlighted certain text passages that would still need additional information. Three out of four therapists reported to write parts of the report after each session and follow up on open questions in the next encounters. The time needed for creating the case report with TBM was for all therapists under the time they usually need (cf. table 1). For example, therapist 1, who usually needs an average of 270 minutes to write a report, needed 40 minutes to turn the generated report into an intermediate draft. After these 40 minutes, he estimated the additional time needed to complete the report at 60 minutes.

VI. DISCUSSION

In this study, we sought to answer two questions. First, how do behavior psychotherapists feel when they take notes with Tele-Board MED in patient sessions? We can say that session time has a highly positive effect on the therapists’ emotional state. Furthermore, with time the focus of attention turns more and more to the patient instead of the system’s operation. This suggests that positive therapist feelings are a matter of habit. We can expect that in follow-up sessions with the same therapists, their emotions will be in the positive range from the earliest moments. Moreover, we found that therapists not only need to get familiar with the system operation, but also with harmonizing the activity of cooperative note-taking with the course of conversation. This is not surprising considering that the act of note-taking as such requires a number of simultaneous, cognitively demanding processes [4]. Therapists feel uncertain when it is not clear whether the information expressed by the patient is relevant to note or when the expressed information is contradictory to their personal perception. On the other hand, TBM creates an increased sense of security in therapists when they give explanations to the patients (e.g. when working on the behavior analysis model or while summarizing the session content).

The second research question was on how TBM supports therapists in writing clinical documents. We found that the TBM report generation feature speeds up the administrative task of writing case reports. The report creation time is reduced by 60% on the average, even when the therapists used TBM for the first time with a new patient.

Overall, the four therapists had favorable attitudes towards TBM. They were able to integrate the digital cooperative note-taking with their individual approach to patient interviewing. This was also reflected by their choice of input devices and adaption of documentation templates before the session. Especially the psychological finding template (including aspects like self-endangerment, impaired consciousness, and memory) was adapted in various forms, by removing or adding parts and changing the wording. Furthermore, therapists gave feedback on how to refine both the application and the hardware setup. Their experience can be improved by making small adaptations in the software such as the combinations of input keys. They also shared ideas for additional features, for example an improved, smoother navigation between whiteboard panels and the zoom into and out of topics. Regarding the hardware, the digital whiteboard and the tablet computer could be replaced.
by a medium-sized touch screen display, which can be operated more comfortably while sitting. In this respect, the sticky pad app with handwriting recognition, which has been a separate app until now, could be included in the whiteboard interface.

The mixed-method approach including quantitative data (emotion samples, questionnaires) and qualitative data (annotated UX curves, observation protocols) allowed for manifold findings on the therapist’s experience with TBM. The relatively small number of four test users and their non-anonymous relationship with the researchers can be considered a weakness in this study, because a social desirability bias could affect the results. However, since the therapists have no professional relations or interest towards the research institution, we expect this bias to be insignificant if anything. The self-reported evaluation approaches have the advantage of allowing unexpected observations. On the other hand, they might be subject to bias because emotions have a large unconscious component.

VII. CONCLUSION AND FUTURE WORK

In conclusion, we found that even in the very first treatment session using Tele-Board MED, therapists’ feelings became calmer and more positive over time. After the initial phase of setting in, therapists can better concentrate on the patient and are thus not overly distracted from operating this novel documentation system. Regarding administrative documentation tasks, we found with the TBM medical report generation feature the therapists save 60% of the time they normally spend on writing case reports to health insurance companies. Possible future work to save even more time could be the integration of natural language processing and generation to automatically create a running text from the notes. However, only recently do the German case report guidelines allow for a bullet point writing format [14]. Furthermore, the therapists’ long-term experience with TBM remains to be seen. We plan future studies with real psychotherapy patients in order to evaluate the patient’s user experience with TBM and its effect on the treatment progress – as compared to traditional handwritten note-taking.

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