

Assessing Subjective Processes and Vulnerability in Mindfulness-based Interventions: A Mixed-Methods Exploratory Study

Sebastián Medeiros • Millenium Institute for Research in Depression and Personality, Chile • smedeiro/at/uc.cl

Carla Crempien • Millennium Institute for Research in Depression and Personality, Chile • cecrempi/at/uc.cl

Alejandra Vásquez-Rosati • Laboratorio de Fenomenología Corporal, Chile • alejandravasquezrosati/at/gmail.com

Javiera Duarte • Universidad Diego Portales, Chile • javiera.duarte/at/mail.udp.cl

Catherine Andreu • Millennium Institute for Research in Depression and Personality, Chile • ciandreu/at/uc.cl

Álvaro I. Langer • Universidad Austral de Chile, Valdivia, Chile • alvaro.langer/at/uach.cl

Miguel Ibaceta • University of Manchester, UK • miguel.ibaceta/at/postgrad.manchester.ac.uk

Jaime R. Silva • Universidad del Desarrollo, Chile • jaimesilva/at/udd.cl

Diego Cosmelli • Pontificia Universidad Católica de Chile • dcosmelli/at/uc.cl

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Context: Research in the contemplative field has focused on trainable capacities that foster self-regulation and integration. From a psychological perspective, mindfulness and personality research has largely grown with a categorical approach that explores the relationship between personality traits and mindfulness skills in clinical contexts.

Problem: There is still a gap in our understanding of the subjective processes that occur through contemplative learning. Moreover, a dimensional personality approach that

acknowledges personality functioning and individual vulnerability has not formed part of the discussion in the field.

Method: We used a mixed-methods framework to explore change and learning mechanisms among six participants in an eight-week mindfulness-based intervention. Pre- and post-intervention measurements were registered, including a micro-phenomenological interview (Mpl) to explore first-person experience in dealing with difficulty, self-reported personality functioning, symptoms, and mindfulness skills, and heart rate variability, to relate self-reporting and phenomenological accounts.

Results: Multiple levels of observation seem to be sensitive to capturing change and processes occurring in mindfulness-based interventions. The Mpl analysis points to greater awareness and embodied care as central mechanisms. Personality functioning correlates with autonomic activity during critical phases of the Mpl. Conceptual and experiential understanding of new forms of relating to experience are exemplified through a case study.

Implications: This exploratory study contributes to scientific and clinical understanding of healing mechanisms of mindfulness practice. Taking vulnerability into account can help refine therapeutic strategies and clinical sensitivity. The results support more skillful ways of guiding and inquiring in mindfulness practices. Future research should explore subtler levels of experiential and physiological regulatory processes using larger samples, particularly with participants who experience difficulties during practice.

Constructivist content: This work contributes to the development of Francisco Varela's neurophenomenology project and his scientific interest in contemplative practices as tools for the study of consciousness.

Key words: Mindfulness, meditation, mechanisms, mixed methodology, micro-phenomenology, personality functioning, heart-rate variability

Introduction

1. There has been exponential growth in studies on the impact of meditation and mind-body practices on health and well-being. In particular, mindfulness-based interventions have been implemented in clinical and non-clinical settings and have been studied in interdisciplinary frameworks. In this target article, we present a conceptual and methodological approach to exploring change mechanisms of mindfulness and discuss the results of an exploratory study with a mixed-methods design. By integrating first- and third-person perspectives, we aim to contribute to the contemplative field in line with Francisco Varela's enactive and embodied approach to cognition and his interest in contemplative practices as tools for the study of consciousness and therapeutic processes. As Jon Kabat-Zinn comments,

“Francisco Varela would have had a field day with the vast opportunities presented to us in this unique era of the confluence of cognitive science, phenomenology, and dharma that he contributed hugely to bringing about.” (Kabat-Zinn 2016: xv)¹

2. Mindfulness can be defined as “awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment by moment” (Kabat-Zinn 2003: 145). From a psychological point of view, mindfulness can be understood as a trait or predisposition to be mindful in daily life (Baer et al. 2006). Mindfulness is also conceived of as a state occurring in mindfulness meditation and its regular practice may increase trait mindfulness (Kiken et al. 2015). Mindfulness-based interventions (MBI) are standardized group programs, most often 8 weeks in duration, which include formal and informal practices to cultivate attention and attitudinal aspects for application in daily life. Mindfulness-Based Stress Reduction (MBSR) (Kabat-Zinn 2013) and Mindfulness-Based Cognitive Therapy (Segal et al. 2002), for example, are widely applied and appear to be effective in promoting health and preventing and treating mental and somatic disorders. In the following sections, we present concepts and research approaches to understanding change occurring in mindfulness learning.

Contemplative Studies

Quantitative research

3. Research in the contemplative field has grown in recent decades, with evident benefits of MBI in a variety of disorders, including anxiety, chronic pain, depression, and addiction (Bohlmeijer et al. 2010; Piet & Hougaard 2011; Goyal et al. 2014; Goldberg et al. 2018). Improvements have also been observed among non-clinical populations in well-being, quality of life (physical, psychological and relational health), and cognitive and affective outcomes (Khoury et al. 2015; Creswell 2017). Regarding mechanisms of action, studies have largely been quantitative through self-reporting questionnaires that show decreased rumination, experiential avoidance and cognitive and emotional reactivity, and increased self-compassion and dispositional mindfulness (Alsubaie et al. 2017; Kuyken et al. 2010; McCluskey et al. 2020). Self-regulation, which is the capacity to control one’s behavior, emotions and thoughts in pursuit of long-term goals, seems to be a central outcome of mindfulness meditation (Ostafin, Robinson & Meier 2015). From a psychodynamic perspective, self-regulation includes regulation of impulses, tolerance of affects, and regulation of self-esteem (OPD Task Force 2008). Regarding the regulation of emotions, there appears to be circularity between top-down strategies – labelling, metacognition, cognitive defusion, dereification (considering one’s thoughts as mere thoughts rather than being absorbed in their content) – and bottom-up strategies – recognizing and allowing present-moment

¹ “Dharma” is a Sanskrit word meaning laws that govern life and the nature of suffering.

bodily experience (Guendelman, Medeiros & Hampses 2017; Andreu et al. 2017).

Qualitative and mixed methodology

4. There is still a gap in our understanding of subjective processes in contemplative learning and interventions. There is increasing qualitative research in this field, but it remains underrepresented. Studies have been conducted with healthy, subclinical populations and adolescents (Christopher et al. 2006; Shonin, Van Gordon & Griffiths 2014; Langer et al. 2020), as well as clinical populations, particularly individuals with depression (Allen et al. 2009; Burnett-Zeigler et al. 2019). While some studies have assessed implementation and have examined facilitators and barriers to engaging in MBI (Rycroft-Malone et al. 2019; Banerjee, Cavanagh & Strauss 2017), others have focused on subjective effects on participants. For example, Mackenzie et al. (2007) described subjective aspects among individuals with cancer who participated in an MBSR program, including:

- openness to change
- self-control
- shared experience
- personal growth
- spirituality.

5. Given the complexity of these types of experiences, contemporary studies in different fields have drawn on mixed methods and interdisciplinary approaches in an attempt to better capture them. A good example of this is the Mind and Spirit Project, which used a mixed-methods, multiphase approach, drawing on the expertise of anthropologists, psychologists, historians and philosophers to explore how different understandings of “mind” shape the way people tend to interpret “spiritual” or “supernatural” experiences (Weisman & Luhrmann 2020). This project shows that different disciplines have different skills and methods and when used together can improve research. These different methods offer counterpoints that generate alternative explanations, leading researchers to constantly re-evaluate their assumptions and look for new interpretations.

6. As Tuyen Huynh, Holly Hatton-Bowers & Michelle Smith (2018) pointed out, mixed methods are well suited for mindfulness research due to the complexity of the construct of mindfulness itself and, specially, due to the field moving forward in understanding for whom, how, when, and why mindfulness may be beneficial. Although mixed-methods research focused on mindfulness is still relatively new, the study of Diana Kelm et al. (2018) is a good example of how these methods can complement each other. The authors studied the effect of mindfulness-meditation training on healthcare providers in carrying out acute care tasks. Quantitative data showed improvements in team and task-management performance, while the results of qualitative study of

mindfulness-meditation training indicate how participants use new skills in their work and personal lives.

Phenomenology and contemplative research

7. Parallels have been drawn between phenomenology and contemplative practices since the beginnings of the neurophenomenology research project (Varela, Thompson & Rosch 1991; Varela 1996; Petitot et al. 1999). Mindfulness meditation and other contemplative practices have been used as a method for investigating experience, showing remarkable points of convergence with phenomenological *praxis* (Depraz, Varela & Vermersch 2003; Hanna, Wilkinson & Givens 2017). On the one hand, meditative practices can be used in qualitative and phenomenological studies in cognitive sciences, including the investigation of selected experiential phenomena (Markič & Kordeš 2016; Depraz 2019; Kordeš & Demšar 2021). Regarding the meditation-based examination of experience, Urban Kordeš et al. consider it to be:

“the most suitable first step towards developing a contemplative, non-naturalized, and existentially meaningful study of consciousness” (Kordeš et al. 2019: 84).

8. On the other hand, Antoine Lutz et al. (2015) suggested a phenomenological matrix as a framework to map different styles and levels of training in mindfulness. The description of subjective experience is usually difficult because an important part is not accessible to awareness. Claire Petimengin et al. (2019) argued that meditative experience is in itself a research object, highlighting the micro-phenomenological interview (Mpl) as a method to describe and understand its processes. This technique emerged from the Explication Interview developed by Pierre Vermersch (2009) to systematically and rigorously study the procedural aspects of learning. The Mpl has been adapted to cognitive science to describe experiences associated with cognition and embodied processes, including perception of emotion (Depraz, Gyemant & Desmidt 2017; Vásquez-Rosati et al. 2017). The Mpl has recently been used to explore subjective reports of meditative states and differential affective, bodily, and sensory fingerprints of contemplative practices (Przyrembel & Singer 2018; Kok & Singer 2016). Moreover, through the use of the Mpl, Petimengin et al. (2019) suggested that the process of regaining contact with experience, regardless of its content, may account for the therapeutic effects of meditation.

Mindfulness and personality research

9. The research to date exploring the relationship between mindfulness and personality has mainly consisted of cross-sectional studies using self-report measures to study correlations between personality traits (the Big Five) and dispositional mindfulness (e.g., the Five-Factor Mindfulness Questionnaire). For example, in a cross-sectional study, Paul van den Hurk et al. (2011) found a positive association between mindfulness and openness to experience and extraversion among experienced meditators. Although the literature has tended

to report inverse correlations between mindfulness and neuroticism and negative affects, as well as positive associations with responsibility, a meta-analysis by Tamara Giluk (2009) revealed a high degree of variability and inconsistency in the associations described in this field.

Personality functioning

10. Current models, including the proposal of the Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-5) regarding personality disorders and the Operationalized Psychodynamic Diagnostic System (OPD Task Force 2008; Zimmermann et al. 2012) promote a dimensional view of personality functioning as complementary to traits, giving importance to the adaptive capacities of individuals, as well as vulnerability to stress, and resilience. Personality functioning develops in the early years of a person's life and reflects ongoing levels of relational integration and plasticity. According to Allan Schore (2012), regulatory capacities arise early in the dynamics of inter-affective regulation, imprinting implicit personal and relational patterns. Regulatory systems are underdeveloped in relation to early trauma, which manifests itself as threat sensitivity and self and social-affective dysfunctions. Personality functioning is understood as the organization of psychological dispositions, functions, or self-capacities to respond to internal and external demands and stress-related regulation (OPD Task Force 2008). For the purposes of psychotherapy research, these functions are measurable through self-report questionnaires (Ehrental et al. 2012). Although measurable personality functions tend to be stable, they can change over time and context, as we explore in this study.

Autonomic arousal

11. The autonomic nervous system plays a key role in orchestrating mind-body interactions and represents a valuable source of observation in studying self-regulation. It has been suggested that heart rate variability (HRV) is an emergent property of interdependent regulatory systems that operate on different time scales to help us adapt to environmental and psychological challenges (Shaffer & Ginsberg 2017). Increased HRV is regarded as a physiological marker of overall health, well-being, behavioral and social adaptation, sense of coherence, and cognitive flexibility (Kamath, Watanabe & Upton 2013; Quintana, Alvares & Heathers 2016; Kirby et al. 2017). Reduced HRV may reflect a failure to inhibit a maladaptive cardiac autonomic response to stress and perceived threats and is associated with mental (anxiety, addiction, autism) and somatic conditions (Kemp et al. 2010; Kemp & Quintana 2013; Quintana, Alvares & Heathers 2016). Recently, HRV has been introduced in contemplative studies to understand the effects of meditative practices on the modulation of the autonomic nervous system (Christodoulou, Salami & Black 2020). Promising results with clinical and non-clinical populations have been described (Pascoe, Thompson & Ski 2017; Nijjar et al. 2014; Bhatnagar et al. 2013). In this regard,

Kirby et al. (2017) suggested including HRV measurements in the contemplative field (particularly in compassion practice) as a primary outcome in assessment and training. Interestingly, in compassion-based practices, increased HRV and other neurophysiological measurements depend on personality aspects like levels of self-criticism and indicators of insecure attachment (Kirby et al. 2017).

12. In this study, we assume that every person who begins a contemplative practice, whether through an MBI or a contemplative tradition, has personal vulnerabilities as a result of genetic and environmental factors during early life and development. Aiming to contribute to broadening our understanding and treatment of traumatic memories through enactive, incarnate and phenomenological frameworks, we focus on developmental trauma and its impact on habitual forms of relating to difficult experience. According to Philip Bromberg (2011), developmental trauma (also termed relational trauma) shapes early relational patterns through procedural memories that organize the core self and its relative degree of vulnerability to destabilization. While not directly studying people with Post-Traumatic Stress Disorder as a clinical diagnosis, we are acknowledging the impact of early life adversity in terms of vulnerability to stress and psychopathology. This exploratory study assesses these individual landscapes and their interaction with the mindfulness learning processes and outcomes. To fill the gap in understanding subjective processes of mindfulness learning and its application to daily life, we explore change from a phenomenological approach based on the complexity continuum of possible forms of first-person data described by Aviva Berkovich-Ohana et al. (2020). We consider self-report questionnaires as *thin* phenomenology due to their limitations and reductive nature, while we consider the MpI as *thick* phenomenology due to its highly refined and detailed description of subjective experience. Specifically, we use the MpI to examine the impact of an MBI on forms of relating to difficult experiences. From a third-person perspective, we used physiological measurements of arousal. Three types of data were collected (Figure 1):

- Micro-phenomenological interview
- Self-reporting
- Physiology of arousal

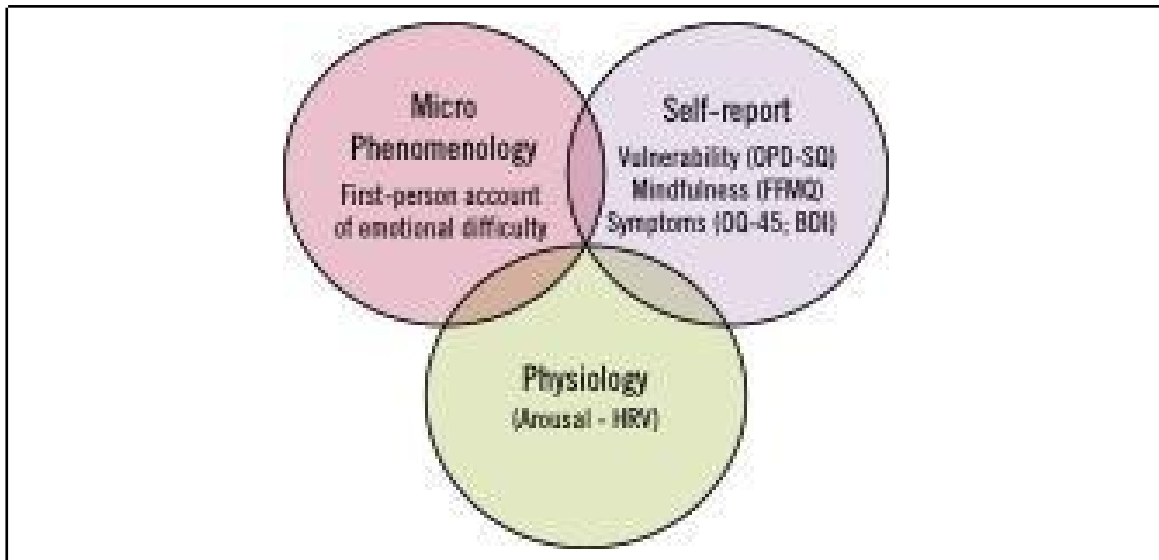


Figure 1. Methodological framework studying change through mindfulness practice, incorporating vulnerability. ECG-HRV: Heart Rate Variability, OPD-SQ: Structure Questionnaire, BDI: Beck Depression Inventory, OQ45: Outcome Questionnaire, FFMQ: Five-Facet Mindfulness Questionnaire).

Method

13. We used a mixed-methods approach to explore complexities of change while considering individual functioning and interaction with mindfulness learning processes. Data was collected before and after the 8-week Mindfulness-based Cognitive Therapy (MBCT) program (Teasdale et al. 2000). First-person accounts relating to emotional difficulty (see below) were assessed using the Micro-phenomenological interview. Self-administered questionnaires were used to describe changes in dispositional mindfulness, personality functioning and symptoms. Correlates of autonomic arousal (HRV) were recorded during the interviews.

14. Sample: The empirical data was obtained from participants attending an MBCT program. The intervention took place in June and July 2017 and was conducted at a mindfulness center in Santiago, Chile. Individuals eligible to participate were (i) aged 18 years and over, and (ii) committed to engaging fully in the intervention. Individuals with severe depression, suicidal ideation, psychosis or addiction (measured by OQ-45.2 and BDI, see below) were excluded from the study. Six participants (all women) gave their informed consent to participate in the study. The average age of the participants was 30 (between 27 and 34). Four had a clinical history of depressive disorders and two of anxiety disorders. As shown in Table 1, all the participants had histories of vulnerability and mental suffering. Almost all the participants were receiving other treatment at the time of the intervention. Their motivations to participate varied, reflecting a heterogenous group in terms of expectations. The study was approved by the Ethics Committee of the Pontificia Universidad Católica de Chile.

N=6	Sex	Age	Symptoms	Reasons for entering the program	Other treatments
P1	F	32	history of depressive symptoms	mood regulation, awareness of emotions and thoughts, self-knowledge to cope with anxiety and depression	none
P2	F	25	depressive and anxiety symptoms, chronic physical illness (hepatitis)	coping with anxiety, self-knowledge, enjoying instead of controlling	psychotherapy, pharmacotherapy (anxiolytics and immuno-modulators)
P3	F	24	anxiety and sleep disorder	self-care practices to cope with thoughts and emotions, self-knowledge, getting to know a new field in psychology	recently completed psychotherapy process
P4	F	33	affective disorder	learning to regulate emotions, to improve quality of life, and reduce anxiety and stress	pharmacotherapy (antidepressant, psychotherapy)
P5	F	31	depressive symptoms	recognizing and coping with difficult emotions and stress to reduce anxiety	psychotherapy
P6	F	27	anxiety symptoms (panic disorder)	coping with anxiety and panic disorder, living a "normal life," to be able to be alone	pharmacotherapy (antidepressant, anxiolytics) psychotherapy,

Table 1. Sociodemographic data and clinical history of the six participants

15. Intervention: MBCT is a clinical intervention designed to prevent relapse among subjects vulnerable to recurrent depression. It focuses on recognizing cognitive and emotional patterns that lead to suffering through the development of mindfulness skills (Teasdale et al. 2000). Participants met weekly for 2.5 hours to learn meditative practices and share their experiences. They committed themselves to a daily practice of 40–60 minutes supported by MP3 recordings and readings. Towards the end of the program, a 7-hour-long silent retreat was carried out. The program was facilitated by two experienced mindfulness facilitators: a psychiatrist trained at the Center for Mindfulness at the University of Massachusetts, and a clinical psychologist trained at the Centre for Mindfulness Studies in Toronto.

16. Procedure: During the group orientation session (one week prior to the intervention), clinical records were completed with the personal data and medical backgrounds of the participants. Also, brief personal interviews were conducted to screen for contraindications. During that week, participants completed online questionnaires and attended the Laboratory of Observation and Analysis of Human Behavior, at the School of Psychology of the Pontificia Universidad de Chile for the recording procedure of the physiological

measurements and the MpI. Once the program had been completed, the participants were reassessed in all the aforementioned domains.

Micro-phenomenological interview

17. The micro-phenomenological interview is a technique used to collect highly reliable and precise descriptions of the microdynamics of singular experiences from an embodied perspective. By means of content-empty questions that guide the interviewee to evoke and describe a retrospective experience, the interviewee is able to consider a more incarnated form of the experience and be more aware of it (Petitmengin & Bitbol 2009). The MpI obtains detailed descriptions of a singular experience that is limited in time and space, focusing on the procedural dimension and from an embodied perspective (Vermersch 2009; Petitmengin 2006). During the MpI specifically designed for this study, participants were invited to recall a difficult emotional situation that had happened to them during the previous week. This approach was designed to evaluate the interviewees' ways of relating to difficulties and any changes after the intervention. Each participant was interviewed before and after the 8-week intervention. The opening question (for both interviews) was "If you agree to do so, I propose you recall a difficult emotional situation you experienced last week. When you have something in mind, let me know." The interviewer guided the interviewee to the state of evocation of this particular moment through the connection of sensory aspects, with the purpose that participants acquire "an increasingly fine reflective awareness of one's experience in real time" (Petitmengin & Bitbol 2009: 384). Some objective indicators of the state of evocation are eyes directed towards the horizon, slower speech, words cut off with silences, co-verbal gestures such as arm movements, and shifts in body posture (Petitmengin & Bitbol 2009). Once the interviewee was in the evocation state, she was guided in the description of the experience through various tools, such as questions without content, echo and fragmentation. Interviews were audio- and video-recorded and later faithfully transcribed.

18. There are several steps in the analysis of the interview, the first being the preparation of the data. To this end, we selected transcribed parts of the interviews that dealt with the main theme and not with asides (Vermersch 2011). A process called "iterative interrogation" was used to capture the temporal units of the development of the experience that compose the diachronic structure of the experience. This process was done first by obtaining the individual structures for each interview. Then, from these structures, the generic diachronic and synchronic (experiential space) structures of experience were built. The diachronic structure refers to the temporal development of the experience under study and the synchronic structure to the characterization of the experience or an aspect of it at a given moment (Petitmengin, Remillieux & Valenzuela-Moguillansky 2019; Valenzuela-Moguillansky & Vásquez-Rosati 2019). We assessed the reliability of the reports and the validity of the results using the same analysis procedure by means of performative consistency

(Petitmengin & Bitbol 2009). In particular, we used confirmation by iteration, inter-subjective validation and neurophenomenological validation: the first consists of detecting a hypothetical structure, which is confirmed and refined with the subsequent analysis of the interviews; the second consists of comparing the results provided by the independent research teams; the last consists of comparing the first- and third-person methods to confirm the results (Petitmengin, Remillieux & Valenzuela-Moguillansky 2018).

Self-reports

OPD-SQ Structure Questionnaire (Ehrenthal et al. 2012)

19. The level of personality functioning is evaluated based on Axis IV of the Operationalized Psychodynamic Diagnosis System OPD-2 (OPD Task Force 2008), which assesses eight functions or regulatory capacities:
 1. Perception of self: differentiated image of self, self-reflective capacity, stable identity;
 2. Perception of the Object: adequate image of others, self-object differentiation;
 3. Self-regulation (impulses and effects);
 4. Regulation of the relationship with the object: being able to protect relationships and balance interests and needs of oneself and others;
 5. Internal emotional communication: emergence and experiencing of effects, internal dialogues, and fantasies as mediators of internal states;
 6. External emotional communication: emotional exchange with others, communication of affects, empathy;
 7. Attachment to internal objects: internalization and use of introjections to regulate internal states;
 8. Attachment to external objects: relating to others emotionally, accepting help, tolerating separation.
20. The questionnaire consists of 95 items with a 5-point Likert-scale format. Higher scores indicate psychological vulnerability, i.e., lower regulatory capacity. A score was obtained for each function and a total score was calculated for overall personality functioning. The questionnaire had adequate psychometric properties (Ehrenthal et al. 2012). A version adapted to the Chilean context was used (De la Parra et al. 2018).

Beck Depression Inventory (BDI-I) (Beck et al. 1961)

21. The BDI-I evaluates depressive symptomatology during the previous week. It consists of 21 items presented in groups of statements, which the participants can select to represent their inner states. Higher scores indicate greater depressive symptomatology. It has been widely used in mental health research in Chile, presenting adequate internal consistency ($\alpha = .92$) (Valdés et al. 2014).

Five-Facet Mindfulness Questionnaire (FFMQ) (Baer et al. 2006)

22. The FFMQ describes mindfulness as a multidimensional construct composed of five facets: observation, description, acting with awareness, non-judging, and non-reactivity toward experiences. It consists of 39 items in a Likert-scale format. The FFMQ has adequate psychometric properties and is widely used to evaluate mindfulness. Validation studies with students show that the Chilean adaptation has adequate psychometric properties (Schmidt & Vinet 2015).

Outcome Questionnaire (OQ-45.2) (Lambert et al. 1996)

23. The OQ assesses progress in psychotherapy through successive measurements that cover three general and interpersonal functioning areas of the patient at the present time in their life: symptoms, interpersonal relationships, and social role. It has proven to be reliable and valid in its sensitivity to psychopathology and change and was validated by Alejandra von Bergen and Guillermo de la Parra (2002).
24. Self-reported measurements were analyzed with SPSS 20.0.² Descriptive statistics (means and standard deviations) were calculated for scales and subscales of each self-reported measurement. The Wilcoxon non-parametric test was used to compare pre- and post-intervention scores of self-reported measurements.

Physiological measure

25. We used three electrocardiogram sensors (MindWare Mobile Impedance Cardiograph, frequency sampling 500 Hz) to explore heart rate variability as an autonomic indicator. The heart rates of the participants were measured at rest and during the Mpi, pre- and post-MBCT intervention. To analyze the HRV data, the inter-beat (RR) intervals from the QRS complex (the ECG waveform corresponding to the electric activity of the heart) were identified, segmented through `qrstdetect` function from the BIOSIG toolbox and processed in R (version 4.2.3) (Rodriguez-Liñares et al. 2008) to obtain temporal indices. The segments provided ultra-short-term HRV indices (Castaldo et al. 2019; Pecchia et al. 2018; Baek et al. 2015) from which the following were chosen for analysis:
- a. the ratio between the standard deviation of the RR intervals (SDNN) and the square root of the successive differences of the RR intervals (RMSSD), where SDNN is an indicator of overall autonomic nervous system activity, while RMSSD shows the functioning of the parasympathetic nervous system (vagal activity)³;

² IBM SPSS statistics for Windows, 2011.

³ We used the SDNN/RMSSD index as a surrogate for the low and high frequency index (Wang & Huang 2012).

- b. the percentage of absolute difference between RR intervals (pNN50), an indicator of parasympathetic nervous system activity that also correlates with the RMSSD.

HRV data was temporally identified from specific segments of the interview:

- Resting state (3 minutes);
- State of evocation: moment when the difficult emotional situation is recalled (3 minutes); and
- Emotional confrontation: segment in which the participant describes coping with a difficult emotional situation (2 minutes).

Results

26. All participants completed the program and attended all weekly sessions and the day-long retreat. No adverse effects were observed during the intervention.

Micro-phenomenological interview analysis

27. The analysis of the six MpI indicated the diachronic and synchronic generic structures before and after the intervention. The diachronic generic structure shows the temporal development of the difficult emotional experience, which is demarcated temporally by the moment of emotional conflict. The synchronic structure shows how different aspects of the experience (emotions, thoughts, self-treatment and strategies) are transformed throughout it. The description of the generic structures before and after the intervention are shown in Figure 2.

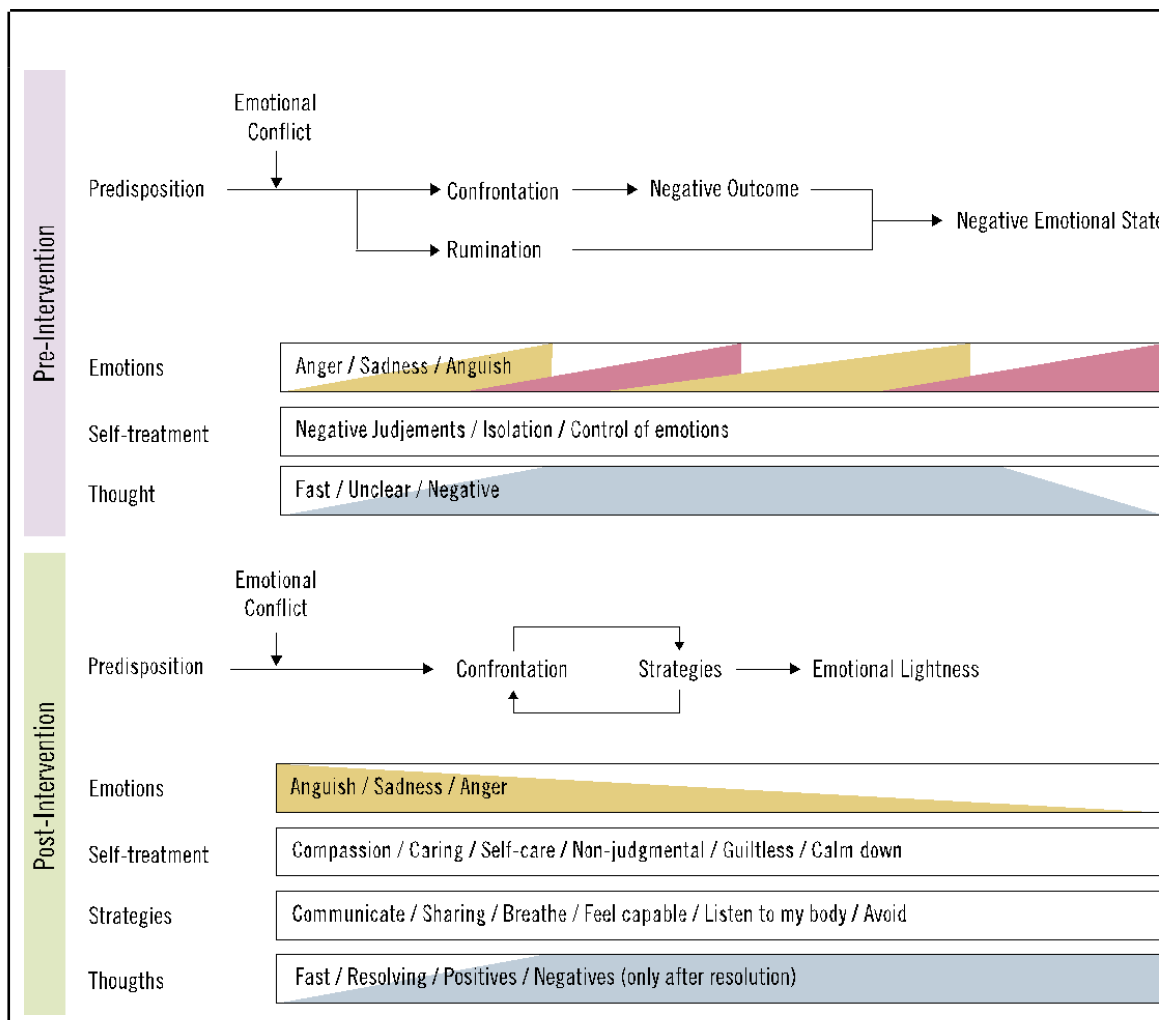


Figure 2. Micro-phenomenological analysis of the difficult emotional situation before (pre-intervention) and after (post-intervention) an 8-week mindfulness-based intervention. The generic diachronic structure starts with a positive/negative attitude toward the emotional event, followed by emotional conflict and its later development varying between the two conditions. The generic synchronic structure shows the multiple axes that emerged from the analysis (emotions, self-care strategies, and thought).

Pre-intervention

28. The generic diachronic structure shows that 2 of the 6 interviewees indicated being in a negative emotional state (anger or anguish) before facing the difficult emotional situation (predisposition phase). When participants faced the stressor, they reported either the will to resolve the conflict or entering a state of rumination. In attempting to confront the situation, participants found strategies like trying to *control emotions* were not effective in helping them to calm down: “Towards him it is more like anger, and with me it is impotence at not being able to control the sadness, to control the anguish” (P2); “I try not to show it so much in my body, but to control it a little, so in the end it is a kind of... like a... is to control, to stop my body from expressing itself...” (P6). In most cases (5/6), the result was negative, generating a negative emotional state: “I stop crying and the anger remains” (P1); “Like judging myself, I don’t know, feeling silly or weak” (P2).

29. The synchronic generic structure shows that emotions like grief, anger, and anguish were present during the confrontation with the difficult situation, and most participants had difficulty in differentiating these emotions. These emotions were accompanied by bodily sensations such as tension, stomach pain, a lump in the throat, disgust, and pressure on the chest. The intensity of these emotions did not diminish over the course of the experience and remained after the emotional conflict. Rumination was described as feeling flooded by thoughts. When the participants entered a state of rumination, they perceived the situation negatively or wished to escape the context, leaving it unresolved. In this state, the flow of negative thoughts increased, being described as fast and unclear. Participants judged themselves negatively, isolated themselves, and tended to control their emotions: “But then when the thought comes, the feelings of guilt, I mistreat myself, I put too much pressure on myself, I am very critical of myself, very hard” (P5); “then a whole guilt mechanism begins” (P4). Only one participant described taking care of herself and thinking positively as having helped her get out of a difficult emotional situation.

Post-intervention

30. The diachronic generic structure, as in the previous condition, shows that two participants reported an emotional state prior to the emotional conflict, but unlike the previous case, this state was characterized by emotional expectation. All the participants dealt with the situation in one way or another using different strategies, which resulted in feelings of emotional lightness: “Being able to say it already relieves me [...] in this situation,” “I feel able to be more compassionate to myself” (P2); “It’s like realizing that I can say something, that I can put limits on it, that feeling of putting limits on it. That’s the feeling of relief, like feeling that I can tell him something” (P3); “I tried to embrace that feeling” (P4).
31. The synchronic generic structure shows that emotions of anguish, grief, and anger were present during the confrontation with the difficult emotional situation, as in the pre-intervention condition. However, the participants were able to differentiate between these emotions. The intensity of emotions diminished over time, while other feelings accompanied the difficult emotional experience, including powerlessness, frustration, and disappointment. After the intervention, participants were better able to describe the bodily sensations that accompanied their emotional response, which in turn allowed them to better recognize their emotions. For example, participants were able to distinguish between anguish and grief. Anguish was accompanied by a sensation of tightness in the chest and accelerated breathing, while grief was accompanied by feelings of despondency, a tightness of the throat (speechlessness), and stomach pain: “anguish is like something that squeezes me, squeezes me and doesn’t go away with crying, the sadness goes away with crying, once I let it out.” (P5). One participant reported feeling nervous, which was described as containing energy, tension, and a feeling in the gut.

32. Figure 2 shows new regulatory abilities arising from changes in the participants' ways of relating to emotional stress. In general, the participants' thoughts appeared to be resolution-directed and positive. Initially, the participants' thoughts were rapid, but later on they slowed down and weakened. The participants treated themselves non-judgmentally and in a compassionate and affectionate way, welcoming their sensations and reassuring themselves: "I calm myself and want to solve it in a tranquil way, perhaps with a more caring attitude" (P6). Interestingly, they moved from avoidance to approximation and used strategies like calming themselves through deep breathing while listening to their bodies and feeling capable, sharing, communicating and asking for help: "my body shows me new things and I realize what is happening to it [...] I manage to be aware of that" (P3). Participants described emotional fading and lightness, and calm. These states were accompanied by bodily sensations of relaxation, including untying the knot in their throats, and being present: "Here comes a rich, peaceful feeling" (P6); "My thoughts changed, like I stopped thinking about anger all the time... but mainly I didn't have that feeling in my gut anymore, I didn't want to cry" (P1). Two participants described that negative sensations came and went towards the end of the experience.

Self-report results

33. In this small sample we observed a trend toward symptom reduction (OQ-45) and enhancement of mindfulness skills (FFMQ: Observation and non-reactivity). Changes in personality functioning were also observed, specifically in self-perception and self-regulation (Table 2).

		Mean (Pre)	Mean (Post)
Depressive symptoms (BDI)		7.5 (2-14)	4 (0-11)
Outcome Questionnaire (OQ-45) OQ-45 Subscales	Subjective distress (SD) Interpersonal Relationships (IR) Social Role (SR)	60.33 (25-75) 36 (19-47) 14.33 (3-22) 10 (3-14)	35.5 (12-66) 21.17 (5-35) 8 (2-17) 6.33 (3-14)
Personality Functions (OPD-SD)	Self-Perception Object Perception Self-Regulation Regulation of Relationships Internal Communication External Communication Attachment to Internal Objects Attachment to External Objects	2.44 (1.75-2.83) 2.23 (1.52-3.59) 2.21 (1.45-2.93) 2.29 (1.67-3.00) 1.60 (1.22-2.08) 1.72 (1.03-2.67) 2.33 (1.13-3.63) 2.52 (1.38-3.63)	1.73 (1.17-2.58) 1.74 (1.11-2.19) 1.72 (0.92-2.68) 2.16 (1.58-3.17) 1.42 (0.75-2.92) 1.57 (1.31-2.36) 1.96 (1.00-2.63) 2.21 (1.63-2.88)
FFMQ	Observation Description Awareness Non-judgment	20.50 (16-26) 27.83 (24-31) 22 (14-25) 32.83 (24-38)	22.83 (17-31) 29.50 (25-32) 25 (22-32) 36.33 (33-39)

	Non-reactivity	19.67 (12-26)	24.33 (20-28)
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Table 2. Self-reported measurements, pre- and post-intervention means and ranges.

Physiological results

34. Table 3 shows the HRV analysis for the three interview segments: resting state, evocation, and emotional confrontation, for the entire group. No significant differences were observed in SDNN/RMSSD or pNN50 indices between pre- and post-intervention phases. Nevertheless, we found a positive correlation between SDNN/RMSSD and personality functioning (OPD-SD) for the entire group during the post-intervention evocation phase (see Figure 3). Less integrated capacities were associated with higher overall autonomic arousal ($R=0,87$; $p=0.02$). These correlations diminished later in the confrontation/resolution phase.

	Pre-Intervention Mean (standard error)	Post-Intervention Mean (standard error)
SDNN/RMSSD		
Resting state	1.52 (0.16)	1.55 (0.11)
Evocation	1.88 (0.16)	1.87 (0.20)
Emotional Confrontation	1.77 (0.13)	1.57 (0.21)
pNN50		
Resting state	17.09 (6.83)	7.91 (3.85)
Evocation	10.98 (3.42)	10.07 (2.53)
Emotional Confrontation	11.77 (3.53)	11.45 (4.17)

Table 3. Mean values and ranges of HRV temporal indices comparing pre- and post-intervention scores for each segment of the data.

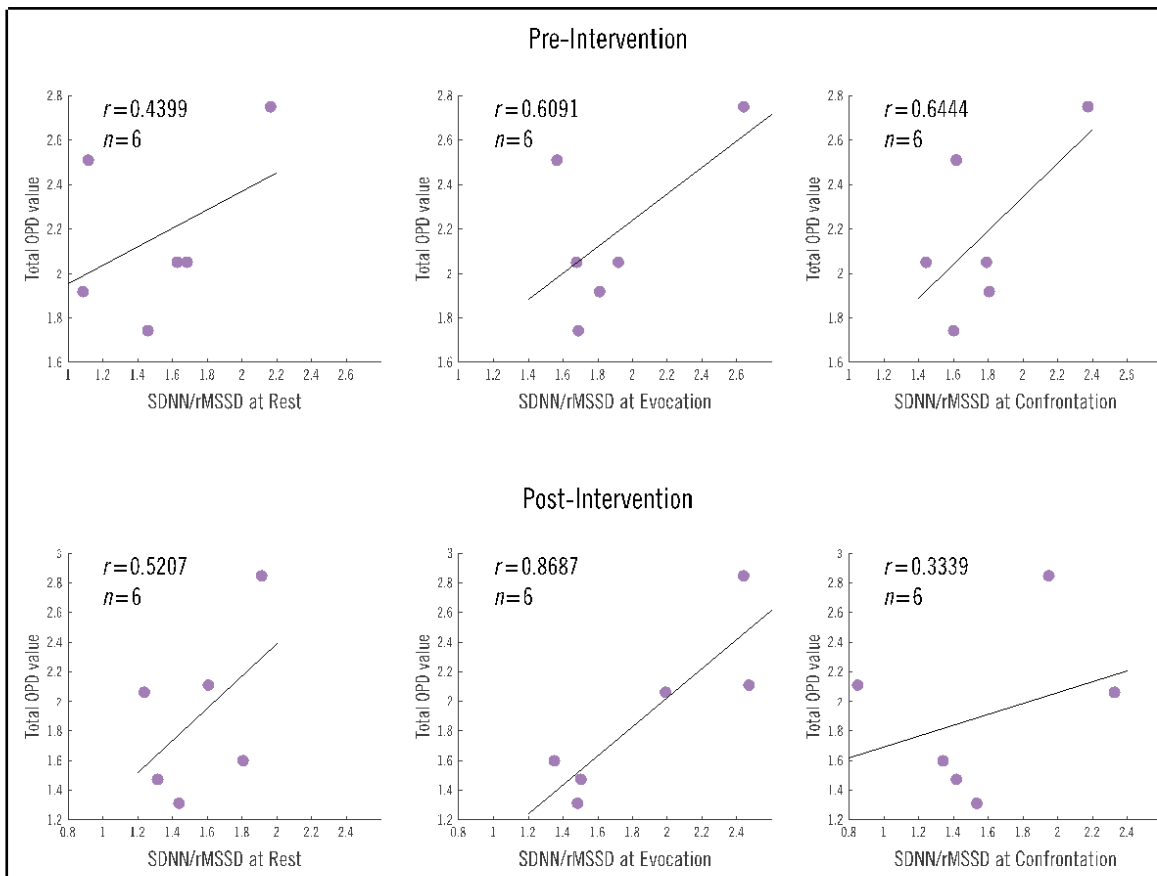


Figure 3. Sympathetic activation and personality functioning associations during the resting state, emotion evocation, and confrontation. Pre-intervention in mauve; post-intervention in green. SDNN/RMSSD index as a surrogate for LF/HF and PNN50 is related to parasympathetic activity. The higher the score in the OPD-SQ, the less integrated the functioning.

Case analysis

35. To exemplify how the three levels of observation can be integrated to understand change in forms of relating to experience, we selected a prototypical example (participant 6). The analysis shows concordance between *first-person* reports, self-assessment of personality functioning and physiological measurements. After the mindfulness intervention, the MpI analysis shows the acquisition of emotion regulation strategies to cope with stress (see Figure 4 for individual analysis). The participant's self-reported scores indicate a 36% improvement in overall personality functioning considering all subfunctions (Table 4). These positive changes in personality functioning are aligned with the MpI analysis with autonomic arousal modifications (Figure 5). After training, the participant's overall arousal activity (SDNN/RMSSD index) was lower during the three segments of the MpI, which can be interpreted as a positive modulation of post-intervention vagal activity. Interestingly, the evocation segment showed greater differences between the two conditions. A higher pNN50 index (activation of the parasympathetic system) was observed in all segments of the MpI: in the resting state, this difference reached 5 points, while in the evocation and emotional resolution states, it reached 2.7 and 4, respectively. Similar to

participant 6, other participants showed a coherent pattern of response at the three levels of observation.

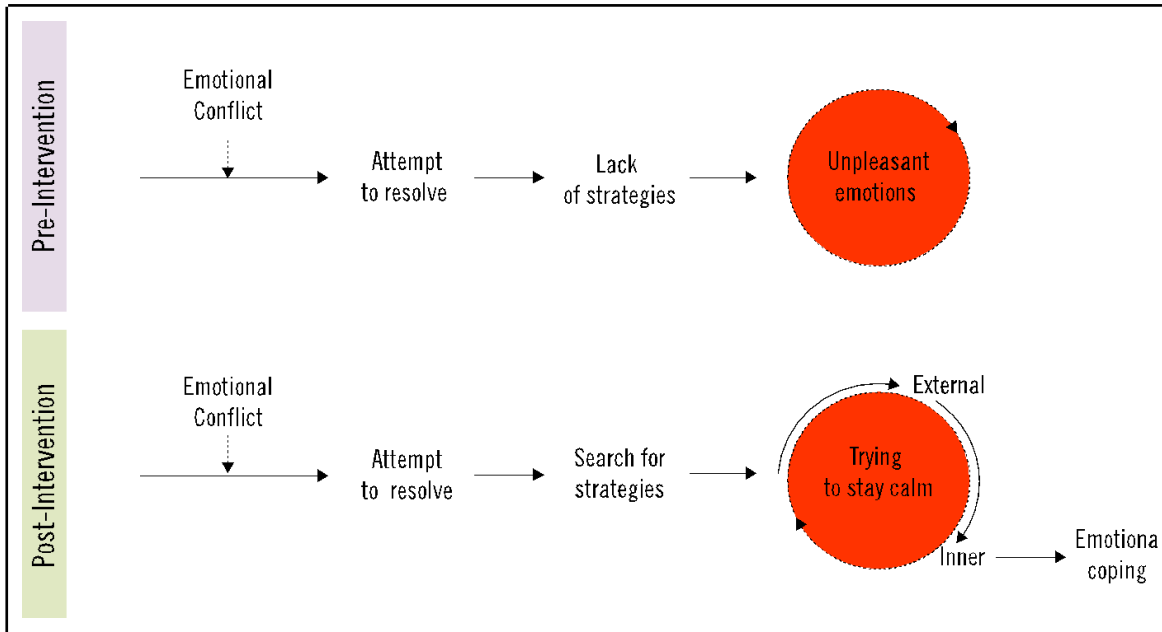


Figure 4: Individual structure of the difficult experience. Before the intervention, the participant tried to resolve the emotional conflict, but in the absence of strategies to do so, she did not succeed and was overwhelmed by unpleasant emotions. After the intervention, the participant tried to resolve the conflict by looking for concrete strategies to stay calm, first by seeking outside help, but when she did not get what she needed after the intervention, she turned to her own resources (attended to breathing and bodily sensations, calming thoughts, and being more present and treating herself kindly) to cope emotionally.

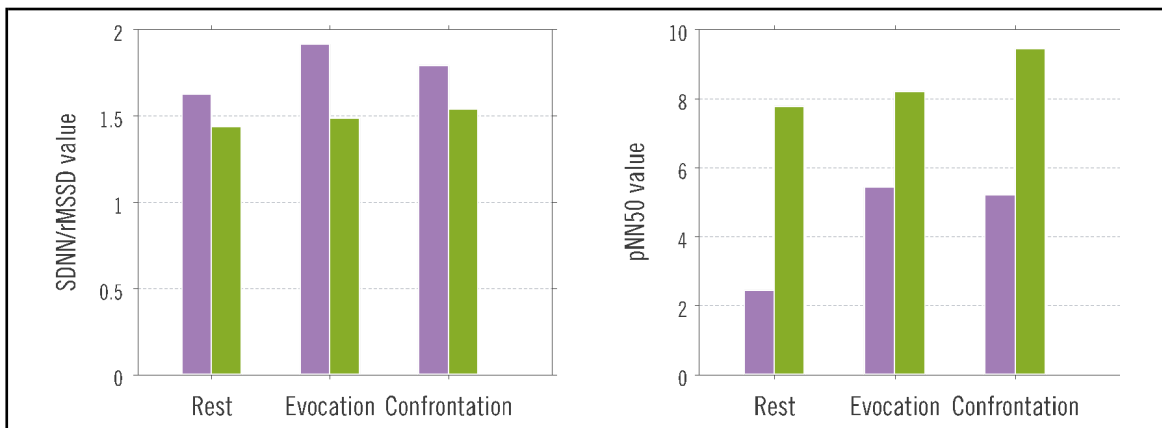


Figure 5. Autonomic activity indices in the case study (participant 6) during the three segments of the MPI (Rest, Evocation, and Emotional Resolution). Pre-intervention in mauve; post-intervention in green.

OPD function	Pre MBCT	Post MBCT
Self-Perception	2.42	1.17
Perception of Objects	1.94	1.11

Self-Regulation	2.47	1.80
Regulation of relationships	2.67	1.58
Internal Communication	1.22	0.78
External Communication	1.67	1.39
Internal Attachment	1.13	1.00
External Attachment	2.88	1.63
Total OPD	2.05	1.31

Table 4. OPD-SQ scores in case study (participant 6)

Discussion

36. This study contributes to theoretical models that aim to integrate mind and body to explore outcomes and mechanisms of mindfulness practice in MBI. A psychological, phenomenological and physiological framework was used to explore change occurring among participants. Research into contemplative practices can benefit from mixed-methods approaches to understand the complexity and different dimensions of clinical and therapeutic processes. To our knowledge, this is the first study to use the MpI before and after an MBI, and to specifically investigate changes in how individuals relate to difficult experiences. Overall, our results point to trainable attitudes and skills that enhance regulatory strategies among the participants. In what follows, we describe exploratory associations between different levels of observation in order to foster further inquiry in a scientific and clinical dialogue. These associations should be further tested using larger samples to establish statistical significance.
37. Personality psychology and phenomenology are two different domains (both epistemologically and methodologically) and their integration can be challenging. Self-report questionnaires are limited in their accuracy to assess subjective experience as they may translate social desirability or unrelated opinions. Although measurable personality functions tend to be stable, they can change over time and context. Indeed, individuals can show great variability in their cognitive, affective, and behavioral inclinations in different contexts (Herz, Baror & Bar 2020). To understand the relationship between stable states and conscious experience, the authors offer a holistic framework whereby all the diverse dimensions of functioning are clustered together, acknowledging that the mind is a dynamic construct that can change according to circumstances. In our study, we offer a dialogue between self-reporting and the MpI, aiming to integrate both domains and deepen the understanding of new regulatory capacities. Our preliminary data may serve to describe *what changes* and to a lesser degree, *how* this happens. While self-report questionnaires (thin

first-person phenomenology) show a trend toward fostering mindfulness skills, as well as enhancing personality functioning (self-perception and self-regulation as main functions), the MpI (thick first-person phenomenology) gives a voice to self-assessed change. For example, change in self-perception (OPD-SQ), which refers to the capacity for self-reflection, differentiation of affects, and stability of identity, correlates with MpI analysis revealing greater awareness of cognitive, emotional and physical phenomena. In the case of self-regulation (OPD-SQ), which includes regulation of impulses, tolerance of affects, and regulation of self-esteem as subfunctions, the MpI describes subjective transformation in self-experiencing, particularly through learning soothing strategies to calm oneself and integrate bodily experience. MpI analysis provides a *view from within* to understand change in ways of relating to stressors.

38. Although participants in the study were not suffering from acute depression, most of them had a clinical history of this disorder and of vulnerability. Taking into consideration Thomas Fuchs's (2013: 222) idea of depression as "a 'detunement' [...] of the resonant body that normally mediates our [...] participation in the shared affective space," our data suggests that greater mindfulness fosters self-attunement, and thus the possibility of healthier participation in a difficult shared affective space. The intensive cultivation of mindfulness practices during the MBI, designed to reduce depressive relapse among vulnerable people, seems to stimulate new procedural learning and forms of coping. Our framework includes personality functioning as a measure of vulnerability. By addressing personality functioning and using the MpI, it is possible to explore changes in implicit memories and how they interact and may change with mind-body approaches such as MBI. Our results point to the role of bodily awareness and care as crucial mechanisms contributing to change.
39. In this study, we have considered self-reporting and the MpI as first-person data and HRV as third-person data. From a physiological perspective, HRV is a useful indicator of flexibility in emotion regulation. Sympathetic deactivation and activation of the parasympathetic autonomic system transforms the regulation of fight-flight reactions into calmness and security (Porges 2011). Our results based on first-person data show parallels between psychological vulnerability and autonomic activity, indicating that those subjects with lower personality functioning are more likely to detect threats and thus express higher autonomic arousal. Interestingly, the association between lower personality functioning and higher sympathetic activity (Figure 3) during the post-intervention evocation phase (MpI) suggests that mindfulness practices generate more direct and somewhat more threatening connections with embodied feelings (increased sympathetic activity when participants report their experience). This study shows that the mutual validation of first- and third-person data gives robustness to the results presented and allows a global understanding of the effects of MBI on people that present some vulnerability at some moment in their lives. This study invites continued investigation and experimentation to acquire physiological data during the evocation and

description of experiences during the MpI. One way to improve this is by incorporating other measures, such as measuring skin conductance or pupil diameter (arousal indicators), which could serve as a guide when choosing the interview segments for the joint analysis of first- and third-person data.

40. We analysed a selected case to exemplify how the three levels of observation can be integrated towards a conceptual and experiential understanding of change in forms of relating to experience. In this regard, the selected participant represents a prototypical example that provides an in-depth understanding of the processes experienced in MBI through mixed-methods design (Creswell & Plano Clark 2018). Intersecting a case study and mixed-methods approach allows a methodological dialogue for a richer description and interpretation of the complex phenomena studied. The participants' self-reported scores indicate a 36% improvement in overall personality functioning considering all subfunctions (Table 4). After the intervention, the MpI describes how the patient is able to direct attention away from thoughts, redirecting it to the sensation of the breath. These observations are in line with third-person neurological findings on mindfulness showing shifts from an auto-referential to an experiential focus of experience that at a neurological level includes deactivation of the default mode network and modulation of the insula as a primary hub for introspection (Farb et al. 2007; Gibson 2019). Positive changes in personality functioning are congruent with MpI data and with autonomic arousal modifications registered during the MpI (Figure 5). Our framework suggests plasticity at pre-reflexive states, pointing to more effective *coupling* between the individual and her environment. This adaptive capacity has been studied through other autonomic markers like pupil diameter (Vásquez-Rosati et al. 2017), where people trained in contemplative practices restore normal pupil diameter more rapidly after negative emotional stimuli.
41. Understanding individual strengths and vulnerabilities helps clarify the experiences and processes that occur when participants engage in mindfulness training. From a personality functioning perspective, we can recognize regulatory functions that have been developed and are more or less integrated, allowing people to generate adaptive and non-adaptive responses to external and internal demands. People whose development has been hindered by early stress are more vulnerable due to regulatory difficulties (OPD Task Force 2008). When organization of mental disposition is vulnerable, direct contact with inner experience during mindfulness practice can reactivate unprocessed and threatening emotions, leading to forms of dysregulation. Our aim with this study is to contribute to a person-centered approach that focuses on how meditation outcomes can be affected by context and individual differences (Farias et al. 2020; Lindahl et al. 2019; Treleaven 2018). MBI can be considered a form of mind-body treatment. By acknowledging vulnerability, we recognize the different manifestations of early trauma and procedural memories. This view can broaden our understanding of the notion of embodied memory and its possible healing process.

42. Further research should explore individual vulnerability, particularly among participants who experience dysregulation (hyper/hypo arousal) during formal practices. According to Jonathan Gibson (2019), increasing interoceptive awareness without compensatory measures may be detrimental to individuals with a history or trauma. A dialogue between phenomenological and physiological data may nourish a Trauma Sensitive Mindfulness approach (Treleaven 2018) to better understand and avoid potential pitfalls of MBI, and to optimize its benefits. At the same time, when dealt with adequately, such states can be a source of transformation and healing.
43. This exploratory study uses a mixed-methodological framework to deepen dialogues between research and clinical applications. The results suggest further assessment is needed into the impact of early life adversity on personality functioning and its interaction with mindfulness training. A vulnerability-sensitive mindfulness research approach may help to refine interventions, as well as providing indications to clinical programs as to what works, for whom and under what conditions. These results can contribute to developing more skillful ways for practitioners to refine guiding and inquiring around mindfulness practices and for participants to explore their own experiences during the learning process. Future studies should identify more parallels between physiological correlates, vulnerability and subjective change to deepen our understanding of individual processes and to optimize therapy. Future studies in the contemplative field can benefit from interdisciplinary research allowing researchers to refine their descriptions and identify points of commonality across cultural context and scholarly perspectives, informing the emerging general theory (Weisman & Luhrmann 2020).
44. Finally, culturally sensitive applications should be investigated further, especially contextual factors and their influence on motivation, attitudes, and learning processes. In the case of Chile, processes of cultural change and transition are occurring. Traditional cultural features, including forms of peer support and a sense of social self, are changing from a collectivist to a more individualistic society. These changes have had a negative impact on the quality of bonds at the individual and community levels (Krause 2019). It is argued that a society going through these processes is more vulnerable in relation to mental health problems. Such socio-cultural contexts can be considered constitutive parts of the participants' experiences, especially in a clinical setting.

Conclusion

45. A multilevel framework was used in this study to examine changes in mindfulness training. The results point to parallels between first-person descriptions and conceptual and physiological perspectives. Our work contributes to the development of Varela's neurophenomenology project and interest in contemplative practices as tools for the study of consciousness and therapeutic processes. Within an enactive approach to contemplative practices,

bodily and subjective experiences are fruitful objects of study that can provide insights into complex issues in mindfulness studies. Giving consideration to vulnerability may help refine therapeutic strategies and clinical sensitivity.

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Competing interests

The authors declare that they have no competing interests.

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The authors

Sebastián Medeiros MD is a psychiatrist trained at University Denis Diderot – Paris 7 and a qualified Mindfulness-based Stress Reduction teacher trained at the Mindfulness Center at Brown University. He is co-founder/director at Centro Mindfulness y Medicina and director at Programa Mindfulness – Unidad de Salud Mental, Red UC-Christus and Psychiatry Department, Pontificia Universidad Católica de Chile, and a researcher at the Millennium Institute for Research in Depression and Personality (MIDAP). His research interests are (a) self-regulatory processes and the impact of early trauma in contemplative practices and health, and (b) mindfulness and psychotherapy training. Member of the Chilean chapter of the International Association of Relational Psychotherapy and Psychoanalysis and the Society for Psychotherapy Research.

Carla Crempien is a clinical psychologist from Universidad de Chile. She has a PhD in psychotherapy research from Pontificia Universidad Católica de Chile and Heidelberg University, Germany. Carla is an MBCT Teacher in Training at Oxford Mindfulness Centre, and certified instructor for Operationalized Psychodynamic Diagnostic (OPD-2) at OPD Chilean Task-Force. She works as a collaborating professor at Pontificia Universidad Católica de Chile, School of Psychology and Department of Psychiatry, School of Medicine, and is a researcher at Millennium Institute for Research in Depression and Personality. Her research interests focus on mindfulness and personality, depression, psychotherapy and primary health care.

Alejandra Vásquez-Rosati has a PhD in Psychology from the Pontificia Universidad Católica de Chile, and Master in Neurosciences from Universidad de Chile. Her interest in research focuses on emotional states and body movement, mindfulness and embodied cognition from a first- and third- person approach. For this, she has used the micro-phenomenological interview as a tool to explore subjective experience. Alejandra is also a specialist in the Cognitive-Body Integration Method. This method integrates the body as a fundamental dimension of human behavior and experience, restoring the

natural operation of the basic emotions. She is founder and researcher at the Laboratorio de Fenomenología Corporal.

Javiera Duarte has a PhD in Psychotherapy from Pontificia Universidad Católica de Chile, and a Master in Constructivist Clinical Psychology from Universidad de Chile. She also has training in MBT from Anna Freud Center and a Diploma in OPD-2 from Pontificia Universidad Católica de Chile. Javiera is academic and researcher at Center of Studies in Clinical Psychology and Psychotherapy, Universidad Diego Portales and a Young Researcher at the Millennium Institute for Research in Depression and Personality. She has specialized in qualitative research in psychotherapy. Her research interests include subjective experience in mental health, psychotherapy process research, and attachment mentalization and mutual regulation.

Catherine Andreu has a PhD in neurosciences from the Pontificia Universidad Católica de Chile. In her PhD thesis, she investigated the effects of Mindfulness practice on cognitive control using electrophysiological measures. She was a postdoctoral researcher at the Millennium Institute for Research in Depression and Personality (MIDAP), and received the Francisco Varela Award from Mind and Life Europe. She currently works as a postdoctoral researcher at the Mindfulness and Cognitive Sciences chair at the Complutense University of Madrid. Her current research focuses on the effects of mindfulness-based interventions and compassion-based interventions on psychobiological measures.

Álvaro I. Langer is a clinical psychologist and has a master's degree in functional analysis of the University of Almería (UAL), Spain, and a doctoral degree in psychology from the same university. He is currently an associate professor and Director of the Institute of Psychological Studies of the Faculty of Medicine at the Universidad Austral de Chile (UACH), deputy director of the ANID, Millennium Science Initiative Program, Millennium Nucleus to Improve the Mental Health of Adolescents and Youths (Imhay) and researcher of the ANID, Millennium Science Initiative Program, Millennium Institute for Research in Depression and Personality (MIDAP). His research interests address the topics of prevention and promotion in mental health, psychosocial interventions based on mindfulness, and the study of social and cultural variables linked to the health/disease process. Alvaro is founder and researcher at the Mind-Body Lab.

Miguel Ibaceta is an educational psychologist with a master's degree in educational psychology from the School of Psychology of the Pontificia Universidad Católica de Chile. He is a member of the Work-Emotion Lab in the School of Administration, Pontificia Universidad Católica de Chile. Currently, he is a PhD student at the Alliance Manchester Business School, University of Manchester, where he studies the role of mind wandering and meta awareness in the workplace together with the impact of attentional process in the worker's creative performance.

Jaime R. Silva is a psychologist and has a doctoral degree in psychobiology at the Universidad Complutense de Madrid. He is Full Professor and a member of the Center for Attachment and Emotional Regulation (CARE-UDD) as well as the director of the

doctoral program in developmental sciences and psychopathology, Faculty of Psychology, Universidad del Desarrollo. Jaime has developed a career as a researcher in the area of psychobiology, where his main contributions have been in the field of stress regulation and its relationship with different medical or mental health conditions (including obesity, eating disorders, personality, depression, etc.), throughout the lifespan. Currently, he is working on projects linking interpersonal relationships, metacognition and stress.

Diego Cosmelli is a biochemist by training but went on to obtain a PhD in cognitive sciences from École Polytechnique, France, working on conscious experience from an integrated phenomenological and brain dynamics perspective. He then did his postdoctoral training at the Department of Philosophy of York University, Toronto, Canada, on philosophical aspects of cognitive science. He is currently full professor at the School of Psychology, Faculty of Social Sciences, Pontificia Universidad Católica de Chile, where he leads the Psychophysiology Lab. He is also an Associate Researcher at the Millennium Institute for Research in Depression and Personality (MIDAP). His research interests focus on attentional expertise, sensorimotor coordination and the relationship between contemplative practices and well-being.

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