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Computer-supported mindfulness: Evaluation of a mobile thought distancing application on naive meditators ☆

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ABSTRACT

The last 2 decades have seen a constantly increasing interest in mindfulness, due to its positive effects on health and well-being. Recently, a number of mobile applications aimed at supporting people in practicing mindfulness techniques have appeared, but their efficacy has not been formally evaluated yet. In this paper, we first introduce the reader to mindfulness techniques, traditional as well as computer-based. Then, we propose and evaluate a mobile application (called AEON) aimed at helping users in practicing thought distancing, i.e. a mindfulness technique that requires one not to react in response to his/her thoughts but to be aware of them and observe them while they go away. AEON allows the user to enter his/her thoughts and visualize them as written in ink on a parchment placed under water. By touching the screen, the user can interact with the water and produce waves that progressively dissolve each written thought. We evaluate AEON on a sample of naive meditators (i.e. people with no or minimal experience with meditation), contrasting it with two traditional thought distancing techniques that are not computer-based. The first traditional technique requires users to mentally visualize their thoughts as printed on clouds and observe them as they pass by, while the second requires users to write their thoughts on cards, then pick up the cards one at a time, look at them and toss them into a wastepaper basket. AEON obtained better results in terms of achieved mindfulness, perceived level of difficulty and degree of pleasantness. Since practicing mindfulness tends to be difficult for naive meditators, these results suggest that AEON can be a novel and effective way to help them approach mindfulness.

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1. Introduction

The last 2 decades have seen a constantly increasing interest in mindfulness techniques, due to the positive effects they bring in several domains, such as physical health, psychological well-being, social relationships, sports, work and performance (even including military training (Stanley et al., 2011)). Extensive reviews of the positive effects of mindfulness are provided in Brown et al. (2007), Chiesa and Serretti, (2011) and Keng et al. (2011).

Originally associated to specific meditation techniques (Kabat-Zinn, 1990), a more recent definition considers *mindfulness* as a psychological process that consists of two components: *orientation to experience*, which refers to an orientation of curiosity, openness and acceptance toward one's experience, and *self-regulation of attention*, which refers to the non-elaborative awareness of mental events, i.e. thoughts, feelings and sensations, as they arise (Bishop et al., 2004). Some authors refer to self-regulation of attention as (i) *decentering*, defined by Teasdale et al. (2002) as "a cognitive set in which negative thoughts and feelings are experienced as mental events, rather than as aspects of self or direct reflections of truth", or (ii) *detached mindfulness*, defined as "a state of awareness of internal events, without responding to them with sustained evaluation, attempts to control or suppress them, or respond to them behaviorally" (Wells, 2006). Studies in the literature have shown that decentering can be an ameliorator of worry (Sugiura, 2004) and, in adjunct to other procedures, appears to be effective in the treatment of obsessive-compulsive disorders (Fisher and Wells, 2005, 2008). Other studies have found that decentering can reduce ruminative thinking (Lykins and Baer, 2009; Raes and Williams, 2010; Ramel et al., 2004) and frequency of negative thoughts (Frewen et al., 2007). A typical way to achieve decentering is through techniques that require individuals not to react in response to their thoughts, but to be aware of them and observe them while they go away (*thought distancing*, for short). The study in this paper will focus specifically on mindfulness techniques that aim at achieving decentering through thought distancing.

Unfortunately, the practice of mindfulness techniques can be difficult for people with no or minimal experience with meditation (in the following, *naive meditators*) (Kabat-Zinn, 2005; Segal et al.,

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2002). This can discourage them to start practicing or lead them to abandon the practice soon. There is thus the need to explore new and simpler ways to bring the benefits of mindfulness to people. Recently, a number of mobile applications that aim at helping people in practicing mindfulness techniques have appeared, e.g. Mindfulapps (2012). Unfortunately, to the best of our knowledge, the effectiveness of these applications has not been formally studied yet.

In our research, we developed a smartphone application aimed at helping users in practicing thought distancing. The goal of the present study is to assess whether our proposed application can be of help to naive meditators in achieving decentering. To this purpose, we contrasted practicing thought distancing with our application and with two traditional techniques, assessing the achieved level of decentering as well as participants' perception of pleasantness and difficulty.

The paper is organized as follows: Section 2 provides an introduction to the concept of mindfulness and surveys the major modern approaches to mindfulness. Then, it reviews related work on computer-supported mindfulness techniques. Section 3 illustrates the motivations and the design process that led us to the development of our mobile app, which is then described. Section 4 presents the experimental evaluation we carried out, whose results are reported in Section 5 and discussed in Section 6. Finally, Section 7 draws conclusions and outlines future work.

2. Related work

The origins of the first mindfulness techniques can historically be traced back to Eastern philosophies. In particular, they are central to Buddhist traditions which attribute the first teachings of mindfulness to the Buddha himself (Gunaratana, 2002).

Unlike Eastern traditions, Western conceptualizations of mindfulness are generally independent of any specific circumscribed philosophy, ethical code, or system of practices (Keng et al., 2011). In such conceptualizations, mindfulness was initially defined as a particular way of paying attention, a way of looking deeply into oneself in the spirit of self-inquiry and self-understanding (Kabat-Zinn, 1990). Although other definitions have been proposed over the years, the recent review on scientific studies of mindfulness by Keng et al. (2011) points out that most surveyed research follows the operational definition proposed by Bishop et al. (2004). This definition considers mindfulness as “a process of self-regulation of attention in order to bring a quality of non-elaborative awareness to current experience within an orientation of curiosity, experiential openness, and acceptance”. Also, Bishop et al.'s definition supports the decoupling of mindfulness from meditation. Indeed, as pointed out by Hayes and Shenk (2004), if mindfulness is considered as a psychological mode or process, then any technique that is effective in producing that mode or process can be considered as a mindfulness technique. As a consequence, new mindfulness practices are emerging in addition or as an alternative to traditional meditation techniques.

In the following, we first summarize the most established mindfulness-based interventions followed in medical and psychological contexts. Then, we illustrate new, recently proposed computer-based approaches.

2.1. *Mindfulness-based interventions*

Although they often include techniques taken from Eastern traditions, modern Western approaches to mindfulness are clinically oriented and emphasize standardization and manualization to facilitate scientific study and empirical research (Chiesa and Malinowski, 2011). A large and growing number of studies assessed the effects of these approaches on different aspects of well-being (Keng et al., 2011).

The first standardized approach to be introduced was the Mindfulness-Based Stress Reduction program (MBSR) (Kabat-Zinn, 1990) which was developed by Kabat-Zinn in 1979 and has been the subject of several studies among clinical and non-clinical populations (Keng et al., 2011). MBSR is a group-based intervention for populations with a wide range of stress-related disorders or chronic pain and is offered in hospitals and clinics around the world, as well as in schools, workplaces, corporate offices, law schools, adult and juvenile prisons, inner city health centers and a range of other settings (Kabat-Zinn, 2003). The program consists of an 8- to 10-week course in which a group of up to 30 participants meets weekly for 2–2.5 h sessions together with an all-day (7–8 h) intensive session usually held around the sixth week. During the sessions, participants receive instructions and training about three kinds of mindfulness techniques, which they have to practice also at home: *sitting meditation*, *body scan* and *mindfulness yoga* (Baer, 2003). Sitting meditation consists of different exercises, such as *mindful breathing* and *thought distancing*. In mindful breathing, participants learn how to direct their attention to the sensations of breathing. They have to notice when their mind wanders away, observing it nonjudgmentally and bringing it back to breathing (Baer, 2003). In thought distancing, participants shift their awareness to the process of thinking itself. They have to try to perceive thoughts as “events” in their minds. In particular, they have to note the thoughts' charge and possibly not be drawn into them, but just maintain the “frame” through which they are observing the process of thought. Participants have to be aware that each individual thought does not last long, i.e. it is impermanent, and that some thoughts keep coming back. Thus, participants have to act as a “non-judging observer” and to note how they feel about their thoughts (Kabat-Zinn, 1990). The body scan technique requires instead participants to sequentially direct their attention to the different parts of their body. They have to note the sensations arising from each part of the body and, as in the mindful breathing exercise, bring their attention back when their mind wanders away. Finally, mindfulness yoga consists of a series of postures to learn mindfulness of bodily sensations during gentle movements and stretching (Carmody and Baer, 2008). Participants are instructed to practice the above techniques at home for at least 45 min a day, 6 days per week, and are provided with CDs containing spoken instructions to be used as a support to mindfulness practice in the early weeks (Baer, 2003). They are also encouraged to engage in informal mindfulness practice by doing everyday activities (such as eating, walking, washing the dishes) with full awareness of the associated movements, sensations, cognitions and feelings that may be present. The goal of this out-of-class practice is to bring the capacity of mindfulness in everyday life, together with its associated benefits (Carmody and Baer, 2008).

The same techniques of MBSR are included in the Mindfulness-Based Cognitive Therapy program (MBCT) (Segal et al., 2002), which is an 8-week manualized intervention program developed to prevent depressive relapse in formerly depressed individuals. Unlike MBSR, MBCT incorporates also techniques and exercises derived from Cognitive Therapy that aim at helping participants view thoughts as mental events rather than as facts and thus change one's awareness of and relationship to thoughts and emotions (Keng et al., 2011; Teasdale et al., 2000).

While MBSR and MBCT are meditation-oriented approaches to mindfulness, Dialectical Behavioral Therapy (DBT) (Linehan, 1993a) and Acceptance and Commitment Therapy (ACT) (Hayes et al., 1999) do not involve formal meditation (Chiesa and Malinowski, 2011; Keng et al., 2011). DBT was first developed as an intervention for patients who meet criteria for borderline

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