Present-biased Meditators? The Effects of Mindfulness on Inter-temporal Choice

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Abstract

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

Keywords: Mindfulness, meditation, inter-temporal choice, present-bias, impatience.

JEL codes: C91, C93, D15, D91.

"*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*

1. Introduction

Mindful Schools is a non-profit training organization founded in 2007 as a program for a school in Oakland, CA. Today, it has become an organization with online and in-person courses, content, and a network of mindful educators spanning all 50 U.S. states and 100+ countries. By 2015 it had trained more than 300,000 young people worldwide.

The creation of programs and organizations like Mindful Schools is the result of the work of Jon Kabat-Zinn, who, in the last 30 years, has popularized mindfulness worldwide. According to Jon Kabat-Zinn, "Mindfulness is the awareness that arises through paying attention, on purpose, in the present moment, non-judgmentally". But the concept of mindfulness is not new; it is a secular philosophy and set of techniques adapted from ancient Buddhist meditation traditions, which have only recently caught on in Western societies.

Nowadays, we find mindfulness practitioners in all kinds of corporations and institutions. Companies such as Apple, Procter & Gamble, General Mills, Google, and many others offer mindfulness courses, meditation retreats, and other related resources to their employees. Mindfulness has also caught the attention of governments. In 2014, the British Parliament organized a mindfulness session for its members, and even the U.S. Army provides mindfulness training to its soldiers. Mindfulness is also entering some schools in countries like the U.S. and the U.K, where Oxford researchers have announced plans to launch a large-scale, seven-year, $10 million study on mindfulness in education.

The benefits of mindfulness in certain areas have been well established. Mindfulness has been frequently applied in clinical contexts 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 (Sauer et al., 2013). Several reviews have summarized the main findings and generally supported the clinical effectiveness of mindfulness (see Bowen et al., 2006; Burke, 2010; Chiesa et al., 2011; Creswell, 2017; Fjorback et al., 2011; Hofmann et al., 2010; Mars and Abbey, 2010; Walach et al., 2012). Results from brain imaging studies have also found a positive relationship between mindfulness and neural functions associated with well-being (Farb et al., 2007; Tang et al., 2007, 2009). Other studies have found positive effects on immune-system parameters (Carlson et al., 2004; Davidson et al., 2003; Witek-Janusek et al., 2008). In relation to decision-making, research on the effects of mindfulness is much more limited, but it has also found positive effects in important domains, such as ethical decisions (Ruedy and Schweitzer, 2010; Shapiro et al., 2012), cooperative and pro-social decisions (Hafenbrack et al., 2020; Kirk et al., 2016), and the sunk-cost bias (Hafenbrack et al., 2014).

Overall, while mindfulness has received some criticism (Bazzano, 2014; Foster, 2016; Shonin et al., 2015), the overarching conclusion is that it has positive effects on mental health, well-being and decision-making.

Despite all the desirable consequences of mindfulness meditation, there is one fundamental aspect of it that raises concerns in relation to decision-making. Mindfulness practices are largely conceived to focus meditators on the present moment, abstracting from concerns related to the past or the future. While this can have beneficial effects in terms of anxiety and stress relieve, etc., it might also make meditators discount the value of future outcomes more heavily and be more present-biased. A large literature in economics, psychology and neuroscience has shown that, when people make choices that involve inter-temporal 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 Cohen et al., 2020; Frederick et al., 2002, for reviews). These tendencies have been linked to numerous detrimental behaviors, such as lower academic performance (Mischel et al., 1988), insufficient saving (Epper et al., 2020), and unhealthy eating and obesity (Barlow et al., 2016), among others. If, by focusing people on the present, mindfulness exacerbates these patterns, this could have important negative consequences. In fact, some existing research has linked mindfulness with patterns of drug use related to impulsivity (Karyadi et al., 2014; Murphy and MacKillop, 2012). Given the prevalence of mindfulness meditation across western societies, these patterns could in turn have a substantial impact on the economy and society as a whole.

With this picture in mind, in this paper, we aim to systematically study how mindfulness mediation affects inter-temporal decision making. Prior research…

In the present study, we aim to do that. We have decided to study the effects of mindfulness in inter-temporal decision-making. This is a particularly unexplored subject of research. Surprisingly, only a handful of research papers have dealt with the topic (Hendrickson and Rasmussen, 2013, 2017; Morrison et al., 2014; Yao et al., 2017). But crucially, none of these papers have focused on the effects of mindfulness in decision-making per se or have used formal mindfulness training as a treatment. For instance, Yao et al. (2017) analyze the impact of a mindfulness intervention on decision impulsiveness to curve Internet gaming disorder. However, the authors use as a treatment a combination of real therapy and mindfulness meditation, which does not allow for the isolation of the effects of the mindfulness treatment. Morrison et al. (2014) use as a treatment an acceptance-based training session to learn its effects on decision impulsiveness. 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, which we believe is a limitation

of the study. On the other hand, in Hendrickson and Rasmussen (2013, 2017) participants a mindfulness practice was used as a manipulation. However, the authors were not interested directly in the effects of mindfulness on inter-temporal decision-making but studied its effects to reduce impulsive choices to curve obesity. That meant that the authors only produced a unique measure of inter-temporal discounting for money using a just one task[1] and only one type of mindfulness induction which reflected null effects and did not provide any insights about potential mechanisms that could explain their results.

That is why there is a need for a study that uses a pure decision-making perspective to investigate the effects of mindfulness on decision-making. We believe that a study that analyzes the effects of mindfulness on inter-temporal decisions with some of the various tools that are available for behavioral scientists in the decision-making field is needed to bring light to the topic. Our study improves existing studies in the followings six ways. It is the first study that uses an intensive and very popular onsite eight-week course in mindfulness, the mindfulness-based stress reduction program (MBSR), designed by Jon Kabat-Zinn[2] as treatment[3]. This compares to the most robust mindfulness manipulation up to now, which consisted of a 50-minute prerecorded video on a mindfulness workshop focused on mindful eating (Hendrickson and Rasmussen, 2013, 2017).

Second, in our study, we measure the trait level mindfulness of participants, and we are able to correlate this trait level with particular inter-temporal outcomes. This allows us to test whether a higher baseline mindfulness level is associated with particular inter-temporal choice behaviors. Third, we collect a measure of the experience in the mindfulness practice. By measuring how long participants have practiced mindfulness, we are able to test whether the duration of its practice is associated with particular inter-temporal behaviors.

Fourth, our study uses three different tasks to measure inter-temporal choice behaviors. Our three tasks vary, from classical choices between a smaller amount of money sooner to a larger amount of money later (as it was used in the best studies up to this point) to hypothetical real-world scenarios in which particular decisions must be taken based on these scenarios (which have never been used before). These new measures allow us to test previously unknown concepts; for instance, two of the tasks allow us to test whether the effects of mindfulness are different for choices that involve exclusively delayed rewards or a mix of delayed and immediate rewards; moreover, these tasks also allow us to test whether participants display time consistency in their choices. This compares to only one task to measure the effects of mindfulness on an inter-temporal choice, which was the best available in this type of study so

[1] Which was the same in the two studies.
[2] One of the notorious individuals that have popularized mindfulness techniques in the western world.
[3] In one of the studies.

far and which provided less varied insights about the relationship between mindfulness and inter-temporal choice (Hendrickson and Rasmussen, 2013, 2017).

Fifth, we measure inter-temporal choice behavior both in a laboratory setting and also outside the lab, which, once again, is novel in a study of this topic and has been proven to be needed since we have evidence that some lab findings do not correlate well with field behaviors. Sixth, contrary to the previous existing studies on the topic, which have been manipulation-based, our research combines manipulation and training-based studies. This is important since training based interventions can be more useful to target individuals for which delay aversion is the main reason for steep delay discounting and thus need a treatment that allows them to change behavior and not an only particular one-off choices, and the effects of mindfulness training on inter-temporal choice have never been studied before Scholten et al. (2019). Seventh, in our study, we present a mixture of purely hypothetical and potentially real tasks[4] this is a novel feature since already existing studies only used purely hypothetical choices and had a fixed participation payment.

Finally, our study not only studies the effects of a mindfulness-based intervention but also tests a particular mechanism that could explain the effects of mindfulness. More precisely, in our research, we test whether the potential effect of mindfulness on the inter-temporal decision is derived from choices that involve decisions between the present and a distant moment in time or is also present in choices between two delayed moments in time. That is, we are able to test whether mindfulness affects inter-temporal choices by altering the present bias of participants. Previous studies on the topic have not previously tested any mechanism that could explain their findings.

But why have we chosen to study the effects of mindfulness on inter-temporal decisions? Because of the following five reasons. First, it has received very little attention, given the importance of the practice of mindfulness in our society. Mindfulness interventions are used in clinical treatments (Dimidjian and Segal, 2015), the workplace (Good et al., 2015), in schools (Sibinga et al., 2016), the military (Johnson et al., 2014), and in prisons (Samuelson et al., 2007) and a deeper understanding of its effects is important. Second, because it has been shown that impatience in inter-temporal choices have important consequences for people's lives (e.g., Mischel and Ebbesen, 1970; Mischel et al., 2011), for instance, higher impatience is associated with important health outcomes like obesity (Komlos et al., 2004), substance and alcohol use disorders (Li and Sinha, 2008), but also with important life outcomes such as a divorce rate (De-Paola and Gioia, 2017) or suicide rate (Wang et al., 2014). Third, focusing on the present moment is the cornerstone on which almost all the mindfulness techniques and Buddhist

[4] Participants knew that in tasks, they could obtain for real the outcome that they chose at the proposed delay.

teachings are based (Kabat-Zinn, 1990; Hanh, 2010). Fourth, as we have previously pointed out, the existing studies have severe limitations. Fifth and final, most practitioners are only aware of the positive benefits of mindfulness and could fail to predict the unintended consequences of its practice, which is reflected in the various null and negative effects of mindfulness interventions that target undesired outcomes in people's lives (Britton, 2019).

During the design of this study, we hypothesized that mindfulness would bias choices toward the present moment or toward more immediate rewards. This hypothesis was underpinned by the fact that focusing on the present moment is a key teaching of prominent Buddhist philosophers and top mindfulness authors. However, here we show that mindfulness does not affect inter-temporal choices. To support this claim, we provide both laboratory evidence and field evidence.

2. Inter-temporal Decisions

Delayed rewards, throughout most of history, have been assumed to be discounted at a constant rate over time. However, empirical advances in economics, neuroscience, and psychology have revealed a much more complex pattern (for a review: Berns et al., 2007). Four mechanisms have been identified as determinants of inter-temporal choice.

The first one is time discounting, which has been thoroughly studied in the three mentioned disciplines during the past and current centuries. Time discounting refers to the degree to which a future reward is discounted. It is well known that both animals and humans discount future rewards hyperbolically (Herrnstein, 1961). That is, hyperboloid discount functions represent well how both animals and humans behave. A feature of these functions is that they decay at a more rapid rate in the short run than in the long run. This means that hyperbolic discounters are more impatient when making short-run tradeoffs than when making long-run tradeoffs. However, researchers have found a large degree of variation regarding the dimension of time discounting both between and within species. For instance, cotton-top tamarin monkeys display a discount factor that sharply falls to zero after a delay of about one minute (Stevens et al., 2005) which reflects a much steeper temporal discount compared to that of humans. And within the human species, people with alcohol or substance dependence display higher time discounting than healthy control (Li and Sinha, 2008).

A potential explanation for these differences within and between species has been identified. It has been shown that the differential size and functioning of the prefrontal cortex have an important role in shaping time discounting. For instance, humans present a disproportionately large prefrontal cortex compared to animals, and some researchers speculate that this allows humans to care more and discount less delayed outcomes (Cottle and Klineberg, 1974). Evidence of the role of the prefrontal cortex in explaining the difference in time discounting within the human species comes from studies with people who experience damage

in the prefrontal cortex (Cottle and Klineberg, 1974; Damasio, 1994) or that present a differential neurological development of the prefrontal cortex (Durston et al., 2002). All in all, it seems that the extent to which the prefrontal cortex is developed and used can account for why some individuals can make decisions valuing more delayed rewards.

The above findings could not account for the following empirical pattern. Why can the same individual sometimes present differential time discounting? More recently, a new theory has tried to reconcile these facts in a new theory that would encompass all the previous knowledge. In McClure et al., (2004), a correlational study using functional magnetic resonance imaging showed that two separate systems are involved when people make choices between monetary reward options that vary by delay to delivery. The study showed that parts of the limbic system associated with the dopamine system are preferentially activated by decisions involving immediately available rewards while, in contrast, regions of the lateral prefrontal cortex and posterior parietal cortex are engaged uniformly by inter-temporal choices irrespective of delay.

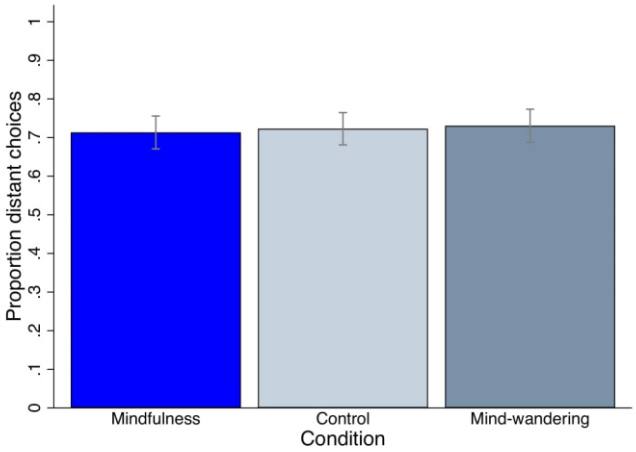

Figure 1. Proportion of distant choices per condition

Notes: This figure shows the proportion of distant choices combining the 4 inter-temporal decisions as a function of the condition. Large numbers indicate a greater proportion of distant choices. Error bars indicate the 95% confidence interval.

More recently, however, three sometimes competing mechanisms that are implemented in the brain: representation, anticipation, and self-control, have been identified as additional key influential factors that shape inter-temporal decision-making (Berns et al., 2007). Anticipation refers to an individual's propensity to imagine and experience pleasure and pain in anticipation of a future event. Self-control refers to the tensions that people experience when they attempt to implement a far-sighted decision in the presence of immediate temptation. Representation refers to the way that the brain interprets or frames a set of choices.

Overall, the literature on inter-temporal choice does not provide a clear guide on what to expect from the effects of mindfulness on inter-temporal decisions. Mindfulness effects would vary according to how it affects a variety of factors. Our main hypothesis in this study is that mindfulness manipulations and training bias people toward the present moment or towards more immediate rewards. This hypothesis is underpinned by the fact that focusing on the present moment is a crucial teaching of mindfulness authors, is present in many mindfulness inductions, and is a central concept of the mindfulness philosophy.

Table 1. Distant Choices and Time-consistent Choices in the Mindfulness, Control, and Mind-wandering Conditions

Dependent Variable	*Distant Choices*$_i$		*Proportion Consistent*$_i$	
Control$_i$	0.0387	0.0238	0.0307	0.0364
	(0.21)	(0.13)	(0.73)	(0.85)
Mind-wandering$_i$	0.0691	0.0444	0.00739	0.00953
	(0.38)	(0.24)	(0.18)	(0.23)
Age$_i$		0.258		-0.0387
		(1.60)		(-1.11)
Gender$_i$		0.0366*		0.00172
		(1.92)		(0.47)
Constant	2.853***	1.653***	0.794***	0.819***
	(21.91)	(3.12)	(25.84)	(7.70)
R^2	0.000454	0.0162	0.00188	0.00611
Observations	323	323	323	323

Notes: The dependent variables in the regression models above are respectively, Distant Choices$_i$ *which is the number of choices of asset A*[5] *that participant i made in the 4 choices of Experiment 1, Proportion Consistent*$_i$ *which is the proportion of time consistent choices per participant in Experiment 1. The independent variables included are Control*$_i$ *indicator variable, which is equal to one if participant i was allocated to the control condition and zero if the participant was allocated to the mindfulness or mind-wandering conditions, Mind-wandering*$_i$ *indicator variable, which is equal to one if participant i was allocated to the mind-wandering condition and zero if the participant was allocated to the control or mindfulness conditions, Age*$_i$ *which is the number of years old that participant i reports, and Gender*$_i$ *indicator variable, which is equal to one if participant i reports being a woman and zero if the participant reports being a man. Standard errors are robust to heteroskedasticity. t-statistics are in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% level, respectively.*

3. Experiment 1

[5] *Asset A always offered a higher € amount but in a more distant moment in time than the other alternative.*

3.1. Method

We assigned 323 participants[6] (219 females, 104 males; mean age = 21 years, range = 18–51 years[7]) 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 (Kabat-Zinn, 1990; Arch and Craske, 2006; Kiken and Shook, 2011; Hafenbrack et al., 2014).

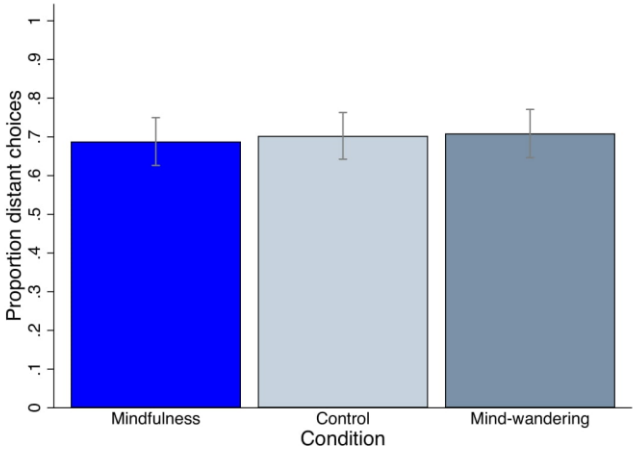

Figure 2. Proportion of distant choices per condition in the items involving decisions in the present

Notes: This figure shows the proportion of distant choices combining the 2 inter-temporal decisions in which participants had to choose between monetary outcomes in the present and in the future as a function of the condition. Large numbers indicate more proportion of distant choices. Error bars indicate the 95% confidence interval.

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. This type of induction has been used as a control condition in prior mindfulness experiments (Arch and Craske, 2006; Kiken and Shook, 2011; Hafenbrack et al., 2014) because it replicates a waking, baseline mental state (Mason et al.,

[6] In two different waves
[7] One participant stated being one year old, but it must be an erroneous input since in the subject pool there are no children

2007). Participants in the control condition were not subjected to any procedure. We decided to include this condition to improve on other mindfulness studies by trying to replicate a scenario without any manipulation in which participants only had to decide the task at hand.

Then participants in the first of the two waves of the experiment[8], in which we had a total of 129 participants (78 females, 41 males; mean age = 22 years, range = 18–51 years[9]), had to complete three manipulation check items in order to advance in the experiment. The three items are included in section A of the appendix. 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. To measure the three items, we used a 5-point Likert scale.

Table 2. Distant Choices Involving the Present Moment and not Involving the Present Moment in the Mindfulness, Control, and Mind-wandering Conditions

Dependent Variable	*Distant Choices Present$_i$*		*Distant Choices No Present$_i$*	
Control$_i$	0.0293	0.0282	0.00942	-0.00444
	(0.28)	(0.27)	(0.09)	(-0.04)
Mind-wandering$_i$	0.0413	0.0289	0.0278	0.0155
	(0.40)	(0.28)	(0.27)	(0.15)
Age$_i$		0.0256***		0.0109
		(2.73)		(0.98)
Gender$_i$		0.105		0.153*
		(1.19)		(1.66)
Constant	1.376***	0.657**	1.477***	0.996***
	(18.16)	(2.45)	(20.49)	(3.21)
R^2	0.000532	0.0179	0.000233	0.0106
Observations	323	323	323	323

*Notes: The dependent variables in the regression models above are respectively, Distant Choices$_i$ which is the number of choices of asset A[10] that participant i made in the 4 choices of Experiment 1, Proportion Consistent$_i$ which is the proportion of time consistent choices per participant in Experiment 1. Standard errors are robust to heteroskedasticity. t-statistics are in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% level, respectively.*

After all participants went through some items for an unrelated study and then made four hypothetical choices, inspired by tasks in Frederick et al., (2002), between two assets, asset A

[8] In the second wave and in the rest of the studies we did not include it again since we demonstrated the effectiveness of our manipulations in this first wave.
[9] One participant stated being one year old but it must be an erroneous input.
[10] *Asset A always offered a higher € amount but in a more distant moment in time than the other alternative.*

and asset B. Asset A always offered a smaller amount of money 200€, but gave it sooner in time (either now or in 12 weeks). Asset B always gave a higher amount of money (either 220€, or 250€) but gave it at a more distant moment in time (either in 4 or in 16 weeks). Crucially, in 2 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 both Asset A and Asset B offering in the first two choices, and then also in the last two choices, the same monetary amounts at different moments in time, we can compare whether participants behaved in a time-consistent manner.

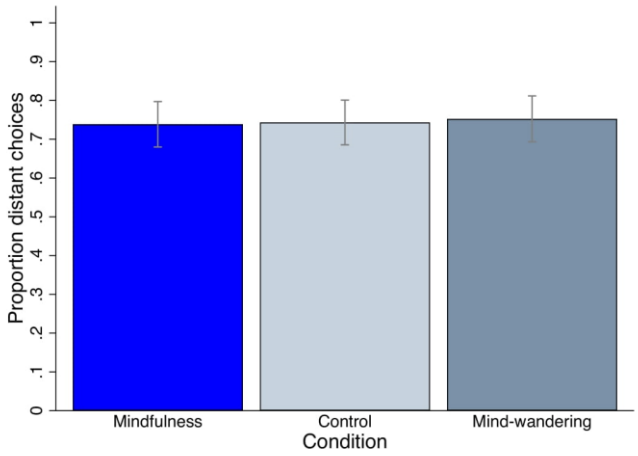

Figure 3. Proportion of distant choices per condition in the items involving decisions between alternatives in the future

Notes: This figure shows the proportion of distant choices combining the 2 inter-temporal decisions in which both, the earlier and the later monetary outcome were in a future moment as a function of the condition. Large numbers indicate more proportion of distant choices. Error bars indicate the 95% confidence interval.

3.2. Results and discussion

We start our analysis focusing on the manipulation check items. Overall, we find that both our mindfulness and mind-wandering manipulations were effective. The first two items, that measured the level of mindfulness of participants during the task show that, mindfulness participants reported being significantly more focused on the present moment (*mean* = 3.64) than mind-wandering (*mean* = 2.61; $t = 4.87$, $p < .00001$) or control participants (*mean* = 2.98; $t = 3.00$, $p < .01$) did. But, as expected, there was no significant difference between the control and mind-wandering conditions ($t = 1.41$, *ns*). Results were similar for the second item, which measure the level of attention to the physical sensations of their body. Mindfulness participants

reported being significantly more focused on the physical sensations of their body (*mean* = 3.73) than mind-wandering (*mean* = 1.95; $t = 8.81$, $p < .00001$) or control participants (*mean* = 2.30; $t = 6.35$, $p < .00001$) did. Moreover, once again, there was no significant difference between the control and mind-wandering conditions ($t = 1.36$, *ns*).

The third item of the manipulation check was designed to measure the level of mind-wandering experienced during the experiment. The item showed that participants in the mind-wandering condition reported being significantly more freely mind-wandering (*mean* = 3.47) than mindfulness (*mean* = 2.82; $t = 2.76$, $p < .01$) or control participants (*mean* = 2.83; $t = 2.47$, $p < .02$) did. But, as expected, there was no significant difference between the mindfulness and control conditions ($t = -.05$, *ns*).

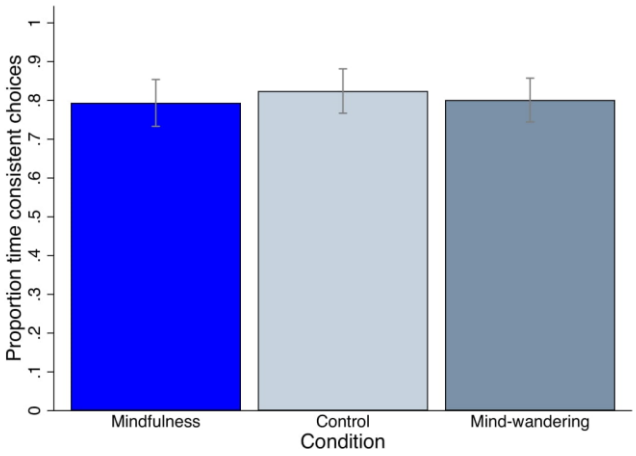

Figure 4. Proportion of time consistent choices per condition

Notes: This figure shows the proportion of time consistent choices. This proportion is obtained by calculating the number of identical asset selections between the first and second choices, which displayed the same amounts in the two choices at different moments in time, and between the third and fourth choices, which also displayed the same amounts in the two choices in different moments in time. Then dividing this number by two and plotting this proportion as a function of the condition. Large numbers indicate a greater proportion of time consistent choices. Error bars indicate the 95% confidence interval.

Figure 1 shows the proportion of participants that chose the distant choices combining the four items in Experiment 1. In the mindfulness condition the portion of participants choosing the distant alternatives (71%) was no different than that of mind-wandering participants (73%) chi^2 (1, $N = 412$) = .23, *ns*; and neither significantly different than the proportion of participants choosing distant choices in the control condition (72%) chi^2 (1, $N = 436$) = .06, *ns*. The difference in the proportion of people selecting the distant alternative between the mind-wandering and control conditions was also not statistically significant chi^2 (1, $N = 412$) = .03, *ns*.

Table 1 shows the analysis of distant choices in a regression form. Columns (1) and (2) show that there is no significant difference between mindfulness and both the control and mind-wandering conditions if we control for the age and gender of the participants. Regarding included covariates, we observe a marginally significant positive association between gender and the number of distant choices in experiment one (0.0366, $p < 0.1$).

Figure 2 shows the proportion of participants that chose the distant choices combining just the two items in Experiment 1 that involved choices in which the earlier choice was in the present moment. In the mindfulness condition the portion of participants choosing the distant alternatives (69%) was no different from that of mind-wandering participants (71%) chi^2 (1, N = 206) = .13, *ns*; and neither significantly different than the proportion of people choosing distant choices in the control condition (70%) chi^2 (1, N = 218) = .05, *ns*. The difference in the proportion of people selecting the distant alternative between the mind-wandering and control conditions was also not statistically significant chi^2 (1, N = 206) = .00, *ns*.

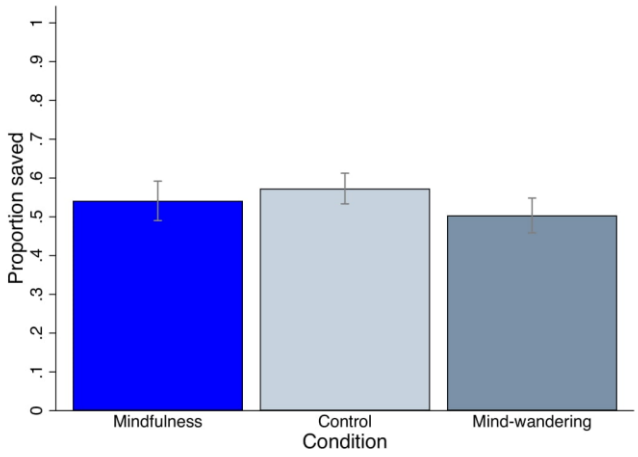

Figure 5. Proportion of money saved per condition in tasks 1 and 2

Notes: This figure shows the proportion of money allocated to saving alternatives as a function of the condition. Large numbers indicate more savings. Error bars indicate the 95% confidence interval.

Columns (1) and (2) of Table II show the analysis of distant choices combining just the two items in Experiment 1 that involved choices in which the earlier choice was in the present moment in a regression form. These columns show that there is no significant difference between the mindfulness and both the control and mind-wandering conditions if we control for the age and gender of the participants. Regarding included covariates, we observe a significant positive association between age and the number of distant choices (0.0256, $p < 0.01$) in experiment one.

Figure 3 shows the proportion of participants that chose the distant choices combining just the two items in Experiment 1 that involved choices in which both the earlier and the later

alternative were not in a future moment in time as a function of the condition. In the mindfulness condition the portion of participants choosing the distant alternatives (74%) was no different from that of mind-wandering participants (75%) chi^2 (1, N = 206) = .05, *ns*; and neither significantly different than the proportion of people choosing distant choices in the control condition (74%) chi^2 (1, N = 218) = .00, *ns*. The difference in the proportion of people selecting the distant alternative between the mind-wandering and control conditions was also not statistically significant chi^2 (1, N = 206) = .01, *ns*.

Columns (3) and (4) of Table 2 show the analysis of distant choices combining just the two items in Experiment 1 that involved choices in which both the earlier and the later alternative were not in a future moment in time as a function of the condition. These columns show that there is no significant difference between mindfulness, and both, the control and mind-wandering conditions, if we control for the age and gender of the participants. Included covariates show a marginally significant positive association between gender and the number of distant choices (0.153, $p < 0.1$) in experiment one.

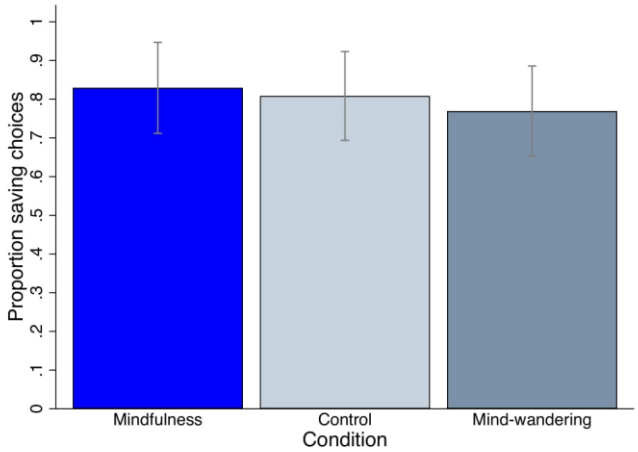

Figure 6. Proportion of participants that chose the savings alternative per condition in task 3

Notes: This figure shows the proportion of saving choices per condition in task 3. Large numbers indicate more savings. Error bars indicate the 95% confidence interval.

Figure 4 shows the proportion of participants that displayed consistent time choices in Experiment 1 as a function of the condition. This proportion is obtained by calculating the number of identical asset selections between the first and second choices, which displayed the same amounts in the two choices at different moments in time, and between the third and fourth choices, which also displayed the same amounts in the two choices in different moments in time, per condition—then dividing this number by two. Then we used a Wilcoxon Rank Sum Test with continuity correction to test whether the samples were likely to derive from the same population, and we observed that in the mindfulness condition, the portion of participants

choosing consistent alternatives (79%) was no different than that of mind-wandering participants (80%; W = 5640, *ns*); and neither significantly different than the proportion of people choosing consistent alternatives in the control condition (82%; W = 5746, *ns*). The difference in the proportion of people selecting consistent alternatives between the mind-wandering and control conditions was also not statistically significant (W = 6052, *ns*).

Columns (3) and (4) of Table 1 show the analysis of the proportion of time-consistent choices in a regression form. These columns show that there is no significant difference between mindfulness and both the control and mind-wandering conditions if we control for the age and gender of the participants. Included covariates do not show significant associations between gender or age and the proportion of time-consistent choices in a regression form.

Table 3. Amount of Savings in the Mindfulness, Control, and Mind-wandering Conditions

Dependent Variable	*Amount of Savings$_i$*		
Control$_i$	423.9	700.3	775.1
	(1.02)	(1.23)	(1.34)
Mind-wandering$_i$	-512.5	-652.3	-651.9
	(-1.15)	(-1.05)	(-1.05)
Practice Mindfulness$_i$		91.58	57.30
		(0.14)	(0.09)
*Control$_i$ * Practice Mindfulness$_i$*		-778.8	-762.1
		(-0.88)	(-0.86)
*Mind-wandering$_i$ * Practice Mindfulness$_i$*		382.3	449.5
		(0.41)	(0.50)
Age$_i$			-40.37
			(-0.70)
Gender$_i$			402.6
			(1.08)
Constant	8032.4***	7990.0***	8566.9***
	(24.48)	(15.98)	(8.85)
R^2	0.0373	0.0507	0.0626
Observations	140	140	140

Notes: The dependent variable in the regression models above, Amount of Savings$_i$ is the amount of savings that participant i allocated in both tasks 1 and 2 to the alternatives related to savings[11]. A new independent variable is included, Practice Mindfulness$_i$ an indicator variable, which is equal to one if participant i reports having any experience practicing meditation and zero if the participant reports no

[11] *Amount included in the Gastos en actividades de ocio box in task 1. And the amount included in either Cuenta de ahorro a plazo fijo or Plan de pensiones in task 2.*

*experience in meditation practice. Standard errors are robust to heteroskedasticity. t-statistics are in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% level, respectively.*

Overall, experiment 1 shows that there is no significant difference in these classical inter-temporal decision items between any of the three conditions. That is true both when we consider differences in choices involving all types of delays or when we just consider differences when one of the alternatives offers a monetary reward in the present or in the future. Moreover, there is also no difference in the time consistency of choices between the three conditions.

Table 4. Probability of Savings Choice in the Mindfulness, Control, and Mind-wandering Conditions

Dependent Variable	*Savings Choice$_i$*		
Control$_i$	-0.0208	0.0337	0.0574
	(-0.25)	(0.29)	(0.50)
Mind-wandering$_i$	-0.0600	0.0710	0.0471
	(-0.72)	(0.63)	(0.45)
Practice Mindfulness$_i$		0.122	0.100
		(1.05)	(0.90)
*Control$_i$ * Practice Mindfulness$_i$*		-0.116	-0.174
		(-0.68)	(-1.00)
*Mind-wandering$_i$ * Practice Mindfulness$_i$*		-0.316*	-0.267
		(-1.83)	(-1.64)
Age$_i$			0.0146
			(1.26)
Gender$_i$			0.219***
			(3.01)
Constant	0.829***	0.773***	0.349
	(13.96)	(8.46)	(1.26)
R^2	0.00392	0.0313	0.113
Observations	140	140	140

*Notes: The dependent variable in the regression models above, Savings Choice$_i$ gets value 1 if participant i decided to wait to save money to buy the car in task 3 and a value of 0 if the participant decided to borrow the money. Standard errors are robust to heteroskedasticity. t-statistics are in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% level, respectively.*

4. Experiment 2

4.1. Method

To test whether the effects of mindfulness go over and above the classical intertemporal tasks in the decision-making literature, we decided to test whether the effects hold in tasks

inspired by real-world scenarios. In Experiment 2, all procedures were generally the same as in Experiment 1. We assigned 140 participants (83 females, 57 males; *mean* age = 21 years, *range* = 18–37 years[12]) 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 Experiment 1.

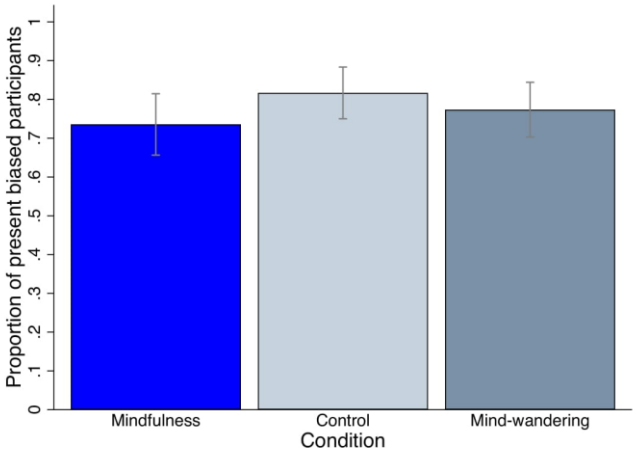

Figure 7. Proportion of present biased participants per condition

Notes: This figure shows the proportion of individual present bias (β) parameters lower than 1 as a function of the condition. Large proportions indicate less patience. Error bars indicate the 95% confidence interval.

After, all participants completed three hypothetical tasks in which participants had to make choices between saving money for the future or spending it now. In the first task, participants were told to imagine that they had won 10,000€ in the lottery and that they should allocate an amount that sums up to 10,000€ between two different categories: leisure activities or saving in a checking account. In the second task, participants were told to imagine that they earn 2,000€ net per month, and they were asked to allocate an amount that sums up to the 2,000€ between these different categories: saving in a checking account, pension plan, rent and home expenses, leisure, food, and other expenses. Finally, in the third task, participants were told to consider a scenario in which they need to purchase a car, but they only have half of the required purchase price. Then they have two options; first, borrow the missing money from a bank and pay interest on it; second, they wait two years until they have saved enough, and in this way, they do not have to pay any amount. In the B section of the appendix, we include the three tasks. The tasks were not directly incentivized. Participants only received a fixed payment for participation and a potential bonus in a later experiment in the same experimental session.

[12] One participant stated being four years old, but it must be an erroneous input.

4.2. Results and discussion

Figure 5 gives the average proportion of money saved by combining task 1 and task 2 savings. To calculate this, we added the money amounts allocated to the saving alternative in the two tasks per condition and we divided this amount by two. Mindful participants allocated an equal proportion to saving (*mean* € = .541) than did mind-wandering participants (*mean* € = .503; $W = 1155$, *ns*), or control participants (*mean* € = .573; $W = 823$, *ns*). The difference in the proportion allocated to savings between mind-wandering participants and control participants was significant ($W = 1495$, *ns*).

Table 5. Present Biased Participants in the Mindfulness, Control, and Mind-wandering Conditions

Dependent Variable		*Present Biased*$_i$	
Control$_i$	0.0813	0.0991	0.102
	(1.54)	(1.34)	(1.37)
Mind-wandering$_i$	0.0382	0.0663	0.0757
	(0.71)	(0.89)	(1.00)
Practice Mindfulness$_i$		0.0774	0.0900
		(0.97)	(1.10)
Control$_i$ * *Practice Mindfulness*$_i$		-0.0288	-0.0393
		(-0.27)	(-0.37)
Mind-wandering$_i$ * *Practice Mindfulness*$_i$		-0.0537	-0.0617
		(-0.49)	(-0.56)
Age$_i$			-0.0114
			(-1.35)
Gender$_i$			0.0198
			(0.42)
Constant	0.736***	0.698***	0.918***
	(18.27)	(11.99)	(4.68)
R^2	0.00617	0.0102	0.0183
Observations	389	389	389

Notes: The dependent variable in the regression models above, Present Biased$_i$ *is an indicator variable, which is equal to one if participant i has an individual (β) parameter lower than one, thus is what the literature calls a present biased individual, and zero if the participant has a (β) parameter equal to one. Standard errors are robust to heteroskedasticity. Standard errors are robust to heteroskedasticity. t-statistics are in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% level, respectively.*

Figure 6 shows the proportion of participants that chose the savings alternative per condition in task 3. In the mindfulness condition, the portion of participants choosing the savings alternative (83%) was marginally different from that of mind-wandering participants (77%) chi^2 (1, N = 41) = 2.83, p = .084 and equal to the proportion of saving choices in the control condition (81%) chi^2 (1, N = 41) = .86, *ns*. The difference in the proportion of people selecting the saving alternative between the mind-wandering and control conditions was not significant chi^2 (1, N =47) = .85, *ns*.

Table 3 includes a regression analysis of the first two tasks. In columns (1) to (3), the regression analysis shows that controlling for the age, gender, and a measure of experience in the meditation practice of participants there is no significant difference in the amount of money allocated to the saving alternatives between the mindfulness condition and the control or mind-wandering conditions. Moreover, Table 3 additionally shows that there is no significant association between previous meditation experience and the amount of money allocated to saving alternatives in any of the three experimental conditions.

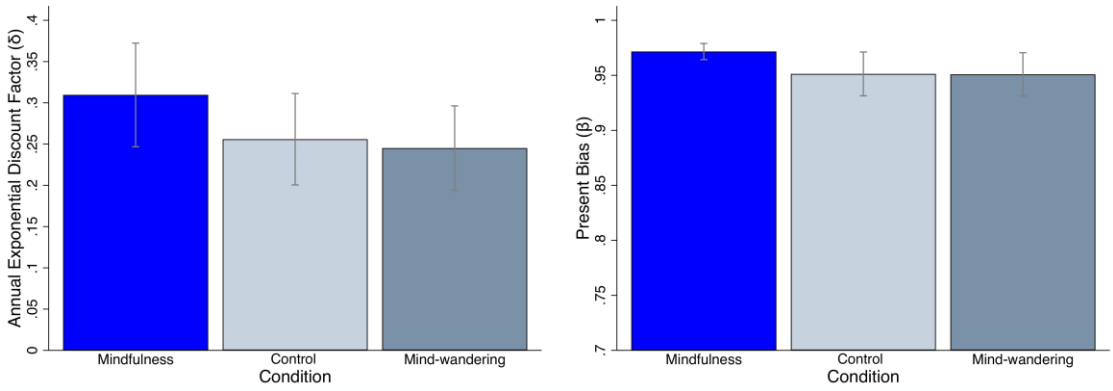

Figure 8. Average individual δ and β per condition

Notes: This figure shows the mean of the individual time-consistent annual exponential discount factor (δ) (left graph) and present bias (β) (right graph) as a function of the condition. Large numbers indicate more patience. Error bars indicate the 95% confidence interval.

Table 4 shows a regression analysis of the third task. The dependent variable is an indicator variable that indicates whether a participant decided to wait and save money to buy a car, instead of borrowing it. Coefficients of the control and mind-wandering condition respectively indicate probability differences in choosing the savings alternative with respect to those in the mindfulness condition. Columns (1) to (3) of the regression analysis show that controlling for the age, gender, and a measure of experience in the meditation practice of participants there is no significant difference in the probability of selecting the saving choice between the mindfulness condition and the control or mind-wandering conditions. Moreover, Table 4, once again, shows that there is no significant association between previous meditation experience

and the probability of choosing the saving option in any of the three experimental conditions. However, column (3) shows that being a woman is significantly associated with a higher probability of choosing the savings choice (0.219, $p < 0.01$).

The results of Experiment 2 suggest that there are no significant differences between the mindfulness condition and the control and mind-wandering condition in the outcomes of tasks 1 and 2. The point estimates of task 3, a binary decision between consuming now and incurring a cost, or waiting and saving so that one does not need to borrow money, also indicate that there are no significant differences between the mindfulness condition and the control and mind-wandering even if we control for age, gender, and previous experience in the meditation practice.

Table 6. Present Bias Parameter of Participants in the Mindfulness, Control, and Mind-wandering Conditions

Dependent Variable		$Beta_i$	
$Control_i$	-0.0203*	-0.0338**	-0.0338**
	(-1.88)	(-2.12)	(-2.10)
$Mind\text{-}wandering_i$	-0.0208*	-0.0241*	-0.0240*
	(-1.94)	(-1.71)	(-1.66)
$Practice\ Mindfulness_i$		-0.00773	-0.00785
		(-1.02)	(-1.04)
$Control_i * Practice\ Mindfulness_i$		0.0325	0.0321
		(1.63)	(1.57)
$Mind\text{-}wandering_i * Practice\ Mindfulness_i$		0.00671	0.00653
		(0.31)	(0.30)
Age_i			0.000231
			(0.22)
$Gender_i$			0.00259
			(0.24)
Constant	0.972***	0.975***	0.969***
	(259.78)	(220.60)	(40.30)
R^2	0.00914	0.0146	0.0148
Observations	389	389	389

*Notes: The dependent variable in the regression models above, $Beta_i$ is the individual present bias β parameter fitted to the decisions made by participant i in Experiment 3. Standard errors are robust to heteroskedasticity. t-statistics are in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% level, respectively.*

5. Experiment 3

5.1. Method

In Experiment 3, all procedures were generally the same as in the first and second experiments. We assigned 389 participants (263 females, 126 males; *mean* age = 21 years, *range* = 18–51 years[13]) 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. Once again, participants in the control condition were not subjected to any procedure.

Table 7. Time-consistent Discounting Parameter of Participants in the Mindfulness, Control, and Mind-wandering Conditions

Dependent Variable		$Delta_i$	
$Control_i$	-0.0537	-0.103*	-0.103*
	(-1.26)	(-1.73)	(-1.73)
$Mind\text{-}wandering_i$	-0.0644	-0.109*	-0.111*
	(-1.56)	(-1.90)	(-1.92)
$Practice\ Mindfulness_i$		-0.0757	-0.0802
		(-1.19)	(-1.26)
$Control_i$ * $Practice\ Mindfulness_i$		0.108	0.107
		(1.25)	(1.23)
$Mind\text{-}wandering_i$ * $Practice\ Mindfulness_i$		0.0980	0.0984
		(1.18)	(1.18)
Age_i			0.00523
			(0.94)
$Gender_i$			0.0190
			(0.54)
Constant	0.310***	0.346***	0.226*
	(9.69)	(7.31)	(1.83)
R^2	0.00726	0.0126	0.0155
Observations	389	389	389

*Notes: The dependent variable in the regression models above, $Delta_i$ is the individual time-consistent discounting parameter δ fitted to the decisions made by participant i in Experiment 3. Standard errors are robust to heteroskedasticity. t-statistics are in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% level, respectively.*

After, all participants made 42 choices as in McClure et al., (2004) 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

[13] One participant stated being four years old but it must be an erroneous input

(between 7€ and 43€) later (2, 4, or 6 weeks, respectively, from the day of the experiment). Thus, 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 2 out of every 50 participants to realize one of his or her choices, paying that person his or her preferred alternative for a randomly selected choice pair. The payment was made at the chosen moment and for the chosen amount using Amazon.com gift certificates. All gift certificates were sent electronically.

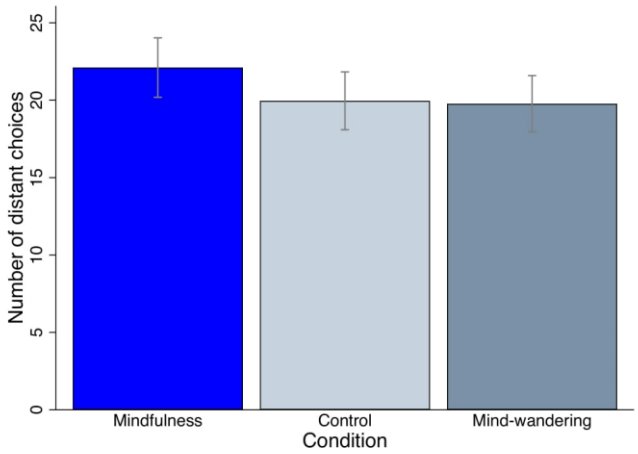

Figure 9. Average number of distant choices selected per condition

Notes: This figure shows the mean number of distant choices selected as a function of the condition. Large numbers indicate more patience. Error bars indicate the 95% confidence interval.

This task will allow us to fit the parameters of a model that distinguishes between two types of processes that are represented in the quasi hyperbolic discounting function, $D(t) = \beta\delta^t$, for length of delay $t > 0$, and $D(0) = 1$ as in Laibson (1997) or Odonoghue and Rabin (1999). One process (δ) reflects a time-consistent exponential discounting of rewards that is sensitive to the length of delay, t. The other process, present bias (β), discounts all future rewards when there is any delay (regardless of its length). We hypothesized that mindfulness (compared to the other conditions) would make people more patient but had no particular prediction whether it would impact more the present bias (β) or the time-consistent discounting (δ).

5.2. Results and discussion

To test whether the parameters differ between the three conditions, we fit the parameters in two different ways. In the first way, we fit each participant's choices to the quasi hyperbolic discounting function using maximum-likelihood estimation, constraining β and δ between 0 and 1. With this procedure, we get as many sets of parameters as participants in our study.

Then we can analyze the distribution of β parameters. In Figure 9 we observe that a significant portion of participants showed evidence of present bias by displaying a β lower than 1 (78%); β was marginally less likely to be lower than 1 among mindfulness participants (74%) than among mind-wandering participants (77%) chi^2 (1, N = 212) = 2.76, p = .097 and significantly lower than the share of present biased participants of the participants in the control condition (82%) chi^2 (1, N = 121) = 5.70, $p < .05$. The difference in percentage of people with present bias between the mind-wandering and control conditions was not significant chi^2 (1, N =131) = 1.59, *ns*.

Table 8. Average Number of Distant Choices in the Mindfulness, Control, and Mind-wandering Conditions

Dependent Variable	*Number of Distant Choices$_i$*		
Control$_i$	-2.146	-4.006**	-3.985**
	(-1.57)	(-2.15)	(-2.13)
Mind-wandering$_i$	-2.334*	-3.768**	-3.725**
	(-1.74)	(-2.03)	(-1.99)
Practice Mindfulness$_i$		-1.796	-1.800
		(-0.92)	(-0.92)
*Control$_i$ * Practice Mindfulness$_i$*		4.315	4.195
		(1.56)	(1.50)
*Mind-wandering$_i$ * Practice Mindfulness$_i$*		3.307	3.248
		(1.21)	(1.19)
Age$_i$			0.0315
			(0.17)
Gender$_i$			0.646
			(0.54)
Constant	22.11***	22.97***	21.87***
	(22.63)	(15.82)	(5.46)
R^2	0.00925	0.0174	0.0182
Observations	389	389	389

*Notes: The dependent variable in the regression models above, Number of Distant Choices$_i$ is the number of distant choices in the 42 binary decisions that participant i chose in Experiment 3. Standard errors are robust to heteroskedasticity. t-statistics are in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% level, respectively.*

Table 5 shows a regression analysis of the probability of being present biased between the different conditions. Columns (1) to (3) show that after controlling for the age, gender, and a measure of experience in the meditation practice of participants, there is no significant

difference in the probability of being present biased between the mindfulness condition and the control or mind-wandering conditions. Moreover, Table 5 also shows that there is no significant association between previous meditation experience, age, or gender and the probability of choosing the saving option in any of the three experimental conditions.

Figure 8 gives the mean values for both parameters in the three conditions. If we look at the results reflected in Figure 8 and we use Wilcoxon Rank Sum Test with continuity correction to test whether two samples are likely to derive from the same population we observe that mindful participants displayed less present bias (*mean* β = .972, *median* β = .989) than did mind-wandering participants (*mean* β = .95, *median* β = .987; *W* = 8629, *ns*), discounting all nonimmediate rewards by almost 2 percentage points less than mind-wandering participants did. Mindfulness participants also displayed marginally less present bias than control participants (*mean* β = .951, *median* β = .993; *W* = 8282, *ns*), discounting all nonimmediate rewards by also almost 2 percentage points less than control participants did. The difference in the present bias parameter between mind-wandering participants (*mean* β = .95, *median* β = .987) and control participants was not significant (*W* = 8930, *ns*).

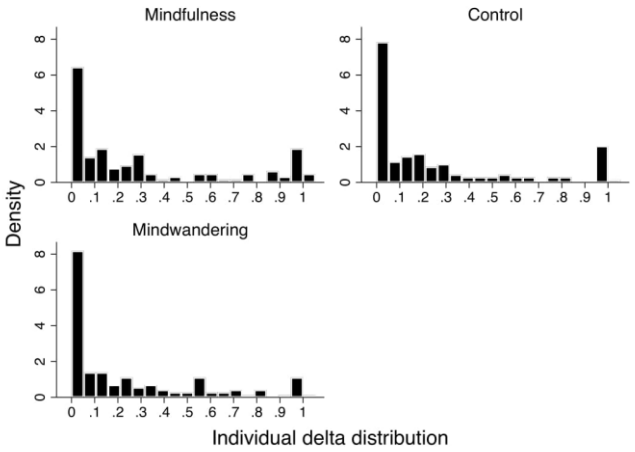

Figure 10. Histogram of δ per condition

Notes: This figure shows the histogram plot of the time-consistent annual exponential discount factor (δ) as a function of the condition.

Table 6 shows a regression analysis of the present bias parameter (β) in the different conditions. Columns (1) to (3) show that after controlling for the age, gender, and a measure of experience in the meditation practice of participants, there is a significant difference in the present bias parameter of the mindfulness and the control conditions (-0.0338, $p < 0.05$) and marginally significant between the mindfulness and mind-wandering conditions (-0.0240, $p < 0.1$). That is, participants in the mindfulness condition, on average, discounted all

nonimmediate rewards by three percentage points less than control participants did and two percentage points less than mind-wandering participants did.

When we compare conditions with decisions involving only choices between delayed rewards, mindful participants (*mean* δ = .310, *median* δ = .154) discounted already delayed rewards equally than mind-wandering participants (*mean* δ = .245, *median* δ = .104); (W = 9238, *ns*). There were also no differences in discounting delayed rewards between mindful participants and control participants (*mean* δ = .256, *median* δ = .126; W = 8757, *ns*) and between mind-wandering and control participants (W = 9045, *ns*).

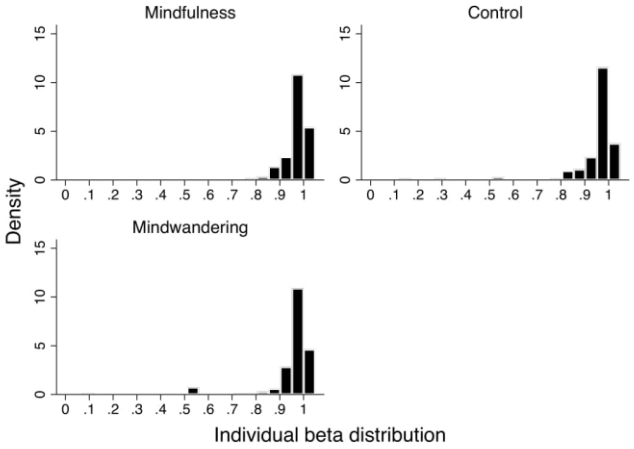

Figure 11. Histogram of β per condition

Notes: This figure shows the histogram plot of the present bias parameter (β) as a function of the condition.

Table 7 shows a regression analysis of the time-consistent discounting parameter (δ) in the different conditions. Columns (1) to (3) show that after controlling for the age, gender, and a measure of experience in the meditation practice of participants, there is a marginally significant difference in the δ parameter of the mindfulness and the control conditions (-0.103, $p < 0.1$) and marginally significant difference between the mindfulness and mind-wandering conditions (-0.111, $p < 0.1$). That is, participants in the mindfulness condition, on average, discounted all already delayed rewards by ten percentage points less than control participants did and 11 percentage points less than mind-wandering participants did.

Figure 9 shows the average number of distant choices per condition. That is the number of choices in a more distant moment out of the 42 choices in Experiment 3. Performing t-tests to test for differences between the experimental conditions we find that mindful participants chose a marginally higher number of distant choices (*mean* = 22.1) than did mind-wandering participants (*mean* = 19.8; t = -1.73, $p < 0.1$). However the differences between the mindfulness participants and the control participants (*mean* = 20.0; t = -1.57, $p < 0.12$), were

not significant. The difference in the number of distant choices between the mind-wandering participants and control participants was not significant (t = -0.14, *ns*).

Table 8 shows a regression analysis of the number of distant choices in Experiment 3. Columns (1) to (3) show that after controlling for the age, gender, and a measure of experience in the meditation practice of participants, participants in the mindfulness condition chose a significantly higher number of distant choices than participants in the control (-3.985, $p < 0.05$) and mind-wandering conditions (-3.725, $p < 0.05$). That is, participants in the mindfulness condition, on average, chose nearly four less distant choices than control participants did and also close to 4 less distant choices than mind-wandering participants did. Comparing these quantities to their respective means, it shows that mindfulness participants chose on average 20% less distant choices than control participants and 19% less distant choices than participants in the mind-wandering condition.

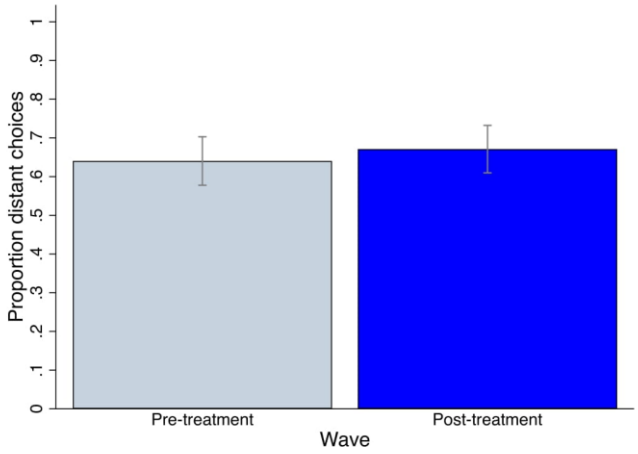

Figure 12. Proportion of distant choices per wave

Notes: This figure shows the proportion of distant choices combining the 4 inter-temporal decisions as a function of the wave. Large numbers indicate a greater proportion of distant choices. Error bars indicate the 95% confidence interval.

To further test whether the individual parameters of participants in the three conditions differ, we decided to evaluate their distributions. To do so, we produced a histogram for each of the experimental conditions and for each parameter. In Figure 10, we observe the histograms for the δ parameter. If we compare the plot of the mindfulness condition in the top left to those of the control and mind-wandering one, we observe that we tend to have a lower density for values close to zero in the mindfulness condition. Moreover, when we evaluate the values close to one, we also observe a higher density of values in that range for the mindfulness condition compared to the other ones. However, a Kolmogorov-Smirnov test suggested that the distribution of the δ parameters does not differ between the mindfulness and control conditions

(D(252) = .11; Z = .85; *ns*), the mindfulness and the mind-wandering conditions (D(258) = .11; Z = .84; *ns*), and nor between the control and mind-wandering conditions (D(268) = .07; Z = .09; *ns*).

In Figure 11 we find the plots of the histograms for the β parameter. Analyzing the plots we observe that the β parameters in the mindfulness condition tend to have a higher density in values equal to one than the plots in the other two conditions. However when we perform a Kolmogorov-Smirnov test, this suggests that the distribution of the β parameters does not differ between the mindfulness and control conditions (D(252) = .09; Z = .37; p = .70), the mindfulness and the mind-wandering conditions (D(258) = .06; Z = .04; p = 0.97), and nor between the control and mind-wandering conditions (D(268) = .10; Z = .65; p = 0.52).

Table 9. Distant and Time-consistent Choices in the Pre-treatment and Post-treatment waves

Dependent Variable	*Distant Choices*$_{iw}$		*Consistent Choices*$_{iw}$	
Post-treatment$_{iw}$	0.143	0.143	0	0
	(0.85)	(0.60)	(0.00)	(0.00)
Constant	2.589***	2.589***	1.732***	1.732***
	(11.86)	(21.71)	(23.22)	(27.63)
Subject fixed effects	No	Yes	No	Yes
R^2	0.00202	0.847	0	0.666
Observations	112	112	112	112

Notes: The dependent variables in the regression models above are respectively, Distant Choices$_{iw}$ *which are the number of choices of asset A*[14] *that participant i made in the 4 choices of Experiment 4 in wave w, and Consistent Choices*$_{iw}$ *which is the number of time consistent choices per participant in wave w of Experiment 4. This number is obtained by calculating the number of identical asset selections between the first and second choices, which displayed the same amounts in the two choices in different moments in time, and between the third and fourth choices, which also displayed the same amounts in the two choices in different moments in time in each wave w. The independent variable included is Post-treatment*$_{iw}$ *indicator variable, which is equal to one if participant i was deciding in the post-treatment wave w and zero if the participant was deciding in the pre-treatment wave w. Subject fixed effects are included in the second and fourth specifications. Standard errors are robust to heteroskedasticity. t-statistics are in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% level, respectively.*

All in all, mindfulness individual parameter estimations (compared to the mind-wandering and control conditions ones) decreased the desire to get something immediately but not sooner. However, when we test for differences in the distributions, we do not observe significant differences between the three experimental treatments. It seems thus that the difference in the

[14] Asset A always offered a higher € amount but in a more distant moment in time than the other alternative.

present bias parameter between the mindfulness and the control and mind-wandering conditions comes from a subtle shift in the higher and lower bound of the range of the estimated betas that is not sufficient to create significant differences in the parameter distributions.

To summarize, in this third experiment, we find three main findings. These findings point to an effect of mindfulness making participants in that condition more patient. First, if we compare the share of participants that experience present bias, we observe that the share of present biased participants is 3% and 8% lower in the mindfulness condition with respect to the mind-wandering and control one. Second, if we compare the average of the individually estimated betas per condition, we find that, on average, a participant in the mindfulness condition discounts all nonimmediate rewards by almost two percentage points less than mind-wandering or control participants. Third, when we analyze the average of the individual deltas per condition, we do not find significant differences. However, the point estimates of the averages suggest that participants in the mindfulness condition are more patient than participants in the other two conditions.

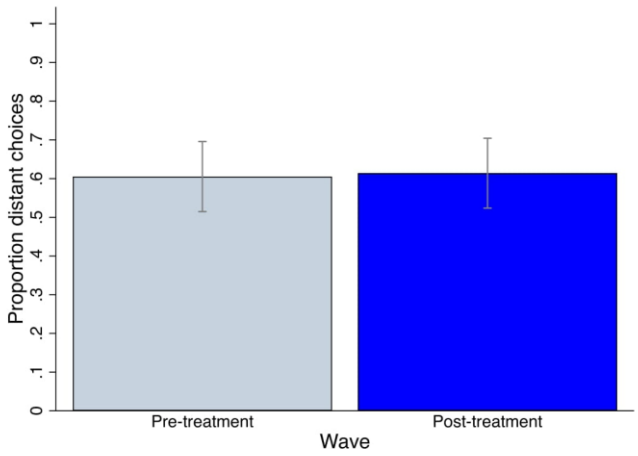

Figure 13. Proportion of distant choices per condition in the items involving decisions in the present

Notes: This figure shows the proportion of distant choices combining the 2 inter-temporal decisions in which participants had to choose between monetary outcomes in the present and in the future as a function of the experimental wave. Large numbers indicate a greater proportion of distant choices. Error bars indicate the 95% confidence interval.

6. Experiment 4

6.1. Method

In experiment 4, we tested the effects of mindfulness on inter-temporal choices outside the lab. To that effect, we contacted the largest provider of the mindfulness-based stress reduction program (MBSR) in Spain, and we agreed on a partnership to do a field experiment on their

premises. The MBSR program, according to the American Psychological Association, is a therapeutic intervention that involves weekly group classes and daily mindfulness exercises to practice at home over an 8-week period. MBSR taught people how to increase mindfulness through yoga and meditation and was developed by Jon Kabat-Zinn, the founder of the Stress Reduction Clinic and the Center for Mindfulness in Medicine, Health Care, and Society at the University of Massachusetts Medical School. And as of 2017, just at the University of Massachusetts, more than 24,000 people have taken this course which is the most popular standardized program on mindfulness worldwide.

Table 10. Distant Choices Involving the Present Moment and not Involving the Present Moment in the Pre-treatment and Post-treatment waves

Dependent Variable	*Distant Choices Present*$_{iw}$		*Distant Choices No Present*$_{iw}$	
Post-treatment$_{iw}$	0.0179	0.0179	0.125	0.125
	(0.19)	(0.13)	(1.22)	(0.86)
Constant	1.232***	1.232***	1.357***	1.357***
	(10.26)	(18.53)	(12.03)	(18.71)
Subject fixed effects	No	Yes	No	Yes
R^2	0.000106	0.840	0.00566	0.792
Observations	112	112	112	112

Notes: The dependent variables in the regression models above are respectively, Distant Choices Present$_{iw}$ *which are the number of choices of asset A*[15] *that participant i made in the 4 choices of Experiment 4 in wave w, and Distant Choices No Present*$_{iw}$ *which is the number of time consistent choices per participant in in wave w of Experiment 4. This number is obtained by calculating the number of identical asset selections between the first and second choices, which displayed the same amounts in the two choices in different moments in time, and between the third and fourth choices, which also displayed the same amounts in the two choices in different moments in time in each wave w. The independent variable included is Post-treatment*$_{iw}$ *indicator variable, which is equal to one if participant i was deciding in the post-treatment wave w and zero if the participant was deciding in the pre-treatment wave w. Subject fixed effects are included in the second and fourth specifications. Standard errors are robust to heteroskedasticity. t-statistics are in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% level, respectively.*

The study had a within-subject design; inter-temporal measures were taken prior to the course, before the start of the course in a guidance session, and during the last session of the course –after a guided meditation in the middle of more than the 2 hours of the session. Participation in the study was voluntary, there was no direct monetary compensation for the

[15] *Asset A always offered a higher € amount but in a more distant moment in time than the other alternative.*

participation, but a mindfulness book, written by the director of the center in which the program was taught, was offered as a gift for those that decided to participate in the two waves of the study. A total of 57 participants (37 females, 20 males; *mean* age = 43 years, *range* = 23–69 years) opted to participate in the study and completed the pre-treatment and post-treatment waves (the attrition in the second wave was 14%).

As measures of inter-temporal choice, we used the same four items of experiment 1. As in experiment 1, we also included the same unrelated tasks prior to their completion. We displayed the four inter-temporal choice items in a booklet format. In appendix D, we include a copy of the booklet used as support for our study, plus the instructions and consent form that participants completed are included in section D of the appendix.

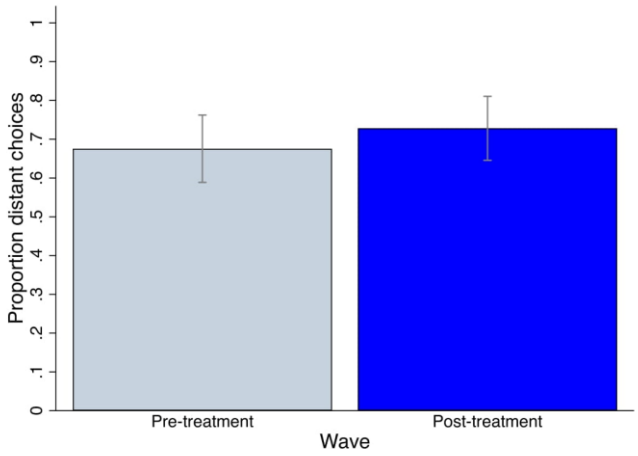

Figure 14. Proportion of distant choices per condition in the items involving decisions between alternatives in the future

Notes: This figure shows the proportion of distant choices combining the 2 inter-temporal decisions in which both, the earlier and the later monetary outcome were in a future moment as a function of the experimental wave. Large numbers indicate a greater proportion of distant choices. Error bars indicate the 95% confidence interval.

6.2. Results and discussion

Figure 12 shows the proportion of participants that chose the distant choice 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 = 228) = .35, *ns*.

Table 9 shows the analysis of the number of distant choices in a regression form. Columns (1) and (2) show that there is no significant difference between the pre-treatment and post-treatment waves when controlling for participant fixed effects.

Results are similar if we calculate the proportion just using the two items in the study that involved choices in which the earlier choice was in the present moment. Figure 13 shows this.

In the pre-treatment wave, the portion of participants choosing the distant alternatives (61%) was equal to that of the participants in the post-treatment wave (61) chi^2 (1, N = 114) = .00, *ns*.

Columns (1) and (2) of Table 10 show the analysis of distant choices combining just the two items in Experiment 1 that involved choices in which the earlier choice was in the present moment in a regression form. These columns show that there is no significant difference between the pre-treatment and post-treatment waves when controlling for participant fixed effects.

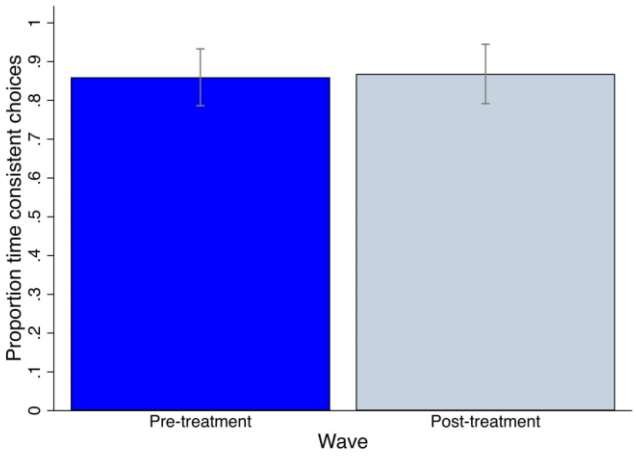

Figure 15. Proportion of time consistent choices per wave

Notes: This figure shows the proportion of time consistent choices. This proportion is obtained by calculating the number of identical asset selections between the first and second choices, which displayed the same amounts in the two choices in different moments in time, and between the third and fourth choices, which also displayed the same amounts in the two choices in different moments in time. Then dividing this number by two and plotting this proportion as a function of the experimental wave. Large numbers indicate a greater proportion of time consistent choices. Error bars indicate the 95% confidence interval.

However, the point estimates differ if we calculate the proportion just using the two items in the study that involved choices in which both the earlier and the later alternative were not in the present moment. Figure 14 shows this. Although if we look at the statistical significance, in the pre-treatment wave, the portion of participants choosing the distant alternatives (68%) was equal to that of the participants in the post-treatment wave (73%) chi^2 (1, N = 114) = .52, *ns*.

Columns (3) and (4) of Table 10 show a regression analysis of the distant choices combining the two items in Experiment 4 that involved choices in which both earlier

alternatives were not in the present moment. These columns reveal that, once again, there is no significant difference between the pre-treatment and post-treatment waves controlling whether we control for participant fixed effects or not.

Figure 15 shows the proportion of participants that displayed time-consistent choices in Experiment 4 as a function of the experimental wave. This proportion is obtained with the same method as in the first experiment, but instead of doing the calculation by the condition, this time, we do it per experimental wave. We then use a Wilcoxon Rank Sum Test with continuity correction to test whether the samples are likely to derive from the same population. And we observed that in the pre-treatment wave, the portion of participants choosing consistent alternatives (86%) was no different from that of the post-treatment wave (87% $W = 1625$, *ns*).

Table 9 shows the analysis of consistent choices in a regression form. Columns (3) and (4) show that there is no significant difference between the pre-treatment and post-treatment waves controlling for participant fixed effects.

We then explored whether mindfulness as a trait and exposure to meditation influence the inter-temporal decisions of the participants. Columns (1) and (2) of Table 11 show that while there is no significant association between the analysis of distant choices and the accumulated score in the mindful attention awareness scale (MAAS), when we control for the months of meditation practice, age, and gender of participants, there is a significant positive association between the months of meditation practice prior to the treatment and the number of distant choices in the pre-treatment wave of Experiment 4 when we control for the same covariates and the cumulative score in MAAS. Moreover, when we look at the coefficients of the included covariates, we observe a significant positive relationship between gender and the dependent variable. That is, being a woman is positively associated with the number of distant choices in the pre-treatment wave.

Columns (3) to (5) of Table 11 show that there is a significant negative association between the MAAS and the number of distant choices in the post-treatment wave if we control for the months of meditation practice, age, and gender of participants. Additionally, it shows the same positive association between the months of meditation experience and the post-treatment number of distant choices when we control for the same covariates and the cumulative score in MAAS. However, this association becomes marginal when we control for the number of distant choices in the pre-treatment wave.

Combining just the 2 items in Experiment 1 that involved choices in which the earlier choice was in the present moment in a regression form. These columns show that there is no significant difference between the pre-treatment and post-treatment waves when controlling for participant fixed effects.

Overall, experiment 4 shows that there is no significant difference in these classical inter-temporal decision items in a field experiment that used a very popular eight-week intensive

program as a base for the treatment in the study. This is true both when we consider differences in choices involving all types of delays or when we just consider differences when one of the alternatives offers a monetary reward in the present. However, although not statistically significant, we find point estimate differences in the proportion of distant choices when we only analyze choices involving decisions in which both alternatives that participants can choose are in the future. Those differences point to participants, after receiving the mindfulness training becoming more patient. After checking time consistency, we find that there is no difference in this regard between experimental waves.

7. Conclusion

This study shows that mindfulness does not affect inter-temporal choices. Although focusing on the present moment is a vital teaching of the prominent Buddhist philosophers, best mindfulness authors, and even the Buddha himself, as attested by quotes such as: "When we are mindful, deeply in touch with the present moment" or "The past is gone, the future is not yet here, and if we do not go back to ourselves in the present moment, we cannot be in touch with life." of Thich Nhat Hanh. Or like the ones of the Buddha himself: "The secret of health for both mind and body is not to mourn for the past, nor to worry about the future, but to live the present moment wisely and earnestly." or "Do not dwell in the past, do not dream of the future, concentrate the mind on the present moment." Here we show that mindfulness practitioners do not seem to be biased toward the present moment. Mindfulness practitioners do not prefer more immediate rewards compared to those of mind-wandering or control participants despite the protagonist role that the focus on the present moment has on the philosophy behind the modern mindfulness practice. Lots of new opportunities are ahead in this area, and lots of work is still needed to better understand the mechanisms behind this thousands-of-years-old tradition, the importance of which is growing day by day.

Table 11. Mindfulness Trait and Meditation Experience Effects on Pre and Post-treatment Number of Distant Choices

Dependent Variable	*Number of Distant Choices Pre-treatment*$_i$		*Number of Distant Choices Post-treatment*$_i$		
MAAS$_i$	0.00546	0.00108	-0.0254*	-0.0255*	-0.0262**
	(0.28)	(0.06)	(-1.75)	(-1.68)	(-2.10)
Months Meditation Practice$_i$	0.00318*	0.00394**	0.00492***	0.00525***	0.00239*
	(1.68)	(2.04)	(4.55)	(3.75)	(1.94)
Age$_i$		0.0135		-0.00438	-0.0142
		(0.69)		(-0.20)	(-1.01)
Gender$_i$		0.929**		0.139	-0.536*
		(2.19)		(0.30)	(-1.75)
Number of Distant Choices Pre-treatment$_i$					0.726***
					(7.56)
Constant	2.254**	1.575	4.075***	4.216***	3.072***
	(2.10)	(1.32)	(5.03)	(3.54)	(2.80)
R^2	0.0127	0.0919	0.0584	0.0609	0.570
Observations	56	56	56	56	56

Notes: The dependent variables in the regression models below are respectively, Number of Distant Choices Pre-treatment$_i$ *which are the number of choices of asset A*[16] *that participant i made in the 4 choices of Experiment 4 in the pre-treatment wave, and Number of Distant Choices Pre-treatment*$_i$ *which are the number of time consistent choices per participant in the post-treatment wave of Experiment 4. The independent variables include the MAAS*$_i$*, which is the cumulative score of participant i in the mindful attention*

[16] *Asset A always offered a higher € amount but in a more distant moment in time than the other alternative.*

*awareness scale (MAAS) in the pre-treatment wave, as well as Months of Meditation Practice$_i$, which are the number of months of meditation practice stated in the pre-treatment wave. Standard errors are robust to heteroskedasticity. t-statistics are in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% level, respectivel*

Acknowledgements

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References

Arch JJ, Craske MG (2006) Mechanisms of mindfulness: emotion regulation following a focused breathing induction. Behaviour research and therapy 44(12):1849–1858.

Bazzano M (2014) After Mindfulness: New Perspectives on Psychology and Meditation (Palgrave Macmillan UK).

Berns GS, Laibson D, Loewenstein G (2007) Intertemporal choice–toward an integrative framework. Trends Cogn Sci 11(11):482–488.

Bowen S, Witkiewitz K, Dillworth TM, Chawla N, Simpson TL, Ostafin BD, Larimer ME, Blume AW, Parks GA, Marlatt GA (2006) Mindfulness meditation and substance use in an incarcerated population. Psychology of addictive behaviors : journal of the Society of Psychologists in Addictive Behaviors 20(3):343–347.

Britton WB (2019) Can mindfulness be too much of a good thing? the value of a middle way. Current Opinion in Psychology 28:159–165.

Burke CA (2010) Mindfulness-based approaches with children and adolescents: A preliminary review of current research in an emergent field. Journal of Child and Family Studies 19(2):133–144.

Carlson LE, Speca M, Patel KD, Goodey E (2004) Mindfulness-based stress reduction in relation to quality of life, mood, symptoms of stress and levels of cortisol, dehydroepiandrosterone sulfate (dheas) and melatonin in breast and prostate cancer outpatients. Psychoneuroendocrinology 29(4):448–474.

Chiesa A, Calati R, Serretti A (2011) Does mindfulness training improve cognitive abilities? a systematic review of neuropsychological findings. Clinical psychology review 31(3):449–464.

Cottle TJ, Klineberg SL (1974) The present of things future: Explorations of time in human experience (Free Press New York).

Creswell JD (2017) Mindfulness interventions. Annual Review of Psychology 68(1):491–516.

Damasio A (1994) Descartes' error: Emotion, reason, and the human brain (gp putnam's sons).

Davidson RJ, Kabat-Zinn J, Schumacher J, Rosenkranz M, Muller D, Santorelli SF, Urbanowski F, Harrington A, Bonus K, Sheridan JF (2003) Alterations in brain and immune function produced by mindfulness meditation. Psychosomatic medicine 65(4):564–570.

De Paola M, Gioia F (2017) Does patience matter in marriage stability? some evidence from italy. Review of Economics of the Household 15(2):549–577.

Dimidjian S, Segal ZV (2015) Prospects for a clinical science of mindfulness-based intervention. The American psychologist 70(2):593–620.

Durston S, Thomas KM, Yang Y, Ulug AM, Zimmerman RD, Casey B (2002) A neural basis for the development of inhibitory control. Developmental science 5(4):F9–F16.

Farb NAS, Segal ZV, Mayberg H, Bean J, McKeon D, Fatima Z, Anderson AK (2007) Attending to the present: mindfulness meditation reveals distinct neural modes of self-reference. Social cognitive and affective neuroscience 2(4):313–322.

Fjorback LO, Arendt M, Ornbøl E, Fink P, Walach H (2011) Mindfulness-based stress reduction and mindfulness-based cognitive therapy: a systematic review of randomized controlled trials. Acta psychiatrica Scandinavica 124(2):102–119.

Foster D (2016) Is mindfulness making us ill. https://www.theguardian.com/lifeandstyle/2016/jan/ 23/is-mindfulness-making-us-ill, note = Accessed: 27th May 2020.

Frederick S, Loewenstein G, O'Donoghue T (2002) Time discounting and time preference: A critical review. Journal of Economic Literature 40(2):351–401.

Good DJ, Lyddy CJ, Glomb TM, Bono JE, Brown KW, Duffy MK, Baer RA, Brewer JA, Lazar SW (2015) Contemplating mindfulness at work: An integrative review. Journal of Management 42(1):114–142.

Hafenbrack AC, Kinias Z, Barsade SG (2014) Debiasing the mind through meditation: mindfulness and the sunk-cost bias. Psychological science 25(2):369–376.

Hanh TN (2010) Peace is every step: The path of mindfulness in everyday life (Random House).

Hendrickson KL, Rasmussen EB (2013) Effects of mindful eating training on delay and probability discounting for food and money in obese and healthy-weight individuals. Behaviour research and therapy 51(7):399–409.

Hendrickson KL, Rasmussen EB (2017) Mindful eating reduces impulsive food choice in adolescents and adults. Health psychology: official journal of the Division of Health Psychology, American Psychological Association 36(3):226–235.

Herrnstein RJ (1961) Relative and absolute strength of response as a function of frequency of reinforcement. Journal of the experimental analysis of behavior 4(3):267–272.

Hofmann SG, Sawyer AT, Witt AA, Oh D (2010) The effect of mindfulness-based therapy on anxiety and depression: A meta-analytic review. Journal of consulting and clinical psychology 78(2):169–183.

Johnson DC, Thom NJ, Stanley EA, Haase L, Simmons AN, Shih PAB, Thompson WK, Potterat EG, Minor TR, Paulus MP (2014) Modifying resilience mechanisms in at-risk

individuals: a controlled study of mindfulness training in marines preparing for deployment. The American journal of psychiatry 171(8):844–853.

Kabat-Zinn J (1990) Full catastrophe living: The program of the stress reduction clinic at the university of massachusetts medical center.

Kiken LG, Shook NJ (2011) Looking up: Mindfulness increases positive judgments and reduces negativity bias. Social Psychological and Personality Science 2(4):425–431.

Komlos J, Smith PK, Bogin B (2004) Obesity and the rate of time preference: is there a connection? Journal of biosocial science 36(2):209–219.

Laibson D (1997) Golden eggs and hyperbolic discounting. Quarterly Journal of Economics 112(2):443–477.

Li CsR, Sinha R (2008) Inhibitory control and emotional stress regulation: neuroimaging evidence for frontal limbic dysfunction in psycho-stimulant addiction. Neuroscience and biobehavioral reviews 32:581–597.

Mars TS, Abbey H (2010) Mindfulness meditation practise as a healthcare intervention: A systematic review. International Journal of Osteopathic Medicine 13(2):56–66.

Mason MF, Norton MI, Van Horn JD, Wegner DM, Grafton ST, Macrae CN (2007) Wandering minds: the default network and stimulus-independent thought. Science 315(5810):393–395.

McClure SM, Laibson DI, Loewenstein G, Cohen JD (2004) Separate neural systems value immediate and delayed monetary rewards. Science 306(5695):503–507.

Mischel W, Ayduk O, Berman MG, Casey BJ, Gotlib IH, Jonides J, Kross E, Teslovich T, Wilson NL, Zayas V, Shoda Y (2011) 'willpower' over the life span: decomposing self-regulation. Social cognitive and affective neuroscience 6(2):252–256.

Mischel W, Ebbesen EB (1970) Attention in delay of gratification. Journal of Personality and Social Psychology 16(2):329–337.

Morrison KL, Madden GJ, Odum AL, Friedel JE, Twohig MP (2014) Altering impulsive decision making with an acceptance-based procedure. Behavior therapy 45(5):630–639.

O'Donoghue T, Rabin M (1999) Doing it now or later. American Economic Review 89(1):103–124.

Samuelson M, Carmody J, Kabat-Zinn J, Bratt MA (2007) Mindfulness-based stress reduction in massachusetts correctional facilities. The Prison Journal 87(2):254–268.

Sauer S, Walach H, Schmidt S, Hinterberger T, Lynch S, B¨ussing A, Kohls N (2013) Assessment of mindfulness: Review on state of the art. Mindfulness 4(1):3–17.

Scholten H, Scheres A, de Water E, Graf U, Granic I, Luijten M (2019) Behavioral trainings and manipulations to reduce delay discounting: A systematic review. Psychonomic bulletin & review 26(6):1803–1849.

Shonin DE, Van Gordon W, Griffiths M (2015) Mindfulness in psychology: A breath of fresh air? The Psychologist 28:28–31.

Sibinga EMS, Webb L, Ghazarian SR, Ellen JM (2016) School-based mindfulness instruction: An rct. Pediatrics 137(1).

Stevens JR, Hallinan EV, Hauser MD (2005) The ecology and evolution of patience in two new world monkeys. Biol Lett 1:223–226.

Tang YY, Ma Y, Fan Y, Feng H, Wang J, Feng S, Lu Q, Hu B, Lin Y, Li J, Zhang Y, Wang Y, Zhou L, Fan M (2009) Central and autonomic nervous system interaction is altered by short-term meditation. Proceedings of the National Academy of Sciences of the United States of America 106(22):8865–8870.

Tang YY, Ma Y, Wang J, Fan Y, Feng S, Lu Q, Yu Q, Sui D, Rothbart MK, Fan M, Posner MI (2007) Short-term meditation training improves attention and self-regulation. Proceedings of the National Academy of Sciences 104(43):17152–17156.

Walach H, Ferrari MLG, Sauer S, Kohls N (2012) Mind-body practices in integrative medicine. Religions 3(1):50–81.

Wang L, He CZ, Yu YM, Qiu XH, Yang XX, Qiao ZX, Sui H, Zhu XZ, Yang YJ (2014) Associations between impulsivity, aggression, and suicide in chinese college students. BMC Public Health 14:551.

Witek-Janusek L, Albuquerque K, Chroniak KR, Chroniak C, Durazo-Arvizu R, Mathews HL (2008) Effect of mindfulness based stress reduction on immune function, quality of life and coping in women newly diagnosed with early stage breast cancer. Brain, behavior, and immunity 22(6):969–981.

Yao YW, Chen PR, Li CsR, Hare TA, Li S, Zhang JT, Liu L, Ma SS, Fang XY (2017) Combined reality therapy and mindfulness meditation decrease intertemporal decisional impulsivity in young adults with internet gaming disorder. Computers in Human Behavior 68:210–216.

Appendix A: Experiment 1

A.1. Tasks

A.1.1. Specific Instructions mindfulness condition Ahora vas a pasar unos 15 minutos haciendo un ejercicio relacionado con tu respiración. Cuando acabes de leer estas instrucciones, inicia el archivo de audio que hay debajo (dándole al botón de "play") y utiliza tus auriculares para escucharlo. El audio te guiará en el ejercicio. Una vez inicies el audio, por favor sigue las instrucciones que éste te vaya dando lo mejor posible y no lo interrumpas hasta el final. No saltes tampoco adelante o atrás en el audio y deja que siga su curso. Cuando acabes, espera a que te demos el código que necesitas para continuar.

Por favor haz el ejercicio y espera a que te demos el código que necesitas para continuar.

A.1.2. Specific Instructions mind-wandering condition Ahora vas a pasar unos 15 minutos haciendo un ejercicio relacionado con tu pensamiento. Cuando acabes de leer estas instrucciones, inicia el archivo de audio que hay debajo (dándole al botón de "play") y utiliza tus auriculares para escucharlo. El audio te guiará en el ejercicio. Un vez inicies el audio, por favor sigue las instrucciones que éste te vaya dando lo mejor posible y no lo interrumpas hasta el final. No saltes tampoco adelante o atrás en el audio y deja que siga su curso. Cuando acabes, espera a que te demos el código que necesitas para continuar.

Por favor haz el ejercicio y espera a que te demos el código que necesitas para continuar.

A.1.3. Decision Instructions for all conditions Ahora tendrás que responder a una serie de decisiones que se te van a presentar. Por favor lee cuidadosamente cada una de ellas y responde lo que crees que harías en este momento si la decisión fuese de verdad. Dale al botón que hay debajo para empezar.

A.1.4. Manipulation check items Cómo de acuerdo estás con las afirmaciones que aparecen debajo. Por favor responde utilizando las escalas proporcionadas:

	Muy poco o nada				Mucho
1. Durante los últimos 15 minutos, he estado mayormente absorto en el momento presente.	1	2	3	4	5
2. Durante los últimos 15 minutos, he estado centrado en las sensaciones físicas de mi cuerpo.	1	2	3	4	5

Ahora sitúate en la escala que hay debajo:

3. Durante los últimos 15 minutos, he estado.

Absorto en el presente				Divagando libremente
1	2	3	4	5

Cuando hayas respondido, haz click en el botón que hay debajo para continuar.

A.1.5. Task 1 Imagina que tuvieses que elegir entre los dos activos (A y B) que se muestran a continuación, los cuales te darían distintas cantidades de dinero en distintos momentos del tiempo. Cuál de los dos escogerías?

- Activo A: Da **200€ hoy**
- Activo B: Da **220€** dentro de **4 semanas**

Cuando hayas tomado tu decisión, dale al botón que hay debajo para continuar.

A.1.6. Task 2 Imagina que tuvieses que elegir entre los dos activos (A y B) que se muestran a continuación, los cuales te darían distintas cantidades de dinero en distintos momentos del tiempo. Cuál de los dos escogerías?

- Activo A: Da **200€** dentro de **12 semanas**
- Activo B: Da **220€** dentro de **16 semanas**

Cuando hayas tomado tu decisión, dale al botón que hay debajo para continuar.

A.1.7. Task 3 Imagina que tuvieses que elegir entre los dos activos (A y B) que se muestran a continuación, los cuales te darían distintas cantidades de dinero en distintos momentos del tiempo. Cuál de los dos escogerías?

- Activo A: Da **200€ hoy**
- Activo B: Da **250€** dentro de **4 semanas**

Cuando hayas tomado tu decisión, dale al botón que hay debajo para continuar.

A.1.8. Task 4 Imagina que tuvieses que elegir entre los dos activos (A y B) que se muestran a continuación, los cuales te darían distintas cantidades de dinero en distintos momentos del tiempo. Cuál de los dos escogerías?

- Activo A: Da **200€** dentro de **12 semanas**

- Activo B: Da **250€** dentro de **16 semanas**

Cuando hayas tomado tu decisión, dale al botón que hay debajo para continuar.

Appendix B: Experiment 2

B.1. Tasks

B.1.1. Task 1 Imagina que inesperadamente recibes 10.000€ en una lotería. Imagina que tienes las siguientes dos opciones para asignar todo el dinero.

¿Cómo querrías asignarlo?

- o Gastos en actividades de ocio ☐
- o Ahorro en una cuenta de ahorro a plazo fijo ☐

B.1.2. Task 2 Imagina que al graduarte consigues tu primer trabajo y ganas 2.000€ netos al mes. Por favor, asigna el dinero que dedicarías al mes a estas categorías:

- o Cuenta de ahorro a plazo fijo ☐
- o Plan de pensiones ☐
- o Alquiler y gastos de vivienda ☐
- o Ocio ☐
- o Comida ☐
- o Otros ☐

B.1.3. Task 3 Estas considerando comprar un coche pero únicamente tienes ahorrado la mitad del dinero necesario. Tienes dos opciones: 1) pedir prestado el dinero restante al banco y poder disfrutar ya del coche, por lo que tendrías pagar un interés de 1.000€ en los próximos 2 años; 2) esperar 2 años hasta que hayas ahorrado lo suficiente para poder tener el coche y no pagar ningún interés. ¿Qué opción eliges?

- o Pedir prestado el dinero
- o Ahorrar el dinero

Appendix C: Experiment 3

C.1. Common Instructions

C.1.1. First Part Gracias por participar en este experimento del BES Lab (Behavioral and Experimental Sciences Laboratory, Universitat Pompeu Fabra).

En este experimento tendrás que realizar varias tareas distintas que se te irán explicando conforme vayas avanzando. La duración total debería ser de menos de 40 minutos. Al final recibirás un pago de 8 euros por participar en el experimento y seguir las instrucciones correctamente.

Si tienes alguna duda durante el experimento, pregunta por favor a la persona a cargo de la sesión experimental. Haz click en el botón que hay debajo para empezar.

C.1.2. Second Part Ahora vas a tomar una serie de decisiones en las que siempre tendrás 2 opciones disponibles. Las opciones proporcionarían distintas cantidades de dinero en distintos momentos del tiempo. Escoge en cada decisión la opción que preferirías escoger en este momento si las decisiones fuesen reales.

En esta tarea puedes obtener un pago adicional al de participación. El pago se determinará de la siguiente manera. Hoy, después de la sesión, seleccionaremos aleatoriamente a una de las personas participantes y también una de las decisiones que ha tomado esa persona. La persona seleccionada recibirá como pago adicional lo que haya escogido en la decisión seleccionada en el momento del tiempo indicado. El pago se efectuará mediante un cheque regalo de Amazon.es por el importe y en el plazo elegidos, que será enviado por email al participante. Por tanto, cualquiera de las decisiones que tomes puede ser la que determine tu pago adicional. Haz click en el botón "Avanzar" para empezar con las decisiones de esta parte.

¿Qué opción preferirías?

- o 27,10 euros dentro de 2 semanas
- o 27,10 euros dentro de 6 semanas

¿Qué opción preferirías?

- o 0,16 euros hoy
- o 34,04 euros dentro de 6 semanas

¿Qué opción preferirías?

- o \${lm://Field/1} euros \${lm://Field/3}[17]
- o \${lm://Field/2} euros \${lm://Field/4}

C.2. Specific Mindfulness Condition Instructions

Este es un test para verificar que el audio de tu ordenador y tus auriculares funcionan correctamente. Por favor, escribe abajo lo que está haciendo la persona en la pista de audio. Si no escuchas el audio correctamente levanta la mano y acudiremos a ayudarte.

Ahora vas a pasar unos 15 minutos haciendo un ejercicio relacionado con tu respiración. Cuando acabes de leer estas instrucciones, inicia el archivo de audio que hay debajo (dándole al botón de "play") y utiliza tus auriculares para escucharlo. El audio te guiará en el ejercicio. Una vez inicies el audio, por favor sigue las instrucciones que éste te vaya dando lo mejor posible y no lo interrumpas hasta el final. No saltes tampoco adelante o atrás en el audio y deja que siga su curso. Cuando acabes, pulsa el botón de continuar.

C.3. Specific Mind-wandering Condition Instructions

Este es un test para verificar que el audio de tu ordenador y tus auriculares funcionan correctamente. Por favor, escribe abajo lo que está haciendo la persona en la pista de audio. Si no escuchas el audio correctamente levanta la mano y acudiremos a ayudarte.

Ahora vas a pasar unos 15 minutos haciendo un ejercicio relacionado con tu respiración. Cuando acabes de leer estas instrucciones, inicia el archivo de audio que hay debajo (dándole al botón de "play") y utiliza tus auriculares para escucharlo. El audio te guiará en el ejercicio. Una vez inicies el audio, por favor sigue las instrucciones que éste te vaya dando lo mejor posible y no lo interrumpas hasta el final. No saltes tampoco adelante o atrás en el audio y deja que siga su curso. Cuando acabes, pulsa el botón de continuar.

[17] This is an automatic function that displays in a random order the next 40 choices. The complete list of choices will be provided later in this annex.

C.4. Intertemporal choice task items

List of Choices

Trial	Early delay	Late delay	% of Early over Late	Early reward	Late reward
1	2 weeks	6 weeks	0%	27,10	27,10
2	today	6 weeks	n.a.	0,16	34,04
3	today	2 weeks	1%	21,53	21,75
4	today	2 weeks	3%	24,45	25,19
5	today	2 weeks	5%	21,49	22,57
6	today	2 weeks	10%	31,70	34,87
7	today	2 weeks	15%	30,45	35,02
8	today	2 weeks	25%	27,12	33,91
9	today	2 weeks	35%	18,12	24,46
10	today	2 weeks	50%	27,61	41,41
11	today	4 weeks	1%	16,75	16,92
12	today	4 weeks	3%	6,34	6,53
13	today	4 weeks	5%	19,77	20,76
14	today	4 weeks	10%	20,23	22,25
15	today	4 weeks	15%	23,11	26,58
16	today	4 weeks	25%	18,83	23,54
17	today	4 weeks	35%	17,86	24,10
18	today	4 weeks	50%	23,43	35,14
19	2 weeks	4 weeks	1%	33,20	33,53
20	2 weeks	4 weeks	3%	16,85	17,35
21	2 weeks	4 weeks	5%	10,43	10,95
22	2 weeks	4 weeks	10%	28,93	31,83
23	2 weeks	4 weeks	15%	17,48	20,10
24	2 weeks	4 weeks	25%	14,59	18,24
25	2 weeks	4 weeks	35%	27,56	37,21
26	2 weeks	4 weeks	50%	14,50	21,75
27	2 weeks	6 weeks	1%	14,94	15,09
28	2 weeks	6 weeks	3%	16,44	16,93
29	2 weeks	6 weeks	5%	23,05	24,20
30	2 weeks	6 weeks	10%	11,94	13,13
31	2 weeks	6 weeks	15%	34,29	39,44
32	2 weeks	6 weeks	25%	20,70	25,88
33	2 weeks	6 weeks	35%	11,79	15,92
34	2 weeks	6 weeks	50%	28,79	43,19
35	4 weeks	6 weeks	1%	30,49	30,80
36	4 weeks	6 weeks	3%	5,13	5,28
37	4 weeks	6 weeks	5%	25,12	26,37
38	4 weeks	6 weeks	10%	24,05	26,45
39	4 weeks	6 weeks	15%	5,60	6,44
40	4 weeks	6 weeks	25%	16,59	20,73
41	4 weeks	6 weeks	35%	20,84	28,13
42	4 weeks	6 weeks	50%	6,70	10,05

Appendix D: Experiment 4

D.1. Common information sheet

Universitat Pompeu Fabra

Departamento de Economía y Empresa
Universitat Pompeu Fabra
Barcelona, Ramon Trias Fargas 25-27, 08005
Teléfono: 93.542.2000
Fax: 93.542.2002

Título del Proyecto de Investigación: Estudio en el Instituto EsMindfulness

Investigadores: Josep Gisbert Rodriguez, UPF josep.gisbert@upf.edu; Dr. Natalia Karelaia, INSEAD natalia.karelaia@insead.edu; Dr. Andrés Martín Asuero, Instituto EsMindfulness andres.martin@esmindfulness.com; Dr. Daniel Navarro Martinez, UPF daniel.navarro@upf.edu; Dr. Jordi Quoidbach, UPF jordi.quoidbach@upf.edu.

Introducción y Propósito: Agradeceríamos tu participación en este proyecto de investigación, dedicado a entender los efectos del Curso MBSR (Reducción del Estrés Basada en Mindfulness) en sus participantes.

Desarrollo del Estudio: El estudio constará de dos partes. Si accedes a participar, la primera parte la contestarás hoy; la segunda al finalizar el curso. En ambas partes deberás simplemente contestar lo más sinceramente posible una serie de preguntas. No prevemos ningún tipo de riesgos ni problemas derivados de la participación en el estudio. Cada parte durará aproximadamente 10 minutos.

Confidencialidad: Toda la información que proporciones será estrictamente confidencial. Esta hoja de consentimiento es el único documento que contendrá la información con tus datos identificativos; la hoja será almacenada en un armario con cerradura en una oficina de la Universitat Pompeu Fabra. Todas las otras respuestas serán codificadas numéricamente y el acceso a ellas estará limitado a los investigadores mencionados en este documento. Los resultados de este estudio pueden ser usados en la tesis doctoral de Josep Gisbert Rodriguez.

Remuneración: Este estudio no será remunerado económicamente. Sin embargo, una vez completada la segunda parte se entregará a cada participante que la haya completado una copia del libro de Andrés Martín Asuero *Plena Mente: Mindfulness o el Arte de Estar Presente* como agradecimiento por su colaboración.

Información de Contacto: Este estudio será llevado a cabo por los investigadores presentados en el primer párrafo de este documento. Por favor contacta con Josep Gisbert Rodriguez a través de josep.gisbert@upf.edu si tienes alguna pregunta sobre el estudio.

Consentimiento: La participación en el estudio es completamente voluntaria por lo que puedes retirar tu consentimiento en cualquier momento en que lo desees y por cualquier razón. Si participas o no, o completas o no el estudio, no tendrá efecto alguno en tu trato en el resto del Curso MBSR (Reducción del Estrés Basada en Mindfulness).

Puedes preguntar cualquier duda que tengas durante el transcurso del estudio. Intentaremos responder a tus preguntas lo mejor posible, de manera que entiendas el desarrollo del estudio en todo momento. Al firmar este documento estas indicando que aceptas participar en el estudio y reconoces haber recibido una copia de este formulario de consentimiento.

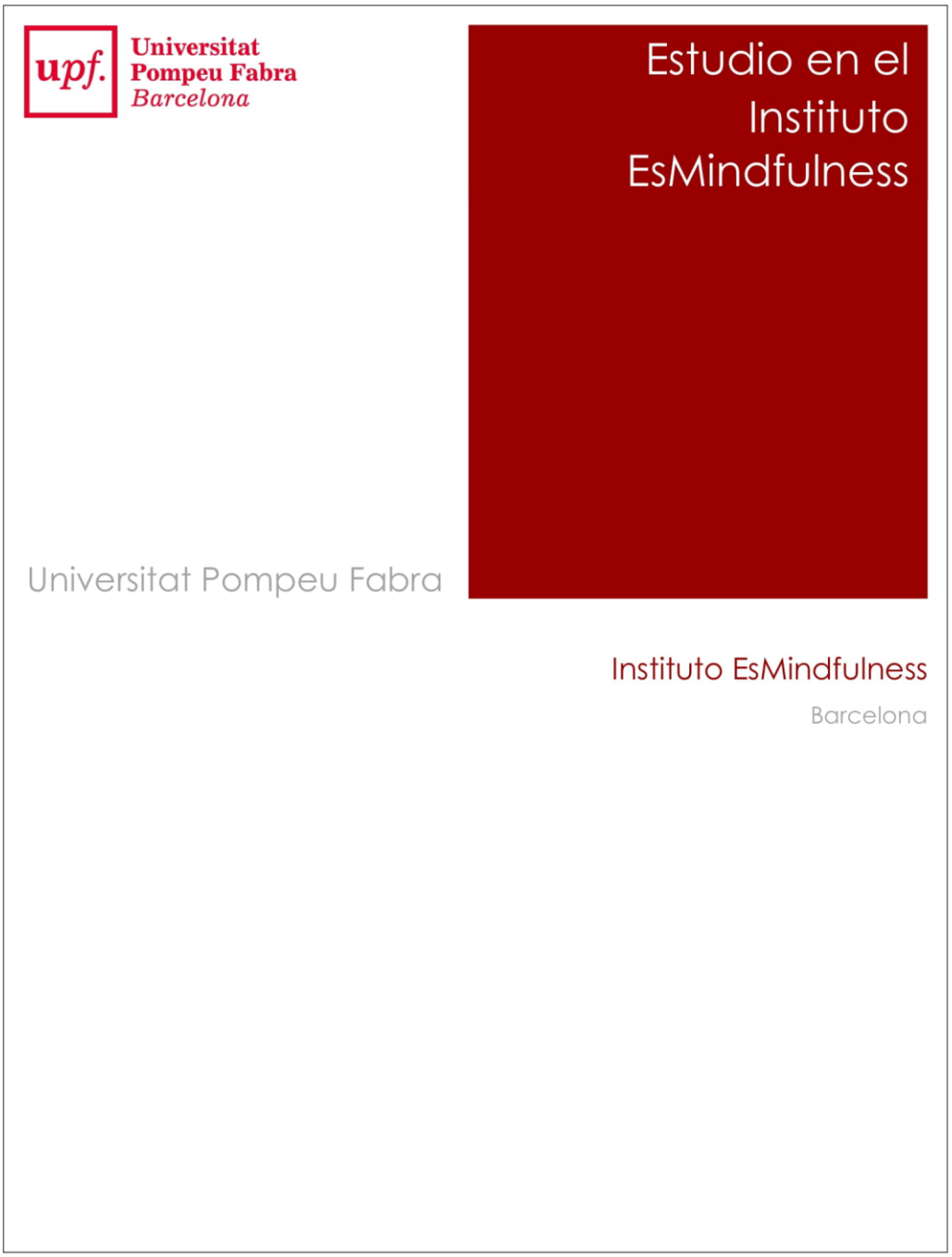
Nombre del Participante: _____ Fecha de hoy: _____

Firma del Participante: _____

Email del Participante: _____

Formulario de consentimiento Página 1 de 1 Versión: Enero, 2016

D.2. Task booklet



Estudio en el
Instituto EsMindfulness

INSTRUCCIONES:

En las siguientes páginas tendrás que responder a una serie de decisiones que se te van a presentar (una por página). Por favor lee cuidadosamente cada una de ellas y responde lo que crees que harías en este momento si la decisión fuese de verdad. En la parte final tendrás que responder también a un cuestionario. El tiempo total debería ser inferior a 15 minutos.

Pasa a la siguiente página del folleto para empezar.

Estudio en el
Instituto EsMindfulness

DECISIÓN 13:

Imagina que tuvieses que elegir entre los dos activos (A y B) que se muestran a continuación, los cuales te darían distintas cantidades de dinero en distintos momentos del tiempo. Cuál de los dos escogerías? (Marca con una X la casilla correspondiente)

☐ Activo A: Da **200€ hoy**

☐ Activo B: Da **220€** dentro de **4 semanas**

Estudio en el
Instituto EsMindfulness

DECISIÓN 14:

Imagina que tuvieses que elegir entre los dos activos (A y B) que se muestran a continuación, los cuales te darían distintas cantidades de dinero en distintos momentos del tiempo. Cuál de los dos escogerías? (Marca con una X la casilla correspondiente)

☐ Activo A: Da **200€** dentro de **12 semanas**

☐ Activo B: Da **220€** dentro de **16 semanas**

Estudio en el
Instituto EsMindfulness

DECISIÓN 15:

Imagina que tuvieses que elegir entre los dos activos (A y B) que se muestran a continuación, los cuales te darían distintas cantidades de dinero en distintos momentos del tiempo. Cuál de los dos escogerías? (Marca con una X la casilla correspondiente)

☐ Activo A: Da **200€ hoy**

☐ Activo B: Da **250€** dentro de **4 semanas**

Estudio en el
Instituto EsMindfulness

DECISIÓN 16:

Imagina que tuvieses que elegir entre los dos activos (A y B) que se muestran a continuación, los cuales te darían distintas cantidades de dinero en distintos momentos del tiempo. Cuál de los dos escogerías? (Marca con una X la casilla correspondiente)

☐ Activo A: Da **200€** dentro de **12 semanas**

☐ Activo B: Da **250€** dentro de **16 semanas**

Estudio en el
Instituto EsMindfulness

- Para acabar, por favor proporciónanos la siguiente información.

1) Cuál es tu edad? (por favor escríbela en la casilla que hay debajo)

Edad: ☐

2) Cuál es tu género? (Marca con una X la casilla correspondiente)

☐ Mujer ☐ Hombre