wPresent-biased Meditators? The Effects of Mindfulness on Intertemporal Choice

[Version: Figures included]

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Present-biased Meditators? The Effects of Mindfulness on Intertemporal Choice

Abstract

In this paper, we study the effects of mindfulness meditation on intertemporal decision-making. One essential aspect of mindfulness practice is to help people focus on the present moment. While this has been shown to have several positive consequences, it introduces the possibility that mindfulness meditators become more present-biased, which may have negative implications for decision-making. In three laboratory experiments and one longitudinal field study, we investigated the intertemporal decisions of people who engaged in mindfulness meditation. In our lab experiments, people were guided through short mindfulness exercises and then asked to make economic decisions with an intertemporal component. In our field study, participants completed an eight-week mindfulness course organized by an established mindfulness institute, and they faced intertemporal choices before and after their training. Our results show that mindfulness does not make people more present-biased or substantially affect their intertemporal decisions.

Keywords: Mindfulness, meditation, intertemporal choice, present-bias, impatience.

The analyses for all our experiments were conducted using STATA and R. Data is provided within the manuscript. The code, experimental instructions, and supplementary materials and analyses can be found in the following repository:
https://osf.io/swg79/?view_only=c3bc543bedee4b48ad23b6d65002521e

"*Breathing in, I calm body and mind. Breathing out, I smile. Dwelling in the present moment I know this is the only moment.*"

— Thich Nhat Hanh

Introduction

Mindfulness is no longer confined to yoga studios and meditation retreats; it has become mainstream in boardrooms and executive training programs worldwide. Many Fortune 500 companies — including industry giants like Google, Apple, Nike, and Goldman Sachs — have adopted mindfulness initiatives aimed at sharpening leaders' attention, reducing stress, and improving decision-making [1–2]. Yet, despite its widespread popularity and enthusiastic endorsements by millions of professionals, mindfulness practice has recently come under scrutiny for potential unintended consequences. Scholars and commentators have raised concerns that mindfulness, by enhancing focus on the present moment, might unintentionally encourage present-biased decision-making — leading people to prioritize immediate gratification at the expense of future benefits [3–6]. Given mindfulness's rapid and extensive integration into corporate cultures, rigorously investigating its impact on intertemporal choice is critical for both organizational effectiveness and individual well-being.

General effects of mindfulness and potential concerns for intertemporal decision-making

Mindfulness, defined as "the awareness that arises through paying attention, on purpose, in the present moment, non-judgmentally" [7], has positive effects that have been well-established across many domains. Mindfulness interventions have been frequently applied in clinical contexts — when the group under study is diagnosed with or considered at risk of a

healthcare condition — to improve a variety of conditions, such as anxiety and personality disorders, substance abuse, stress, as well as chronic pain, to name just a few [8]. Several reviews have summarized the main findings and generally supported the clinical effectiveness of mindfulness (see [9–17]). This effectiveness continues to find support in recent research (see [16, 18–22]). Moreover, the positive effects of mindfulness are not limited to clinical contexts. Results from brain imaging studies also found a positive relationship between mindfulness and neural functions associated with well-being [23–25]. These results have been supported by studies that found mindfulness was positively associated with life satisfaction by reducing deviations from a balanced time perspective (DBTP) [21, 26]. Other studies found positive effects on immune system parameters [27–29].

Research on the effects of mindfulness on decision-making is much more limited, but studies have also found positive effects in important domains, such as ethical decisions [30–31], cooperative and pro-social decisions [32–33], and the sunk-cost bias [34]. Mindfulness was also associated with enhanced self-regulation and reduced aversion to waiting [35] and to lower risk-aversion [36]. Overall, while mindfulness received some criticism [37–39], the overarching conclusion is that it has desirable effects on mental health, well-being and decision-making.

While the practice of mindfulness may improve ethical, pro-social, and reduce risky decisions people make for their present self, could it actually hurt the intertemporal choices they make for their future self? Mindfulness practices are broadly conceived to focus meditators on the present moment, abstracting from concerns related to the past or the future. This can have beneficial effects on several well-being metrics but it might also make meditators discount the value of future outcomes more heavily and become more present-biased. A large literature in economics, psychology, and neuroscience has shown that when people made choices that involve intertemporal trade-offs — such as the ones related to saving, climate change mitigation, healthy eating, etc. —, they tend to hyperbolically discount the value of future rewards and display a drive for immediate gratification (see [40–41]). These tendencies have been linked to numerous detrimental behaviors, such as lower academic performance [42],

insufficient saving [43], unhealthy eating and obesity [44–45], and substance and alcohol use disorders [46], among others. They have also been linked to important life outcomes such as divorce rates [47] or suicide rates [48]. If, by focusing people on the present, mindfulness exacerbates these patterns, its practice could also carry negative consequences. Some existing research has linked mindfulness with patterns of substance abuse related to impulsivity [49]. Given the increased prevalence of mindfulness across Western societies, these patterns could, in turn, have a substantial detrimental impact on the economy and society. Therefore, in the present paper, we aim to systematically study how mindfulness meditation affects intertemporal decision-making.

Empirical evidence on the effects of mindfulness on intertemporal choice

Several studies have examined the effects of mindfulness or related treatments on intertemporal decision-making in clinical and general populations — with very mixed results for both. At the clinical population level, several studies concluded that mindfulness can successfully reduce delay discounting by improving self-regulation, tolerance, and present-moment acceptance (see [19–20, 36, 50–52]). However, other studies found null effects [53–54]; and others argued that mindfulness can even increase discount rates depending on the population under study (see [55]). For instance, Rasmussen et al. [56] found that a mindful eating treatment increased the discounting of rewards for food-insecure women. These findings, which run contrary to the results of previous studies, are interpreted as mindfulness inducing them into a 'survival mode' by increasing their focus on present scarcity.

At the general population level, several studies found that mindfulness can reduce discount rates [35, 50, 57–62], but that this effect can be contingent upon framing [35] and whether the type of reward is primary (e.g. food) or monetary [51]. These contingent effects are consistent with other studies that found that delay discounting is decreased when time is framed in terms of calendar dates rather than days [63–64]; and studies that found that primary rewards are

discounted more steeply than monetary rewards [40, 65]. Other studies found no significant effects of mindfulness or related treatments on intertemporal choices [18, 51, 66]. Finally, some studies suggested that mindfulness induces higher discount rates when making financial decisions [56–57].

Limitations of previous research

Research on the effects of mindfulness on intertemporal choice is still underexplored, and existing studies are limited in at least four ways.

First, most studies focus on very specific clinical populations and decision-making contexts. For instance, Hendrickson and Rasmussen [50–51] studied the effects of mindfulness to reduce impulsive food choices to curb obesity. Similarly, Rasmussen et al. [55] focused on food-insecure women, while Shead et al. [54] focused on regular gamblers, and Yao et al. [52] on gaming addiction. The relatively narrow focus of these studies — while important — makes it difficult to draw meaningful conclusions for the hundreds of millions of non-clinical mindfulness practitioners worldwide who make everyday decisions about how to invest their time and money (see [19–20, 36, 50–55]).

Second, the handful of studies that did examine the relationship between mindfulness and inter-temporal choice in the general population mainly did so using observational data. For instance, Duchêne et al. [66], Marcowski et al. [36], and Murphy & McKillop [20] did not induce mindfulness but estimated statistical relationships based on self-reported traits, using questionnaires like the Five Facet Mindfulness Questionnaire. This makes it impossible to establish causality , especially given socially desirable responding and the conceptual overlap between trait-mindfulness and inter-temporal choice questionnaires.

Third, regardless of the focus and methodological approach of the study, mindfulness manipulations or traits have often been mixed with other factors and interventions (see [36, 52–53, 60–62]). For instance, Yao et al. [52] analyzed the impact of a mindfulness intervention on decision impulsiveness to curve Internet gaming disorder. However, the authors used a

combination of classic therapy and mindfulness meditation as a treatment, which did not allow for the isolation of the effects of mindfulness. Similarly, Morrison et al. [60] and Morrison et al. [53] used acceptance-based training sessions as a treatment to investigate the effects of mindfulness on impulsivity. Although acceptance-based therapy is rooted in the philosophy that underpins the mindfulness movement, in the acceptance-based therapy used in the study, no formal mindfulness training was given to treated participants. Scholten et al. [61] also mixed mindfulness and acceptance-based training as a treatment, whereas Wang et al. [62] used a broad Buddhist practice intervention that includes some mindfulness but also other elements like chanting. Finally, observational research by Marcowski et al. [36] used a composite of trait mindfulness and psychological flexibility scores to create behavioral profiles and relate them to discounting.

Fourth, existing studies often exclusively used very short mindfulness treatments and focused on measuring the immediate effects of mindfulness on intertemporal decision-making (see [35, 54, 56–59]). For instance, Bazley et al. [56–57], Dixon et al. [58], and Errmann [35] used mindfulness video or audio inductions of just about 5 minutes, casting doubt on the conceptual validity of the manipulation and providing no insights into the medium- and long-term effects of mindfulness. To the best of our knowledge, only Alem et al. [18] has investigated the effects of a fully-fledged mindfulness program (conducted online for four weeks) on intertemporal choices — finding some patterns suggestive of reduced time discounting but no significant results.

The present research

We present four studies — three lab experiments and one longitudinal field experiment — that address the aforementioned gaps and improve upon the existing literature in five main ways.

First, in our filed study (Experiment 4), we used as a treatment the popular and intensive course in mindfulness known as the Mindfulness-Based Stress Reduction (MBSR) program,

designed by Jon Kabat-Zinn, which is conducted onsite and lasts for eight weeks. This improves on the most robust mindfulness manipulation used until know in the domain of intertemporal choice (see [18]), which lasted for four weeks and was conducted online.

Second, expanding on previous studies on the topic, our research combines both manipulation- and training-based approaches. This is important because we can compare the effects of momentary interventions that change the current state of the participants to the consequences of a longer program that reshapes behavior at a deeper level.

Third, we also combine our manipulation- and training-based approaches with the measurement of participants' trait mindfulness levels and experience in mindfulness practice. This allows us to analyze if either personal dispositions or experience over longer periods of time are associated with any particular effects.

Fourth, our research uses three different tasks to measure intertemporal choice behaviors. In Experiments 1 and 4, we used a reduced number of classic choices between smaller amounts of money sooner and larger amounts of money later, designed to measure both intertemporal preferences and time inconsistency. In Experiment 3, we implemented a more sophisticated design involving more choices that allows us to estimate model parameters related to time discounting and to preferences for immediate gratification. In Experiment 2, we employed hypothetical real-world scenarios to analyze intertemporal decisions in more realistic settings. This combination of tasks provides a relatively comprehensive analysis of inter-temporal decision making.

Fifth, in our research, we employ a mixture of hypothetical and real choices (i.e., participants knew that in certain tasks, they could actually obtain the outcome that they chose at the proposed time). This provides a test of the effects of mindfulness on intertemporal choice across different incentive systems.

Experiment 1

Method

We assigned 323 participants — in two different waves — (219 women, 104 men; *mean* age = 21 years, range = 18–51 years) to mindfulness, mind wandering, and control conditions, randomizing per session. Participants were students and local residents from the Universitat Pompeu Fabra Behavioral and Experimental Sciences Laboratory participant pool who responded to an advertisement offering 8€ for participation. Each participant sat in a semi-private cubicle within a laboratory. Our mindfulness and mind-wandering induction procedures drew on established methods [7, 34, 67–68]. All methods were carried out in accordance with relevant guidelines and regulations. The experimental protocols were approved by the Ethics Committee of Universitat Pompeu Fabra. Informed consent was obtained from all participants involved in the studies.

Participants listened to a 15-min audio-recorded induction created specifically for this research by a professional mindfulness-meditation instructor. Participants were led through a focused-breathing meditation exercise that instructed them to focus on the physical sensations of breath entering and leaving their body and repeatedly reminded them to focus on their experience of breathing. The content of the mind-wandering induction repeatedly instructed participants to think of whatever came to mind. Although this type of induction has commonly been used as a control condition in prior mindfulness experiments [34, 67–68] because it replicates a waking, baseline mental state [69], research has shown that such "forced" mind-wandering can be aversive (e.g., [70]). Therefore, going beyond prior studies, we also included a true control condition in which participants were not subjected to any manipulation, ensuring that observed mindfulness effects were not merely driven by negative reactions to the mind-wandering condition.

Then, participants in the first of the two waves of the experiment, in which we had a total of 129 participants (78 women, 41 men; mean age = 22 years; age range = 18–51), had to

complete three manipulation check items in order to advance in the experiment — something we did not include in the second wave and in the rest of the studies since we demonstrated the effectiveness of our manipulations in this first wave. The three items are included in the instructions in our online repository. The first two items were designed to test to which extent participants had been focused on the present moment or on the physical sensations in their bodies. The third item was designed to test to which extent participants had been mind-wandering. We measured the three items with a 5-point Likert scale.

Table 1. Experiment 1 Task Description.

Choice	Option A (sooner reward)	Option B (later reward)
1	€200 today	€220 in 4 weeks
2	€200 in 12 weeks	€220 in 16 weeks
3	€200 today	€250 in 4 weeks
4	€200 in 12 weeks	€250 in 16 weeks

Notes: In each decision, respondents chose between a sooner, smaller reward (Option A) and a later, larger reward (Option B). All amounts are nominal euros.

Finally, all participants made four hypothetical choices, presented in Table 1, between two assets. Asset A always offered a smaller amount of money (200€) sooner in time (either now or in 12 weeks). Asset B always gave a larger amount of money (either 220€ or 250€) at a later time (either in 4 or in 16 weeks). In two of the choices, asset A offered amounts only in the present moment, while in the other two choices, both Asset A and B offered delayed monetary rewards. Thus, participants made choices between smaller immediate rewards and larger later rewards or between smaller later rewards and larger even later rewards. Additionally, by offering the same monetary amounts with the same temporal distance between them at different moments in time, we can compare whether participants behaved in a time-consistent manner. Time inconsistency is one of the central phenomena in research on intertemporal decision making, and it typically takes the form of choosing the smaller sooner amount when it is close to the present (as in choices 1 and 3) and switching to the larger later reward when the same

options are delayed into the future (as in choices 2 and 4) (see [41]). The experiment also included other items, mostly related to risk aversion, ambiguity aversion, and loss aversion, not relevant to the current study.

Results and discussion

Manipulation check. Both our mindfulness and mind-wandering manipulations were effective. Participants in the mindfulness condition reported being significantly more focused on the present moment (*mean* = 3.64) than participants in the mind-wandering condition (*mean* = 2.61; $t = 4.87$, $p < .0001$) and the control condition (*mean* = 2.98; $t = 3.00$, $p = .0035$). There was no significant difference between the control and mind-wandering conditions ($t = 1.41$, $p = .1618$). Likewise, participants in the mindfulness condition reported being significantly more focused on their body sensations (*mean* = 3.73) than participants in the mind-wandering condition (*mean* = 1.95; $t = 8.81$, $p < .0001$) and control condition (*mean* = 2.30; $t = 6.35$, $p < .0001$). Again, there was no significant difference between the control and mind-wandering conditions ($t = 1.36$, $p = .1773$). Finally, participants in the mind-wandering condition reported more mind-wandering (*mean* = 3.47) than participants in the mindfulness condition (*mean* = 2.82; $t = 2.76$, $p = .0072$) and control condition (*mean* = 2.83; $t = 2.47$, $p = .0154$). There was no significant difference between the mindfulness and control conditions ($t = -.05$, $p = .9599$).

Time Preference. As depicted in Figure 1, most participants preferred more money later over less money sooner, regardless of the experimental condition. The portion of participants who chose the distant alternative across the four choices in the mindfulness condition (71%) did not differ from the mind-wandering condition (73%), chi^2 (1, $N = 848$) = .23, $p = .6280$, or the control condition (72%), chi^2 (1, $N = 880$) = .06, $p = .8073$. The proportion of people selecting the distant alternative in the mind-wandering and control conditions did not statistically differ either, chi^2 (1, $N = 856$) = .03, $p = .8628$.

A similar pattern emerged when focusing exclusively on the two choices that contrasted immediate and future rewards (Figure 2A), and the two choices that contrasted rewards in the

near vs. distant future (Figure 2B). Specifically, participants in the mindfulness condition chose the future rewards over immediate ones in similar proportions (69%) than participants in the mind-wandering condition (71%), chi^2 (1, N = 424) = .13, p = .7208, and the control condition (70%), chi^2 (1, N = 440) = .05, p = .8183. Likewise, participants in the mindfulness condition chose the more distant over the less distant future rewards in similar proportions (74%) than participants in the mind-wandering condition (75%), chi^2 (1, N = 424) = .05, p = .8284, and the control condition (74%), chi^2 (1, N = 440) = .00, p = .9968. In addition, the choice proportions of delayed vs. immediate rewards and more distant vs. less distant future rewards did not statistically differ between the mind-wandering and control conditions, chi^2 (1, N = 428) = .00, p = .9755 and chi^2 (1, N = 428) = .01, p = .9146, respectively.

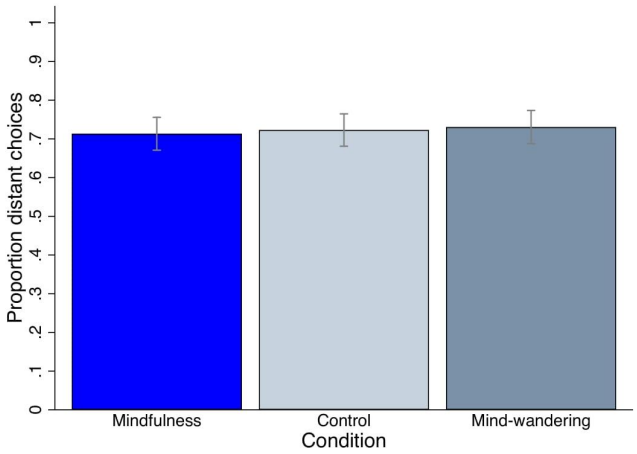

Fig 1. Proportion of distant choices per condition. This figure shows the proportion of distant choices combining the four intertemporal decisions as a function of the condition. Larger values indicate a greater proportion of distant choices. Error bars indicate the 95% confidence interval.

Time consistency. In Experiment 1, participants could potentially be time inconsistent two times, one comparing choices 1 and 2 and another comparing choices 3 and 4. To analyze if there were differences between conditions in this respect, we gave participants a time-consistency score of 1 if their choices were fully time-consistent and zero otherwise. We then tested whether the proportions of people with a score of 1 were significantly different across conditions. Figure 3 shows that the portion of participants choosing in a fully consistent way in the mindfulness condition (67%) was not significantly different from the proportion in the

mind-wandering condition (65%) chi^2 (1, N = 212) = .02, p = .8803, or the control condition (72%) chi^2 (1, N = 220) = .46, p = .4995. The difference in the proportion of fully consistent people between the mind-wandering and control conditions was also not statistically significant chi^2 (1, N = 214) = .92, p = .3373).

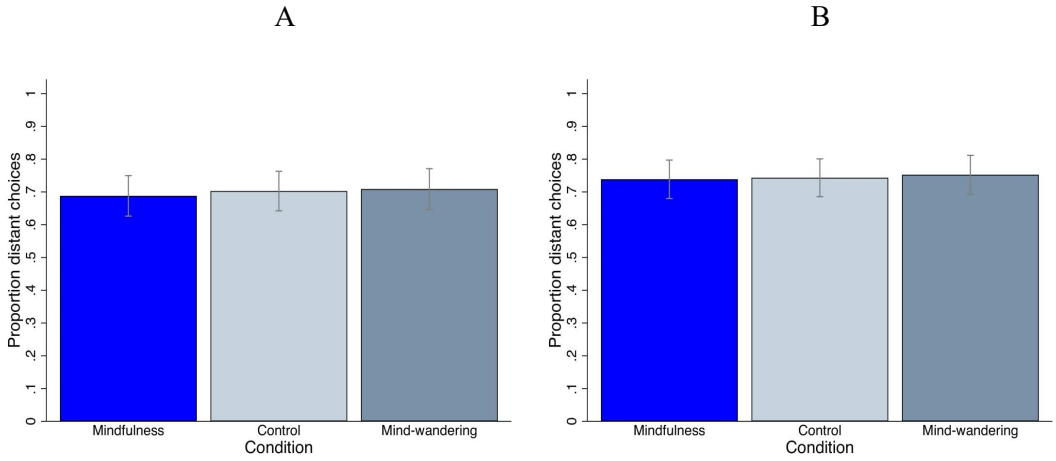

Figure 2. Proportion of distant choices per condition for choices between immediate vs. future rewards (Panel A) and near vs. distant future rewards (Panel B). Error bars indicate the 95% confidence interval.

Overall, Experiment 1 shows that a 15-min mindfulness meditation does not increase the preference for short-term gratification using a typical task to study intertemporal decision making. This is true both when considering differences in choices involving all types of delays and when breaking down decisions between immediate vs. future alternatives and near vs. distant future alternatives. Moreover, mindfulness does not change the consistency of people's time preferences. Finally, all these null results were robust to including participants' age and gender as control variables (see Table S1 in the Supplementary Materials, located in our online repository).

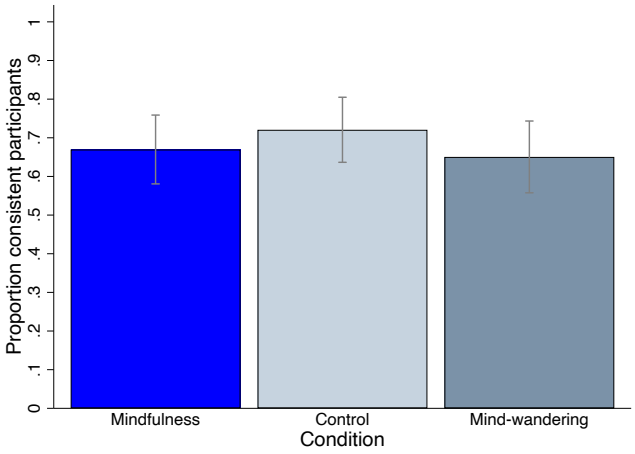

Figure 3. Proportion of time consistent participants per condition. This figure shows the proportion of time consistent participants. We define a participant as time consistent if they chose the same asset selections in the first and second choices and in the third and fourth choices. Large numbers indicate a greater proportion of time-consistent choices. Error bars indicate the 95% confidence interval.

Experiment 2

Method

To investigate the effects of mindfulness beyond the classical intertemporal tasks found in the decision-making literature, we decided to use additional tasks inspired by real-world scenarios. In Experiment 2, our procedures were generally the same as in Experiment 1. We assigned 140 participants (83 women, 57 men; *mean* age = 21 years; age range = 18–37) to a mindfulness, a mind-wandering, or a control condition, randomized per session. Participants in the mindfulness and mind-wandering conditions completed the same mindfulness or mind-wandering induction procedures as in Experiment 1 and all procedures were approved by the Ethics Committee of Universitat Pompeu Fabra and conducted in accordance with the same ethical standards described for Experiment 1.

Next, all participants completed three hypothetical resource allocation scenarios. Participants were first asked to imagine that they had won €10,000 and to indicate how much of this money they would allocate to immediate hedonic spending and how much they would save in a checking account for a rainy day. Next, participants were told to imagine that they earned €2,000 net per month (a decent salary at the time for our Spanish undergraduate participants) and indicate how they would allocate this monthly income between saving in a checking account, pension plan, rent and home expenses, leisure, food, and other expenses (all summing to €2,000). Finally, participants were asked to imagine a scenario where they needed to buy a car but had only half the necessary funds. They were presented with two options: borrow the remaining amount from a bank and pay interest, or wait two years until they had saved enough, avoiding any interest payments (see the instructions in the online repository for full details).

These three tasks capture in different ways the trade-off between smaller short-term rewards and larger longer-term ones. In the first task, allocating more money to savings indicates a stronger preference for the long-term rewards, which is typically associated with

less time discounting. In the second task, the options that represent longer-term rewards are saving and investing in a pension plan. In the third one, the longer-term option is waiting to avoid paying interest. These tasks were not directly incentivized; participants received a fixed payment for participation. The experiment also included other items, mostly related to risk aversion, ambiguity aversion, and loss aversion, not relevant to the current study.

Results and discussion

Figure 4 gives the average proportion of money allocated to longer-term options per condition across scenarios 1 and 2 (i.e., the amounts allocated to the long term divided by the total available amount). Because participants could allocate any amount along a continuous scale (rather than making binary choices), and these allocation proportions showed non-normal distributions, we used Wilcoxon rank-sum tests (Mann–Whitney U) to compare conditions. Mindful participants allocated a statistically similar proportion to longer-term alternatives (M = .669) than did mind-wandering participants (M = .621; W = 1237, p = .1345) and control participants (M = .705; W = 841, p = .3054). The difference between mind-wandering participants and control participants was significant this time (W = 1599, p = .0044), with mind-wandering resulting in favoring the long term less than in the control condition.

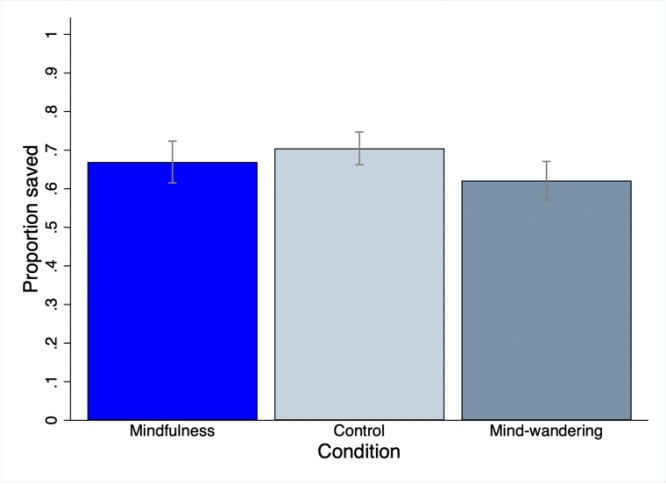

Figure 4. Proportion of money allocated to longer-term options per condition in tasks 1 and 2. This figure shows the average proportion of money allocated to the longer-term options as a function of the condition. Larger values indicate greater allocations to the long term. Error bars indicate the 95% confidence interval.

Figure 5 shows the proportion of participants who chose the waiting alternative per condition in scenario 3. In the mindfulness condition, the proportion of participants deciding to wait (83%) was not significantly different from that of mind-wandering participants (77%) chi^2 (1, N = 93) = .51, p = .476, or the control condition (81%) chi^2 (1, N = 88) = .06, p = .801. The difference in the proportion of people selecting the waiting alternative between the mind-wandering and control conditions was also not significant chi^2 (1, N = 99) = .23, p = .633.

The results of Experiment 2 replicate the findings from Experiment 1 using more naturalistic scenarios: A 15-min mindfulness meditation does not increase people's propensity to pursue immediate gratification over longer-term rewards. These results hold true even when controlling for age, gender, and previous meditation practice (see Table S2 in Supplementary Materials). However, Experiments 1 and 2 relied on hypothetical decisions, which may not fully reflect actual decision-making behavior. In Experiment 3, we address this limitation by examining whether mindfulness affects intertemporal choices in consequential, incentive-compatible contexts. Going beyond basic choice scenarios, we use a more comprehensive measure of intertemporal choice, allowing us to separately measure how people choose between delayed rewards and how strongly they favor immediate rewards over delayed ones (present bias).

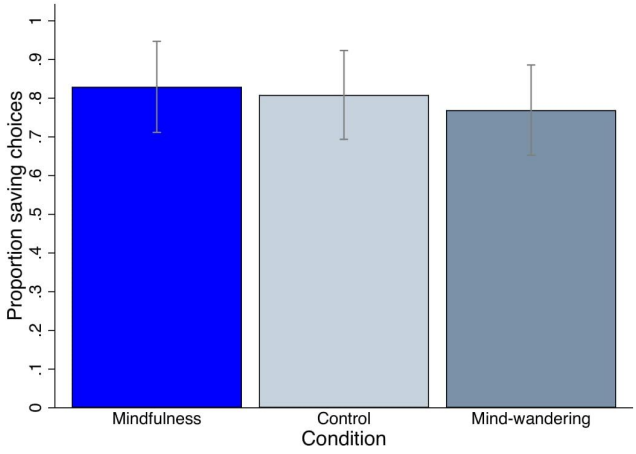

Figure 5. Proportion of participants who chose the waiting alternative per condition in task 3. This figure shows the proportion of waiting decisions per condition in task 3. Large numbers indicate more waiting. Error bars indicate the 95% confidence interval.

Experiment 3

Method

We assigned 389 participants (263 women, 126 men; *mean* age = 21 years; age range = 18–51) to mindfulness, mind-wandering, and control conditions, randomizing per session. Participants in the mindfulness and mind-wandering conditions completed the same mindfulness or mind-wandering induction procedure as in Experiments 1 and 2. Again, participants in the control condition were not subjected to any procedure and all procedures were approved by the Ethics Committee of Universitat Pompeu Fabra and conducted in accordance with the same ethical standards described for Experiment 1.

Next, all participants made 42 choices as in McClure et al. [71] between receiving smaller cash amounts (between 5€ and 34€) earlier (immediately, two weeks from the day of the experiment, or four weeks from the day of the experiment) and larger cash amounts (between 7€ and 43€) later (two, four, or six weeks, respectively, from the day of the experiment). The full list of the 42 choices is available in the instructions in our online repository. Participants made choices between smaller immediate rewards and larger later rewards, or between smaller later rewards and larger even later rewards. We incentivized participants to express their true preferences by randomly selecting 1 out of every 25 participants to realize one of their choices, paying the preferred alternative for a randomly selected choice pair. The payment was made at the chosen moment and for the chosen amount using electronically sent Amazon.com gift certificates. The experiment also included other items, mostly related to risk aversion, ambiguity aversion, and loss aversion, not relevant to the current study.

This task allows us to estimate the parameters of a model that distinguishes between two types of processes, as captured by the following quasi-hyperbolic discounting function (Laibson [72], O'Donoghue and Rabin [73]):

$$D(t) = \begin{cases} 1 & \text{if} \quad t = 0 \\ \beta\delta^t & \text{if} \quad t > 0 \end{cases}.$$

One of the parameters of the function (δ) captures time discounting when choosing between delayed rewards, assuming exponential discounting. The other parameter (β) captures what is known as present bias: the additional discounting occurring between rewards in the present and any delayed rewards. This bias occurs when $0 < \beta < 1$, and it is also associated with time-inconsistent behavior.

Results and discussion

To test whether the parameters differ between the three conditions, we estimated them by fitting each participant's choices to the quasi-hyperbolic discounting function using maximum-likelihood estimation, constraining β and δ to be between 0 and 1. This approach generated two parameters per participant, allowing us to compare the distribution of β and δ across conditions.

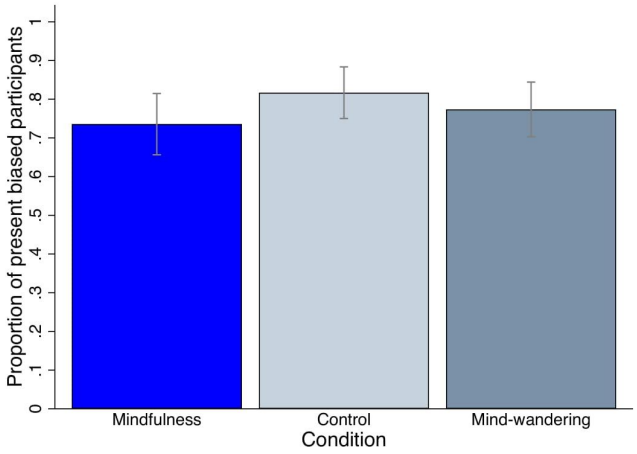

Figure 6. Proportion of present-biased participants per condition. This figure shows the proportion of individuals displaying present bias (β parameters lower than 1) as a function of the condition. Error bars indicate the 95% confidence interval.

To begin with, Figure 6 presents the proportion of participants who showed present bias (by displaying a β lower than 1) in the different conditions. β was statistically equally likely to be lower than 1 among mindfulness participants (74%) than among mind-wandering participants (77%) chi^2 (1, $N = 258$) = .51, $p = .476$, and also not significantly different than the share of present-biased participants in the control condition (82%) chi^2 (1, $N = 252$) = 2.40, p

= .121. The difference in the proportion of people with present bias between the mind-wandering and control conditions was also not significant chi^2 (1, N =268) = .76, p = .383.

Figure 7 shows the mean values for both parameters (β and δ) in the three conditions. When we compare conditions focusing on discounting in choosing between delayed rewards (δ), we observe that mindful participants (*mean* δ = .310, *median* δ = .154) discounted equally as mind-wandering participants (*mean* δ = .245, *median* δ = .104; W = 9238, p = .1128). Due to the markedly skewed distributions of the intertemporal choice parameters β and δ (see Figures 7 and 8), we used Mann–Whitney U instead of parametric t-tests to compare conditions in this case. The results show there were also no differences in terms of δ between mindful participants and control participants (*mean* δ = .256, *median* δ = .126; W = 8757, p = .1506) or between mind-wandering and control participants (W = 9045, p = .9115).

Focusing on the degree of present bias (β), we see that mindful participants (*mean* β = .972, *median* β = .989) did not significantly differ from mind-wandering participants (*mean* β = .951, *median* β = .987; W = 8629, p = .5669), or control participants (*mean* β = .951, *median* β = .993; W = 8282, p = .5357). The level of present bias in mind-wandering (*mean* β = .951, *median* β = .987) and control participants did not significantly differ either (W = 8581, p = 1).

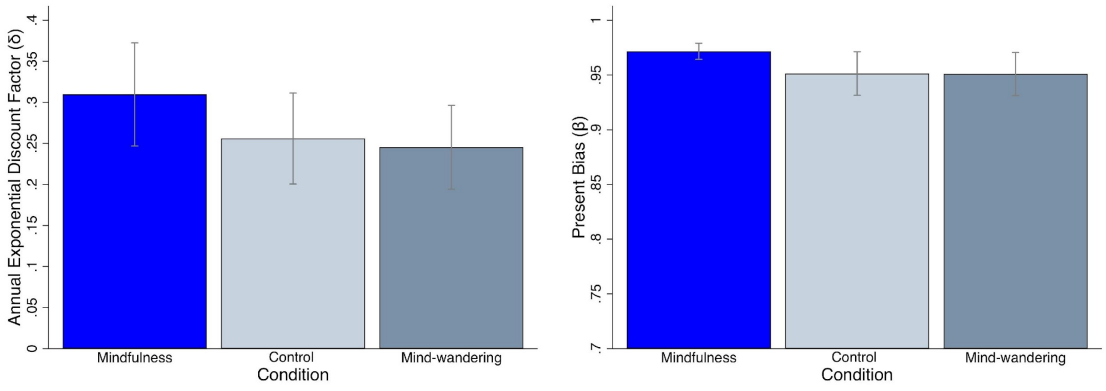

Figure 7. Average individual discount factor (δ) (left graph) and present bias (β) (right graph) as a function of condition. Large numbers indicate more patience. Error bars indicate the 95% confidence interval.

To further test whether the distributions of individual parameters of participants in the three conditions differed, we conducted a series Kolmogorov-Smirnov tests. As depicted in Figure 8, the distribution of the δ parameters did not differ between the mindfulness and control

conditions (D(252) = .11; p = .359), the mindfulness and the mind-wandering conditions (D(258) = .11; p = .367), or between the control and mind-wandering conditions (D(268) = .07; p = .900).

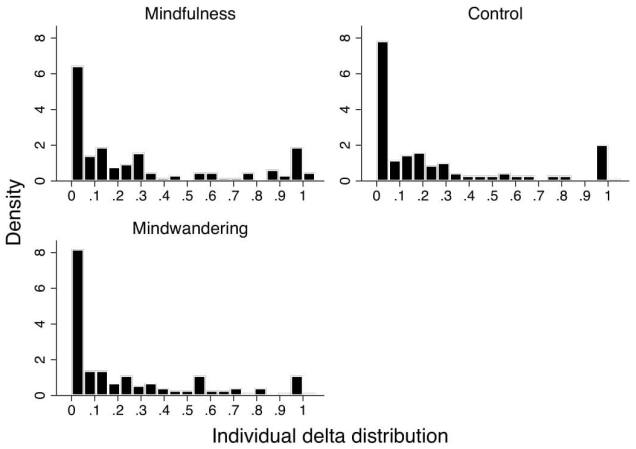

Figure 8. Histogram of δ per condition. This figure shows the histogram plot of the discount factor (δ), plotted as a function of the condition.

Similarly, as depicted in Figure 9, Kolmogorov-Smirnov tests for the distribution of the β parameters showed no difference between the mindfulness and control conditions (D(252) = .09; p = .664), the mindfulness and the mind-wandering conditions (D(258) = .06; p = .956), or between the control and mind-wandering conditions (D(268) = .10; p = 0.476).

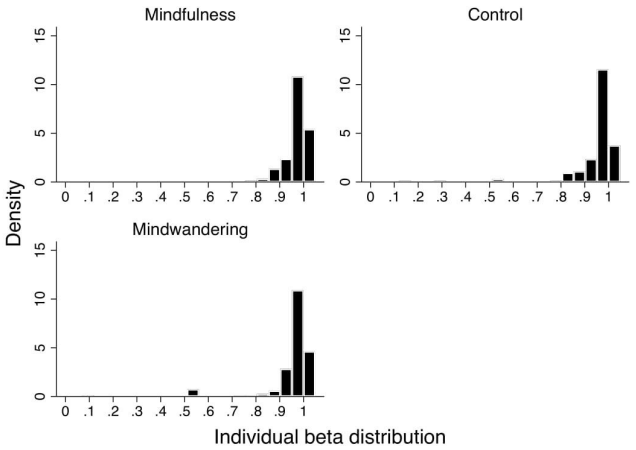

Figure 9. Histogram of β per condition. This figure shows the histogram plot of the present bias parameter (β), plotted as a function of the condition.

Taken together, these results suggest that while we observe a small average trend in the individual parameter estimations, whereby mindfulness slightly decreased the desire to get

something sooner, we did not observe significant differences between the three experimental conditions in our tests.

In sum, Experiment 3 replicates the null effect of mindfulness on intertemporal choice using incentivized decisions and a more sophisticated estimation approach. On possibility, however, is that our short-term mindfulness induction may not have been powerful enough to fundamentally shift underlying decision-making patterns. To address this potential limitation, Experiment 4 moves beyond brief experimental interventions, exploring whether a longer, structured mindfulness training — the classic eight-week Mindfulness-Based Stress Reduction (MBSR) program — can meaningfully influence intertemporal choices.

Experiment 4

Method

We partnered with the largest provider of the mindfulness-based stress reduction program (MBSR) in Spain to conduct a field experiment testing the effects of mindfulness on intertemporal choices. The MBSR program is a therapeutic intervention developed by Jon Kabat-Zinn that involves weekly group classes and daily mindfulness exercises to practice at home over an 8-week period [7]. MBSR teaches people how to increase mindfulness through yoga and meditation [7], and it is the most popular standardized program on mindfulness worldwide [74].

We used a within-subject design, measuring participants' intertemporal choices at two points in time: first, prior to beginning the mindfulness course during an initial orientation session, and second, in the final session — specifically, after a guided meditation midway through the two-hour session. Participation was voluntary, with no direct monetary compensation. However, participants who completed both assessments received a mindfulness book authored by the director of the center, as a token of appreciation. A total of 57 participants (32 women, 19 men; *mean* age = 43 years; age range = 23–69) completed the pre-treatment and post-treatment waves (the attrition in the second wave was 35%). All methods were carried out in accordance with relevant guidelines and regulations. The experimental protocols were approved by the Ethics Committee of Universitat Pompeu Fabra. Informed consent was obtained from all participants involved in the studies.

For practical reasons, we used the short 4-item measure of intertemporal choice from Experiment 1 in a booklet format (see the online repository). We also elicited trait mindfulness using the Mindful Attention Awareness Scale (MAAS), developed by Brown and Ryan (2003). The MAAS is a 15-item self-report questionnaire designed to assess an individual's dispositional tendency to attend to and be aware of present-moment experiences in daily life. Respondents rate items on a 6-point Likert scale ranging from 1 ("almost always") to 6 ("almost

never"), with higher average scores indicating greater trait mindfulness. The MAAS has been widely validated and is commonly used in psychological and behavioral research to quantify individual differences in mindful attention and awareness. In addition, we asked participants two questions related to their prior mindfulness meditation experience: whether they had ever practiced mindfulness before the program, and for how many months they had practiced mindfulness. The experiment also included other items, mostly related to risk aversion, ambiguity aversion, and loss aversion, not relevant to the current study.

Results and discussion

Figure 10 shows the proportion of participants who chose the distant options combining the four items in Experiment 4. In the pre-treatment wave, the portion of participants selecting the distant alternatives (64%) was not significantly different from that of the participants in the post-treatment wave (67%) chi^2 (1, N = 456) = .35, p = .5543.

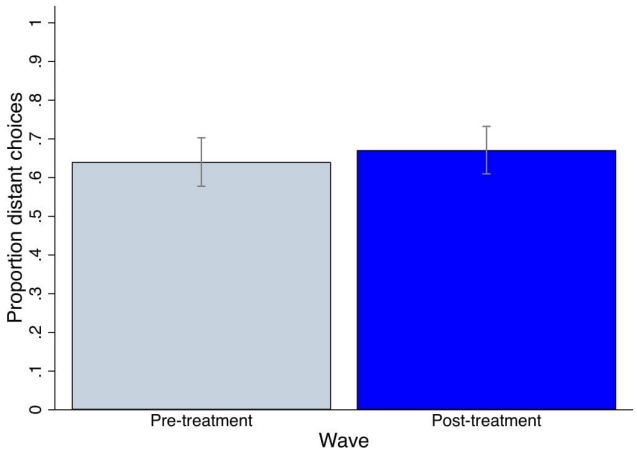

Figure 10. Proportion of distant choices per wave. This figure shows the proportion of distant choices combining the four intertemporal decisions as a function of the wave. Larger values indicate a greater proportion of distant choices. Error bars indicate the 95% confidence interval.

Table 2 reports the results from three OLS regression models further examining the impact of mindfulness training and trait mindfulness on the number of distant intertemporal choices participants made before and after the eight-week MBSR program. The dependent variable is the number of distant (i.e., delayed reward) options selected across eight binary

decisions — four in the pre-treatment wave and four in the post-treatment wave. The primary independent variables include a post-treatment indicator ($Post_i$), a trait mindfulness score ($MAAS_i$), and their interaction. Additional covariates include our prior meditation experience variables, age and gender. Standard errors are clustered at the participant level and are robust to heteroskedasticity.

In the model in column 1, which includes no controls or fixed effects, the coefficient for $Post_i$ was not statistically significant (b = 0.880, SE = 1.471, p = .552), suggesting that the average number of distant choices did not increase following the mindfulness course. Similarly, neither the main effect of trait mindfulness (b = 0.00295, SE = 0.0206, p = .887) nor its interaction with the post-treatment indicator (b = –0.0108, SE = 0.0234, p = .645) were statistically significant, indicating no meaningful association between mindfulness traits and intertemporal choice, nor evidence of moderation by trait mindfulness. The model explains very little of the variance in the dependent variable (R^2 = 0.005).

The model in column 2 adds individual-level covariates, including two indicators for prior mindfulness practice, age, and gender. The post-treatment coefficient remained statistically non-significant (b = 0.925, SE = 1.409, p = .514), as did the interaction term ($Post_i \times MAAS_i$; b = –0.0107, SE = 0.0220, p = .628). Notably, the number of months of prior meditation practice emerged as a positive and statistically significant predictor of distant choices (b = 0.00380, SE = 0.00177, p = .036), suggesting that individuals with longer-standing mindfulness experience are more inclined toward delayed gratification, regardless of the formal course. Other covariates, including gender (b = 0.558, SE = 0.407, p = .176) and age (b = 0.00454, SE = 0.0207, p = .828), were not significantly associated with the outcome. The inclusion of these controls slightly improved model fit (R^2 = 0.048).

Column 3 introduces participant fixed effects to account for unobserved, time-invariant heterogeneity at the individual level, while omitting the additional controls. In this within-subject specification, the post-treatment effect shrinks substantially and remains non-significant (b = 0.919, SE = 1.858, p = .623). The MAAS score shows a larger, though still statistically insignificant, association with distant choices (b = 0.0251, SE = 0.0217, p = .253),

and the interaction term remains insignificant (b = –0.0152, SE = 0.0289, p = .601). The fixed effects specification substantially increases explanatory power, with the model explaining 87% of the variance in the outcome (R^2 = 0.87), consistent with the inclusion of subject-level intercepts.

Table 2. Mindfulness Training and Mindfulness Trait Effects on Number of Distant Choices.

Dependent Variable	***Number of Distant Choices$_i$***		
Post$_i$	0.880	0.925	0.919
	(0.60)	(0.66)	(0.49)
MAAS$_i$	0.003	−0.002	0.025
	(0.14)	(−0.08)	(1.16)
Post$_i$ * MAAS$_i$	−0.011	−0.011	−0.015
	(−0.46)	(−0.49)	(−0.53)
Practice Mindfulness$_i$		−0.227	
		(−0.53)	
Months Meditation Practice$_i$		0.004*	
		(2.15)	
Age$_i$		0.005	
		(0.22)	
Gender$_i$		0.558	
		(1.37)	
Constant	2.403**	2.341	1.197
	(2.12)	(1.62)	(0.96)
Controls	No	Yes	No
Participant Fixed Effects	No	No	Yes
***R*^{2}**	0.006	0.048	0.870
Observations	110	110	110

Notes: The dependent variable in the regression models above is *Number of Distant Choices$_i$*, which is the number of choices of asset B that participant *i* made in the 8 intertemporal choices of Experiment 4 in the pre-treatment (four) and post-treatment (four) waves. The independent variables include: *Post$_i$*, an indicator variable that takes a value of one when participant *i* was in the second wave and zero when in the first wave; *MAAS$_i$,* the cumulative score of participant *i* on the mindful attention awareness scale (MAAS) in the pre-treatment wave; the interaction term *Post$_i$ * MAAS$_i$*; *Practice Mindfulness$_i$,* an indicator variable that takes a value of one if participant *i* had practiced meditation before the start of the course; *Months of Meditation Practice$_i$,* which is the number of months of meditation practice stated in the pre-treatment wave of participant *i*. Standard errors are robust to heteroskedasticity. *t*-statistics are in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% level, respectively. Asset B always offered a higher € amount, but in a more distant moment in time than the other alternative.

Overall, across all three specifications, there is no evidence that participation in the mindfulness program influenced intertemporal choice behavior. Trait mindfulness as measured by the MAAS does not predict distant choices nor interacts meaningfully with the intervention. The only statistically significant finding is the positive relationship between months of prior meditation practice and patient decision-making, once the covariates are introduced in the second regression. This may suggest that accumulated meditation practice over longer periods of time is associated with a greater propensity to delay gratification in intertemporal trade-offs. However, given the nonsignificant differences in all our other mindfulness indicators, it is unclear whether this is a reliable result or a spurious correlation.

General Discussion

There has been growing concern both inside and outside academia about potential deleterious effects of mindfulness for decision-makers, particularly in corporate environments. Our research provides the most comprehensive investigation into the relationship between mindfulness and intertemporal choice conducted to date. Across four studies — including non-incentivized and incentivized decisions, hypothetical real-life scenarios, and a longitudinal field intervention — we found no evidence that mindfulness makes people more present-biased or impatient. While some minor differences in the opposite direction emerged in Experiment 3 (see also the regressions reported in the Supplementary Materials), they did not generalize across studies, outcomes, or methods. Importantly, even a structured, eight-week Mindfulness-Based Stress Reduction (MBSR) program did not produce significant changes in intertemporal decision-making.

These findings suggest that the extensively documented well-being benefits associated with cultivating awareness of the present moment do not appear to compromise people's ability to make patient decisions regarding the future. This is particularly reassuring given the widespread adoption of mindfulness-based interventions in corporate and educational settings

(see [1,75]), where the balance between immediate and delayed gratification is essential to success (see, for example, [76–77]).

Additionally, our findings contribute to the broader theoretical understanding of intertemporal decision-making by suggesting that temporal attention and temporal valuation might be more separable than previously assumed. Specifically, our research implies that enhancing present-focused attention through mindfulness practices does not necessarily influence how individuals value immediate versus delayed rewards. This dissociation aligns with neuroscientific evidence highlighting separate neural networks for attentional control (e.g., the dorsal frontoparietal network [79–80]) and valuation processes (e.g., the ventromedial prefrontal cortex and ventral striatum [81–82]). Recent research further emphasizes flexible interactions among these networks rather than uniform responses to attentional manipulation alone [83].

Nonetheless, these results should be interpreted with care. Although we controlled for basic demographic variables (age, gender) and previous meditation experience, it is possible that specific individual differences (e.g., baseline impulsivity, cognitive control ability), contextual factors (e.g., stress, reward framing), and mindfulness components (e.g., awareness of breath vs. awareness of thoughts and feelings) could moderate the insignificant effect of mindfulness on intertemporal decision-making.

Overall, our research consistently demonstrates that mindfulness does not inherently promote present-biased choices. In this sense, our findings suggest that organizations and individuals can confidently adopt mindfulness practices without concerns about undermining long-term decision-making.

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