



Scrutinizing the Components of Mindfulness: Insights from Current, Past, and Non-meditators

Dandan Pang¹ · Willibald Ruch¹

Published online: 5 July 2018
© The Author(s) 2018

Abstract

The factor structure of the Five Facets Mindfulness Questionnaire (FFMQ) seems to vary across samples depending on whether meditators or non-meditators are studied and whether a sample is analyzed before or after mindfulness-based cognitive therapy. The current study illustrates the inconsistencies typically found (e.g., whether all five facets can load on an overall construct of mindfulness), as well as provides and tests alternative explanations in three samples with different levels of meditation experience (i.e., current meditators, past meditators, and non-meditators). Altogether, 2247 German-speaking volunteers completed the FFMQ and reported their meditation experiences online. Results showed that the scaling of three facets of the FFMQ (i.e., observing, describing, and non-judging) were constrained in all samples. The past meditators revealed unique features in terms of their mindfulness level: (1) stopping practicing meditation reduced their levels of mindfulness in facets of awareness, non-judging, and non-reacting, yet observing and describing seemed to remain and (2) those past meditators with intensive trainings scored higher in all five facets than those past meditators who practiced less. The CFA yielded a good fit in all three samples. A hierarchical factor analysis showed how the factors unfolded from level to level and demonstrated that in particular the observing facet loaded on the overall construct of mindfulness differently across the three samples. The empirical results confirmed the alternative interpretations on why the discrepancy regarding the loading of the “observing” facet on an overall mindfulness construct occurs, but future studies might think of investigating each hypothesis specifically.

Keywords Constrained scaling · FFMQ · Hierarchical factor analysis · Mindfulness · Previous meditation experience

Introduction

Derived originally from ancient Buddhist practice, mindfulness (“[...] to pay attention in a particular way – on purpose, to the present moment, nonjudgmentally,” Kabat-Zinn 1994, p. 4) has received considerable attention and developed enormously over the past 30 years. A large amount of studies showed the beneficial effects of mindfulness and mindfulness-based interventions in different domains of life (e.g., Eberth and Sedlmeier 2012; Grossman et al. 2004). The development of the research in mindfulness was facilitated through the recent advancement of valid and reliable measures

of mindfulness (for reviews, see Baer 2011; Sauer et al. 2013). One of the most comprehensive instruments in terms of dimensional coverage is the Five Facet Mindfulness Questionnaire (FFMQ; Baer et al. 2006), which was developed on the basis of the combined pool of items from five other mindfulness scales. Exploratory factor analysis of the combined 112 items yielded five clear factors labeled as observing, describing, acting with awareness, non-judging of experience, and non-reactivity to inner experience (Baer et al. 2006). The FFMQ was therefore considered to measure mindfulness through these five facets. The scale demonstrated satisfactory psychometric properties and has been validated across cultures (e.g., Aguado et al. 2015; de Bruin et al. 2012; Michalak et al. 2016).

Typically, the five facets were positively inter-correlated and also loaded on a single overall mindfulness construct (Baer et al. 2008). A second pattern was found with observing being different from the others. More specifically, often a non-significant correlation between observing and non-judging (e.g., Baer et al. 2006, 2008; Lilja et al. 2011; Michalak et

✉ Dandan Pang
d.pang@psychologie.uzh.ch

¹ Section Personality and Assessment, Department of Psychology, University of Zurich, Binzmuehlestrasse 14, CH-8050 Zurich, Switzerland

al. 2016) was found, and only four of the facets (all but observing) constituted to the overall mindfulness construct. The former pattern was found in participants with meditation experience (meditators) or patients after participating in mindfulness-based cognitive therapy (MBCT; Segal et al. 2013), while the latter was found in participants without meditation experience (non-meditators) or patients before participating in MBCT (Baer et al. 2006; Gu et al. 2016; Williams et al. 2014). By the same token, a few studies used confirmatory factor analysis (CFA) to compare the correlated five-factor model (which assumes that the scale measures five distinct, but related, facets of mindfulness) with the hierarchical five-factor model (in which the five factors were indicators of an overall mindfulness construct). They found out that the latter performed worse than the former, especially among the non-meditators (e.g., Hou et al. 2014; Veehof et al. 2011). In a nutshell, we encountered convincing evidence suggesting that the inter-correlations of the five facets and the hierarchical five-factor model of the FFMQ cannot be replicated consistently across different samples (meditators vs. non-meditators) and time points (before vs. after mindfulness-based cognitive therapy).

What could account for the discrepancy regarding the observing facet between people with and without meditation experience? Baer (2016) suggested that attention to the present moment can be either reactive and judgmental (i.e., not mindful for the non-meditators) or open, curious, and accepting (i.e., mindful for the meditators). People with limited meditation experience tend to observe in a judgmental way, while experienced meditators tend to observe mindfully (Baer et al. 2006, 2008). Reviewing previous research on the findings of the FFMQ, two additional interpretations were put forward. The observed effects might be related to (1) the

constrained scaling of the FFMQ and (2) the heterogeneous sampling.

First, enhanced scores (because of being a meditator or completing a MBCT training) might yield a ceiling effect when there is a constrained scaling. This hypothesis was preliminary supported by a few observations in the literature. At first, we found that across different samples using different language versions of the FFMQ, the mean scores of certain facets were always higher than the middle value, even among people with very limited or no meditation experience (e.g., Aguado et al. 2015; Taylor and Millier 2016). Second, combining the studies that used the English version of the FFMQ (see Table 1), we also noticed that across the 11 samples from five different studies, a high mean score for a given facet has usually been linked to a low standard deviation.

As shown in Table 1, the correlations (Pearson's r) between the mean and the standard deviation across the 11 samples were $-.53$ for the observing facet, $-.92$ for the describing facet, $-.62$ for the awareness facet, $-.83$ for the non-judging facet, and $-.53$ for the non-reacting fact, respectively. This negative association might accord to the hypothesis that the meditation experience made participants reach a similar level of mindfulness facets and thus made them more homogeneous. However, it might also be that the scales were skewed: certain facets (e.g., describing and non-judging) might have been constrained by the scaling even among people without meditation experience. This is in line with a few studies that reported the multivariate non-normality of the FFMQ scales (e.g., Christopher et al. 2012; Gu et al. 2016).

Second, while one can expect randomly drawn samples to show the same pattern of inter-correlations of the five facets, this will change once a training is involved (as learning curves are different and the training effects would be differently

Table 1 Descriptive data of the five facets of mindfulness across English-speaking samples

Study	Sample	Observing		Describing		Awareness		Non-judging		Non-reacting	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Baer et al. 2008	Community sample ($n = 293$)	3.04	5.48	3.08	7.06	3.07	6.57	2.98	7.33	2.79	4.88
Baer et al. 2008	Students ($n = 259$)	3.04	4.84	3.31	6.01	3.16	5.77	3.47	5.90	2.93	3.82
Baer et al. 2008	Highly educated ($n = 252$)	3.38	5.63	3.75	5.63	3.54	5.21	3.64	5.79	3.26	4.19
Baer et al. 2008	Meditators ($n = 213$)	4.00	4.16	3.98	5.30	3.51	5.10	4.06	5.63	3.67	4.01
Bowman 2014	Students ($n = 735$)	3.32	5.73	3.37	5.91	3.24	6.00	3.15	6.91	3.00	4.31
Curtiss and Klemanski 2014	Heterogeneous clinical sample ($n = 153$)	3.16	5.78	3.28	6.51	2.96	6.45	2.84	7.58	2.54	4.43
Gu et al. 2016	Pre-MBCT participants ($n = 238$)	3.13	5.78	3.28	6.36	3.02	5.29	3.09	6.12	2.87	4.94
Gu et al. 2016	Post-MBCT participants ($n = 238$)	3.54	5.02	3.47	6.11	3.23	4.93	3.46	5.85	3.24	4.28
Williams et al. 2014	Community sample ($n = 940$)	3.31	5.29	3.30	6.60	2.96	5.95	2.95	7.38	2.91	4.73
Williams et al. 2014	Participants with depressive disorder ($n = 424$)	3.01	5.65	3.25	6.79	3.01	5.44	3.12	6.62	2.81	4.80
Williams et al. 2014	Meditators ($n = 235$)	3.81	4.56	3.81	5.34	3.43	4.89	3.81	6.21	3.57	4.27
Correlation between <i>M</i> and <i>SD</i> (Pearson's r)		$-.76$		$-.92$		$-.62$		$-.83$		$-.53$	

M mean, *SD* standard deviation

sustained), or when the meditators with different levels of experience are jointly investigated. The reason is that the variation in the scores increases when some yield a stronger training effect than the others (just as when the meditators and the layperson are mixed in one sample), and this subsequently also affects the covariations; i.e., there will be higher inter-correlations. Furthermore, if for some individuals some components of mindfulness are more easily improved than the others or faded out more quickly than the others once training was stopped, then the inter-correlations among the facets will also be affected. Not systematically controlling for these factors might explain the differences found for different studies as mentioned above.

However, no comparison has been made between people who are currently practicing meditation and people who had meditation experience in the past and stopped training at the moment. The criteria to categorize participants as meditators remained somewhat unclear and inconsistent in the literature. A few selected open issues are as follows: how intensive should their meditation experience be until they could be considered as meditators; do meditators have to practice meditation regularly at the moment; or once they practiced meditation in the past, is it already enough to categorize them as meditators. People stopped their meditation practice for various reasons, such as a change of personal interests or not having enough time. Simply framing them as meditators because of their past meditation experience or simply framing them as non-meditators because they gave up meditation was not appropriate. The meditation experience of these people could range from “tried once and never was interested again” to “constantly practiced for a few years and then stopped.”

In sum, we listed three possible explanations (incl. Baer’s and ours) for the observed discrepancies that could have an impact on the inter-correlations and factor structure of the FFMQ in different samples and we aim to test all proposed interpretations empirically. First, we aimed at exploring if there is constrained scaling of FFMQ, if it occurs in our German-speaking samples as well, and if this leads to an alternative explanation of the current issue regarding the observing facet. Second, we aimed at ruling out possible diversities in the sample and for the first time exploring the unique features of an unstudied group in the mindfulness research—the past meditators, who practiced meditation a while ago, but stopped for different reasons. Third, we aimed at replicating the factor structure of the FFMQ in three German-speaking samples, which contain participants with different levels of meditation experience (the current meditators, the past meditators, and the non-meditators). Finally, to highlight these effects (components of mindfulness being differently related to each other in a predictable way in different samples), we aimed at illustrating how the factor structure of the FFMQ changes from level to level across participants with different levels of meditation experience by employing a top-down method. We

expect to provide an empirically based answer to the question why the discrepancy regarding the loading of the “observing” facet on an overall mindfulness construct occurs.

Method

Participants

In total, 2582 participants registered for the study on the website, of which 2474 participants completed the questionnaire. Seventy-two participants’ data were omitted because they gave unusual/inconsistent responses (e.g., those who rated at least 80% of the items with the same value, or those who claimed to have no meditation experience but reported at the same time practicing meditation regularly/unregularly). Participants who did not specify whether they were practicing meditation or what their meditation type was, as well as those who practiced meditations other than Buddhist-based meditations (such as Christian meditation, Yoga, and Tai Chi), were not included for further analysis ($n = 155$). The final sample consisted of 2247 German-speaking volunteers (571 men, 1676 women). Three samples were identified according to their meditation experience. The current meditators (sample 1, $n = 745$) comprised a sample of adults who were currently practicing meditation and most of them had intensive meditation experience. The past meditators (sample 2, $n = 791$) consisted of participants who had practiced meditation in the past, but have currently stopped practicing. The non-meditators (sample 3, $n = 711$) comprised people who had no experience with meditation at all.

The meditation experience of the current meditators and the past meditators was measured following a procedure adapted from Baer et al. (2008). First, participants were asked if they had any meditation experience before (yes; yes, but a while ago; no). If they answered “yes” or “yes, but a while ago,” they were instructed to provide the following information: (1) duration of regular practice (less than 1 year; 1–5 years; 6–10 years; more than 10 years); (2) frequency of meditation sessions (less than once a week; 1–2 per week; 3–4 per week; 5–6 per week; 7 or more per week); and (3) length of a typical meditation session (less than 10 min; 10–20 min; 21–30 min; 31–45 min; 46–60 min; more than 60 min). If they answered “no,” they were instructed not to provide the information. In addition, participants were also asked about the type of meditation they were practicing or have been practicing. A list of options was provided. Participants could mark all that apply from the following: Mindfulness, Breathing, Zen, Focused-awareness, Vipassana, Tibetan, Samatha, and others. They were required to specify which applied. The characteristics of the meditation experience for the current meditators and the past meditators are shown in Table 2.

Table 2 Meditation experiences of the current and past meditators

Characteristics	Total (<i>n</i> = 1536)		The current meditators (<i>n</i> = 745)		The past meditators (<i>n</i> = 791)	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Duration of regular practice						
Less than 1 year	748	48.7	233	31.3	515	65.1
1–5 years	484	31.5	281	37.7	203	25.7
6–10 years	126	8.2	91	12.2	35	4.4
More than 10 years	147	9.6	120	16.1	27	3.4
Missing	31	2.0	20	2.7	11	1.4
Frequency of sessions						
Less than once a week	644	41.9	107	14.4	537	67.9
1–2 per week	386	25.1	221	29.7	165	20.9
3–4 per week	227	14.8	176	23.6	51	6.4
5–6 per week	150	9.8	131	17.6	19	2.4
7 or more per week	114	7.4	106	14.2	8	1.0
Missing	15	1.0	4	.5	11	1.4
Length of typical session						
Less than 10 min	414	27.0	119	16.0	295	37.3
10–20 min	682	44.4	352	47.2	330	41.7
21–30 min	261	17.0	159	21.3	102	12.9
31–45 min	83	5.4	59	7.9	24	3.0
46–60 min	59	3.8	39	5.2	20	2.5
More than 60 min	21	1.4	13	1.7	8	1.0
Missing	16	1.0	4	.5	12	1.5
Type of Buddhism meditation ^a						
Mindfulness	1000	65.1	550	73.8	450	56.9
Breathing	1107	72.1	518	69.5	589	74.5
Zen	189	12.3	110	14.8	79	10.0
Focused-awareness	166	10.8	97	13.0	69	8.7
Vipassana	144	9.4	107	14.4	37	4.7
Tibetan	78	5.1	53	7.1	25	3.2
Samatha	12	.8	8	1.1	4	.5
Others (please specify) ^b	146	9.5	94	12.6	52	6.6

The data of the non-meditators (*n* = 711) were not included in this table since they did not have any meditation experience

^a The question form of the “Type of Buddhism meditation” was “check all that apply”, for which participants were asked to mark all that apply from a list of options

^b Participants who marked others in the “type of Buddhism meditation” also marked at least one of the listed Buddhism meditation types

As shown in Table 2, compared to the past meditators, the current meditators had extensive meditation experience. Around one third of them had meditated regularly for more than 6 years and around another one third had done so for 1 to 5 years, and the remaining third had meditated less than a year. Most of them (85.1%) reported practicing meditation quite frequently (more than once a week). A typical practice session for most of them (68.5%) lasted for 10 to 30 min. In contrast, slightly less than two thirds of the past meditators (65.1%) stopped practicing meditation regularly within a year. The majority of them

(67.9%) practiced less than once a week, while a typical practice session for them usually lasted less than 20 min (79.0%).

Participants’ age ranged from 18 to 80 years ($M = 42.7$, $SD = 11.9$) and more than half of them ($n = 1418$, 63.1%) had a university degree or were studying at the time they filled in the questionnaire. Around half of the participants classified themselves as Christians ($n = 1189$, 52.9%), while only a few participants adhered to other religions ($n = 95$, 4.2%), such as Buddhism ($n = 55$, 2.4%). The rest of the participants either reported that they did not have a religion ($n = 674$, 30.0%) or

chose not to provide an answer ($n = 259$, 11.5%). Around a quarter of all participants ($n = 539$, 24.0%) were practicing their religion and slightly more than one third ($n = 851$, 37.9%) were not, while the rest of the participants either did not report religious affiliation or chose not to answer this question ($n = 857$, 38.1%).

Procedure

Participants were requested to complete the FFMQ on a well-established website (www.charakterstaerken.org; hosted by the Section of Personality and Assessment at the Department of Psychology at the University of Zurich) for research purposes between May 2015 and June 2017. The study was promoted by different means through the Internet (e.g., online forum, social media, and the university mailing list). To reach a larger audience of meditation experts, the contact details of German-speaking meditation practitioners were sought on the Internet, after which an invitation letter/email, as well as the instruction of how to participate in the study, was sent to the meditation experts. The volunteers registered on the website with their personal computers and completed the questionnaires online. Respondents were not paid for participating but were provided an automatically generated feedback of their individual results. The procedure was in line with the guidelines of the Ethics Committee of the Department of Psychology at the University of Zurich.

Measures

The *Five Facet Mindfulness Questionnaire-German* was adapted (FFMQ; Baer et al. 2006; German translation from Michalak et al. 2016). The FFMQ (Baer et al. 2006) is a self-report questionnaire. It consists of 39 items, which measure mindfulness as a trait with five facets: observing, describing, acting with awareness, non-judging of experience, and non-reactivity to inner experience. Answers are given on a 5-point frequency scale ranging from 1 = “never or very rarely true” to 5 = “very often or always true”. The instrument showed adequate psychometric properties across different samples. For instance, Cronbach’s α ranged from .75 (non-reacting) to $\alpha = .91$ (describing) in the original publication (Baer et al. 2006) and .74 (observing) to .90 (non-judging of experience) in the German version (Michalak et al. 2016).

Data Analyses

Descriptive Statistics Descriptive statistics included internal reliability of instrument (using Cronbach’s alpha), mean, standard deviation, and correlations with demographics, as well as distribution characteristics (using skewness, skewness divided by the respective standard errors, and kurtosis).

One-Way Analyses of Covariance Differences in mindfulness levels (in the form of five facets) across three samples were assessed using analysis of covariance (ANCOVA) with assumption of homogeneity of slopes was met. Demographics (e.g., age and education) were controlled as covariates as they were shown to be related to mindfulness in previous studies (Baer et al. 2008). Subsequently standardized effect sizes were calculated using Cohen’s d family of effect sizes (Cohen 1988). According to Cohen’s logic, an effect size of .80 or larger was considered as large, .50–.79 as medium, and .20–.49 as small, and an effect size smaller than .20 as negligible.

Cluster Analysis Cluster analysis was conducted to group the past meditators based on their different profiles of scores on the five FFMQ scales and their meditation experience (duration, frequency, and length) using the clustering algorithm PAM (partitioning around medoids; Reynolds et al. 2006). The “cluster” package in R was used and we chose “Gower distance function” as the distance measure because the data consisted of both continuous variables (i.e., the FFMQ) as well as ordinal variables (i.e., duration, frequency, and length). The silhouette width (Rousseeuw 1987) was used to identify the optimal cluster solution, which is an aggregated measure of how similar an observation is to its own cluster compared to its closest neighboring cluster. The metric can range from -1 to 1, where higher values indicate a better fit.

Factor Analysis CFA was performed to examine the factor structure of the FFMQ using robust maximum likelihood (RML) estimation with the R package lavaan (Rosseel 2012). RML was used due to the non-normality nature of the scales. Three models were specified, namely (1) a correlative five-factor model, which was identified via EFA and allowed the five factors to inter-correlate, (2) a hierarchical five-factor model, in which the five factors were themselves indicators of an overall mindfulness factor, and (3) a hierarchical four-factor model, which defined describing, awareness, non-judging, and non-reacting as facets of an overall mindfulness construct but excluded observing.

A top-down method namely the hierarchical factor analysis (HFA; Goldberg 2006) was employed to highlight the components of mindfulness being differently related to each other in a predictable way in different samples. Iteratively the number of factors extracted by the algorithm was increased (e.g., one, two, and three) until one reached a point where a component would have been extracted on which no variable has its highest factor loading. Factors were represented as rectangles, whose width corresponds to the factor’s size, i.e., to the amount of variance accounted by that factor. The factor scores of adjacent factor solutions were correlated with each other, and the salient relations ($r > .35$) were represented using arrows. By this means, we could examine how the factors

unfold and how they split up or stayed stable from solution to solution. This method elucidates the hierarchical structure of a set of variables top-down, as opposed to the bottom-up tradition that first identifies lower order trait structures and then defines higher order traits based on the patterns of covariance among those. In the present case, we expect that the observing items will not be represented well in the first un-rotated principle component and gain independence (i.e., form a separate factor) at earlier stages in the unfolding in the non-meditators compared to the current meditators and the past meditators.

Data Availability Statement All data are available at the Open Science Framework (<https://osf.io/kcb4d/>).

Results

Descriptive Statistics

The descriptive statistics of the FFMQ are displayed in Table 3. The German version of the FFMQ was reliable for all three samples, yielding satisfactory internal consistencies (all scales' Cronbach's $\alpha \geq .76$). The Kolmogorov-Smirnov (K-S) and the Shapiro-Wilk (S-W) tests indicated that all scales of mindfulness were not normally distributed (all with $p < .000$).

However, since the sample size was very large, it was more likely to obtain significant p values for the normality tests. Therefore, the distribution of each scale was visualized by histograms with normal distribution curves. We noticed that, for the non-meditators and the past meditators, the observing, describing, and non-judging facets were positively skewed, while for the current meditators, in addition to the three facets, the non-reacting facet was also skewed. Specifically, more than 15% of the respondents of the observing, describing, and non-judging items reached the highest value (i.e., 5): 24.6, 25.9, and 32.0% for the current meditators, 19.7, 20.0, and 23.8% for the past meditators, and 15.7, 17.6, and 22.9% for the non-meditators. We calculated also the S/SE ratio (skewness divided by its standard error) for each scale (see Table 3). The S/SE ratio smaller than -2.56 could be an indicator that these scales were constrained (Ghasemi and Zahediasl 2012). These results aligned with our assumption that some facets of the FFMQ were constrained and that they were skewed to different extents.

Because of the non-normality nature of scales of the FFMQ, we conducted further adjustments. We carried out log-transformations for our outcome variables and ran the analyses (those require the normal distribution assumption) twice: once for the non-transformed data and once again for the log-transformed data. As we did not notice any differences

Table 3 Descriptive statistics, distribution characteristics, and the correlations with demographics of the FFMQ for the current meditators, the past meditators, and non-meditators

	α	M	SD	S	S/SE	K	r_{sex}	r_{age}	r_{edu}
The current meditators ($n = 745$)									
Observing	.80	3.86	.55	-.41	-4.58	-.03	.04	.11**	.01
Describing	.90	3.90	.68	-.48	-5.29	-.11	-.00	.11**	.16***
Acting with awareness	.88	3.44	.68	-.22	-2.42	.00	-.10*	.17***	.08*
Non-judging	.92	3.81	.82	-.55	-6.09	-.41	-.08*	.19***	.05
Non-reacting	.91	3.31	.72	-.27	-2.96	-.33	-.14***	.17***	.06
The past meditators ($n = 791$)									
Observing	.76	3.68	.55	-.40	-4.54	.39	.11**	.04	.03
Describing	.91	3.72	.73	-.37	-4.22	-.29	.06	.02	.16***
Acting with awareness	.87	3.26	.68	-.12	-1.38	-.18	-.07*	.16***	.07
Non-judging	.91	3.55	.83	-.23	-2.60	-.65	-.08*	.15***	.09*
Non-reacting	.86	3.02	.66	-.13	-1.47	-.18	-.11**	.13**	.03
The non-meditators ($n = 711$)									
Observing	.79	3.48	.64	-.50	-5.38	.12	.06	.08*	.03
Describing	.91	3.59	.78	-.34	-3.73	-.50	.02	.08*	.17***
Acting with awareness	.84	3.28	.66	-.13	-1.46	-.07	-.05	.07*	.01
Non-judging	.90	3.51	.84	-.28	-3.07	-.50	-.02	.20***	.09*
Non-reacting	.84	2.98	.66	-.07	-.74	-.19	-.15***	.07	.07

α = Cronbach's alpha; M = mean; SD = standard deviation; S = skewness; S/SE = skewness divided by the respective standard errors; K = kurtosis; r_{sex} = Spearman's correlation with gender (1 = "male," 2 = "female"); r_{age} = Pearson's correlation with age; r_{edu} = Spearman's correlation with education (1 = "less than compulsory education", 2 = "compulsory education", 3 = "apprenticeship", 4 = "baccalaureate", 5 = "university degree")

* $p < .05$, ** $p < .01$, *** $p < .001$, two-tailed

regarding the outcomes, we reported the results for the non-transformed data. A few significant correlations were found between the five facets of mindfulness and the demographics, such as gender (e.g., females scored higher on the facet non-reacting than the males), age (e.g., non-judging facet), and education (e.g., describing facet) across all three samples (see Table 3).

The Unique Features of the Past Meditators

We conducted the one-way analyses of covariance (gender, age, and education were controlled as covariates as they correlated with the mindfulness facets, as shown in Table 3) to test the assumption that the mindfulness levels (in the form of five facets) of the past meditators would be between the levels of the non-meditators (i.e., higher) and the current meditators (i.e., lower). The results are presented in Table 4.

As shown in Table 4, the main effects were significant for all five facets of the FFMQ. Post hoc tests (Fisher's least significant difference; LSD) showed significant differences. For the facets observing and describing, the current meditators scored higher than both the past meditators (Cohen's $d = .33$ and $.25$) and the non-meditators (Cohen's $d = .64$ and $.42$), while the past meditators scored higher than the non-meditators in these two facets as well with smaller effect sizes (Cohen's $d = .33$ and $.18$). The current meditators scored higher than both the past meditators (Cohen's $d = .26$, $.31$, and $.41$) and the non-meditators (Cohen's $d = .24$, $.36$, and $.48$) in acting with awareness, non-judging, and non-reacting, while no significant differences were found between the other two samples. Results showed that the current meditators did score higher than the other two samples on all five facets. Although the past meditators gave up practicing meditation, they still scored significantly higher than the non-meditators in observing and describing, but no differences were found between the two groups regarding awareness, non-judging, and non-reacting. After giving up meditation practice, one

might conclude that people drop down with respect to awareness, non-judging, and non-reacting. Overall, the past meditators still referred to be able to observe and describe. The different effect sizes suggested that practicing meditation raised the scores of the facets at different speeds and stopping training also decreased the scores of the facets at different speeds.

Beyond simply comparing the mean scores of the three samples, we assume that the past meditation behaviors (the duration of their regular practice, the frequency of their practice, as well as the length of each session) also contributed to the past meditators' current levels of mindfulness, even though they stopped practicing meditation for a while. However, we could not know in advance whether these factors (duration/frequency/length) separately or jointly influence participants' level of mindfulness and to what extent. Thus, a cluster analysis was implemented to explore the systematic patterns of the score profiles of the FFMQ facets among the past meditators. By making no prior assumptions about important differences within a sample, the cluster analysis is a good fit for answering such an explorative question. After calculating silhouette widths for clusters ranging from 2 to 20 for the PAM algorithm, we noticed that 2 or 3 clusters yield the highest value. To further distinguish among different patterns, we decided to take the three-cluster solution. The profiles of the three clusters are summarized in Table 5.

As shown in Table 5, from cluster 1 to cluster 3 the level of meditation experience increased. Cluster 1 mainly consisted of the past meditators who practiced less than a year, less than once a week, and less than 10 min each session. Cluster 2 consisted of the past meditators who practiced also less than a year, less than once a week, but more than 10 min each session. Cluster 3 consisted of the past meditators who practiced more than once a year, more than once a week, and more than 10 min each session. Five one-way analyses of covariance (one-way ANCOVA; controlled for demographics—gender, age, and education) were conducted to explore the differences of the mindfulness facets among the three clusters. The main

Table 4 Mean differences of mindfulness facets among three samples (controlled for age, gender, and education)

	The current meditators		The past meditators		The non-meditators		Variance		
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>F</i> (2, 2241)	<i>p</i>	η^2
FFMQ									
Observing	3.86 _a	.55	3.68 _a	.55	3.48 _a	.64	63.57	.000	.05
Describing	3.90 _a	.68	3.72 _a	.73	3.59 _a	.78	24.15	.000	.02
Awareness	3.44 _{a,b}	.68	3.26 _a	.68	3.28 _b	.66	11.14	.000	.01
Non-judging	3.81 _{a,b}	.82	3.55 _a	.83	3.51 _b	.84	17.04	.000	.02
Non-reacting	3.31 _{a,b}	.72	3.02 _a	.66	2.98 _b	.66	42.16	.000	.04

The current meditators: $n = 745$; the past meditators: $n = 791$; the non-meditator: $n = 711$. Means in a row sharing subscripts are statistically different from each other at $p < .05$ (two-tailed) according to Fisher's least significant difference (LSD) procedure. For all measures, higher means indicate higher scores

M mean, *SD* standard deviation

Table 5 Cluster analysis of the past meditators based on different profiles of the FFMQ scales and meditation experience

	Observing		Describing		Awareness		Non-judging		Non-reacting		Duration of the practice		Frequency of the sessions		Length of typical session	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>n</i>		<i>n</i>		<i>n</i>	
Cluster 1	3.57 _a	.58	3.64 _a	.73	3.19 _a	.68	3.51 _a	.50	2.92 _a	.64	< a year	222	< once a week	228	< 10 min	260
											1–5 years	34	1–4 times a week	30	10–20 min	0
											> 5 years	4	> 4 times a week	2	> 20 min	0
Cluster 2	3.65 _b	.53	3.65 _b	.70	3.09 _b	.62	3.41 _b	.47	2.88 _b	.65	< a year	249	< once a week	248	< 10 min	0
											1–5 years	30	1–4 times a week	35	10–20 min	261
											> 5 years	10	> 4 times a week	6	> 20 min	28
Cluster 3	3.87 _{a,b}	.50	3.92 _{a,b}	.70	3.57 _{a,b}	.64	3.81 _{a,b}	.55	3.34 _{a,b}	.60	< a year	37	< once a week	58	< 10 min	33
											1–5 years	138	1–4 times a week	145	10–20 min	165
											> 5 years	47	> 4 times a week	19	> 20 min	24
Variance											> 5 years	47	> 4 times a week	19	> 20 min	24
<i>F</i>	19.75		13.60		31.78		15.89		34.43							
<i>p</i>	< .001		< .001		< .001		< .001		< .001							
η^2	.05		.03		.08		.04		.08							

Cluster 1: $n = 260$; cluster 2: $n = 289$; cluster 3: $n = 222$. Means in a column sharing subscripts are statistically different from each other at $p < .05$ (two-tailed) according to Fisher's least significant difference (LSD) procedure. For all measures, higher means indicate higher scores

M mean, *SD* standard deviation

effects were significant for all five facets of the FFMQ. Post hoc tests (Fisher's least significant difference; LSD) uncovered the following significant differences: For all facets of the FFMQ, the past meditators in cluster 3 scored higher than both the past meditators in cluster 1 (Cohen's $d = .55, .39, .58, .57$, and $.68$, respectively) and the past meditators in cluster 2 (Cohen's $d = .43, .39, .76, .78$, and $.74$, respectively), while no significant differences were found between the latter two samples. Results showed that those who practiced more among the past meditators (cluster 3) achieved significantly higher mindfulness levels (in all five facets) than those who practiced less (cluster 1 and cluster 2). The results revealed that the meditation experience that influenced the level of mindfulness among the past meditators indicated the need to carry out separate analyses for the past meditators and the other two samples.

The Factor Structure of the FFMQ

The goodness-of-fit indices of the CFA models among the three samples are displayed in Table 6. All models fit the three samples well. In accordance with the literature, we also noticed a slight drop of the fit indices of the hierarchical five-factor model for the non-meditators compared to the other two models. Unlike what has been found in the literature, observing loaded significantly on the overall construct of mindfulness in our non-meditator sample. However, similar to what has been reported before, the same loading patterns were also detected in our samples, i.e., the non-meditators had a lower loading (.41) of the observing facet on the overall mindfulness construct compared to the current meditators (.60). The

loadings of the past meditators ranged in the middle with .48. When we compared the mean score of our non-meditator sample with the non-meditator samples from the previous studies (see Table 1), we noticed that our non-meditator sample has a slightly higher mean in almost all facets.

Furthermore, the correlations among the facets were computed. As shown in Table 7, all facets correlated significantly with each other for all three samples, but the facet observing correlated much lower with the facet non-judging for both the past meditators and the non-meditators. These two correlations were significant despite a very low value of $r = .09$ because we have a rather large sample size. The correlations of the current meditators and non-meditators were comparable to the previous studies (Baer et al. 2008; Michalak et al. 2016).

To further disclose the development of the factor structure, the HFA procedure proposed by Goldberg (2006) was conducted. An overview of the succession of factor extraction with correlations between the factors from adjacent levels of extraction is depicted in Fig. 1a for the current meditators, Fig. 1b for past meditators, and Fig. 1c for the non-meditators. The codes above the factor names refer to the factor numbers at a certain level; for instance 4/1 and 5/3, respectively, refers to the first factor at the four-factor level and third factor at the five-factor level. At the top level of Fig. 1a–c is the first unrotated principal component (FUPC), which reflects the general factor of “mindfulness.”

For the current meditators (cf. Fig. 1a), in the first step, all items of the FFMQ loaded on the FUPC except three items of the observing facet. Then, the FUPC split into “awareness

Table 6 Goodness-of-fit indices for the FFMQ among three samples

Models	χ^2	<i>df</i>	χ^2/df	RMSEA 90% CI <i>p</i> value	SRMR	CFI	TLI	NNFI	AIC
Correlative five-factor model									
The current meditators	208.64	80	2.61	.05 90% [.04–.05] <i>p</i> = .766	.03	.99	.98	.98	17,342.34
The past meditators	200.85	80	2.51	.04 90% [.04–.05] <i>p</i> = .912	.03	.99	.98	.98	19,866.63
The non-meditators	305.17	80	3.81	.06 90% [.06–.07] <i>p</i> = .002	.04	.97	.96	.96	19,290.27
Hierarchical five-factor model									
The current meditators	258.28	85	3.04	.05 90% [.05–.06] <i>p</i> = .291	.04	.98	.98	.98	17,381.98
The past meditators	286.26	85	3.37	.05 90% [.05–.06] <i>p</i> = .128	.06	.98	.97	.97	19,942.04
The non-meditators	369.00	85	4.34	.07 90% [.06–.08] <i>p</i> = .000	.07	.96	.95	.95	19,344.10
Hierarchical four-factor model									
The current meditators	130.95	50	2.62	.05 90% [.04–.06] <i>p</i> = .702	.03	.99	.99	.99	13,893.42
The past meditators	132.70	50	2.65	.04 90% [.03–.06] <i>p</i> = .760	.03	.99	.99	.99	15,897.35
The non-meditators	212.70	50	4.25	.07 90% [.06–.08] <i>p</i> = .001	.05	.97	.96	.96	15,290.94

The current meditators: *n* = 745; the past meditators: *n* = 791; the non-meditator: *n* = 711

with acceptance (2/1)” and “attentive describing and observing (2/2).” All items of awareness, non-judging, and non-reacting loaded on the first factor of the second level (2/1), whereas all items of describing and 5 items of observing loaded on the second factor of the second level (2/2), and item 23 had a double loading on both factors (2/1 and 2/2) at this level. While the factor “awareness with acceptance (2/1)” remained

unchanged until the third iteration (3/1), the factor “attentive describing and observing (2/2)” split into “describing (3/2)” (which remained unchanged with respect to the following factor solutions) and “attentive observing (3/3).” “Observing (4/4)” and “non-judging (4/2)” then became separate factors at the next level and stayed unchanged for the following iterations, whereas a new factor “nonreactive awareness (4/4)”

Table 7 Correlations of five facets scales of the FFMQ among three samples

Facets	The current meditators (<i>n</i> = 745)					The past meditators (<i>n</i> = 791)					The non-meditator (<i>n</i> = 711)				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
1. Observing	–					–					–				
2. Describing	.38***	–				.37***	–				.35***	–			
3. Acting with awareness	.46***	.45***	–			.37***	.43***	–			.23***	.37***	–		
4. Non-judging	.28***	.38***	.57***	–		.09**	.31***	.50***	–		.09*	.25***	.40***	–	
5. Non-reacting	.45***	.41***	.61***	.60***	–	.33***	.37***	.53***	.51***	–	.25***	.27***	.44***	.46***	–

p* < .05, *p* < .01, ****p* < .001, two-tailed

was fused from factors (3/1) and (3/3). At the following level, the “non-reactive awareness” continued to split into “non-reacting” (5/3, remained unchanged) and “acting with awareness” (5/4). The former remained unchanged at the next level while the latter further broke down into two lower hierarchical factors: “attention” and “autopilot.”

The non-meditators showed a different pattern in two folds in comparison to the current meditators (see Fig. 1c): First, the majority of the items of the facet observing (6 out of 8) did not load on the FUPC, while for the current meditators, more than half of the observing items (5 items) loaded on this general factor. Second, at the third level, the items of observing began loading on one factor and remained stable for the non-meditators, while for the current meditators, the observing items were embedded with some items of other facets (such as items of awareness and non-reacting) from the beginning and only became a separate factor at later levels. The remaining pattern was very similar to the current meditators.

For the past meditators (see Fig. 1b), the HFA yielded a pattern in between the current meditators and the non-meditators. The majority of the observing (6 out of 8 items) items did not load on the FUPC, which is similar to the pattern provided by the non-meditators. However, at the third level, the third factor (3/3) was still fused from items of observing, awareness, and non-reacting. This fusion continued at the fourth iteration where the factor “non-reacting (4/3)” emerged. Thus, “observing (5/5)” only became a separate factor at the fifth level, together with “awareness (5/3)” and “non-judging (5/1).” Similar as the current meditators and the non-meditators, while the other factors remained unchanged, “acting with awareness (5/3)” broke down into two lower hierarchical factors: “attention” and “autopilot.”

To sum up, observing loaded lower than the other facets on the overall construct of mindfulness across all three samples. Moreover, much less observing items loaded on the overall construct of mindfulness for those who had less meditation experience (i.e., the past meditators and the non-meditators). For the non-meditators, the facet observing emerged as a separate factor already at the third level and stayed unchanged since then. However, for the current meditators, observing was a more significant part of the general factor from the very beginning and was fused with items of other facets until it finally crystallized as a unique factor at the fourth iteration.

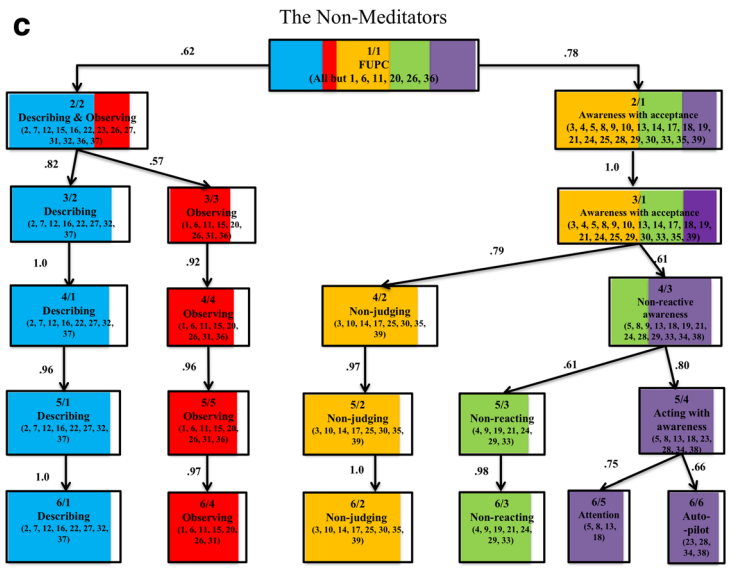
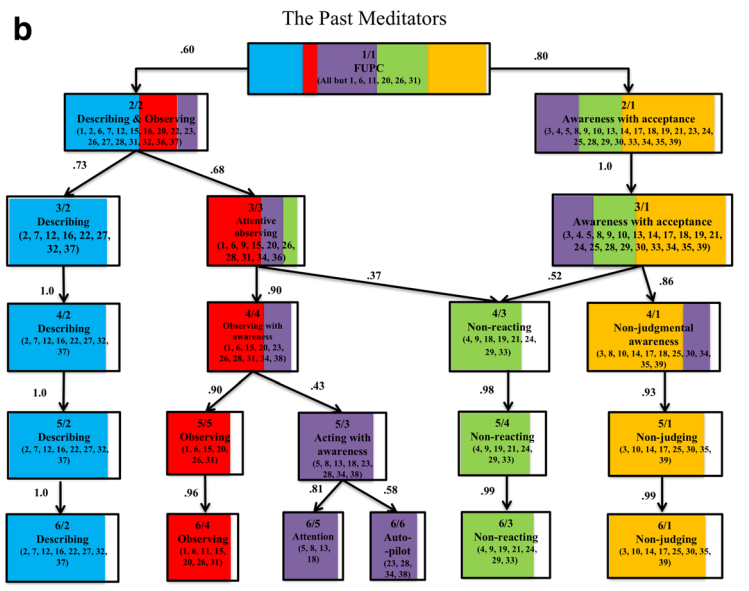
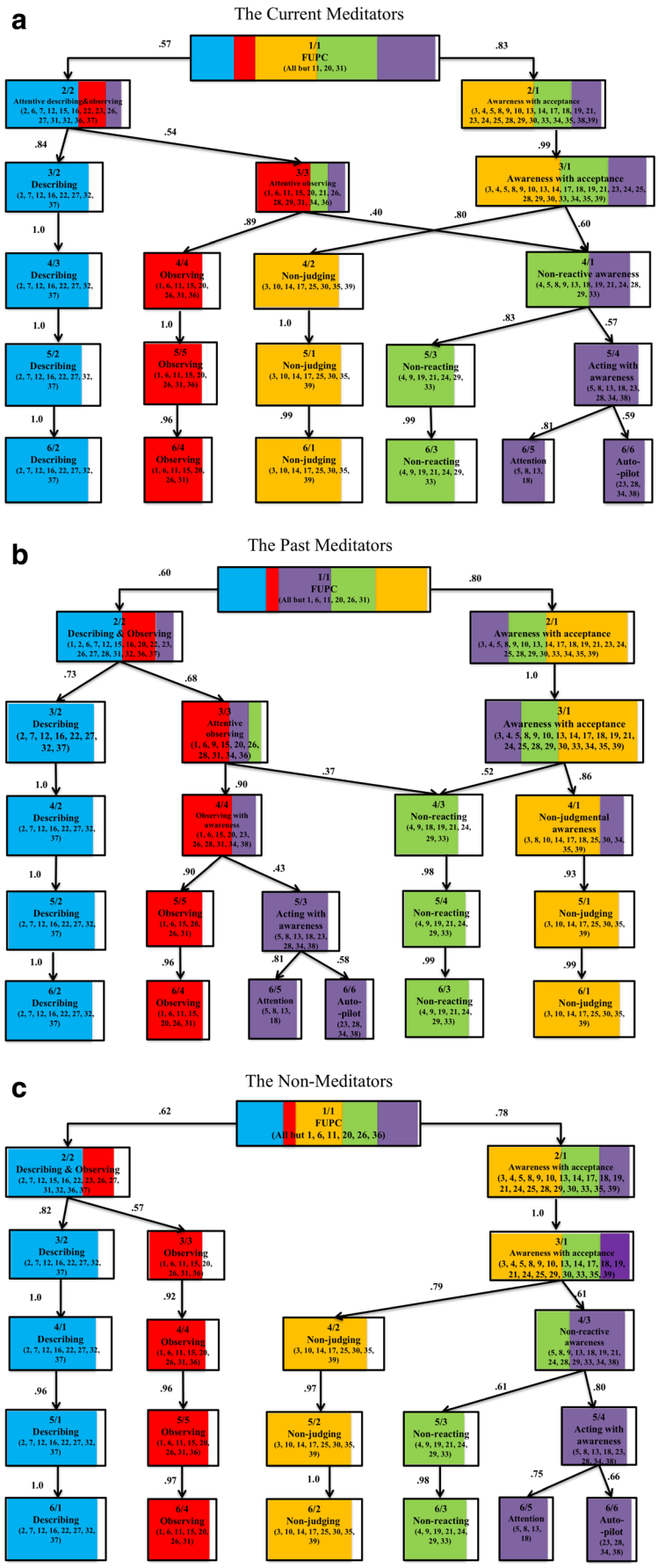
Discussion

The primary goals of the study were to (1) examine the constrained scaling of the FFMQ; (2) explore the unique features of the past meditators; (3) replicate the factor structure of FFMQ using CFA in German-speaking samples; and (4) using HFA to illustrate how the factor structure of FFMQ changes

from level to level across participants with different levels of meditation experience.

We indeed found evidence that three scales of the FFMQ were constrained (i.e., observing, describing, and non-judging). An average of 15% of the respondents of these scales reaching the highest value was too high and we would not expect it from a normal distribution. In an ideal situation of the normal distribution whose mean equals three and which ranges from one to five, the respondents reaching the highest value should be less than 3% (simulated with a sample size of 10,000, and SD of .50 to .75). This meant that some items of the FFMQ were too simple, and those who could have had a higher score were more prone to reach the highest level possible, in particular the meditators or participants after the MBCT. Therefore, as reported in previous studies (Baer et al. 2006; Gu et al. 2016; Williams et al. 2014), in those samples whose scores were skewed in a similar way, the facets correlated higher and all load on the overall construct, whereas for the non-meditators or participants before the MBCT, not as many people reached the highest value possible and thus the correlation and the loadings were also lower. These results could also be linked to our CFA results. Because our non-meditators scored high in the five facets and reached the constrained scaling in observing, describing, and non-judging as what usually happened in the meditators, the CFA model which assumes all five facets loaded on the overall mindfulness also gained a great fit despite a slight lower loading of the observing facet across all three samples. Unlike what has been found in the literature, observing loaded significantly on the overall construct of mindfulness even in our non-meditator sample. This should be linked to the fact that our non-meditator sample obtained higher mean scores on almost all facets compared to previous samples. The reason behind it could be that our non-meditators were probably very open-minded and curious because they came and filled in the questionnaires on our website voluntarily without any incentives and were curious to get a feedback on their own scores. On the other hand, our sample was also rather well educated: More than half of the participants had a university degree or were studying at the time they filled in the questionnaire.

Compared to the past meditators and the non-meditators, the current meditators had extensive meditation experience. This was why the current meditators scored significantly higher in all five facets of mindfulness. The fact that the past meditators were similar to the non-meditators in acting with awareness, non-judging, and non-reacting, but scored higher in observing and describing as well as different effect sizes among the five facets across all three samples suggested that there might be different cultivation and extension procedures for the five facets of mindfulness. For example, once people learned how to link body sensations to emotions, they would be able to observe and describe feelings more precisely and this is unlikely to wash out fast, maybe not at all. On the other hand, the other three facets



◀ **Fig. 1** Hierarchical factor analysis for the current meditators (a, $n = 754$), the past meditators (b, $n = 794$), and the non-meditators (c, $n = 716$). Varimax-rotated principal components (FUPC, first un-rotated principal). Codes refer to factor numbers at a certain level, e.g., 3/1, the first factor at the three-factor level. Factors are represented as rectangles, whose width corresponds to the factor's size—that is, to the amount of variance accounted for by that factor (the width of the colored rectangles indicated each facets' explained variance on this factor; only facets had items that their loadings were equal or larger than .40 were indicated). Numbers in brackets indicate the items of the scale, which had loadings that were equal or larger than .40 on the corresponding factor. The colored code: observing = red; describing = blue; acting with awareness = purple; non-judging = yellow; non-reacting = green

might need continuous training or regular training at the current moment to develop them, as they were cultivated by actively applying certain techniques (e.g., using breathing as an anchor). The fact that those past meditators with intensive trainings (cluster 3—more than once a year, more than once a week, and more than 10 min each session) scored higher in all five facets than those past meditators who practiced less (cluster 1 and cluster 2) revealed that giving up training would not be too much of a loss as long as one trained intense enough in the past. These results supported the hypothesis that the past meditators should be separated from the current meditators and the non-meditators and be investigated as an independent sample. Although some of them did have extensive meditation experience, stopping practicing meditation made them notably different in terms of their mindfulness level from both the current meditators and the non-meditators. This can also be revealed in our findings of HFA, how the factors unfolded from solution to solution differed across all three samples.

The HFA illustrated a clear picture on how observing facet loaded on the overall construct of mindfulness differently across the three samples. Observing loaded lower on the overall construct of mindfulness across all three samples, and much lower for those who had less meditation experience (i.e., the past meditators and the non-meditators). Regarding people with no meditation experience, the facet observing emerged at the third iteration and stayed unchanged since then. However, with respect to the current meditators, observing was a more significant part of the general factor from the very beginning and crystallized as a unique factor only at the fourth iteration. Furthermore, the results also supported the proposed explanation by Baer et al. (2006, 2008): People with different levels of meditation experience may observe differently with non-meditators tending to observe in a judgmental way and the meditators tending to observe mindfully. This pattern could be discovered within the development of the factor structures from solution to solution. For the non-meditators, instead of being fused with other items into one factor, observing became a separate factor quite early, while for the current meditators and the past meditators, there were levels where observing items were fused with the items from other facets (i.e., awareness and non-reacting). This could provide a

statistical support for the statement that meditators and non-meditators observed differently, with the former being more likely to observe mindfully and the latter being more likely to observe without being attentive and non-reactive.

All in all, the study provided empirical answers to the issues of the observing facets of the FFMQ. It could be a combination of different reasons: (1) the non-normality nature of the FFMQ; (2) the heterogeneous sampling, which leads to the different procedures of the cultivation as well extinction of the five facets; (3) differences between laypersons and meditators on how they observe. However, these effects were currently mixed up and future studies might think of investigating each hypothesis specifically.

Limitations and Future Research

The results of the study must be interpreted with caution due to several limitations. First, although by using internet recruitment we could reach large and geographically distributed populations (all over German-speaking countries), it could also cause a selection bias in our data. For instance, we were more likely to recruit participants who were interested in positive psychology in general or who were curious about themselves. We tried to avoid this selection bias by advertising our study as much as we can and by writing invitation letters/e-mails and addressing the importance of the study to the targeted participants. It is different as simply putting the questionnaires on the website and waiting for individuals who happen to have Internet, visit the website, and decide to participate in the survey. However, we must acknowledge that at least some participants were biased, and this could affect the representativeness of the study, and it could also be the reason why we have a rather mindful non-meditator sample. Given that it is hard to reach the relevant sample (in particular the meditators), this sample method is still effective despite its limitations. Future studies could consider it as the first approach and expand to other means such as paper-pencil questionnaire, telephone, or personal interview to obtain a broader sample.

Second, we discussed the impact of meditation experience on mindfulness cultivation (i.e., whether one is currently practicing meditation and how intense one practices) and we found inconsistency across the five facets (i.e., some were easier to cultivate and some fade away faster). However, the practicing experience alone is not the full picture, as the participants in our study as well as reported in other studies all uniformly underwent similar trainings. Other factors should also play a role, which was not controlled in our current study. For instance, why the past meditators stopped their meditation practice could be of importance, and future studies might explore this question in more details. In addition, we could well imagine participants' education, personal experiences, and their cognitive ability (e.g., memory and learning) could also influence their mastery of mindfulness skills. Taking describing as

an example, which encourages practitioners to describe, label, or note the observed phenomena by covertly applying words (Baer et al. 2004), was related to education as shown in previous studies (Baer et al. 2008; Van Dam et al. 2009). Therefore, future studies should consider controlling the possible covariance.

Third, the measure of the meditation experience was not optimal in the current study. The meditation experience of participants was asked by using ordinal scales, which was hard to compare in further analysis. Future studies might consider asking directly the concrete numbers to make linear modeling possible. In addition to the general questions, one should also consider asking participants' daily behavior in specific context (e.g., event sampling methods).

Acknowledgments The authors thank Richard Brunsch and Sonja Heintz for their help with setting up the questionnaires on the website, as well as Jennifer Hofmann and Alexander Stahlmann for their comments on an earlier version of the manuscript.

Author Contributions DP: initiated, designed, and executed the study, analyzed the data, and wrote the paper. WR: initiated and designed the study, assisted with the data analysis, and collaborated in the writing.

Funding This study was funded by the Swiss National Science Foundation (grant number 165465).

Compliance with Ethical Standards

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

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the Ethics Committee of Department of Psychology at the University of Zurich and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

Open Access This article is distributed under the terms of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made.

References

- Aguado, J., Luciano, J. V., Cebolla, A., Serrano-Blanco, A., Soler, J., & García-Campayo, J. (2015). Bifactor analysis and construct validity of the Five Facet Mindfulness Questionnaire (FFMQ) in non-clinical Spanish samples. *Frontiers in Psychology, 6*, 404. <https://doi.org/10.3389/fpsyg.2015.00404>.
- Baer, R. A. (2011). Measuring mindfulness. *Contemporary Buddhism, 12*, 241–261. <https://doi.org/10.1080/14639947.2011.564842>.
- Baer, R. (2016). Assessment of mindfulness and closely related constructs: introduction to the special issue. *Psychological Assessment, 28*, 787. <https://doi.org/10.1037/pas0000309>.
- Baer, R. A., Smith, G. T., Hopkins, J., Krietemeyer, J., & Toney, L. (2006). Using self-report assessment methods to explore facets of mindfulness. *Assessment, 13*, 27–45. <https://doi.org/10.1177/1073191105283504>.
- Baer, R. A., Smith, G. T., Lykins, E., Button, D., Krietemeyer, J., Sauer, S., et al. (2008). Construct validity of the five facet mindfulness questionnaire in meditating and nonmeditating samples. *Assessment, 15*, 329–342. <https://doi.org/10.1177/1073191107313003>.
- Baer, R., Smith, G., & Allen, K. (2004). Assessment of mindfulness by self-report: the Kentucky inventory of mindfulness skills. *Assessment, 11*, 191–206. <https://doi.org/10.1177/1073191104268029>.
- Bowman, A. S. (2014). *Evaluating the psychometric properties of the five-facet mindfulness questionnaire: An item response theory analysis* (Master's thesis, Middle Tennessee State University). Available from ProQuest Dissertations & Theses Global database. (UMI No. 1556621)
- Christopher, M. S., Neuser, N. J., Michael, P. G., & Baitmangalkar, A. (2012). Exploring the psychometric properties of the five facet mindfulness questionnaire. *Mindfulness, 3*, 124–131. <https://doi.org/10.1007/s12671-011-0086-x>.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale: Erlbaum.
- Curtiss, J., & Klemanski, D. H. (2014). Factor analysis of the five facet mindfulness questionnaire in a heterogeneous clinical sample. *Journal of Psychopathology and Behavioral Assessment, 36*, 683–694. <https://doi.org/10.1007/s10862-014-9429-y>.
- de Bruin, E. I., Topper, M., Muskens, J. G., Bögels, S. M., & Kamphuis, J. H. (2012). Psychometric properties of the Five Facets Mindfulness Questionnaire (FFMQ) in a meditating and a non-meditating sample. *Assessment, 19*, 187–197. <https://doi.org/10.1177/1073191112446654>.
- Eberth, J., & Sedlmeier, P. (2012). The effects of mindfulness meditation: a meta-analysis. *Mindfulness, 3*, 174–189. <https://doi.org/10.1007/s12671-012-0101-x>.
- Ghasemi, A., & Zahediasl, S. (2012). Normality tests for statistical analysis: a guide for non-statisticians. *International Journal of Endocrinology and Metabolism, 10*, 486–489. <https://doi.org/10.5812/ijem.3505>.
- Goldberg, L. R. (2006). Doing it all bass-ackwards: the development of hierarchical factor structures from the top down. *Journal of Research in Personality, 40*, 347–358. <https://doi.org/10.1016/j.jrp.2006.01.001>.
- Grossman, P., Niemann, L., Schmidt, S., & Walach, H. (2004). Mindfulness-based stress reduction and health benefits: a meta-analysis. *Journal of Psychosomatic Research, 57*, 35–43. [https://doi.org/10.1016/S0022-3999\(03\)00573-7](https://doi.org/10.1016/S0022-3999(03)00573-7).
- Gu, J., Strauss, C., Crane, C., Barnhofer, T., Karl, A., Cavanagh, K., & Kuyken, W. (2016). Examining the factor structure of the 39-item and 15-item versions of the Five Facet Mindfulness Questionnaire before and after Mindfulness-Based Cognitive Therapy for people with recurrent depression. *Psychological Assessment, 28*, 791–802. <https://doi.org/10.1037/pas0000263>.
- Hou, J., Wong, S. Y. S., Lo, H. H. M., Mak, W. W. S., & Ma, H. S. W. (2014). Validation of a Chinese version of the Five Facet Mindfulness Questionnaire in Hong Kong and development of a short form. *Assessment, 21*, 363–371. <https://doi.org/10.1177/1073191113485121>.
- Kabat-Zinn, J. (1994). *Wherever you go, there you are: mindfulness meditation in everyday life*. New York: Hyperion.
- Lilja, J., Frodi-Lundgren, A., Hanse, J., Josefsson, T., Lundh, L.-G., Sköld, C., et al. (2011). Five Facets Mindfulness Questionnaire—

- reliability and factor structure: a Swedish version. *Cognitive Behaviour Therapy*, 40, 291–303. <https://doi.org/10.1080/16506073.2011.580367>.
- Michalak, J., Zarbock, G., Drews, M., Otto, D., Mertens, D., Ströhle, G., et al. (2016). Erfassung von Achtsamkeit mit der deutschen Version des Five Facet Mindfulness Questionnaires (FFMQ) [Assessment of mindfulness with the German version of the Five Facet Mindfulness Questionnaires (FFMQ)]. *Zeitschrift für Gesundheitspsychologie*, 24, 1–12. <https://doi.org/10.1026/0943-8149/a000149>.
- Reynolds, A. P., Richards, G., de la Iglesia, B., & Rayward-Smith, V. J. (2006). Clustering rules: a comparison of partitioning and hierarchical clustering algorithms. *Journal of Mathematical Modelling and Algorithms*, 5, 475–504. <https://doi.org/10.1007/s10852-005-9022-1>.
- Rosseel, Y. (2012). Lavaan: an R package for structural equation modeling. *Journal of Statistical Software*, 48, 1–36. <https://doi.org/10.18637/jss.v048.i02>.
- Rousseeuw, P. (1987). Silhouettes: a graphical aid to the interpretation and validation of cluster analysis. *Computational and Applied Mathematics*, 20, 53–65. [https://doi.org/10.1016/0377-0427\(87\)90125-7](https://doi.org/10.1016/0377-0427(87)90125-7).
- Sauer, S., Walach, H., Schmidt, S., Hinterberger, T., Lynch, S., Büssing, A., & Kohls, N. (2013). Assessment of mindfulness: review on state of the art. *Mindfulness*, 4, 3–17. <https://doi.org/10.1007/s12671-012-0122-5>.
- Segal, Z. V., Williams, J. M. G., & Teasdale, J. D. (2013). *Mindfulness-based cognitive therapy for depression* (2nd ed.). New York: Guilford Press.
- Taylor, N. Z., & Millier, P. M. R. (2016). Validity of the Five Facet Mindfulness Questionnaire in an Australian, meditating, demographically diverse sample. *Personality and Individual Differences*, 90, 73–77. <https://doi.org/10.1016/j.paid.2015.10.041>.
- Van Dam, N. T., Earleywine, M., & Danoff-Burg, S. (2009). Differential item function across meditators and non-meditators on the Five Facet Mindfulness Questionnaire. *Personality and Individual Differences*, 47, 516–521. <https://doi.org/10.1016/j.paid.2009.05.005>.
- Veehof, M. M., Peter, M., Taal, E., Westerhof, G. J., & Bohlmeijer, E. T. (2011). Psychometric properties of the Dutch Five Facet Mindfulness Questionnaire (FFMQ) in patients with fibromyalgia. *Clinical Rheumatology*, 30, 1045–1054. <https://doi.org/10.1007/s10067-011-1690-9>.
- Williams, M. J., Dalgleish, T., Karl, A., & Kuyken, W. (2014). Examining the factor structures of the Five Facet Mindfulness Questionnaire and the Self-Compassion Scale. *Psychological Assessment*, 26, 407–418. <https://doi.org/10.1037/a0035566>.