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Abstract

Self-related processing pertains to the complex construct of “self”, as studied across varied disciplines such as cognitive science, neuroscience, modern psychology (including clinical and behavioral psychology), and Western and Eastern philosophy. On a theoretical level, most contemporary models propose that mindfulness training impacts self-related processes. In this review, the empirical evidence for this hypothesis is examined and discussed. Overall, very few self-related processes have been measured in randomized controlled trials of mindfulness-based interventions to date, and, of those processes that have been measured, only negative self-rumination improved significantly. The data so far remain inconclusive as to whether mindfulness-based interventions have an impact on other self-related processes. Studies are especially needed on more basic levels of self such as embodiment and sense of agency.

Introduction

Self-related processing is an umbrella term that covers a broad range of processes that have to do with the notion of “self”. Definitions of self-related processes vary widely across disciplines, including cognitive science, neuroscience, modern psychology (including clinical and behavioral psychology), and Western and Eastern philosophy — and especially in phenomenology and Buddhist philosophy, with Buddhism being the main inspiration behind modern mindfulness interventions [1] [2] [3] [4] . I will therefore present some of the most common definitions of self-related processes before reviewing their putative relationship to mindfulness training.

Self-related processing in cognitive science and phenomenology

While modern philosophical conceptions of the self are complex and multifaceted, Gallagher proposed that they can be broadly categorized into two dimensions: the *minimal self* and the *narrative self* [5]. The minimal self corresponds to the experience of the self from within, also known as (i) the *self-as-subject*, (ii) the *experiential self* [6], and also both (iii) the *proto-self* (responsible for primordial feelings reflecting the current state of the body, or interoception, along the pleasure-to-pain range) and (iv) the *core self* (which is about the relationship between the organism and external objects) [7]. One of its aspects is the sense that experience is situated from a specific perspective or vantage point, known as the *perspectival self* [8,9]. In addition, the minimal self encompasses a *sense of ownership* of the thoughts, emotions and sensations that are being experienced, as well as a sense of ownership of one's body [10]. Psychometric experiments show that the feeling of having a body is made of several subcomponents, mainly *spatial location*, *sense of ownership*, and *sense of agency*, which can be dissociated experimentally [11] [12]. Agency itself may correspond to the sense of ownership extended to actions [5].

The second dimension, the narrative self, corresponds to the subject's autobiographical story, with a temporally extended identity, including past, future, and imaginary selves [5] [13] [7].

Self-related processing in clinical psychology

Clinical psychology places central importance on the *self-concept*, a cognitive construct comprising "descriptions, prescriptions, and expectations about one's attributes, weaknesses, and goals," "cognitive appraisals of self-related attributes," or "an implicit theory about oneself" [14]. The self-concept includes evaluative beliefs about the self, which can be positive and negative [2]. The self-concept is especially relevant to personality disorders, but also to anxiety and depression, two conditions on which mindfulness-based interventions show significant benefits [15]. Evaluative self-related processes are thought to be key in both etiology and treatment of these psychopathologies [2]. Self-criticism and self-related rumination are examples of negative self-evaluations; positive self-evaluations include self-esteem and self-efficacy. Psychotherapy, in various forms, has typically aimed to increase

self-esteem, reduce self-related rumination, and shift the valence of the self-concept from negative to positive [2].

Additionally, from the perspective of social theory, the self-concept is a multifaceted construct that is defined and evaluated based on different domains of social life, including relationships and social roles. According to attachment theory, the role of caregivers in early life is critical for the development of a healthy self-concept. Mikulincer and Doron proposed a theoretical framework linking attachment styles and perception of self [16]. Securely attached individuals develop a cohesive and comfortable self-structure, also known as healthy narcissism. Conversely, individuals who did not experience attachment security in their early years become more prone to disorders of the self, such as a lack of self-cohesion, low self-efficacy, vulnerable or unstable self-esteem (as measured both explicitly with self-reports and implicitly using the Implicit Association Test), excessive self-criticism or perfectionism, defensive self-enhancement (narcissism), or doubts about their own self's coherence and continuity over time. Attachment insecurity increases vulnerability to psychopathology such as depression and obsessive-compulsive disorder and interferes with self-compassion [16]. Recent studies indicate that mindfulness interventions may enhance secure attachment [17] and thereby a healthy self-concept; however, much more research is needed in this domain.

Another important aspect of the self-concept is that it can vary across cultures. For instance, in Western cultures the self is usually conceived as independent, while in Asian cultures the self is seen as interdependent (reviewed in [18]). Therefore, perspectives of self in the Asian, Buddhist contexts where mindfulness originated differ significantly from perspectives of self in the Western, secular contexts to which mindfulness is being transposed. This recontextualization may change the nature and effects of mindfulness practice [19].

Self-related processing in behavioral and health psychology

In the context of health behavior change — such as quitting smoking (or other substance use), increasing physical exercise, etc. — other self-related processes such as *self-efficacy* and *self-regulation*

are centrally involved. Self-efficacy, a type of self-evaluation, is “concerned with judgements of how well one can execute courses of action required to deal with prospective situations” [20]. Self-regulation is a broadly used concept lacking a consensus definition. A recent study attempted to synthesize the various usages of this term across disciplines and proposed the following definition:

“Self-regulation involves the monitoring and management of the self, by the self, so that behavior can be appropriately controlled—especially in learning situations. Differences in personality traits are implicated, as are differences in individual agency (or, more popularly, in willpower). But self-monitoring dominates: the control of the self is preceded by observations of the self” [21].

The authors also note, “all three domains of the neoclassical psyche—cognition, affect, and conation—are implicated” [21]. Self-regulation has been a central concept in both Western and Eastern philosophies since ancient times, and has been broadly studied in psychology [22].

Self-related processing and mindfulness

On a theoretical level, most contemporary models propose that mindfulness training impacts self-related processes [23-27]. However, which aspects of the self are being impacted by meditation practice has been subject to considerable debate in historical sources across Buddhist traditions, as well as in contemporary scholarship — a rich topic well beyond the scope of this review [28-32] [33]. On an empirical level, the effects of mindfulness-based interventions on various self-related processes have been measured in a number of studies. However, the vast majority of studies did not use a randomized controlled design, and therefore their results should be considered tentative. We recently conducted a systematic review and meta-analysis of randomized controlled trials of the two most standard interventions, namely mindfulness-based stress reduction (MBSR) and mindfulness-based cognitive therapy (MBCT). We found that only a few self-related processes have been measured in randomized controlled trials to date, namely self-compassion, self-esteem, other positive self-evaluation, negative self-evaluation (rumination), and self-efficacy (Desbordes, Acabchuk, Peters, Dumais, Moitra, Lipsky, Kimmel, Sager, Rahrig, Cheaito, Acero, Scharf, Lazar, Vago, Schuman-Olivier, Lindahl, Ferrer, Loucks,

and Britton, *unpublished*). These self-related processes are reviewed below in the context of mindfulness-based interventions.

Self-compassion. Self-compassion has been defined by Neff as entailing three main components: (a) self-kindness—being kind and understanding toward oneself in instances of pain or failure rather than being harshly self-critical, (b) common humanity—perceiving one’s experiences as part of the larger human experience rather than seeing them as separating and isolating, and (c) mindfulness—holding painful thoughts and feelings in balanced awareness rather than over-identifying with them [34]. Previous studies suggested that self-compassion may be an important component of mindfulness-based interventions [35,36]. However, in our systematic review, the evidence for the effect of mindfulness-based interventions on self-compassion was equivocal: only three of the six studies that measured self-compassion found significant effects; of note, those studies used inactive control groups, and two of them were in non-clinical samples; the other three studies (one with a non-clinical sample, one with a depression sample, and one with an anxiety sample), which all used active control interventions, found no significant effects. More randomized controlled studies are needed to assess the effects of mindfulness training on self-compassion in various populations.

Self-esteem. Self-esteem is the attitude that an individual has towards oneself that reflects one’s sense of individual competence and personal worth in dealing with life challenges; self-esteem buffers negative emotions and enhances personal adjustment. A systematic review of self-esteem and mindfulness reported that mindfulness-based interventions increased self-esteem and that self-esteem was correlated with dispositional mindfulness, but also pointed to methodological weaknesses in those studies [37]. With more restrictive inclusion criteria, our systematic review found only one randomized controlled trial that measured self-esteem; a null result was reported. Self-esteem has been implicated as an important factor in the self-regulation of health behaviors, as well as in physical and mental health and overall wellbeing [38]. While early research did not adequately delineate whether self-esteem was a cause or a consequence

of better health, prospective and intervention studies have confirmed self-esteem as a causal factor in affective disorders (depression, anxiety) and health behaviors related to eating, substances use, and sexual behaviors [39-41]. As a result, multiple models of health behavior change and proposed interventions include self-esteem as a key mechanistic target (see [42] for a review). Of note, although research typically examines levels of self-esteem, the ways in which an individual strives for self-esteem may be more consequential than the individual's absolute level of self-esteem [43]. For instance, approaching self-esteem with self-compassion may attenuate maladaptive pursuit of self-esteem [44]. Thus, future studies may consider whether mindfulness-based interventions influence the way that individuals pursue and engage with self-esteem, and how self-esteem intersects with self-compassion.

Negative self-evaluation (rumination). Rumination has been proposed as a key target for mindfulness training in affective disorders, on the basis that mindfulness, as a skill, helps with disengaging from maladaptive rumination [35,45,46]. Supporting this hypothesis, a recent meta-analysis found that compared to usual care, MBCT produced a significant, moderate reduction in rumination (based on eight studies). In addition, MBCT was found as effective (but not more effective) at reducing rumination as other active treatments (e.g. medication, cognitive-behavioral therapy, and behavioral activation) [47].

Self-efficacy. Self-efficacy reliably predicts health behavior and medical treatment adherence [48], yet self-efficacy is not a unified measurement construct. General and task-specific self-efficacy measures often function differently based on selected outcome, sample type, or context. General self-efficacy often emphasizes overall optimism and confidence about one's capacity to exert control over symptoms and environment broadly, while mindfulness-based interventions instead emphasize acceptance of present-moment symptoms and experience, through a non-interfering, non-fixing, allowing stance [49,50]. In contrast to general self-efficacy, task-specific self-efficacy measures may align better with mindfulness as they are often designed to evaluate change in confidence with respect to a targeted behavior, which may be more sensitive to interventions that employ mindfulness in the service of a specific behavior change. In

our systematic review, we found only two studies measured self-efficacy [51] [52], and none observed significant effects of the mindfulness-based intervention. More studies are needed with well-defined task-specific self-efficacy measures.

Conclusion

Overall, while self-related processing has been proposed as a key mechanism of mindfulness [24], very few of these processes have been measured in randomized controlled trials of MBSR and MBCT to date, and, of those processes that have been measured, only negative self-rumination improved significantly. The data so far remain inconclusive as to whether mindfulness-based interventions have an impact on other self-related processes. The most frequently measured self-related constructs were those derived from the clinical and health psychology literatures (rather than cognitive science, behavioral science, or philosophy), which is perhaps an indication of the investigators' preferences or familiarity with constructs from their own fields. Of note, more basic levels of self — such as embodiment (interoception, proprioception), sense of agency, sense of ownership — have not yet been measured in randomized controlled trials of MBSR and MBCT. Trans-disciplinary studies that include experts on these other aspects of self may be worthwhile, considering that the theoretical framework underlying mindfulness interventions is derived from traditions with perspectives very different from those of modern clinical psychology. We urge mindfulness researchers to work across disciplines to overcome the field's current limitations.

Conflicts of interest

No conflicts of interest.

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