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Rumination and Mindlessness Processes: Trajectories of Change in a 42-Day Mindfulness-Based Intervention

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This preliminary study aimed to understand the effects of an autonomous mindfulness-based intervention (MBI) on mindlessness propensities: rumination, automatic pilot functioning, and attentional distractibility. The ecological momentary assessment was completed by com- munity participants assigned to two nonrandomized groups: an experimental group (n = 45) that practiced 20-minute daily mindfulness meditation for 42 days and a control group (n = 44) that was on the waiting list for the MBI. All participants completed a self-assessment on rumination and mindlessness propensities twice a day. The MBI led to a favorable gradual decrease in automatic pilot functioning and attentional distractibility. Rumination evolved in three stages: a rapid decrease during the first week, a stabilization phase between the 10th and 30th days, and an additional decrease after 30 days of practice. This innovative study provides a promising perspective regarding rumination, automatic pilot functioning, and attentional distractibility dynamic trajectories over the course of an MBI.

Keywords: mindfulness; rumination; automatic pilot; attentional distractibility; mindlessness; ecological momentary assessment

This study innovatively contributes to the literature by considering longitudinal day-by-day changes in mindlessness propensities over the course of a 6-week mindfulness-based inter- vention (MBI) conducted in a community sample. Mindlessness propensities aspects are detailed and their undesirable characteristics are described in the first part of this introduction.

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The second part introduces mindfulness and how it may reduce mindlessness propensities, thanks to underlying processes. Finally, the relevance of a longitudinal approach to the evolution of mindlessness propensities throughout the study of their specific trajectories is highlighted.

Mindlessness Propensities

Mindlessness propensities encompass a number of constructs that conflict with mindful presence and awareness. Among these constructs, rumination, attentional distractibility, and automatic pilot functioning were selected in this study due to their specific relationships with the mindful- ness construct (Brown & Ryan, 2003; Creswell, 2017; Kang, Gruber, & Gray, 2013; Malinowski & Lim, 2015; Watkins, 2008).

Rumination involves a past- and self-focused automatized cycle of rehashing former events, as well as difficulty in avoiding persistent thoughts (Watkins, 2008). Attentional distractibility is the inability to focus when performing an activity that requires sustained attention (Brown & Ryan, 2003; Creswell, 2017; Kang et al., 2013). Automatic pilot functioning involves engaging in an action in an effortless and unconscious manner (Creswell, 2017; Kang et al., 2013). These three constructs have been proven to involve several drawbacks.

Rumination intensifies and retains negative affect (Nolen-Hoeksema, Morrow, & Fredrickson, 1993), which might result in narrowing of the thought–action repertoire (*broaden-and-build theory*; Fredrickson, 2004; Pavani, Le Vigouroux, Kop, Congard, & Dauvier, 2016), potentially bi- asing the attentional focus. Rumination may also be involved in the inception and maintenance of depression and anxiety (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008; Watkins, 2008), as highlighted by the response styles theory (Nolen-Hoeksema, 1991), which posits that rumina- tion consists of perseverated negative thoughts that could be the reasons for or implications or outcomes of a depressed mood and could exacerbate distress. By drawing attention away from the present experience to scrutinize prior negative moments, maladaptive rumination is positively related to automatic pilot functioning and attentional distractibility (Alleva, Roelofs, Voncken, Meevissen, & Alberts, 2014; Brown & Ryan, 2003; Creswell, 2017; Kang et al., 2013; Malinowski & Lim, 2015). Automatic pilot functioning can lead to the fusion of cognitive and emotion infor- mation, to a reactivity tendency, and to automatic behaviors that may underlie mental disorders (Creswell, 2017; Kang et al., 2013; Malinowski, 2013). Attentional distractibility can poten- tially alter cognitive, emotion, and behavior regulation (Brown & Ryan, 2003; Creswell, 2017; Malinowski, 2013). Rumination, attentional distractibility, and automatic pilot functioning are characterized by lack of awareness of the present moment (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006).

Mindfulness

Mindfulness encourages people to live an engaged life without avoidance (Nolen-Hoeksema et al., 2008) and to pay purposeful, nonjudgmental attention to all internal and external events (Bishop et al., 2004; Kabat-Zinn, 1994). Mindfulness skills are meant to help individuals direct their attention toward concrete, present moment experiences by enhancing attention to one's body or thoughts (Kabat-Zinn, 1994). Through mindfulness practice, individuals are invited to notice automatic mind wandering and perpetually reorient their thoughts toward a focus area as they develop the ability to prevent being caught up in their cognition, emotion, or sensations (Creswell, 2017). Therefore, mindfulness provides an opportunity to disengage from automatic pilot functioning and to mindfully choose how to respond with full awareness rather than simply reacting (Kang et al., 2013; Segal, Williams, & Teasdale, 2002; Shapiro, Carlson, Astin, & Freedman, 2006).

Several processes involved in mindfulness practice are thought to challenge mindlessness propensities (Semple, 2010). First, mindfulness practice cultivates *decentering*, which allows individuals to act as observers and distance themselves from their own temporary thoughts pat- terns (Carmody, Baer, Lykins, & Olendzki, 2009; Shapiro et al., 2006) rather than identifying with them (Alleva et al., 2014). Second, mindfulness is an appropriate technique to help individu- als dissociate themselves from automatic reaction patterns, such as automatic pilot functioning, and from rumination patterns, even when faced with distressing events (Chambers, Gullone, & Allen, 2009; Malinowski & Lim, 2015; Mandal, Arya, & Pandey, 2012; Strauss, Cavanagh, Oliver, & Pettman, 2014; Teper, Segal, & Inzlicht, 2013). Studies have shown that mindfulness facilitates the acknowledgment of repetitive negative thoughts and their decrease (Alleva et al., 2014; Svendsen, Kvernenes, Wiker, & Dundas, 2017) and that rumination could be reduced over a 8-week MBI (Heeren & Philippot, 2011). Third, a mindful stance could lead to a broadening of the thought– action repertoire and individual attentional resources (Fredrickson, 2004; Malinowski, 2013; Malinowski & Lim, 2015). Incidentally, several MBIs have been proven to successfully cultivate sustained and controlled attention (Chambers, Lo, & Allen, 2008; Semple, 2010; Zeidan, Johnson, Diamond, David, & Goolkasian, 2010). Furthermore, reviews and meta-analyses have found evi- dence that cultivating attentional skills and reducing rumination were potential mechanisms un- derlying the clinically positive impacts of MBIs (Chiesa, Anselmi, & Serretti, 2014; Creswell, 2017; Gu, Strauss, Bond, & Cavanagh, 2015).

Evolution of Mindlessness Propensities

Although the body of research highlighting mindfulness processes is growing, to our knowledge, no study has investigated how the dynamic trajectories of mindlessness propensities change on a daily basis throughout an MBI. This lack of interest deserves to be remedied. Thus, this orig- inal study is a preliminary opportunity to build on the current understanding of mindfulness effectiveness, which, thus far, has been primarily investigated through cross-sectional studies or pre- and posttest comparisons (Guendelman, Medeiros, & Rampes, 2017), and to contribute to the literature by identifying the particular trajectories of change and temporality of these pro- cesses. Such an innovative perspective could provide new insight to clinicians to better guide mindfulness participants so that they receive optimal benefits from their practices, according to their specific objectives (i.e., attention enhancement, rumination decrease, or increased pres- ence to the here and now experience). To achieve these aims, a relevant methodological strategy would include a longitudinal approach that includes frequent measurements, such as an eco- logical momentary assessment using Generalized Additive Models (GAMs) (Snippe, Nyklíček, Schroevers, & Bos, 2015). Indeed, as later detailed, GAMs overcome repeated measures analyses of variance (ANOVAs) flaws by taking into account the continuous temporal aspects of the variables over the 42-day period.

Thus, this preliminary research is based on the previously mentioned theory and research findings, and we hypothesized that the MBI would affect mindlessness propensities and help contribute to reduce (a) rumination, (b) attentional distractibility, and (c) automatic pilot func- tioning. These hypotheses aimed to provide insight regarding underlying mindfulness processes and, therefore, respond to Semple's (2010) suggestion, allowing for the consideration of future interventions using ideal temporal aspects (Carmody et al., 2009).

Method

Participants

Eighty-nine 20- to 80-year-old adults (M = 38.5 years, SD = 15.1) from a community sample par- ticipated in this study. The participants were recruited through written and oral announcements made by students of the University of Lille in their surrounding social networks inviting people to take time off to practice mindfulness meditation at home for 42 days, within the framework of an interventional study. The participants had to be older than 18 years of age to be included in the study. Exclusion criteria were assessed based on declarative information provided by the participants and included deafness, an Axis 1 disorder, or ongoing therapy. All participants were nonremunerated volunteers.

This study used an interventional, nonrandomized design that involved a control group (n = 44, 30 females [68%]) and an experimental group (n = 45, 33 females [73.3%]). Demographic characteristics are displayed in Table 1.

Mindfulness-Based Intervention

Two trained mindfulness instructors created the 6-week MBI and recorded six 20-minute formal mindfulness audio guidance sessions that were available on a dedicated website or on CD for the experimental group participants. The participants in the experimental group were invited to practice a formal mindfulness exercise for 20 min each day, with recorded audio guidance, for a duration of 42 days between days 4 and 45. Each guidance session invited the participants to find a quiet place and to kindly and nonjudgmentally bring their attention to their bodily sensations, breathing, and to the thoughts or emotions that could arise during the exercise. The MBI included a body scan practice (week 1), a sitting meditation centered on breathing (week 2), a mindful walking meditation (week 3), a sound- and thought-focused meditation (week 4), a meditation on negative thoughts (week 5), and finally a loving-kindness meditation (week 6). In case they encountered any trouble with the program, the participants were free to get in touch with the investigators, whose contact details had been previously given. The audio guidance is available from the first author upon request.

Procedure

This study received ethical approval from the French Ethical Research Comity Nord West III. Information about the study was shared through phone calls and letters. The participants were informed that the collected data would be anonymized and that they were free to quit the study at any time. Written informed consent was obtained from the participants prior to starting the study. During the recruitment process, the participants were allocated to each group, according to their preferences, although gender and age variables were balanced between the groups to ensure their comparisons. After signing up for the intervention study, detailed instructions, investigators' contact details, complementary information about mindfulness, and paper packet questionnaires were mailed to all participants. In addition, the experimental group participants received the 6-week MBI program, as well as a link to download the recorded audio guidance, or a CD.

The participants completed a 48-day ecological momentary assessment (EMA). This assess- ment was administered in the form of a printout self-assessment diary, which was to be com- pleted twice a day by each participant. The participants completed the assessments between two provided time windows (noon–2 p.m. and 7 p.m.–9 p.m.), whenever it was suitable for them. The experimental group participants started the MBI on day 4. Previously gathered data were used to assess baseline specificities.

TABLE 1. Demographic Data

Variables	Value	Full Sample (n = 89)	Control Group (n = 44)	Experimental Group (n = 45)
Gender	Female (%)	63 (70.70)	30 (68)	33 (73.30)
Age	Mean (range, *SD*)	38.50 (20–80, 15.10)	37 (20–80, 15.10)	39.90 (21–67, 15.20)
Prior mindfulness meditation experience	Yes (%)	45 (50.50)	21 (47.70)	24 (53.30)
Education level (in years after primary school)	Mean (range, *SD*)	8.60 (0–15, 2.02)	8.30 (0–12, 2.10)	9.00 (4–15, 2.30)
Professional status	Professional (%)	57 (64.00)	29 (65.90)	28 (62.20)
	Student (%)	26 (29.20)	13 (29.50)	13 (28.90)
	Retired (%)	6 (6.70)	2 (4.50)	4 (8.90)
Marital status	Divorced (%)	7 (7.80)	5 (11.30)	2 (4.40)
	Married (%)	24 (26.90)	9 (20.40)	15 (33.30)
	Single (%)	53 (59.50)	27 (61.30)	26 (57.80)
	Civil union (%)	2 (2.20)	2 (4.50)	0
	Widowed (%)	3 (3.30)	1 (2.20)	2 (4.40)

The participants responded to three subscales on the topics of rumination and other mind- lessness propensities. The participants returned the questionnaires and EMA in a prestamped envelope.

Measures

Demographic Information. The participants were given a questionnaire to complete to deter- mine their ages, genders, family situations, education levels, and previous mindfulness practice experiences.

Adherence. This daily self-observation diary, as part of the EMA, was also meant to evaluate the participants' practice adherence, and an adherence score was computed based on it.

Rumination. Two items from the Rumination-Reflection Questionnaire (RRQ; Trapnell & Campbell, 1999) were presented to the participants: "I always seem to be 'rehashing' in my mind recent things I've said or done" and "I often find myself re-evaluating something I've done." The items were selected due to their high factor loadings (.77 and .70, respectively, Trapnell & Campbell, 1999). The participants were invited to rate their degree of agreement with each state- ment using a 5-point Likert scale ranging from 1 (*hardly ever true*) to 5 (*very often true*). The responses given for the two items were averaged. The internal consistency within this sample is
$\alpha = .74$.

Automatic Pilot Functioning and Attentional Distractibility. The participants were assessed using four items from the Acting with Awareness subscale, which was obtained from the Five Facets of Mindfulness Questionnaire (FFMQ; Baer et al., 2006). These items were di- vided into the following two specific components: (a) The tendency to perform activities using automatic pilot functioning was evaluated with the following two items ("I rush through activ- ities without being really attentive to them" and "I do jobs or tasks automatically without being aware of what I'm doing") and (b) Attentional distractibility (i.e., difficulty staying focused on the present moment) was evaluated with the following two items ("When I do things, my mind wanders off and I'm easily distracted" and "I find it difficult to stay focused on what's happening in the present"). These items were chosen according to their highest saturation within the orig- inal dimension (i.e., –.67, –.61, –.64, and –.66, respectively; Baer et al., 2006). The participants rated their answer on a 5-point Likert scale in the same manner as the previous assessment. The responses to the two items were averaged separately for each specific component. The internal consistencies within this sample were $\alpha = .72$ for the automatic pilot functioning scale and $\alpha = .78$ for the attentional distractibility scale.

Data Analyses

GAMs were used to investigate the evolution of rumination, attentional distractibility and automatic pilot functioning during the MBI. GAMs can be considered to be extensions of Generalized Linear Models (GLMs) to take into account complex nonlinear relations between explicative variables and explained variables. GAMs provide the flexibility needed to describe what are often nonlinear changes (e.g., MBI) in affective states and mindlessness propensities (McKeown & Sneddon, 2014). They have an inferential aspect, based on a model selection pro- cess. Thus, they are not just descriptive smoothing techniques because they have an inferential aspect, based on a model selection process (Wood & Augustin, 2002). GAMs can be seen as a stepwise regression with polynomials. Beginning with multiple regression, in the form of $y = b0 + b1x + b2x^2 + b3x^3$, a descending stepwise algorithm allows only significant variations in y to be selected, according to the linear, quadratic, or cubic function of x. If all three components make an independent, significant contribution, the whole polynomial function will have four degrees of freedom. These degrees of freedom reflect the complexity of the nonlinear function, which is a

combination of a linear trend, a U-shaped function, and an S-shaped function. The best method of interpreting the model is to look at the plot of the whole function, bearing in mind that if no significant trend is present in the data, the result will be a horizontal line. When comparing changes in two different groups over time, if there is no group difference in the data, the curves will be roughly superimposed. It could be useful to know precisely whether one point in the curve is significantly different from another, as with a post hoc test in an ANOVA, but as the variables are continuous, the number of possible comparisons is infinite. Knowing that the visible varia- tions are significant does not exempt us from taking effect size into account, and it seems reason- able to interpret only trends with a meaningful amplitude on the y-axis.

Technically, GAM models implemented with the "mgcv" library in R use splines basis func- tions, not polynomial functions, and rely on a model selection process that includes a wiggliness penalty term to avoid local overfitting (Wood & Augustin, 2002). This procedure is intended to ensure that the best model is selected, in terms of the fit to the data, parsimony and smoothness of the retained function.

Additionally, Student's *t* tests were computed with JASP software version 0.8.1.1 for Windows to compare the group at baseline on the studied variables. Cronbach's α (shown in the Measure section) were calculated for each time of measure and within persons, to be averaged afterwards.

Results

Adherence to the MBI

The adherence score in the intervention group was, on average, 84.27% for the whole MBI, a mean of 13.52 assessments (ranging from 0 to 21) was not completed.

Descriptive Statistics

Table 2 presents the descriptive statistics and correlations among the variables. Significant positive relationships were found between all variables; however, they remained small, which prompted us to perform separate analyses of the variable across time. The results of the GAMs on mindfulness practice and its influence on attentional distractibility, automatic pilot functioning and rumina- tion are shown in Figure 1.

TABLE 2. Descriptive Statistics, Correlations, and Estimated GAM Parameters of the Subjective Assessments of Mindlessness Propensities

Variables	*M*	*SD*	1	2	DE	edf (CG)	edf (MMF)
Attentional distractibility	2.80	1.00	1		.08	1	1.11
Automatic pilot functioning	2.35	1.04	.30**	1	.68	1	2.31
3. Rumination	2.71	1.12	.21**	.25**	.50	1	3.86

Note. DE = deviance explained; CG = control group; MMF = mindfulness group; edf = es- timated degree of freedom (when the edf value equals 1, the relationship is linear, and the higher the edf value, the more complex the nonlinear aspects become).
**$p < .01$.

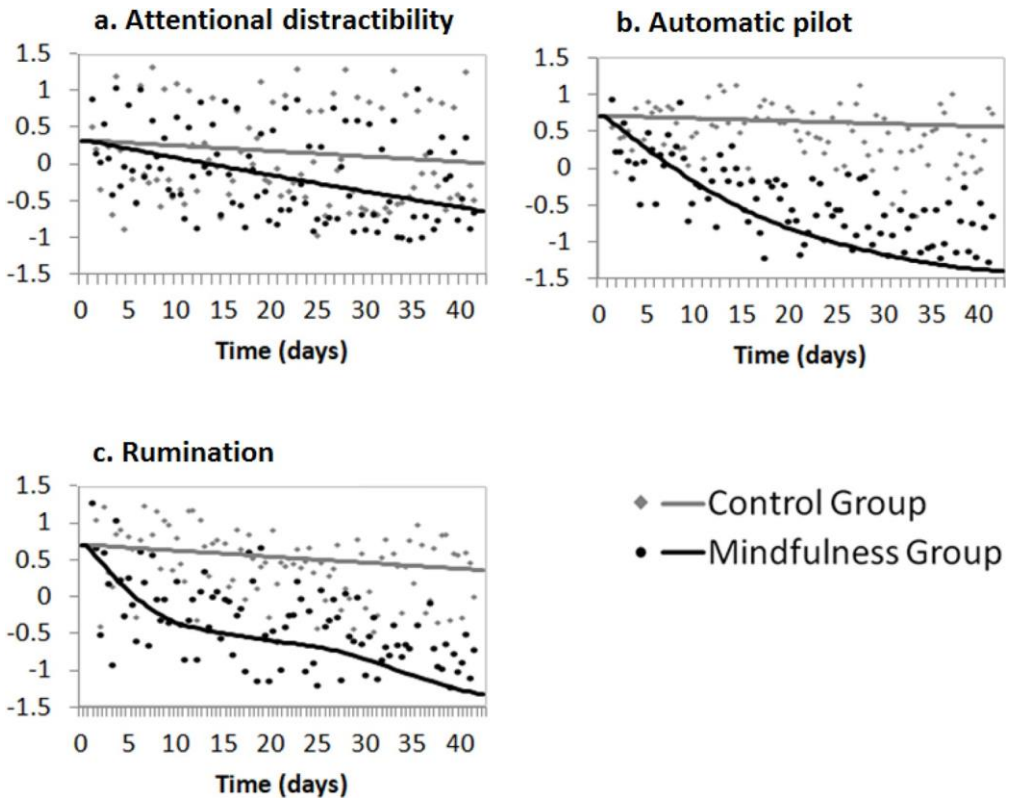

figure 1. Models of change in subjective experiences over time due to MBI, in terms of attentional distractibility, automatic pilot functioning and rumination. *Note*. Each GAM graph shows the longitudinal evolution of the standard deviation (y-axis) over time in days (x-axis). The dots represent the dependent variable mean for all participants at each assessment time.

MBI Impacts Mindlessness Propensities

Student's *t* tests allowed us to notice that there were no significant between-group differences at baseline for each variable of interest (automatic pilot functioning: $M_{cont} = 2.31$, $SD_{cont} = .97$, $M_{exp} = 2.25$, $SD_{exp} = .86$, $t = .33$, $p = ns$; attentional distractibility: $M_{cont} = 2.67$, $SD_{cont} = .68$, $M_{exp} = 2.68$, $SD_{exp} = .72$, $t = -0.06$, $p = ns$; rumination: $M_{cont} = 2.88$, $SD_{cont} = .83$, $M_{exp} = 2.63$, $SD_{exp} = .95$, $t = 1.32$, $p = ns$).

The participants in the mindfulness group experienced significantly less automatic pilot functioning (deviance explained = 67.60%) and moderately less attentional distractibility (de- viance explained = 8.53%) than those in the control group (Figure 1, graphs A and B). The par- ticipants in the mindfulness group gradually decreased their automatic pilot functioning and learned to progressively focus on the present moment, reducing their attentional distractibility levels. Moreover, the subjective experience of rumination (deviance explained = 49.80%) de- creased over the course of the 42-day MBI (Figure 1, graph C). The evolution in this protocol appears to follow the following three-phase pattern: during the first week of the MBI, rumination declined rapidly; then, rumination was maintained at a steady balance between days 10 and 30 and decreased again after 30 days of practice.

Discussion

This innovative study aimed to obtain a better understanding of the dynamic effects of a 42-day home MBI on declarative mindlessness propensities: rumination, attentional distractibility, and automatic pilot functioning. This preliminary study used an ecological approach with dynamic modeling and focused on highlighting the underlying mechanisms over time.

First, this study successfully replicated the beneficial effects of MBI exercises on reducing de- clarative attentional distractibility and, more moderately, reducing automatic pilot functioning in daily activities. These findings are consistent with those found in the literature (Chambers et al., 2008; Chiesa et al., 2014; Creswell, 2017; Gu et al., 2015; Lykins & Baer, 2009; Zeidan et al., 2010). Additionally, the assessment approach and analytic technique led to original novel outcomes re- garding the progressive development of mindfulness skills over the 6-week MBI. Furthermore, while the participants in the control group remained stable, the participants in the mindfulness group reported a decrease in rumination over the course of the MBI. Automatic pilot functioning and attentional distractibility decreased progressively during the 42-day MBI, while rumination evolved in three specific stages. Initially, the rumination levels markedly and rapidly decreased during the first week. The rumination levels remained stable from the 10th to 30th day of the MBI. Then, the rumination levels decreased once again and continued to decrease until the end of the program. These results confirm that individuals who are first experiencing mindfulness achieve rapid progress, and we encouraged the participants to extend their practice beyond 30 days to obtain optimal benefits.

These results are consistent with the current theoretical framework of MBI mechanisms and add novel insight into the temporal and dynamic aspects of mindfulness. Several processes can ex- plain our observations of the trajectories of the evolution of attentional distractibility, automatic pilot functioning, and rumination during the present-centered practice involving attentional self- regulation (Bishop et al., 2004; Malinowski & Lim, 2015).

Mindful individuals who are spontaneously exposed to all aspects of an experience are able to overcome their initial evaluation and disengage from their habitual reaction patterns, thereby extinguishing these patterns (Brake et al., 2016; Creswell, 2017; Hölzel et al., 2011; Uusberg, Uusberg, Talpsep, & Paaver, 2016). These patterns encompass mindlessness biases, such as mind wandering, negative self-statements, and automatic pilot functioning (Creswell, 2017). Another process called decentering influences attentional processes and automatic pilot functioning; individuals use a de-identified meta-aware strategy to pay attention to their inner experiences. This phenomenon allows individuals to craft an intentional response to their experience instead of simply reacting by following the usual patterns (Creswell, 2017). Additionally, a neurocogni- tive perspective of the evolution of attentional distractibility and automatic pilot functioning throughout the MBI suggests the involvement of top-down regulation and bottom-up pro- cessing mechanisms (Chiesa, Serretti, & Jakobsen, 2013; Creswell, 2017; Uusberg et al., 2016). Improvements in top-down regulation processing, stemming from mindfulness training, could enhance cognitive and attentional self-regulation skills (Chiesa et al., 2013). Bottom-up strategies involving concrete body-based automatic processes provide exposure to the world, with a wide range of sensations (Guendelman et al., 2017) and automatic judgment (Zelazo & Lyons, 2012). Top-down regulation and bottom-up processing are invoked in interactions (Guendelman et al., 2017), and they may be activated differently, according to the amount of mindfulness that was practiced (Chiesa et al., 2013).

As discussed above, decentering could also decrease rumination by weakening reactivity to thought content (Bernstein et al., 2015) and mediating psychological distress (Coffey & Hartman, 2008; Coffey, Hartman, & Fredrickson, 2010). The decrease in rumination could also be explained by the enhanced exposure to all aspects of the experience, including negative cognitions or emo- tions, that were encountered in the mindfulness practice (Creswell, 2017). This exposure might

have led to the extinction of rumination in the same manner as the habitual reaction patterns (Brake et al., 2016; Hölzel et al., 2011; Uusberg et al., 2016). Similarly, the neurocognitive bottom- up phenomenon could explain the effects of mindfulness on rumination (Chiesa et al., 2013; Guendelman et al., 2017). Indeed, bottom-up processing might promote a somatic awareness, an acceptance of emotional states, and an attenuation of emotional reactivity, which further reduce rumination (Chiesa et al., 2013; Guendelman et al., 2017).

Some shortcomings and directions for future research stem from this preliminary study. The nonrandom group assignments limit the generality of the findings and should be overcome in future research. Regarding the mindlessness propensities, a longitudinal analysis of the items from the FFMQ could be performed, including the other four dimensions of this questionnaire (observing, describing, nonjudging, and nonreactivity) to strengthen the quality of the scales. An affect scale could be added to better understand the interaction between cognitive and emo- tional processing over the course of an MBI, from an emotion regulation perspective (Snippe et al., 2015). As one reviewer suggested, this perspective would appear to be even more relevant in terms of Selby's Emotional Cascade Model, assuming that rumination and negative emotion promote one another in an increasingly vicious spiral (Selby, Kranzler, Panza, & Fehling, 2016). Considering the specific pattern of rumination evolution in this protocol, adding a longer study period or a follow-up appears to be necessary to better determine the ideal temporality of forth- coming interventions (Creswell, 2017).

Although there are numerous studies in the MBI clinical field, more research is necessary to determine whether the present findings can be generalized to a clinical population. At the crossroad of several psychopathologies, repetitive negative thinking and rumination represent a trans-diagnostic factor (Arditte, Shaw, & Timpano, 2016; McLaughlin & Nolen-Hoeksema, 2011). It would be interesting to determine whether this MBI could be a potential trans-diagnostic in- tervention, particularly within the frame of disorders linked to attentional and ruminative diffi- culties, such as affective disorders (Arditte et al., 2016; McLaughlin & Nolen-Hoeksema, 2011). Additionally, repetitive thoughts may also share constructive consequences (Verplanken & Fisher, 2014; Watkins, 2008) and could alternatively be approached in a self-perception manner, such as through reflection (Trapnell & Campbell, 1999). A conceptualization of rumination was found to encompass the adaptive aspect of reflective pondering and the maladaptive aspect of brooding (Treynor, Gonzalez, & Nolen-Hoeksema, 2003). Future research studies could determine whether mindfulness practice promotes adaptive rumination while decreasing maladaptive rumination (Heeren & Philippot, 2011). Differential effects and dispositional predictors, according to ini- tial characteristics (e.g., mindfulness and rumination), might also be considered for forthcoming interventions to design them more accurately to suit individual needs (Bhayee et al., 2016). In addition, closer attention should be directed toward individuals who may incur undesirable effects from an MBI (Creswell, 2017; Dobkin, Zhao, & Monshat, 2017).

In conclusion, this preliminary study is based on an ecological momentary assessment design and uses GAM analyses to provide promising perspectives to consider dynamic trajectories of change that could be induced by an MBI on rumination, attentional distractibility, and automatic pilot functioning. This approach could be generalized to clinical samples and other related studies in the clinical intervention field.

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