Rehearsing to Control Depressive Symptoms through a Behavior Change Support System

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Abstract
Depressive symptoms are generally coupled with distress and high treatment costs. We present our on-going research on a Web-based behavior change support system, which utilizes Acceptance and Commitment Therapy as a rehearsal tool. We present a summarized account of the research setting, studied persuasive software features, and a brief account of initial data analysis. Our work presents implications on design interventions for mental well-being and human–computer interaction.

Author Keywords
Depressive symptoms; Behavior change support systems; Acceptance and commitment therapy; rehearsal

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

Introduction
Mental health disorders pose stern challenges to healthcare. Depression has been reported as one of the most prevalent mental disorders in the world. By 2030, depression is estimated to be the highest mental
disease burden in developed countries [1]. Clear evidence exists on the effectiveness of face-to-face and online treatments for depression, including digital interventions that enable self-help [1]. However, several barriers hinder people from using available treatments. These barriers include hesitation to discuss personal matters, high treatment costs, and stigma. Behavior change support systems (BCSS) are designed to bring a desirable change in peoples’ behaviors and attitudes [2]. These systems provide comprehensive support through a combination of carefully selected and integrated software features. Emerging technologies open a sublime avenue for the design and implementation of novel BCSSs. These systems can help people overcome some of the aforementioned barriers in receiving treatment and support for managing depressive symptoms.

The effectiveness of interventions delivered through the Internet with the use of Cognitive Behavior Therapy (CBT) has often been reported [3]. Acceptance and Commitment Therapy (ACT), a relatively new addition to CBT, involves mindfulness and acceptance. In ACT, techniques are applied to improve peoples’ psychological flexibility because this aspect is positively correlated with improved mental health [4]. The six core processes of ACT include the following [5]:

- Accepting events and consequent feelings without struggling to change them,
- Stepping back and observing one’s thoughts,
- Experiencing psychological events in a non-judgmental manner by bringing enhanced awareness,
- Becoming aware of one’s personal experiences,
- Understanding what is really important and identifying important directions for life, and
- Taking concrete actions that fulfill personal values.

**Software Artifact: Behavior Change Support System**

To date, researchers have often focused on issues relating to task adherence and self-reported satisfaction levels [6]. This aspect is where our research work takes a step further. While task adherence is an important research area, BCSSs bring in the element of rehearsal as a software feature to educate users and improve their self-confidence in tackling well-being issues. The basic version of the Good Life Compass (Kompassi) BCSS was implemented by software developers and researchers at the Department of Psychology, University of Jyväskylä, Finland. Later, the researchers at the University of Oulu, Finland incorporated e-mail-based reminders in the system. Reminders and rehearsal fit well within the ACT framework because the therapy encourages people to take responsibility for their own well-being by committing to actions in accordance with their personal goals and values. The aim of the reminders was also to prompt participants to rehearse mindfulness and other experiential exercises included in the treatment program. Prompting participants to interact with the system through reminders [7] and to ensure that they practice the techniques (i.e. ACT modules) by rehearsal [7] is critical for the effectiveness of the intervention.

BCSS are inherently persuasive; they are built with carefully incorporated software features [2]. The aim of typical BCSS is to achieve possible voluntary outcomes in the forms of formation, alteration, or reinforcement of attitude, behavior, or compliance. According to [2],
BCSS are transformative and calculatedly designed to bring a rational change in peoples’ behavior and attitude. Examining BCSS is a complicated task. It covers human–computer interaction (HCI), including user interface issues, and computer-mediated communication through carefully crafted socio-psychological theories. In designing BCSS, developers and researchers should ensure that the system is accessible 24/7 without being obtrusive and that the behavior change process is simplified incrementally. BCSS provide support by improving HCI, facilitating social interaction, and empowering users. New software design elements come into play while studying BCSS, such as thorough analyses of persuasive software features. In addition, persuasive approaches, including direct or indirect routes, need to be cautiously selected; special emphasis needs to be laid on the significance of the persuasion context [2].

We decided to analyze the potential effect of reminders and rehearsal on BCSS for depressive symptoms. The content of the system under investigation was based on ACT, which provides depression management skills that can be learned through virtual rehearsal [cf. 7]. The rehearsal feature was incorporated via weekly modules based on ACT techniques. The aim was to increase value-based actions and to improve mindfulness and acceptance in participants with the use of an array of metaphors, experiential exercises, and behavioral interventions [5].

After the screening process was completed, eligible participants were sent an e-mail-based reminder with a URL to the BCSS. In a situation in which a participant does not complete an exercise (weekly task), a second e-mail-based reminder is sent the following day.

Participants could access the system from their home or personal computers. Table 1 presents a brief description of the ACT modules used for rehearsal.

<table>
<thead>
<tr>
<th>Intervention Week</th>
<th>Acceptance and Commitment Therapy Module Used for the Rehearsal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>Creative hopelessness and values</td>
</tr>
<tr>
<td>Week 2</td>
<td>Value-based actions</td>
</tr>
<tr>
<td>Week 3</td>
<td>Contact with the present moment</td>
</tr>
<tr>
<td>Week 4</td>
<td>Cognitive diffusion</td>
</tr>
<tr>
<td>Week 5</td>
<td>Self as context</td>
</tr>
<tr>
<td>Week 6</td>
<td>Acceptance</td>
</tr>
</tbody>
</table>

Table 1. Description of the acceptance and commitment therapy modules used for weekly rehearsal.

**Study Setting**

The study began in September 2012 with collaboration between the University of Oulu and the University of Jyväskylä, Finland. Recruitment took place through advertisements in local newspapers (09.09.2012).

In response to the advertisements, 42 participants contacted the University clinic through e-mail and telephone. One participant decided to drop out before the screening process began. Therefore, 41 participants were interviewed over the phone using a structured interview format. Two participants did not meet the eligibility criteria and were dropped out from the study. Hence, the actual sample size consisted of 39 people.
The inclusion criteria were as follows: (1) a minimum score of 13 on Beck’s Depression Inventory (BDI) (at least mild depression) [cf. 8], (2) no parallel psychotherapy or medication, (3) possession of an e-mail account and access to the Internet and telephone, and (4) above 18 years of age. Therapists received phone calls from prospective participants, and initial screening was performed. Measurement packages explaining the study and informed consent forms were later sent to eligible participants.

Participants were randomized into two groups: (1) an intervention group (n=19) that received measurements, telephone calls for case formulation, access to weekly rehearsal exercises, automated weekly e-mail-based reminders, and performance-based feedback from the therapists, and (2) a wait-list control group (n=20) that received a measurement package only and had to wait for six weeks before they could access the system and receive treatment. In this paper, results of the participants from the intervention group are reported. A total of 13 (68.4%) females and six (31.6%) males with an average age of 50.5 years comprised the intervention group. One participant from the intervention group dropped out before the Post-measurement. Thus, the sample consisted of 18 participants. Login information for the system was provided to the intervention group and therapists were randomly assigned to each participant. Therapists contacted the participants once a week to provide feedback about their progress via e-mail.

In our study, we expected the participants to learn new behavior through rehearsal supplemented by reminders, praise, and feedback as software features.

The system included the following stages of interaction with the participants:

- **Registration:** Participants register with the system with the use of their personal login usernames and passwords.
- **Weekly Rehearsal:** Participants read or listen to weekly exercises and are encouraged to rehearse newly acquired skills.
- **Weekly Reminders:** Participants receive an e-mail-based weekly reminder with motivating quotes and a URL to the system.
- **Feedback/Praise:** Participants receive individual feedback from therapists.

The psychologists who will analyze the potential outcome in depressive symptoms collected 10 pre- and post-study measurements. Statistical analyses from the results of the pre- and post-study measurements are currently being conducted. Upon completion of the six-week intervention, qualitative data were gathered with Likert-scale questionnaires. Some of the statements presented were as follows (listed here for demonstration purposes):

- Reminders helped me complete weekly exercises.
- Reminders did not interrupt my routine.
- Rehearsal improved my confidence.
- I learned new skills by rehearsing.

**Preliminary Data Analysis**

Initial data analyses based on the qualitative surveys indicate encouraging results. Fully describing the survey methodology, such as what questions were asked and how many participants completed the
surveys, is beyond the scope of this work-in-progress. Table 2 shows an overview of the preliminary findings (n=18, scale 1-5).

<table>
<thead>
<tr>
<th>Theme</th>
<th>Validated responses</th>
<th>Mean</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reminders helped me complete weekly exercises.</td>
<td>18</td>
<td>4.06</td>
<td>4.00</td>
</tr>
<tr>
<td></td>
<td>Agreed (13) Disagreed (2) Unsure (3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reminders did not interrupt my routine.</td>
<td>18</td>
<td>4.72</td>
<td>5.00</td>
</tr>
<tr>
<td></td>
<td>Agreed (17) Disagreed (0) Unsure (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rehearsal improved my confidence.</td>
<td>18</td>
<td>4.11</td>
<td>4.00</td>
</tr>
<tr>
<td></td>
<td>Agreed (14) Disagreed (2) Unsure (2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I learned new skills by rehearsing.</td>
<td>18</td>
<td>4.28</td>
<td>4.00</td>
</tr>
<tr>
<td></td>
<td>Agreed (15) Disagreed (0) Unsure (3)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Description of the preliminary data analysis.

At this stage, we have identified four themes that are briefly presented below:

- Reminders helped the participants in completing weekly tasks: The participants of the study generally favored the reminders because reminders prompted system interaction, which led to the completion of the required weekly tasks.

- Rehearsal helped the participants learn new behavior: In response to the question on whether the rehearsal feature influenced the participants’ behavior, encouraging results were found. Comprehending that rehearsal as a persuasive software feature has the potential to support users in acquiring new behavior is essential.

- Rehearsal improved the participants’ self-confidence: We argue that as a software feature, rehearsal can be an effective tool to help users improve their self-confidence. In response to the question on whether rehearsal improved the participants’ confidence in tackling depressive symptoms, the results support our stand.

- Rehearsal facilitated learning new skills: We propose that as a software feature, rehearsal can educate people with new skills. When the participants were asked the same questions, the responses were generally positive.

Discussion and Conclusions

The results of the initial data analysis from qualitative questionnaires show encouraging findings. Reminders can be cautiously suggested to have successfully motivated the participants suffering from depressive symptoms to interact with the system. Based on the results thus far, we also propose that rehearsal is a key persuasive software feature that can help people, and in this case depressive participants, practice and learn new skills. While drawing any strong interpretations
based on the preliminary data analysis is too early, nevertheless initial findings indicate that persuasive reminders and virtual rehearsal can play an integral part in designing effective BCSS. Almost all the participants agreed that the reminders did not disrupt them; it is reasonable to propose that the reminders were well accepted by the participants seeking psychological treatment for depressive symptoms.

The study describes our ongoing work in developing BCSS for depression and mental disorders. In the future, we will perform further analysis and report detailed findings. We are also inspired to continue our research in this direction and add additional software features to the system. In sum, in an era when the Web is becoming humanized [9], the importance of interplay between emerging technologies and psychology will continue to grow.

Acknowledgements
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References