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An interactive thought visualization tool for insomnia treatment

Begum Erten Uyumaz[a]*, Rosa Hendrikx[a], Laury Quaedackers[a,c], Loe Feijs[a], Mili DoCampo Rama[b], Sebastiaan Overeem[a,c], Jun Hu[a]

[a]Industrial Design, Eindhoven University of Technology, La Place 1.61, Eindhoven, 5600 MB, The Netherlands
[b]Philips Design, High Tech Campus 33, Eindhoven, 5656 AE, The Netherlands
[c]Sleep Medicine Centre, Kempenhaeghe, Sterkselseweg 65, Heeze 5591 VE, The Netherlands

Abstract

Insomnia is the most prevalent sleep disorder, characterized by chronic problems with the initiation and/or maintenance of consolidated sleep. Emotional distress and sleep-related dysfunctional thoughts are common reinforcing factors of insomnia. A method to overcome emotional distress is by challenging irrational thoughts throughout practice which will be effective for the patients to adopt healthier thoughts. This well-established principle is an important part of Cognitive Behaviour Therapy for Insomnia (CBTI). We designed a tool intended to create awareness on dysfunctional thinking patterns by providing visualizations and conceptualized as a web-based platform. Thoughts are released via mobile application and collected on a cloud-based system and then visualized based on frequency and emotional intensity. Initially, a cultural probe study was carried out where participants who perceived to have sleep problems recorded their thoughts for seven days, and then shared their experience in a post interview. The concept was visualized with an interactive mock-up, evaluated with usability studies and clinical expert interviews. The results showed that the tool is easy to use, visualizations are clear and has potential to be an educative platform for cognitive part of insomnia therapy. Based on the results, requirements are settled and design is finalized. The next step is to conduct validation studies by using a fully functional prototype and investigate the tool's effect on the treatment of insomnia related disorders.

* Corresponding author. Tel.: +31-40-247-4681
E-mail address: b.erten.uyumaz@tue.nl

1. Introduction

Insomnia is defined as difficulties with initiating and/or maintaining sleep or a feeling of non-restorative sleep, leading to adverse consequences on daytime activities (e.g. tiredness, irritability, concentration problems) [1]. Insomnia is a prevalent disorder affecting up to 10% of the population [16] and it becomes chronic when the concurrent symptoms exist at least three times a week and present for the previous three months or more.

In general, multiple factors contribute to insomnia which could be categorized as behavioral and cognitive-emotional. Behavioral factors are improper lifestyles such as excessive caffeine consumption, prolonged bedtimes. Cognitive - emotional factors are having an aroused state of mind, sleep – related anxiety such as too much worry about not getting sleep. Eventually, such emotional distress can result in a self-triggering state through negative conditioning and lead to a vicious cycle [6].

Insomnia is a treatable disorder through both non-pharmacological and pharmacological interventions (e.g. benzodiazepine, non-benzodiazepine) [15]. Although pharmacotherapy is often used by medical experts, the gold standard method is Cognitive Behavioral Therapy for Insomnia (CBT-I) [6]. CBT-I is the combination of several components: sleep hygiene education, sleep restriction therapy, stimulus control therapy, relaxation training and cognitive therapy [18]. Despite the proven effect of CBT-I, the contribution of individual components and their effect on the treatment outcome are not precisely known [11].

The cognitive part of CBT-I is developed to address and reduce irrational thoughts and emotional distress. Cognitive restructuring is a standardized method used to modify undesired sleep-related thoughts by challenging irrational thoughts and replace them with alternative rational ones [18]. Thought challenging schema is a traditional way for dealing with vicious thoughts, patients write down their thoughts on a paper and a possible alternative thought and then they discuss with the therapist. Even though it is an effective process, it requires extra effort for the therapists since they have to devote their time and interpret the results.

The traditional way of delivering CBT-I is a costly procedure for healthcare institutions and patients in terms of time and money. The waiting lists within the hospitals are long because of the discrepancy between ratio of therapists and patients. Effective digital healthcare solutions could make CBT-I delivery more effective. Additionally, digital systems can add other benefits such as unlimited availability, tracking progress and regular reminders [7].

Information visualizations is a convenient way to provide feedback which allows many possibilities to represent complex information a straightforward and efficient manner. Furthermore, it could help to summarize a complicated concept in a short time since the eye senses a visual scene in less than 150 milliseconds [19]. Moreover, color coding is handy for representing emotions that emotions since colors perception have an affective dimension which would facilitate information processing [14].

The main objective of this study is to design a digital tool for people who suffer from insomnia by providing personalized reflection over their thought patterns. Since people with insomnia disorder have excessive worry and irrational thoughts about their sleep, providing a tool that could reflect someone's thoughts visually would also help people to become aware of the distortions in their thinking patterns. The tool is expected to serve as an educative tool and have a positive effect on cognitive aspects of insomnia treatment.

The current paper describes the design and the development process of a novel though visualization tool. The paper is organized as follows: related work is described in Section 2, the methodology is described in Section 3, results are described in Section 4, findings are discussed in Section 5, and finally conclusion and future work are described in Section 6.