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Meditation Experience and Mindfulness Are Associated with Reduced Self-Reported Mind-Wandering in Meditators—A German Version of the Daydreaming Frequency Scale

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Received: 27 March 2019; Accepted: 6 May 2019; Published: 9 May 2019

Abstract: Mind-wandering or daydreaming can be described as spontaneous thoughts that are independent of the task at hand and the current sensory information. Mindfulness, defined as the ability to focus on the present moment with an accepting attitude towards the present experience, is considered to be the opposite of mind-wandering. We aimed at assessing how long-term meditation practice influences mind-wandering in everyday life and to which extent mind-wandering and self-reported aspects of mindfulness are conceptually linked. We first investigated the factorial structure of a German version of the Daydreaming Frequency Scale (DDFS) in a student population. Then we applied this version in meditators to a) investigate the relationship between meditation experience and reported levels of mind-wandering in daily life and b) explore how different facets of mindfulness, assessed with the Freiburg Mindfulness Inventory (FMI), relate to mind-wandering. Using a correlational design, we show that, among meditators, more meditation practice in years accounts for less self-reported mind-wandering in daily life. There was a negative association between mindfulness (FMI) and mind-wandering (DDFS). Our results provide evidence for clarifying the relationship between, meditation experience, mindfulness and mind-wandering and further validate the use of the FMI as a sensitive tool for assessing a two-factor structure of mindfulness.

Keywords: daydreaming; mind-wandering; mindfulness; meditation; parallel analysis; confirmatory analysis

1. Introduction

A mental characteristic exclusive to humans is the tendency to unintentionally drift away from the present experience. Mind-wandering, a cognitive phenomenon related to this tendency, refers to spontaneously generated thoughts of which the contents are unrelated to the task at hand and independent of any present stimulus [1]. Even if the appearance of these particular thoughts seems to be strongly dependent on the response options provided, they may cover an important part of our conscious experience [2–4]. Given their frequent occurrence in daily life, mind-wandering can be a hindrance when ongoing focused attention is required. Researchers have begun to examine the processes underlying mind-wandering (for reviews see References [5,6]), while a theoretically related area of research has investigated the ability to mindfully focus attention on the current experience [7]. In line with a recent contemplative model of cognition [8], the propensity to engage in unintended thoughts can be reduced by meditation. According to this model, the integrative functioning of three attention-related processes (i.e., intended attention, attention to intention, and awareness of present-moment transient information), while meditating, may lessen distractibility. Most meditation practices, including mindfulness, are thought to shut out distractions and to cultivate awareness and attentional control [9]. Mind-wandering, essentially described as shifting away from the relevant task towards unrelated thoughts [5], contrasts directly with mindfulness, which is positioned at the antithetical edge in the attentional continuum [10].

One important issue concerning the relationship between mindfulness and mind-wandering pertains to how training in mindfulness meditation reduces mind-wandering. Including diverse meditation techniques, experience sampling studies have shown that both intensive [11] and non-intensive training [12] are effective tools for reducing mind-wandering and enhancing the focus of attention. Other studies have provided empirical evidence that even brief mindfulness exercises can weaken indirect indicators of mind-wandering during a sustained-attention task [13–15]. For example, Mrazek et al., (2012) [13] compared the influence of an 8-minute mindful-breathing task to passive relaxation and a reading condition. They found that the 8-minute mindful-breathing exercise reduced the number of errors on the Sustained Attention to Response Task (SART), which correlates with self-reported levels of mind-wandering in daily life [16] and with probe-caught and self-caught mind-wandering [13]. Probe-caught methods involve interrupting a person in a particular situation to ask whether they are currently mind-wandering or focused on the task at hand. Self-caught approaches consist of reporting mind-wandering episodes whenever individuals notice that they have drifted away from the current task [17]. The contrasting nature of these constructs has been corroborated by results showing that mindfulness and mind-wandering states are associated with different patterns of activity and functional connectivity in brain areas related to the default-mode network (DMN) [18–21]. In these studies, meditators reporting less mind-wandering than non-meditators also showed reduced DMN activity compared to control participants. These findings suggest that formal training in mindfulness helps curtail the disruptive effects of mind-wandering by fostering attention to the task at hand and avoid distraction from the here and now.

Although recent work demonstrates that mindfulness training is one effective technique for reducing mind-wandering [11,13,14], the underlying mechanisms leading to these effects are less clear. Researchers addressing this question have focused their investigations on a multi-factor construct of mindfulness which not only emphasizes the ability to maintain the focus of attention on the present experience, but also a state of curiosity, openness, and acceptance towards the immediate experience [22]. Rahl et al. (2017) [15] recently compared participants assigned to 20 mins attention-monitoring mindfulness training plus acceptance or to equivalent mindfulness training without the acceptance component. They found a significant reduction in mind-wandering as assessed with the SART after the mindfulness-training program including acceptance compared with the training without acceptance. The authors concluded that acceptance may be a critical component of mindfulness training [23] that enables enhanced on-task attention through the modulation of emotions [24]. Meditators increased capacity to accept arising thoughts nonjudgmentally (avoiding related emotions and inner dialogues) [25] may minimize their negative emotional impact [26] and improve attentional skills.

Although acceptance (an ingredient of mindfulness training) has been demonstrated to reduce mind-wandering [15], how different facets of trait-mindfulness are associated with reported levels of mind-wandering is still uncertain. Mindfulness is not only mental training or a state, but also a personality trait [27]. Research in trait-mindfulness has revealed associations between the mindfulness construct, self-reported mind-wandering, and indirect measures of mind-wandering through a specific computerized task [13,16,28–31]. Individuals with higher levels of dispositional mindfulness have a lower tendency to mind-wander. However, little attention has been paid to the influence of facets of trait-mindfulness on mind-wandering.

We addressed this issue by dismantling trait-mindfulness in a two-factor structure as assessed with the Freiburg Mindfulness Inventory (FMI). We assessed the relationship between trait-mindfulness and self-reported levels of mind-wandering in daily life. The FMI is a widely used measure of trait-mindfulness as a multifaceted construct. The factors on this scale (i.e., acceptance and presence) are differently sensitive to anxiety and depression; the negative relationship between trait-mindfulness and anxiety and depression is mainly explained by the factor acceptance [32]. The FMI questionnaire has been frequently applied in meditators and is considered to be an effective tool for differentiating them from other individuals [33]. We have identified no previous study which has investigated how facets of trait-mindfulness relate to self-reported measures of mind-wandering in experienced mindfulness meditators. Another unaddressed question is whether meditation experience affects levels of self-reported mind-wandering in daily life. Investigators recently compared a group of experienced meditators to a group of inexperienced meditators. They conducted an experience-sampling study where the sampling probes were embedded in the meditation session. They found that experienced meditators reported less mind-wandering compared to the inexperienced group [34]. We aimed to clarify the association between these opposing constructs by exploring the relationship between mindfulness meditation experience and levels of self-reported mind-wandering in daily life.

Although extensive research has been carried out on mind-wandering [35], no validated instrument exists in the German language to assess how often individuals experience mind-wandering in daily life. The first part of this study (Study A) was devoted to validating the German version of the Daydreaming Frequency Scale [36] (DDFS), which has been related to measures of trait-mindfulness [13,37] and to probed-caught and self-caught mind-wandering during a mindfulness breathing exercise [13]. In the second part (Study B), we used the validated German version of the DDFS and conducted a series of correlations to a) investigate the relationship between meditation experience and reported levels of mind-wandering in daily life and b) explore how different facets of mindfulness as assessed with the Freiburg Mindfulness Inventory (FMI) relate to self-reported mind-wandering.

2. Materials and Methods: Study A

The aim of Study A was to validate the German version of the DDFS. We first examined the factorial structure of the scale using a principal-component analysis followed by a confirmatory factor analysis.

2.1. Participants

Study A included 357 German-speaking individuals (sample A: n = 100; 52 women; sample B: n = 99; 88 women; samples C: mindfulness meditators; n = 94; 53 women, and D: meditators from different traditions; n = 64; 43 women). Participants in sample A were recruited by advertisements on online platforms for student jobs at the University of Freiburg and by word of mouth; participants in sample B were recruited in a seminar at the Catholic University of Applied Sciences in Freiburg, Germany (see Table 1 for more detailed sample properties). Participants from samples C and D were recruited by advertisement in meditation centers, on online platforms for student jobs at the University of Freiburg in Germany and by word of mouth. Individuals did not report any history of neurological or psychiatric disorders in a self-reported checklist which was created for this study. Participants in sample A received 10 Euros for taking part in the study; participants from sample B participated voluntarily without any financial compensation. Participants from samples C and D received financial compensation (sample C, €50; sample D, €25) for volunteering in the studies. All participants signed a written informed consent obtained prior to data collection. The study was approved by the local Ethics Committees (samples A and B) and by the Ethics Committee of the German Society of Psychology (samples C and D).

Table 1. The properties of the investigated variables in samples A, B, C and D.

Variable	Mean (SD)	Range
Sample A (n = 100)		
Age (years)	23.91 (3.37)	18–37
Education level (0–4)	3 (.60)	2–4
DDFS total score	36.52 (8.14)	20–56
Sample B (n = 99)		
Age (years)	24.26 (5.82)	20–58
Education level (0–4)	3 (0)	3
DDFS total score	39.36 (7.22)	20–53
Sample C (n = 94)		
Age (years)	25.22 (3.69)	18–35
Education level (0–4)	3 (.51)	2–4
Years of meditation experience	3 (2.51)	0.08–10
DDFS total score	37.72 (8.06)	15–56
Trait-mindfulness (FMI)		
Acceptance	23.45 (3.03)	16–30
Presence	18.27 (3.26)	13–42
Total score	41.46 (4.32)	33–53
Sample D (n = 64)		
Age (years)	43.40 (14.26)	20–77
Education level (0–4)	3 (.36)	2–4
Years of meditation experience	16.65 (12.28)	2.7–46
DDFS total score	33.43 (9.72)	13–52

Education level: 0 = lower primary education (Grundschule), 1 = upper primary education (Hauptschule), 2 = lower secondary education (Hauptschule), 3 = upper secondary education (Gymnasium), and 4 = university degree (Hochschule).

2.2. Instruments

Daydreaming Frequency Scale: The Daydreaming Frequency Scale (DDFS) is part of the Imaginal Process Inventory [38] (IPI), which is a 344-item questionnaire assessing an individual's internal mental state. In the present study, we used a shortened 12-item version of the original DDFS [36,37,39] that was translated into German (Supplementary Materials) using a back-translation method. Four independent translators (German–English) were involved in the translation process. The 12 items in the English original DDFS were first translated into German by two native-German speakers. The two German versions were then compared, and the discrepancies between them were debated and clarified, resulting in a unique version. Two native-English speakers then translated the German version back into English. The original English version and the back-translated English version were compared, and the differences between them were discussed and modified until an adequate solution was found. Afterward, the German version was adjusted according to the translators' suggestions. Participants were asked to respond to the 12-item scale, which assesses how much they daydream in everyday life on a five-point Likert-scale. The final German questionnaire can be found in the Supplementary Materials.

2.3. Procedure

Participants in samples A and B completed the DDFS among a series of questionnaires. Participants in sample A also performed psychophysical tasks (i.e., a computerized visual duration reproduction task and visual asynchrony task), and were subjected to electrocardiogram resting-state recordings after filling in the questionnaire. After filling in the DDFS, participants in sample B underwent a Depth Relaxation Music Therapy (DRMT) session or attended a seminar. Individuals in sample B filled out the DDFS again a week later to examine the test-retest reliability. Details concerning the study procedures for samples A and B can be found in Wittmann et al. (2017) [40] and Pfeifer et al. (2019) [41], respectively. Participants from samples C and D also completed the DDFS along with a series of questionnaires. Among others, the FMI questionnaire was filled in by participants from sample C.

After filling in the questionnaires, individuals from both samples performed a large array of tasks (i.e., sample C: metronome task, Necker cube task and visual asynchrony task; sample D: ball drawing test) and were subjected to electrophysiological measures (i.e., heart rate and breathing rate recordings). Details concerning the procedures used can be found elsewhere (sample C in Linares Gutiérrez et al., (submitted) [42]; sample D in Schmidt et al., (2019) [43]). In all samples, the accomplished psychophysiological tasks, electrophysiological recordings, and interventions were not relevant for the aims of the present study (i.e., the validation of the German translation).

2.4. Statistical Analyses

As a first step, the factorial structure of the German version of the DDFS was examined using a principal component analysis (PCA). We conducted a parallel analysis [44,45] (PA) on the total number of participants in sample A (n = 100) to determine the number of factors to be retained. PA is an accurate tool to discriminate significant components and determine which variable loadings significantly correspond to the retained components [46,47]. In this procedure, the eigenvalues from the raw data are compared with those from a random data set that parallels the raw data regarding the number of variables and the sample size. Meaningful factors are those which account for more variance in the research data than in the random dataset [48]. The internal reliability of the scale was assessed using Cronbach's alpha, which is the most popular coefficient of internal consistency [49]; values varying between 0 and 1 and 0.70 are considered to be acceptable [50]. The test-retest reliability was evaluated with Pearson's correlation coefficient r.

The theory-guided validity of the factor structure found was then tested computing a confirmatory factor analysis (CFA) on sample B, C and D (n = 257). The maximum likelihood fitting function was performed on the covariance matrix of the DDFS raw scores. An $\chi 2$ test of significance was conducted to address the model fit; a p-value of $\chi 2$ bigger than 0.05 (a non-significant value) corresponds to an acceptable fit. The $\chi 2$ is known to depend on the sample size [51]; as the sample size increases the difference between the empirical and the model-implied distribution becomes more robust and, thus, significant. Paradoxically, in CFA, this difference should be small enough to attain an acceptable fit [52]. Therefore, it has been suggested to evaluate $\chi 2$ by taking df into account; $0 \leq \chi 2/df \leq 2$ corresponds to a good fit [51]. The descriptive indices of model fit Root Mean Square Error of Approximation (RMSEA), the Standardized Root Mean Square Residual (SRMR), and the Comparative Fit Index (CFI) were also computed. An acceptable fit corresponds to an RMSEA smaller than 0.08 and an SRMR below 0.10, whereas CFI-acceptable values should be greater than 0.95 (for a review see Schermelleh-Engel et al., (2003) [51]). All statistical analyses were performed with IBM SPSS Statistics version 21 except for the CFA, which was computed with Lisrel 9.3 Student Edition [53].

3. Results: Study A

3.1. The Factorial Structure of the German Version of the DDFS

The examination of the scree plot obtained from the PA clearly suggests a one-factor solution (Figure 1); the eigenvalues for the real data are larger than the eigenvalues for the random data. The matrix of the individual factor loadings corresponding to the single-component solution found is presented in Table 2. The test-retest reliability was r = 0.827; the internal reliability using Cronbach's alpha was 0.868, indicating very good internal reliability.

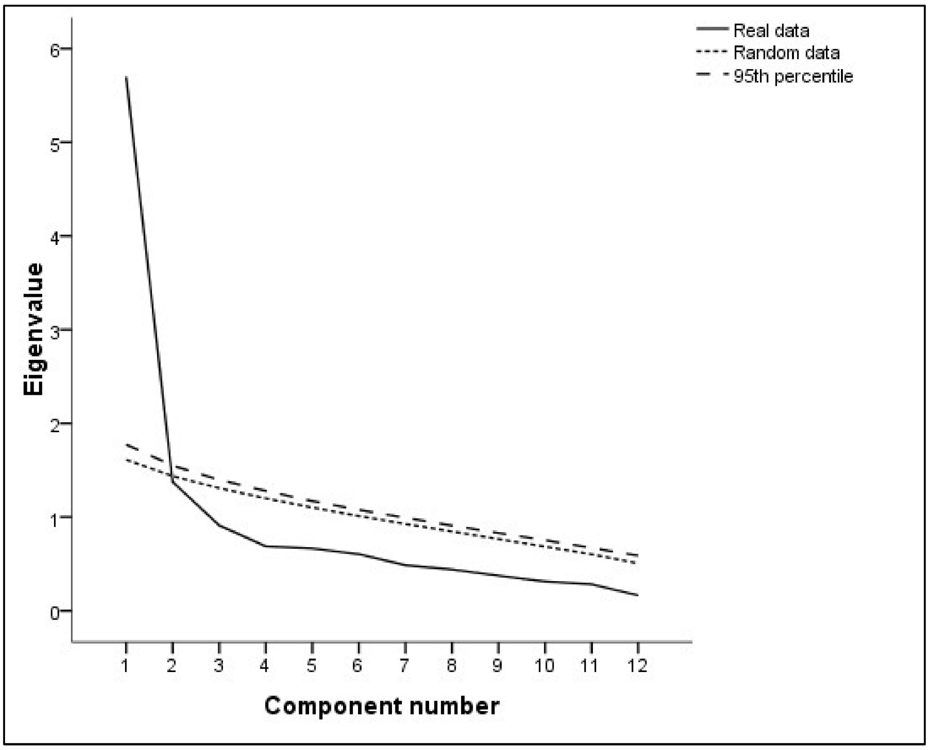

Figure 1. The Scree plot for the principal-component analysis computed on the Daydreaming Frequency Scale (DDFS) items (n = 100, sample A). The curves depict the mean eigenvalues for the real data set, the random data, and upper 95th percentile sets obtained by permutations of the raw data using Castellan's algorithm [54].

Table 2. The matrix of the factor loadings for the principal-component analysis of the German Daydreaming Frequency Scale (DDFS) items (n = 100, sample A; displayed items in original English).

DDFS Items	Factor 1
Explained variance	47.5%
1. I daydream	0.84
2. Daydreams and fantasies make up . . .	0.78
3. As regards daydreaming, I would characterize myself as someone who . . .	0.75
4. I recall or think over my daydreams . . .	0.61
5. When I am not paying attention to some job, book, or TV, I tend to be daydreaming . . .	0.61
6. Instead of noticing events or people in the world around me, I will expend approximately . . .	0.62
7. I daydream at work (or school) . . .	0.62
8. Recalling things from the past, thinking of the future, or imagining unusual kinds of events occupies . . .	0.61
9. I lose myself in active daydreaming	0.77
10. Whenever I have time on my hands, I daydream . . .	0.75
11. When I am at a meeting or show that is not very interesting, I daydream rather than paying attention . . .	0.53
12. On a long bus, train, or airplane ride I daydream . . .	0.69

3.2. Confirmatory Factor Analysis of the DDFS

The resulting uni-factorial structure of the DDFS could not be optimally validated by the CFA. Results indicated that the $\chi 2$ test was significant: $\chi 2$ (54) = 215.78, $p < 0.001$; the $\chi 2$/df value was 3.995. Moreover, we obtained an RMSEA and a CFI above the values required for an acceptable fit (RMSEA = 0.10; CFI = 0.87). Only the SRMR value corresponded to an acceptable fit (SRMR = 0.06). The indices tested are indicative of an unsatisfactory model fit. For models indicating misfits, it has been suggested to examine the standardized residuals as well as the modification indices provided by the CFA [51,52,55]. If one or more standardized residuals are greater than ± 1.96 ($p < 0.05$) or

± 2.58 ($p < 0.01$), and if at least one modification index exceeds 3.84 ($p < 0.05$) or 6.63 ($p < 0.01$), the suggested modification indices should be undertaken by setting the problematic pair of items free. Although such model respecifications are considered to compromise the theoretical basis of the model [56], we followed these suggestions and conducted the CFA by freeing the set of items for which the modification index exceeds 3.84 ($p < 0.05$) or 6.63 ($p < 0.01$); the 11 parameters provided by Lisrel to be modified were above those limits, for instance, Item3-Item1, Item3-Item2, Item6-Item1, Item8-Item3, Item8-Item5, Item8-Item6, Item11-Item2, Item11-Item7, Item12-Item2, Item12-Item10, and Item12-Item11. After model modification, the fit of the model slightly improved. The RMSEA corresponded to an acceptable fit (RMSEA = 0.077) and the $\chi 2$/df and SRMR values decreased (SRMR = 0.044; $\chi 2$/df = 2.529). The CFI did not attain an acceptable fit (CFI = 0.948). Our results exhibit an improvement of a model fit after respecifications of the model. Acceptable CFA criteria were attained for all indices excepted for the CFI.

4. Materials and Methods: Study B

In study B, we first examined whether the average mind-wandering frequency in non-meditators (samples A and B) differed from the average mind-wandering levels in meditators (samples C and D). Since previous research has demonstrated that even brief meditation training diminishes mind-wandering [13], we expected that the frequency of self-reported mind-wandering would be lower in meditators than in non-meditators. We further explored the relationship between mind-wandering and meditation experience (samples C and D). In light of findings showing that meditation expertise reduces trait mind-wandering [34], we hypothesized that meditation experience would be negatively related to levels of self-reported mind-wandering. We also tested the effects of age on mind-wandering in meditators (samples C and D); mind-wandering, as measured with the DDFS, has been reported to decrease with age [37]. Next, we examined the relationship between dimensions of mindfulness and mind-wandering (Sample C). Recent evidence has shown that the conceptual component of acceptance within mindfulness meditation training plays a crucial role in coping with the disruptive effects of mind-wandering [15]. Therefore, we expected that acceptance, as a component of trait-mindfulness, may be related to lower levels of mind-wandering in daily life.

4.1. Participants

Only participants from samples C and D took part in Study B. The characteristics of these samples can be found in the Methods section from study A and in Table 1.

4.2. Instruments

Daydreaming Frequency Scale: The characteristics of this scale can be found in the Methods section of Study A.

Freiburg Mindfulness Inventory-14: The FMI-14 [57] is a measure of self-reported mindfulness. The questionnaire contains 14 items assessing two dimensions with the factor presence and the factor acceptance [32]. The factor presence indicates an individual's capacity to be in the present moment ("I feel connected to my experience in the here-and-now"), and the factor acceptance describes a non-judgmental attitude ("I am able to smile when I notice how I sometimes make life difficult"). Scores are obtained using a 4-point scale ranging from 'rarely' to 'almost always'. The FMI is a psychometrically validated instrument which has been validated on the basis of classical test theory and Rasch analysis [58,59].

4.3. Procedure

Only participants from sample C and D took part in study B. The details for the procedure can be found in the Methods section from Study A.

4.4. Statistical Analyses

In Study B, we first conducted a series of independent-sample t-tests to compare age, gender, educational level and DDFS total score between non-meditators (groups A and B) and meditators (groups C and D). Then, an ANCOVA comparing the DDFS total score between non-meditators and meditators was performed to partial out the potential effects of covariates. A correlation analysis to assess the relationship between daydreaming, meditation experience, and age (samples C and D) was carried out. We additionally conducted a partial correlation analysis to assess whether this relationship remained significant after controlling for the influence of age. A further correlation analysis was performed to examine the relationship between daydreaming and self-reported mindfulness (Sample C); again a partial correlation controlling for age effects was performed. We carried out a test of significance on the difference of correlation coefficients between the sub-scales of the FMI and the DDFS total score, respectively [60].

5. Results: Study B

Mean values and standard deviations for age, years of meditation experience, the DDFS total score, the sub-scales acceptance and presence of the FMI, and the FMI total score are summarized in Table 1. There were significant differences between non-meditators and meditators with respect to gender (males = 1, females = 2; non-meditators: n = 199; M = 1.70, SD = 0.4; meditators: n = 158; M = 1.60, SD = 0.4), age (non-meditators: n = 199; M = 24.08, SD = 4.7; meditators: n = 158; M = 32.93, SD = 13.2), and years of education (non-meditators: n = 199; M = 3, SD = 0.4; meditators: n = 158; M = 3.15, SD = 0.4), t (356) = –1.98, $p = 0.048$, t (355) = 8.76, $p < 0.001$ and t (355) = 3.23, $p = 0.001$, respectively. Mean mind-wandering between non-meditators (n = 199; M = 37.8, SD = 7.8) and meditators (n = 158; M = 35.9, SD = 9.0) also differed significantly, t (335) = −2.04, $p = 0.041$. Meditators had lower levels of self-reported mind-wandering than non-meditators. However, the ANCOVA showed a non-significant difference when the effects of age were taken into account (F (1, 348) = 0.985, $p = 0.322$). The lower levels of self-reported mind-wandering in meditators compared to non-meditators can be thus attributed to the fact that they were older (non-meditators: n = 199; M = 24.08, SD = 4.7; meditators: n = 158; M = 32.93, SD = 13.2). Note that gender and educational level were correlated (r = 0.172, $p = 0.001$). To avoid collinearity in the statistical analysis, and given our assumptions, we decided to exclude these variables from our model.

Age was positively correlated with meditation experience (r = 0.789, $p < 0.001$) in meditators (samples C and D); older participants had more years of meditation experience. Age and meditation experience also correlated negatively with the DDFS total score (r = −0.241, $p = 0.003$ and r = −0.372, $p < 0.001$, respectively) indicating that participants with lower daydreaming rates were older and generally had more meditation experience. The negative relationship between meditation experience and daydreaming remained significant even after controlling for age (r = −0.305, $p < 0.001$); see Table 3. The scatterplots depicting the relationship between the DDFS total score, years of meditation experience, and age in samples C and D can be found in Figures A and B in the Supplementary Materials.

Table 3. The inter-correlations between the DDFS total score, years of meditation experience, and age (n = 158, samples C and D).

	DDFS Total Score	Meditation Experience	Age
DDFS total score	1		
Meditation experience	−372 *** (−0.305 ***)	1	
Age	−0.241 **	0.789 ***	1

DDFS: Daydreaming Frequency Scale; the value in brackets corresponds to the correlation between the DDFS total score and meditation experience after controlling for age; Significant correlation coefficients: * $p < 0.05$; ** $p < 0.01$, *** $p < 0.001$ (two-tailed).

In sample C (mindfulness meditators), the relationship between mindfulness-meditation experience and the DDFS total score was also negative (r = −0.358, $p < 0.001$) (Table 4). Participants with more meditation experience reported less mind-wandering in daily life. There was also a positive correlation between mindfulness-meditation experience and the sub-scale presence (r = 0.237, $p = 0.024$) of the FMI and the FMI total score (r = 0.294, $p = 0.005$); more mindfulness-meditation experience was associated with more presence in daily life and the general tendency to be mindful. The sub-scale acceptance was negatively related to DDFS total score (r = −0.252, $p = 0.016$) however, the comparison between the correlation coefficients corresponding to $r_{acceptance/DDFS}$ and to $r_{presence/DDFS}$ (r = −0.202, $p = 0.055$) did not differ statistically (z = −0.418, $p = 0.338$). The FMI total score (r = −0.270, $p = 0.010$) was also negatively related to the DDFS total score. Individuals reporting being more mindful in daily life showed lower levels of daydreaming. These relationships remained significant after controlling for age (see the values in brackets in Table 4). The scatterplots depicting the relationship between DDFS total score, years of meditation experience, and the FMI subscales in sample C can be found in Figures C and D in the Supplementary Materials.

Table 4. The correlation between the DDFS total score, years of meditation experience, and the FMI subscales (n = 94, sample C).

	DDFS Total Score	Acceptance	Presence	FMI Total Score	Meditation Experience
DDFS total score	1				
Acceptance	−0.252 * (−0.253 *)	1			
Presence	−0.202	0.275 ** (0.272 **)	1		
FMI total score	−0.270 ** (−0.270 **)	0.898 *** (0.898 ***)	0.501 ** (0.500 ***)	1	
Meditation experience	−0.358 *** (−0.369 ***)	0.165	0.237 * (0.254 *)	0.294 ** (0.318 **)	1

DDFS: Daydreaming Frequency Scale; Acceptance and Presence sub-scales of the FMI; the values in brackets corresponds to the correlation between the DDFS total score, the Acceptance and Presence sub-scales of the FMI, the FMI total score, and meditation experience after controlling for age; Significant correlation coefficients: * $p < 0.05$; ** $p < 0.01$, *** $p < 0.001$ (two-tailed).

6. Discussion

An initial objective of this study was to validate a German version of the DDFS [36] and to further use this inventory to investigate how the factors presence and acceptance of self-reported mindfulness and meditation experience, in general, are associated with levels of mind-wandering in daily life. To our knowledge, the present study is the first one to examine these influences in mindfulness meditators as well as meditators from different meditation traditions.

We were unable to meet all CFA criteria to validate a German version of the DDFS [36] even after model re-specifications were undertaken. These results are in contrast to earlier findings, which confirmed the single-factor structure of the DDFS in the French language [37]. Although the CFA has been considered the standard method for examining the factor structure of a test [61,62], a large amount of literature exists that questions the appropriateness of this method in psychological research [52,63] (for a critical review, see Hopwood and Donnellan, (2010) [64]). The CFA has often even led to false approvals or rejections of a model [52]. Despite failing to meet optimally the CFA criteria, the data has an excellent Cronbach's alpha value and high retest reliability. These arguments and the clear single-factor solution found with the PA demonstrate that the DDFS is an instrument with which the relationship between mind-wandering, meditation experience in meditators and self-reported mindfulness can be better distinguished.

Our empirical data shows that the lower mind-wandering levels reported by meditators can be explained by age. These findings support those of other studies showing that individuals are less likely to report mind-wandering episodes with increasing age [37,65]. However, among meditators, the lower levels of self-reported mind-wandering associated with more years of mindfulness-meditation practice seem to be independent of age. These results match those observed in earlier studies, showing a reduction in the occurrence of mind-wandering states associated with meditation expertise [34]. We found that the mindfulness meditation practice was positively associated with self-reported mindfulness as a composite score which, in turn, was negatively related to the frequency of mind-wandering. The effects of mindfulness meditation experience on self-reported mindfulness seem to be mainly explained by the presence factor. Meditation experience in years was only correlated with the sub-factor presence, but not with acceptance. It has been reported that formal training in mindfulness leads to both state and trait changes in mindfulness [66,67]. Different forms of attention regulation in meditation (e.g., focused attention and open monitoring) and variables in its practice (e.g., total lifetime meditation practice, frequency of practice, and minutes of practice) have been associated with specific facets of the trait-mindfulness [68]. For instance, the accumulated total lifetime of focused-attention meditation practice had a predictive effect only on the sub-component acting with awareness as measured with the Five Facet Mindfulness Questionnaire (FFMQ). Given that acting with awareness involves focusing on the current activity rather than automatically engaging in it, this sub-component seems to share similarities with the factor presence measured with the FMI; thus, our results are consistent with Cebolla's et al. (2017) [68] findings. Although only the negative association between the sub-factor acceptance and the DDFS scores appeared to be significantly related to the observed attenuation in the frequency of mind-wandering in daily life, the comparison between the $r_{acceptance/DDFS}$ coefficient and the $r_{presence/DDFS}$ coefficient were not statistically different. It is important to bear in mind the possible bias when interpreting these results. According to a recent suggestion for presenting empirical results [69], the relationship between the sub-factors acceptance and presence and the DDFS scores could be both interpreted as being a substantial association reasonably compatible with our data.

Several limitations of this study need to be considered. Our results are completely based on retrospective, self-reported measures of mind-wandering, as well as on the self-reported trait-mindfulness. The use of these questionnaires has been questioned in the literature. It has been argued that mind-wandering in self-reported questionnaires may rely on the retrieval from memory of past experiences, compromising the accuracy of the reported information [70,71]. Questionnaires assessing mindfulness as a trait may lack divergent validity and contain shifted and biased responses [72]. A reasonable approach to tackle this issue could be to focus on more ecological measures of mind-wandering (e.g., experience sampling) and to take heuristic models for assessing mindfulness into account (e.g., Lutz et al., (2015) [72]). Moreover, causality cannot be inferred due to the correlational nature of our design. Experimental settings providing indications of causal relationships between mind-wandering and the trait-mindfulness are needed in the future.

Finally, whilst the factor structure of the DDFS [36] in the German language only partly meets the validation criteria, this study does substantiate knowledge about the relationship between the constructs of mind-wandering and mindfulness. The combination of our findings provides some support for the premises that meditation experience in meditators may overall reduce the frequency of mind-wandering in daily life and that acceptance and presence, as components of trait-mindfulness, are probably both important factors in this process.

Supplementary Materials: The following are available online at http://www.mdpi.com/2624-8611/1/1/14/s1.

Author Contributions: Conceptualization, D.L.G., E.P. and M.W.; methodology, D.L.G., E.P. and M.W.; validation, D.L.G. and M.W.; formal analysis, X.X.; investigation, D.L.G., E.P., S.S. and M.W.; resources, E.P., S.S. and M.W..; data curation, D.L.G., E.P., S.S. and M.W.; writing—original draft preparation, D.L.G. and M.W.; writing—review and editing, D.L.G., E.P., S.S. and M.W.; visualization, D.L.G.; supervision, M.W.; funding acquisition, S.S. and M.W.

Funding: This research was funded by the Bial foundation, Porto, with two grants: Grant no. 366/14 to Marc Wittmann, Stefan Schmidt, and Karin Meissner: "Changes in subjective time as an indication of increased mindfulness after meditation"; grant no. 386/14 to Stefan Schmidt, Han-Gue Jo, Marc Wittmann, and Thilo Hinterberger: "Remote meditation support—A multimodal distant intention experiment".

Acknowledgments: We thank Rahel Nicolet, Anne Esch, Sophia Braunstein, Lisa Herold, Shanti Gairola, Sophie Fuchs, and Sebastian Kübel for assistance in data collection and data processing.

Conflicts of Interest: The authors declare no conflict of interest.

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