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ORIGINAL PAPER

Assessing the Immediate Effects of Detached Mindfulness on Repetitive Negative Thinking and Affect in Daily Life: A Randomized Controlled Trial

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Abstract

Objectives Repetitive negative thinking (RNT) is a problematic thinking style that is related to multiple mental disorders. Detached mindfulness is a technique of metacognitive therapy that aims to reduce RNT. Our study set out to investigate the immediate effects of detached mindfulness in daily life.

Methods Participants with elevated trait RNT ($n = 50$) were prompted to engage in detached mindfulness exercises three times a day for 5 consecutive days. Immediate effects on RNT and affect were assessed 15 and 30 min after each exercise using experience sampling methodology. We compared the effects of this exercise phase to (1) a 5-day non-exercise baseline phase and (2) a different group of participants that engaged in an active control exercise ($n = 50$).

Results Results of Bayesian multilevel models showed that, across groups, improvements in RNT, negative affect, and positive affect were stronger during the exercise phase than during the non-exercise baseline phase (RNT after 15 min: $b =$ -0.26, 95% $CI =$ [-0.38, -0.14]). However, the two exercise groups did not differ in these improvements (RNT after 15 min: $b = 0.02$, 95% $CI =$ [-0.22, 0.27]). Thus, the detached mindfulness and the active control exercises resulted in similar effects on RNT and affect in daily life.

Conclusions Results of this study imply that there was no additional benefit of having participants observe their thoughts detached and non-judgmentally, compared to excluding these assumed mechanisms of action as done for the active control group. We discuss possible reasons for the non-difference between the groups.

Preregistration This study was preregistered at https://osf.io/rze64.

Keywords Repetitive Negative Thinking · Detached Mindfulness · Metacognitive Therapy · Randomized Controlled Trial · Experience Sampling Methodology

When concerns or problems arise in life, it is natural to reflect on them extensively. When those thoughts continuously repeat themselves and are perceived as intrusive, unproductive, and difficult to control, they are called repetitive negative thinking (RNT; Ehring et al., 2011; Ehring & Watkins, 2008). RNT is a thinking style; it is characterized by the process of the thinking rather than its content. RNT is especially prevalent in depressive and generalized anxiety disorders, where the thinking is often described as rumination or worry, respectively (Ehring & Watkins, 2008). However, heightened levels of RNT have been observed across different mental disorders (Kircanski et al., 2018; Wahl et al., 2019) and are even predictive for their onset (Ehring & Watkins, 2008; Struijs et al., 2021). RNT has been proposed as a transdiagnostic process because of its relevance across various disorders (Ehring & Watkins, 2008). Studies using experience sampling methodology (ESM) showed that stronger momentary RNT is associated with stronger momentary negative affect (Kircanski et al., 2018). More importantly, ESM studies also highlighted that stronger momentary RNT results in a deterioration of negative affect at a later timepoint (Blanke et al., 2022; Stefanovic et al.,

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2021; Zetsche et al., 2023). Deteriorated affect can again trigger stronger RNT (Blanke et al., 2022; Hjartarson et al., 2021; Stefanovic et al., 2021) forming a vicious cycle. This vicious cycle might even be the building block of mental disorders on a micro-level. Indeed, Stefanovic et al. (2021) found that stronger associations between RNT and affect in daily life were predictive for future depressive symptoms. Therefore, it appears critical to provide people with strategies to interrupt RNT and to improve their affect in daily life because such strategies are likely to protect against mental disorders.

A number of interventions that aim to reduce RNT and its associated negative consequences have been developed (for an overview see for example: Teismann & Ehring, 2019; Topper et al., 2010). Interventions can take different approaches to reduce RNT. They may focus on modifying the actual content of thoughts or they may focus on changing a person's relationship to their thoughts. One example of the latter is metacognitive therapy. Metacognitive therapy assumes that emotional problems, such as depression or anxiety, are caused by an interplay of maladaptive metacognitions (e.g., "I have to worry in order to be prepared.") and the so-called cascading attentional syndrome (Wells, 2011). According to the cascading attentional syndrome, individuals are caught in unpleasant feelings because they do not see a negative thought as a spontaneous, transient, and often unimportant event, but focus on the content of that thought and start an inner dialog. Thus, they engage in RNT. By sticking to the thought and by continuously focusing on negative content, they dig themselves deeper into unpleasant feelings. To stop this harmful development, metacognitive therapy aims to reduce RNT with a technique called detached mindfulness (Wells, 2005).

Detached mindfulness is characterized by five elements (Wells, 2005): (1) meta awareness: noticing thoughts, (2) low conceptual processing: refraining from inner dialog and analysis of thought content, (3) low goal directed coping: refraining from changing or suppressing thoughts, (4) attentional detachment: not sticking to a thought and, (5) cognitive de-centering: realizing that thoughts are not facts but transient mental events. Thus, detached mindfulness teaches to notice one's thoughts, while trying not to evaluate, control, suppress, or react to them. Instead, individuals train to move one's attention from one thought to the next, without getting entangled in its content and without trying to change the thought. As such, one is asked to view oneself as a non-judgmental observer, detached from the thoughts, and to realize that thoughts are merely mental events and do not necessarily represent the truth. It is assumed that when engaging in detached mindfulness, engaging in RNT is not possible because the two modes of processing are not compatible with one another (Wells, 2011).

Several studies examined whether detached mindfulness is effective in reducing different psychological problems. These studies either compared a detached mindfulness group with a control group, or they compared a detached mindfulness intervention with an active control intervention within the same individuals. A single session of detached mindfulness delivered in the laboratory reduced RNT-like thinking (i.e. anticipatory processing and pre-event rumination, respectively) in socially anxious participants compared to an active control intervention (Gkika & Wells, 2015) and compared to a passive control group (Modini & Abbott, 2018). Findings further demonstrated that participants' perception of their own thoughts changed. For example, a single session of detached mindfulness delivered in the laboratory made participants rate their thinking as more controllable and less distressing compared to an active control intervention (Caselli et al., 2016) and compared to a passive control group (Modini & Abbott, 2018). Several studies have also reported the effect of detached mindfulness on emotional outcomes. Detached mindfulness administered over multiple weeks in a group setting was related to stronger (Ahmadpanah et al., 2017) reductions in anxiety as well as stronger (Ahmadpanah et al., 2017) or similar (Ahmadpanah et al., 2018) reductions in depressive symptoms than an active control intervention. A single session of detached mindfulness delivered in the laboratory was related to similar reduction in anxiety compared to an active control group (Gkika & Wells, 2015) or no reduction in anxiety compared to an passive control group (Modini & Abbott, 2018). In sum, single sessions of detached mindfulness delivered in the laboratory and group treatments over multiple weeks appear beneficial to improve RNT and emotions (although results concerning emotional outcomes are mixed).

Detached mindfulness has many similarities with mindfulness-based interventions (MBIs). Both intend to change the focus of attention and observe ongoing experiences without trying to change them (Medvedev et al., 2022; Wells, 2011). Detached mindfulness and MBIs may differ in that detached mindfulness directs attention solely towards current thoughts, while MBIs may direct attention towards a broader range of aspects such as emotions or surrounding sounds (Kabat-Zinn, 2009; Wells, 2011). A crucial part of detached mindfulness is to achieve a metacognitive perspective by perceiving thoughts as detached from the self (Wells, 2011). While this metacognitive perspective is a defining element of detached mindfulness, MBIs not necessarily include detachment from experiences (Van Dam et al., 2018). In short, detached mindfulness may equivalently be applied in MBIs, but MBIs may incorporate aspects of mindfulness that are not part of detached mindfulness. For interested readers, Wells (2011) provides an extensive comparison of detached mindfulness

as stemming from metacognitive therapy and other forms of mindfulness (see Chapter 5.4).

Findings of MBIs align with those of detached mindfulness in the context of metacognitive therapy: Mindfulness appears as a promising candidate to reduce RNT and improve affect. For example, two meta-analyses demonstrate that MBIs reduce ruminative thinking to the same level as cognitive behavioral therapies (Mao et al., 2023; McCarrick et al., 2021). Additionally, digital MBIs were shown to improve RNT (Vargas-Nieto et al., 2024) and single inductions of mindfulness to reduce rumination and NA (however, results depend on the control induction used; Leyland et al., 2019).

However, most previous investigations of detached mindfulness either relied on multi-week interventions with pre-post comparisons of outcomes, which leave the immediate effects of the intervention unknown, or are conducted in a lab setting which limits their generalizability to daily life. Therefore, it remains unclear, how applying detached mindfulness in daily life affects the immediately following thought processes and affect. Thus, it is unclear whether approaching thoughts detached and non-judgmentally as one goes about in everyday life can interrupt RNT and improve affect.

The present study aimed to investigate whether manipulating how detached and mindful individuals approach their thoughts in certain moments in daily life impacts their experiences immediately after. For this purpose, we integrated detached mindfulness exercises as well as the assessment of its immediate effects into the daily lives of participants. Specifically, a smartphone app prompted participants to engage in a detached mindfulness exercise three times a day, over multiple days. The exercises consisted of audio files integrated into the smartphone app. We assessed levels of RNT, negative affect, and positive affect before as well as 15 and 30 min after each exercise using ESM. ESM repeatedly assesses individuals' momentary experiences in a natural environment (Myin-Germeys & Kuppens, 2022). This reduces memory bias that can exist in retrospective self-reports (Csikszentmihalyi & Larson, 1987; Zetsche et al., 2019). Therefore, ESM is ideal to validly and reliably capture how practicing detached mindfulness affects everyday experiences.

We recruited individuals with elevated trait RNT rather than a sample with a particular mental disorder. This ensured that all participants shared the same problematic thinking pattern, which is targeted by detached mindfulness. Individuals were randomized to either engage in detached mindfulness exercises or to engage in active control exercises. Both groups took part in a 5-day baseline phase during which they only reported momentary experiences via ESM (ESM-only) followed by a 5-day exercise phase during which they again reported momentary experiences but additionally completed guided exercises (ESM + exercises). This allowed us to compare the effects of the detached mindfulness exercises (1) with the ESM-only baseline phase and, (2) with the effects of the active control exercises. The exercises of the control group comprised similar "ingredients" as the detached mindfulness exercises. Participants in the control group also engaged in audio-guided exercises that included imagination of similar scenes as in the detached mindfulness group. However, the exercises of the control group excluded the specific detached mindfulness characteristics. Hereby, we aimed to dismantle the efficacy of the specific detached mindfulness mechanisms. We chose a 5-day (Wednesday to Sunday) data collection period for both phases to balance feasibility for our participants and to ensure consistency across both phases.

We expected that the exercise phase as compared to the baseline phase would be associated with a stronger immediate decrease of RNT, a stronger immediate decrease of negative affect, and a stronger immediate increase of positive affect from before (t0) to 15 min (t1) after the exercises as well as from before (t0) to 30 min (t2) after the exercises than the baseline phase. Further, we expected that these changes would be stronger in the detached mindfulness group than in the active control group.

Method

Participants

We recruited participants from the general population through online advertisements on eBay Kleinanzeigen, an online platform where users can offer and buy goods and local services. We stated that the goal of our study was to examine specific techniques for dealing with unpleasant thoughts and feelings. Inclusion criteria required participants to have at least moderate trait RNT (i.e., sum score of > 33 on the Perseverative Thinking Questionnaire; Ehring et al., 2011; compare Heckendorf et al., 2019 for cut-off), to be between 18 and 65 years old, to speak German fluently, and to have a smartphone with mobile data. Interested individuals were required to fill out an online screening questionnaire and register with their personal information if screened positive.

We included 107 participants and had complete data of 100 (50 detached mindfulness group, 50 active control group). Sample size determination is provided in the preregistration. Figure 1 displays the participant flow. Participants' demographic characteristics can be found in Table 1.

Participants gave informed consent prior to participation and were reimbursed at the end of the study. Reimbursement included a bonus of 10€ if participants answered more than 85% of all ESM assessments. Participants received a

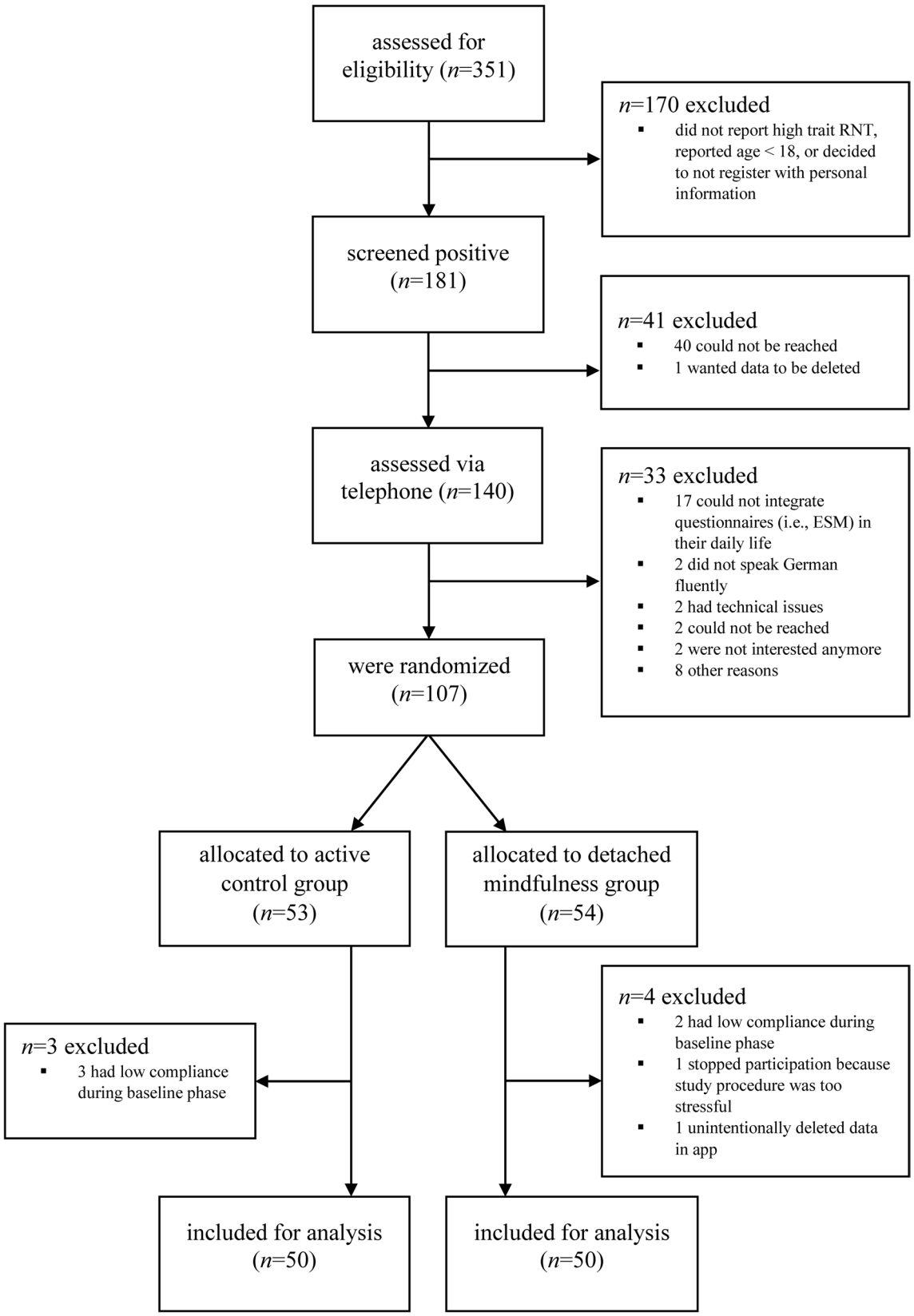

Fig. 1 Flow chart of participants

Table 1 Demographics and clinical characteristics of participants

		Detached mindfulness group (n = 50)	Active control group (n = 50)
Age in years (*M, SD*)		33.8 (11.2)	34.2 (9.83)
Gender (n, %)			
	female	36 (72)	40 (80)
	male	12 (24)	9 (18)
	divers	2 (4)	1 (2)
Current psychotherapeutic/ psychiatric treatment (n, %)			
	no	35 (70)	42 (84)
	yes	12 (24)	5 (10)
	not specified	3 (6)	3 (6)
Prior experience with meditation or mindfulness (*M, SD*)		3.88 (2.03)	3.36 (1.96)

Prior experience with meditation or mindfulness was measured on a scale from 1 (*not at all*) to 7 (*very much*). M = mean; SD = standard deviation; n = number of participants; % = percent of participants

graphical feedback of their baseline phase ESM data if they wished. The study took place from September 2021 to April 2022.

Procedure

We explained the study procedure to participants in a telephone call. During this call, we also guided them to install the app for the experience sampling on their smartphones (m-path; Mestdagh et al., 2023) and tested it. Next, participants filled out an online pre-survey. Then, participants completed the baseline phase, followed by the exercise phase. At the end of the study, participants filled out an online post-survey. All surveys were assessed via the platform formR (Arslan et al., 2020).

Baseline Phase (ESM-only)

The baseline phase lasted 5 days, always ran from Wednesday to Sunday, and included a maximum of nine daily assessments. Each day was split into three time-windows: morning (6am-11am), midday (12pm-5pm), evening (6pm-9pm). Participants self-selected 1.5-hr slots within each time-window to make participation more feasible. Participants received a set of three assessment during each slot. The first (t0) assessment was quasi-randomized within the first 30 min of each slot. The second (t1) assessment was scheduled 15 min after the t0 assessment was submitted; the third (t2) assessment was scheduled 30 min after the t0 assessment was submitted. We ensured that there were at least 90 min between the assessments of the different time-windows. The left-hand side of Fig. 2 depicts the sampling scheme for a day during the baseline phase.

Participants received several reminders in case of unanswered assessments. Participants were excluded after the baseline phase if they had answered less than 60% of possible assessments.

Exercise Phase (ESM + Exercises)

The exercise phase included the same ESM assessments as the baseline phase and followed the same procedure: It lasted 5 days and always ran from Wednesday to Sunday. However, participants were additionally asked to complete the respective exercises three times a day. To do so, the audio file was displayed immediately after participants had answered the ESM questions of the t0 assessment. The t1 and t2 assessments followed 15 and 30 min after the end of the exercise. The right-hand side of Fig. 2 depicts the sampling scheme for a day during the exercise phase.

Measures

Questionnaires

At the beginning and at the end of the study, we assessed several validated questionnaires with pre- and post-surveys. Detailed information on these questionnaires and their descriptive statistics can be found in the Supplemental material. In addition, we assessed participants' age, gender, whether they were currently in psychological and/or psychiatric treatment, and asked about previous experiences with meditation or mindfulness (Table 1).

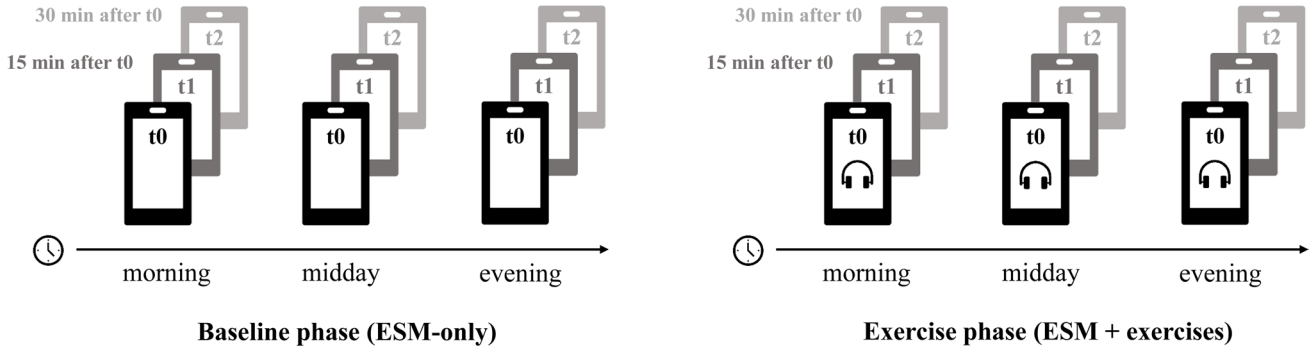

Fig. 2 Daily sampling scheme for the baseline and the exercise phase. Both sampling schemes consist of the same ESM assessments. However, during the exercise phase, participants additionally completed the respective exercises at each t0 assessment

Experience Sampling Items

Participants answered 17 items during each ESM assessment, of which we used 14 (RNT and affect) for our main analysis. All questions were introduced by asking "How much do these statements apply to you at the moment?" and were presented in fixed order as listed below. A score for each of the following scales was created by calculating the mean across all items belonging to one scale. We calculated the within- and between-person reliability for each scale based on Geldhof et al. (2014).

RNT was assessed with 4 items: "The same negative thoughts keep going through my mind again and again.", "I get stuck on certain issues and can't move on.", "Thoughts come to my mind without me wanting them to.", and "How much do you feel weighed down by these thoughts at this moment?". All items were based on the process related items that Rosenkranz et al. (2020) developed for assessing RNT via ESM and were rated on a scale of 1 (*not at all*) to 7 (*very much*). We added the word "negative" in the first item. In our sample, the reliability of the RNT scale was very good (within-person: $\omega = 0.95$ (95% $CI = [0.95, 0.95]$); between-person: $\omega = 0.98$ (95% $CI = [0.98, 0.99]$).

Negative affect was assessed with 6 items: "I am [...]" sad, downhearted, afraid, nervous, upset, and irritable. All items were taken from the PANAS-X (German version: Grühn et al., 2010; Watson & Clark, 1994) and were rated on a scale of 1 (*not at all*) to 7 (*very much*). In our sample, the reliability of the negative affect scale was very good (within-person: $\omega = 0.83$ (95% $CI = [0.83, 0.84]$); between-person: $\omega = 0.94$ (95% $CI = [0.92, 0.96]$)).

Positive affect was assessed with 4 items: "I am [...]" cheerful, happy, relaxed, and energetic. All items were taken from the PANAS-X (German version: Grühn et al., 2010; Watson & Clark, 1994) and were rated on a scale of 1 (*not at all*) to 7 (*very much*). In our sample, the reliability of the positive affect scale was very good (within-person: $\omega = 0.83$ (95% $CI = [0.82, 0.83]$); between-person: $\omega = 0.92$ (95% $CI = [0.90, 0.95]$)).

Exercises

At the beginning of the study, participants were randomized to either the detached mindfulness group or the active control group. We created an excel sheet for the randomization including a random sequence of the two groups and participants were allocated according to this sequence. An error in the created sequence led to an imbalance of the number of participants in the two groups toward the end of the study. Therefore, the last five participants were allocated to the detached mindfulness group to reach balanced group sizes.

Before the exercise phase started, both groups received an instruction sheet that introduced and explained the detached mindfulness and active control exercises, respectively. In both groups, the actual exercises consisted of audio files that included verbal instructions. Each exercise lasted about 4.5 min. The exercises started with the same introduction for both groups (e.g., invitation to close one's eyes if one wanted to) before continuing with the group-specific content.

In the detached mindfulness exercises, participants were asked to imagine either (1) clouds on the sky, (2) leaves on a river, or (3) trains at a station. Next, they were asked to imagine that the clouds, leaves, or trains are their thoughts. They were instructed to observe how their thoughts come and go without getting entangled in their content and without any attempts to change them. We created the scripts for the audio files based on the detached mindfulness exercise "Leaves floating in the river" from the manual cognitive behavioral therapy of depressive rumination (Teismann et al., 2017, p. 158) and adapted it to two other detached mindfulness metaphors (clouds on the sky, trains at a station) proposed by Wells (2005). All detached mindfulness characteristics (i.e., meta-awareness, low conceptual processing, low goal directed coping, attentional detachment, cognitive

decentering; Wells, 2005) were integrated into the exercise instructions.

We used the detached mindfulness exercises as a template for the active control exercises. However, we aimed to exclude all specific detached mindfulness characteristics. In the active control exercises, participants were, therefore, also asked to imagine either (1) clouds on the sky, (2) leaves on a river, or (3) trains at a station. In contrast to the detached mindfulness group, there was no reference to participants' thoughts. Instead, participants received instructions to observe further elements in the imagined scene (e.g., flowers on a meadow).

We recorded all exercises once with a female voice (first author) and once with a male voice (colleague of first author). This resulted in six audio files per group. The order of the files was quasi-randomized. Each participant received each audio file of its group at least twice; no file was played twice in a row. The app tacked how long participants listened to each file. After the exercises, participants were asked: "How well were you able to implement the exercise?", rated on a scale of 1 (*not at all*) to 7 (*very much*). If participants answered this question < 5, we asked for reasons using a multiple-choice item. All participants received a general instruction for the exercises of their group before they started with the exercise phase.

Data Analyses

We estimated Bayesian linear multilevel models to examine our hypotheses. We used the R (R Core Team, 2021) package brms (Bürkner, 2017, 2018), which is based on Stan (Carpenter et al., 2017). Default priors of brms were chosen, which are not or only weakly informative, and thus only have negligible influence on the obtained results (Bürkner, 2017, 2018).

We calculated three models, one for each of the following dependent variables: RNT, negative affect, and positive affect. All models comprised the following factors as predictors: phase (factor levels: baseline, exercise), timepoint (factor levels: t0, t1, t2), group (factor levels: active control, detached mindfulness), and their respective interactions. The factors phase and timepoint varied within persons, whereas the factor group varied between persons. Lastly, we added the factor time-window (factor levels: morning, midday, evening) as a within-person predictor to model potential fluctuations of dependent variables within each day. All factors were effect coded. All models accounted for the existing three-level structure of our data, with beeps (Level 1) nested in days (Level 2) nested in persons (Level 3). The intercept as well as the predictors phase, timepoint, and their interaction were added as random effects in a way that represents the maximal random structure permitted by the study design (Barr et al., 2013; Heisig & Schaeffer, 2019). For more information on the exact model specifications, see the respective html file at https://osf.io/z2e83/.

Effects were considered clearly different from zero if the estimate's 95% credible interval (i.e., Bayesian confidence interval) did not include zero. Following Dushoff et al. (2019), we use the term statistical clarity instead of statistical significance. The latter may be misleading and prone to misinterpretation. We also estimated the posterior probability (*PP*) that the respective effect is in the expected direction. *PP* values range from 0-1 with higher values indicating that the effect is going into the expected direction. We ensured that all models converged with Rhat = 1.00 and estimated effective sample sizes (ESS) of at least 400 for all estimates relevant for hypotheses testing (Vehtari et al., 2021).

We tested specific contrasts to examine our research questions. Firstly, we tested whether the change in RNT or affect from t0 and t1 and from t0 and t2 was stronger during the exercise phase than during the baseline phase. Next, we tested whether the above-mentioned changes were stronger for the detached mindfulness group than for the active control group (for more details see html file at https://osf.io/z2e83/.

Results

Compliance

Compliance with experience sampling was very high. The two groups answered a similar percentage of beeps during the baseline phase (detached mindfulness group: $M = 92.4$, $SD = 7.68$, range = 64.4-100; active control group: $M = 91.6$, $SD = 7.77$, range = 66.7-100) as well as during the exercise phase (detached mindfulness group: $M = 89.1$, $SD = 12.0$, range = 51.1-100; active control group: $M = 86.0$, $SD = 13.3$, range = 48.9-100). However, both groups answered more beeps during the baseline phase than during the exercise phase, $b = 4.47$ (95% $CI = [2.5, 6.44]$, $PP(b > 0) > 0.99$).

Compliance with the exercises was also very high. Participants of both groups started most of the 15 possible exercises (detached mindfulness group: $M = 13.98$, $SD = 1.41$, range: 9-15; active control group: $M = 13.44$, $SD = 1.83$, range: 8-15). If participants started an exercise, they also listened to a high percentage of the audio file (detached mindfulness group: $M = 93.12$, SD = 10.76, range: 59-100; active control group: $M = 90.72$, $SD = 12.84$, range: 43-100). This indicates that the exercises were actually conducted. On a scale from 1 (*not at all*) to 7 (*very much*), participants reported that they were able to implement the exercise rather well (detached mindfulness group: $M = 5.08$, $SD = 1.12$, range: 3-7; active control group: $M = 4.88$, $SD = 1.26$, range: 1-7).

Effects of Exercises on Immediate RNT and Affect

Table 2 displays the posterior means and credible intervals for RNT, negative affect, and positive affect for the two groups stratified by phase and timepoint.

As expected, there was a clearly stronger decrease in RNT from t0 to t1 during the exercise phase than during the baseline phase, across groups, b = -0.26 (95% CI = [-0.38, -0.14], $PP(b < 0) > 0.999$) – see Fig. 3. Similarly, there was a clearly stronger decrease from t0 to t2 during the exercise phase than during the baseline phase, across groups, b = -0.25 (95% CI = [-0.38, -0.12], $PP(b < 0) > 0.999$). However, the stronger decrease from t0 to t1 during the exercise phase than during the baseline phase did not differ between the detached mindfulness and the active control group, b = 0.02 (95% CI = [-0.22, 0.27], $PP(b < 0) = 0.43$). Similarly,

Table 2 Posterior means and 95% credible intervals for RNT, negative affect, and positive affect

	Phase	Detached mindfulness group			Active control group		
		t0	t1	t2	t0	t1	t2
RNT (*M*, *CI*)	Baseline	3.51 (3.17, 3.85)	3.42 (3.07, 3.78)	3.31 (2.94, 3.68)	3.80 (3.42, 4.17)	3.73 (3.34, 4.12)	3.72 (3.33, 4.11)
	Exercise	3.20 (2.82, 3.57)	2.86 (2.49, 3.24)	2.84 (2.46, 3.22)	3.65 (3.31, 4.00)	3.32 (2.95, 3.68)	3.23 (2.86, 3.60)
Negative affect (*M*, *CI*)	Baseline	2.84 (2.52, 3.18)	2.84 (2.50, 3.19)	2.81 (2.47, 3.17)	3.00 (2.67, 3.33)	2.98 (2.65, 3.32)	2.98 (2.65, 3.32)
	Exercise	2.67 (2.33, 3.01)	2.55 (2.20, 2.89	2.53 (2.19, 2.88)	2.85 (2.51, 3.19)	2.68 (2.33, 3.03)	2.66 (2.31, 3.01)
Positive affect (*M*, *CI*)	Baseline	3.47 (3.18, 3.76)	3.49 (3.18, 3.79)	3.53 (3.22, 3.85)	3.73 (3.45, 4.00)	3.69 (3.40, 3.97)	3.68 (3.39, 3.96)
	Exercise	3.69 (3.37, 4.01)	3.85 (3.51, 4.18)	3.85 (3.51, 4.20)	3.64 (3.36, 3.92)	3.78 (3.49, 4.06)	3.77 (3.48, 4.06)

Posterior means and credible intervals are based on the statistical models we used for hypothesis testing. M = posterior mean; CI = 95% credible interval (lower, upper)

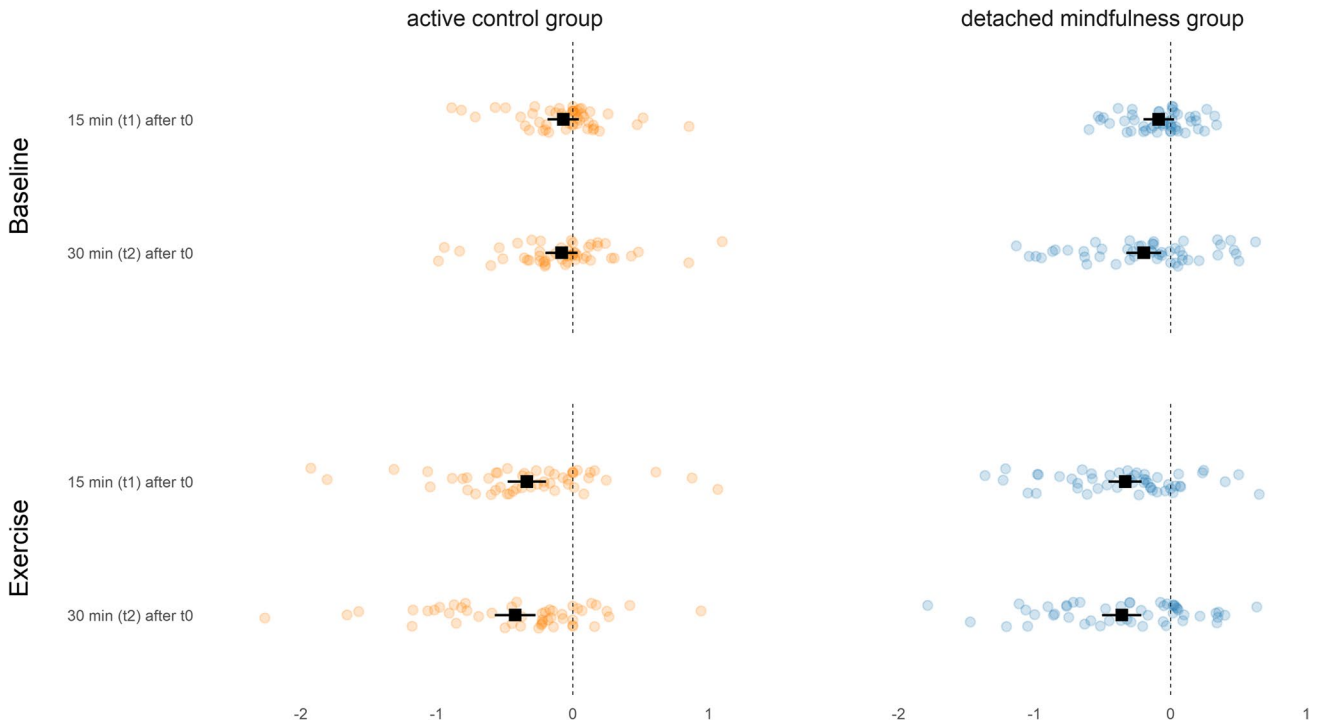

Fig. 3 Changes in RNT between t0 and t1 as well as t0 and t2 stratified by phase and group. Rectangular points represent posterior means, error bars represent 95% CIs based on statistical models. Circular points represent individual changes based on raw data

the stronger decrease from t0 to t2 during the exercise phase than during the baseline phase did not differ between the detached mindfulness and the active control group, $b = 0.18$ (95% CI = [-0.08, 0.44], $PP(b < 0) = 0.09$).

As expected, there was a clearly stronger decrease in negative affect from t0 to t1 during the exercise phase than during the baseline phase, across groups, b = -0.14 (95% CI = [-0.22, -0.06], $PP(b < 0) > 0.999$). Similarly, there was a clearly stronger decrease from t0 to t2 during the exercise phase than during the baseline phase, across groups, b = -0.14 (95% CI = [-0.23, -0.05], $PP(b < 0) > 0.999$). However, the stronger decrease from t0 to t1 during the exercise phase than during the baseline phase did not differ between the detached mindfulness and the active control group, $b = 0.03$ (95% CI = [-0.14, 0.2], $PP(b < 0) = 0.35$). Similarly, the stronger decrease from t0 to t2 during the exercise phase than during the baseline phase did not differ between the detached mindfulness and the active control group, $b = 0.06$ (95% CI = [-0.12, 0.24], $PP(b < 0) = 0.26$).

As expected, there was a clearly stronger increase in positive affect from t0 to t1 during the exercise phase than during the baseline phase, across groups, $b = 0.16$ (95% CI = [0.07, 0.25], $PP(b > 0) > 0.999$). Similarly, there was a clearly stronger increase from t0 to t2 during the exercise phase than during the baseline phase, across groups, $b = 0.14$ (95% CI = [0.05, 0.23], $PP(b > 0) > 0.999$). However, the stronger increase from t0 to t1 during the exercise phase than during the baseline phase did not differ between the detached mindfulness and the active control group, b = -0.04 (95% CI = [-0.22, 0.15], $PP(b > 0) = 0.35$). Similarly, the stronger increase from t0 to t2 during the exercise phase than during the baseline phase did not differ between the detached mindfulness and the active control group, b = -0.08 (95% CI = [-0.27, 0.11], $PP(b > 0) = 0.25$).

Supplemental Analyses

We calculated several sensitivity analyses testing whether the listening duration, the success of implementation, being in psychotherapeutic and/or psychiatric treatment, and prior experiences with mindfulness had an impact on our findings. In short, results revealed that a longer listening duration and a higher success of implementation were related to stronger improvements in RNT and affect but that the groups did not differ in these effects. Moreover, our analyses on being in psychotherapeutic and/or psychiatric treatment and prior experiences with mindfulness, respectively, led to the same conclusions as our main analyses. This underlines the robustness of our findings because of consistent results across different analyses. Additionally, we ran exploratory analyses investigating non-judgmental acceptance as dependent variable and longer-term effects of the exercises (i.e., day to day changes in levels of RNT and affect before each exercise; pre- to post-changes in trait RNT and trait mindfulness). See Supplemental material for details of all respective analyses and results.

Discussion

This study examined how applying short sequences of detached mindfulness in one's daily life influences immediate thought processes and affect. Specifically, we offered participants with elevated trait RNT multiple detached mindfulness exercise in a real-life environment and assessed its immediate effects on the transdiagnostic constructs RNT and affect. Importantly, this study comprised two different control conditions, namely a non-exercise baseline phase as well as a control group that engaged in active control exercises.

Results showed that, across both groups, there were stronger immediate changes during the exercise phase than during the baseline phase. Thus, participants' RNT and affect improved more strongly after they engaged in either the detached mindfulness or active control exercises than when they did not engage in them and instead engaged in what might be understood as their default mode of processing. The groups did not differ in these immediate changes, however. Thus, the improvements in the detached mindfulness group were not meaningfully different from the ones in the active control group.

This study focused on the effects of approaching thoughts detached and non-judgmentally. For this reason, our active control group received exercises that comprised similar ingredients as the detached mindfulness exercises but without the specific mechanism of detached mindfulness. In our view, such a procedure is important to dismantle different mechanisms that might contribute to change thought processes and affect. Our results failed to show a superiority of the detached mindfulness exercises. This implies that, in our study, there was no additional benefit of having participants observe their thoughts detached and non-judgmentally, compared to excluding these assumed mechanisms of action of detached mindfulness as done for the active control group.

Most previous studies did not only remove the detached mindfulness ingredients from their active control condition as we did, but included other potential mechanism of action in them (e.g., used a cognitive behavioral control intervention). Moreover, no previous study investigated the immediate effects of detached mindfulness in daily life. Thus, direct comparison with our finding is difficult. However, some studies assessed the effects of a single session of detached mindfulness delivered in the laboratory or multiple sessions of detached mindfulness delivered in a

group setting and compared these to an active control condition. Those studies produced mixed results, depending on the outcome at focus and the kind of control condition. Specifically, these studies found no differences between detached mindfulness and the active control conditions with respect to depressive symptoms (multiple sessions in group setting; control condition: stress management training; Ahmadpanah et al., 2018) and anxiety (single session in laboratory; control condition: cognitive behavioral intervention; Gkika & Wells, 2015). On the other hand, detached mindfulness was more effective than the active control conditions with respect to anticipatory processing (single session in laboratory; control condition: cognitive behavioral intervention; Gkika & Wells, 2015) and anxiety and depression (multiple sessions in group setting; control condition: leisure activities; Ahmadpanah et al., 2017). Our study extends this existing knowledge about detached mindfulness by analyzing its immediate effects in a daily life context. Our findings of non-difference between the groups are also reflected in the mindfulness literature outside of metacognitive therapy. Costa and Barnhofer (2016) compared a mindfulness intervention to a guided imagery exercise that is comparable to our active control intervention. Both conditions reduced difficulties in emotion regulation and depressive symptoms after 1 week of training. Similarly, meta-analytic results of MBIs show a similar pattern: MBIs are primarily superior when compared to passive control conditions, but results are mixed when the control conditions are active (Goldberg et al., 2022; Mao et al., 2023). As the choice of control conditions is essential to the likelihood of finding an effect and, importantly, to the conclusions that can be drawn from a study, we paid close attention to the design of our control condition. We aimed to carefully dismantle the impact of specific detached mindfulness characteristics by holding non-specific characteristics (e.g., expectations towards the exercises, mode of exercise delivery, imagined scenery in the exercises) constant across the detached mindfulness and active control exercises. Through this approach, our findings contribute to the knowledge about the efficacy of detached mindfulness as one technique of metacognitive therapy: Our findings suggest that the specific detached mindfulness characteristics do not provide additional immediate benefits to RNT and affect compared to the control group. This is at least true for our implementation of detached mindfulness in the exercises and the chosen study design.

Given the lack of differences between the effects of the detached mindfulness group and the active control group, it is difficult to determine what mechanisms drove the changes during the exercise phase compared to the baseline phase. We can speculate about possible reasons. Firstly, the changes in both groups could simply be the result of demand effects. We informed participants of both groups that their exercises might be helpful in dealing with unpleasant thoughts. This could have elicited expectations that led to the similar changes in RNT and affect. Secondly, both exercises include a relaxation component. Participants of both groups were instructed to find a quiet place for the exercise and calm down. Additionally, instructions of both groups included the imagination of a predominantly pleasant scene. This might have made participants of both groups relax, thus leading to similar changes in outcomes. Thirdly, changes might have been induced by distraction. The exercises asked participants to imagine a certain scene. Thereby, attention of participants might have been drawn away from current negative thoughts or feelings. Previous research has shown that such distraction can reduce unpleasant experiences, especially when used in place of rumination (Denson et al., 2012; Huffziger & Kuehner, 2009; Nolen-Hoeksema et al., 2008). Similarly, meta-analytic results showed that mindfulness inductions were equally effective in reducing rumination as distraction (Leyland et al., 2019).

Limitations and Future Research

Our findings have to be interpreted considering the following restrictions. Findings apply to brief exercises (i.e., duration less than 5 min). Future studies may investigate whether differences between the exercise groups emerge when detached mindfulness is practiced with more intense exercises. Moreover, we used a sample of participants with elevated trait RNT. Future studies could examine whether the same results are found for clinical samples. Our participants engaged in detached mindfulness that originates from metacognitive therapy (Wells, 2011). Detached mindfulness may also be part of MBIs. However, the present results may not apply to other forms of mindfulness exercises used within MBIs. Lastly, it is possible that our sample size was too small to detect potential subtle differences between the groups. Future studies could use larger samples or, alternatively, employ a micro-randomized design. In micro-randomized trials, each participant receives both the intervention and the control on different occasions (see Bolzenkötter et al., 2024 for an application of a micro-randomized trial; see Klasnja et al., 2015 for a description of the micro-randomized trial design). This allows for within-person comparisons of conditions and thereby requires smaller samples than between-person comparisons (Klasnja et al., 2015).

Our study also has many strengths. First, detached mindfulness was repeatedly examined in a real-life setting which increases ecological validity and reliability (Csikszentmihalyi & Larson, 1987). Second, the assessment of outcomes via ESM reduces memory bias (Csikszentmihalyi & Larson, 1987). Third, the smartphone app tracked participants'

compliance. This provides support that participants actually engaged in the exercises. One of the most important strengths of our study is, however, that we included two different control conditions. This enabled us to not only compare the effects of detached mindfulness to participants' default mode of processing but also to a control condition that was meant to equal the detached mindfulness exercises except for its assumed mechanisms of action. This approach allowed us to more confidently state that, in our sample and in the way we implemented the detached mindfulness exercises, the assumed mechanisms of detached mindfulness did not have an effect that goes beyond the one of our carefully designed control exercises.

RNT is a problematic thinking style that is related to different mental disorders. Detached mindfulness is one technique of metacognitive therapy that aims to reduce RNT. This study set out to investigate the immediate effects of practicing detached mindfulness in daily life. Results showed that both the detached mindfulness and active control exercises were related to improvements in immediate RNT, negative affect, and positive affect when compared to the non-exercise baseline phase. However, the two exercise groups did not differ. Thus, the detached mindfulness and the active control exercises resulted in similar effects. Finding effective strategies to change RNT in daily life remains a challenging but worthwhile task as it presents the opportunity to eliminate the breeding ground for multiple mental disorders (Topper et al., 2010).

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Use of Artificial Intelligence The authors declare that no artificial intelligence tools were used to prepare this manuscript.

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Data Availability Data, analysis scripts, (additional) results, and further materials, such as a list of all measures assessed and the exercises used, are available on the Open Science Framework at https://osf.io/z2e83/.

Declarations

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval The study was approved by the Ethics Committee of Freie Universität Berlin (no. 014.2021).

Informed Consent All participants gave informed consent prior to participation.

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