



## The effects of mindfulness on executive processes and autobiographical memory specificity

Alexandre Heeren<sup>a,b,\*</sup>, Nady Van Broeck<sup>a</sup>, Pierre Philippot<sup>a</sup>

<sup>a</sup> Department of Psychology, Université Catholique de Louvain, Belgium

<sup>b</sup> Fonds National de la Recherche Scientifique, Belgium

### ARTICLE INFO

#### Article history:

Received 17 June 2008

Received in revised form

10 December 2008

Accepted 21 January 2009

#### Keywords:

Autobiographical memory specificity

Executive processes

Mindfulness

Psychological change processes

### ABSTRACT

Previous studies have found that mindfulness training reduces overgeneral memories and increases autobiographical memory specificity (e.g., [Williams, J. M. G., Teasdale, J. D., Segal, Z. V., & Soulsby, J. (2000). Mindfulness-based cognitive therapy reduces overgeneral autobiographical memory in formerly depressed patients. *Journal of Abnormal Psychology*, 109, 150–155]). However, little work has investigated the mechanisms underlying this effect. The present study explored the role of executive processes as a mediator of MBCT effects in an unselected sample. An autobiographical memory task, a cognitive inhibition task, a motor inhibition task, a cognitive flexibility task and a motor flexibility task were administered before and after intervention. Compared to matched controls, MBCT participants showed increased autobiographical memory specificity, decreased overgenerality, and improved cognitive flexibility capacity and capacity to inhibit cognitive prepotent responses. Mediation analyses indicated that changes in cognitive flexibility partially mediate the impact of MBCT on overgeneral memories. Results are discussed in terms of Conway's [2005. Memory and the self. *Journal of Memory and Language*, 53, 594–628] autobiographical memory model.

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A number of studies have demonstrated that individuals with emotional disturbances, especially patients with a history of depression, show difficulties in retrieving specific autobiographical memories and tend to recall categorical overgeneral memories (OGM; for a review, see Van Vreeswijk & de Wilde, 2004; Williams et al., 2007). More generally, several findings suggest that reduced autobiographical memory specificity is more than a cognitive curiosity and that it might be closely associated with other important aspects of psychological functioning. For instance, reduced specificity has been found to be associated with impaired social problem solving (e.g., Goddard, Dritchel, & Burton, 1997), difficulties in generating specific simulations of future events (Williams et al., 1996), and thought to be not just a state characteristic of mood disturbance, but also a stable cognitive marker of depression (e.g., Brittlebank, Scott, Williams, & Ferrier, 1993). Finally, reduced specificity appears also as a marker of vulnerability to future depression (Gibbs & Rude, 2004; van Minnen, Wessel, Verhaak, & Smeenk, 2005) and delayed recovery from episodes of

emotional disorders (Brittlebank et al., 1993; Peeters, Wessel, Merckelbach, & Boon-Vermeeren, 2002).

Several explanations have been proposed to account for OGM (for a review, see Williams et al., 2007). One explanation focuses on executive processes, which are necessary when a situation requires more than a routine execution of automatic and overlearned schemata (Burgess & Shallice, 1996). Several authors have postulated the existence of separate processes within executive function (e.g., Burgess & Shallice, 1996; Miyake, Friedman, Emerson, Witzki, & Howerther, 2000). Miyake et al. (2000) distinguished between inhibition of prepotent response (i.e., the capacity to deliberately inhibit dominant and automatic responses), mental flexibility (i.e., shifting back and forth between multiple tasks, operations or mental sets) and updating (updating and monitoring of working memory representations). With regards to autobiographical memory, recalling a specific autobiographical memory is considered to be a hierarchical process; here, an intermediate or generic description is first recollected (e.g., Haque & Conway, 2001). This intermediate description is then used to search for more specific events through iterative comparisons with the target. Thus, it is voluntarily recalling that is generative and requires effortful processing (e.g., Conway, 2005; Williams et al., 2006). During this process, generic descriptions are progressively inhibited to reach to a specific event (Conway & Pleydell-Pearce, 2000). However, if

\* Corresponding author. Department of Psychology, Université Catholique de Louvain, Place du Cardinal Mercier, 10, B-1348 Louvain-la-Neuve, Belgium. Tel.: +32 (0) 10 47 86 41; fax: +32 (0) 10 47 85 89.

E-mail address: [alexandre.heeren@uclouvain.be](mailto:alexandre.heeren@uclouvain.be) (A. Heeren).

executive resources are insufficient, the process of specific retrieval is prematurely interrupted, leading to the recollection of a general memory (Haque & Conway, 2001; Williams et al., 2006). Indeed, research has shown that OGM is associated with poor performance on various executive functioning tasks (e.g., Dalgleish et al., 2007). More specifically, Williams and Dritschel (1992) have reported a negative correlation between OGM and a cognitive flexibility task (i.e., verbal fluency) and Dalgleish et al. (2007) have found a negative correlation between autobiographical memory specificity and number of generation task error scores.

From an intervention perspective, however, mindfulness-based cognitive therapy (MBCT) increases autobiographical memory specificity and reduces OGM (Williams, Teasdale, Segal, & Soulsby, 2000). MBCT is a manualized intervention, which trains participants to maintain their attention on a particular present experience, without judging or analytically processing it (Kabat-Zinn, 1982). Weekly training sessions occur and consist of meditative exercises and subsequent group discussion on the clients' experiences of the exercises. Furthermore, the clients, as part of MBCT, are also given daily 45-min homework exercises.

Few studies have investigated processes underlying the effect of mindfulness training on autobiographical memory. As suggested by Bishop et al. (2004), mindfulness training may be associated with improvements in the suppression of elaborative processing and in cognitive flexibility. In fact, during mindfulness training, attention is directed back from intrusive thoughts to an arbitrary focus (e.g., breathing sensations), thereby preventing further elaboration. This focus, Bishop et al. (2004) argue, should inhibit secondary elaborative processing of the thoughts, feelings, and sensations that arise in the stream of consciousness (i.e., cognitive inhibition). In addition, mindfulness training involves flexibility of attention as it requires shifting the focus of attention to different objects. Indeed, Alexander, Langer, Neman, Chandler, and Davies (1989) have found that both transcendental meditation and mindfulness exercises are associated with improvements in cognitive flexibility (e.g., lower Stroop interference scores) in comparison to relaxation and no-treatment conditions. Thus, mindfulness training might be associated with improvements in executive processes, particularly at the level of stimulus selection.

The effects of mindfulness training on autobiographical memory have not yet been replicated, so the first task of this paper is to see whether the reduction of OGM following mindfulness training is reliable. We propose that mindfulness training may have similar effects on OGM as with cognitive inhibition and cognitive flexibility. The present study explored the role of executive processes in the relationship between mindfulness training and OGM in an unselected sample. Our main hypothesis is that the improvement of executive processes mediates the impact of mindfulness training on OGM. We predict that (a) mindfulness training improves autobiographical memory specificity and reduces OGM, and (b) mindfulness training increases the performance on cognitive inhibition and flexibility tasks. Additionally, motor inhibition and flexibility tasks were given as control tasks to make sure the effect is specific to cognitive executive component applied at the level of stimulus selection. Finally, we will also test the mediational role of executive processes on the impact of mindfulness training on specificity.

## Method

### Participants

The study was a quasi-experimental mixed design with a between-subjects variable (Mindfulness group vs. Matched group) and a within-subject variable (Pre-test vs. Post-test). For the Mindfulness group, the study was advertised during information

sessions for individuals interested in an 8 session mindfulness program and presented as an investigation of the impact of mindfulness training on different cognitive functions. Twenty-six people who responded to this advertisement were informed of the procedure, exclusion criteria, and ethical considerations.

Exclusion criteria were reported (a) prior mindfulness or another form of meditation training, (b) other planned psychological interventions during the course of the study, (c) active drug dependency or abuse, (d) known cerebral lesion, cerebral tumor or neurological disease, and (e) use of psychopharmacotherapy. Three participants from treatment group met the exclusion criteria and, thus, were dropped from the study in the beginning. One participant dropped out at the first training session and two participants were excluded from the analyses, because they missed two training sessions. For the Mindfulness group, all analyses were conducted on the remaining 18 participants (15 women) who completed all of the study sessions. Participants ( $M = 54.28$  years old,  $SD = 13.62$ ,  $Min = 27$ ,  $Max = 75$ ) all had at least a secondary school degree and were predominantly university graduates.

A control group was constituted by pairing individually each treatment group participant with a control participant, matching for age ( $\pm 12$  months), gender, education and manual laterality (Matched group). The same exclusion criteria than those used for the treatment group were applied in the selection of the control participants. Participants in the Matched group were recruited in the same population as one of the treatment group. The study was presented as an investigation of different cognitive functions among people presenting some specific characteristics. The individual characteristic profiles needed for the matching and the exclusion criteria were mentioned in the advertisement.

In order to assess the equivalence between the two groups, all participants were asked to complete, only at the Pre-test, the Trait Anxiety Inventory (STAI-Trait; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983), the Beck Depression Inventory (BDI-II; Beck, Steer, & Brown, 1996), and the Symptom Check-List-90-R (SCL-90-R; Derogatis, 1977).

### Measures

#### Autobiographical Memory Test (AMT)

This is a validated French version (Neumann & Philippot, 2006) of the AMT (Williams & Broadbent, 1986) consisting of two lists of 10 emotional cue words (five negative, five positive). The cues were presented in a fixed order alternating positive (e.g., *lucky*) and negative (e.g., *guilty*) words. The two lists of cues were counter-balanced across participants. Participants were required to retrieve a specific memory in response to each cue word. Before the task, a practice trial was run involving two cue words to ensure comprehension of the instructions. If it was necessary, an additional example was presented to the participant until a correct response was given.

During the task, participants were given 30 s for each cue. If no memory was recalled within 30 s, the trial was noted as an omission and the examiner gave the next cue word. Each first response to all cue words was coded on specificity. Memories retrieved were categorized either as specific memories (i.e., referring to personal past events that had happened at a particular place and time that had lasted less than a day; for example, when I sang at the wedding day of my sister), categorical memories (i.e., referring to repeated past events; for example, each morning when I am taking the train), extended memories (i.e., referring to past events that lasted longer than a day; for example, a week-end to Paris with my girlfriend), or as omissions (failures to recall a specific memory within the time limit). A sample of 20% of the responses was rated by a second independent rater, and an inter-rater reliability of 97% ( $k = .97$ ) was obtained.

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