Mind Full of Ideas: A Meta-Analysis of the Mindfulness–Creativity Link

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Mind full of ideas: A meta-analysis of the mindfulness–creativity link

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ABSTRACT

Mindfulness improves people's functioning in many areas, but its relationship with creativity is equivocal. To assess the link between mindfulness and creativity, we present a multilevel meta-analysis of 89 correlations obtained from 20 samples in studies published between 1977 and 2015 and demonstrate a statistically significant, but relatively weak correlation ($r = .22$) between these two constructs. This effect was moderated by the type of mindfulness, being significantly lower in case of the awareness aspect of mindfulness, than in the case of the open-monitoring aspect. We discuss the theoretical and practical implications of these findings.

Mindfulness is a state of nonjudgmental, sustained, and alert awareness resulting from living in the moment (Brown & Ryan, 2003), which improves people's cognitive, emotional, and interpersonal functioning (Carson & Langer, 2006; Sedlmeier et al., 2012) and positively affects the efficacy of stress regulation. In previous studies authors have found that mindfulness also improves the ability to concentrate (Sedlmeier et al., 2012), decreases the fear of being judged, as well as reduces aversive self-conscious experience (Brown, Ryan, & Creswell, 2007), and helps to deal with thoughts and feelings (Shapiro, Carlson, Astin, & Freedman, 2006). The enhancement of mindfulness through practicing meditation (Lutz, Dunne, & Davidson, 2007) as well as high level of self-reported mindfulness have previously been linked to processes important to creativity (Ball, 1980; Colzato, Ozturk, & Hommel, 2012). Creativity, understood as the ability to produce ideas that are both novel and appropriate (Amabile, 1996; Sternberg & Lubart, 1996), is typically measured by the divergent thinking tests, during which participants are asked to name as many uses for a common object (e.g., brick) as possible within a limited amount of time (Guilford, 1967). Responses are scored in terms of fluency (number of ideas), flexibility (number of categories), originality (statistical novelty of responses), and elaboration (level of details). Other measures of creativity include self-report scales concerning creative behavior, personality, and activities (Baas, De Dreu, & Nijstad, 2008; Simonton, 2012), or creative achievement (Carson, Peterson, & Higgins, 2005). Less commonly, creativity researchers use tasks with a single correct answer, such as insight problems — for example, remote association tests (RAT; Mednick & Mednick, 1967).

A number of abilities which are associated with trait mindfulness, or facilitated by mindfulness training are also linked with creativity (De Dreu, Nijstad, Baas, Wolsink, & Roskes, 2012). For instance, mindfulness is associated with the increased ability to switch perspectives (Carson & Langer, 2006; Feldman, Hayes, Kumar, Greeson, & Laurenceau, 2007), while mindfulness training leads to the improvement of working memory (Chiesa, Calati, & Serretti, 2011), as well as increases the ability to respond in a non-habitual fashion (Moore & Malinowski, 2009). Practicing mindfulness also reduces the fear of judgment (Carson & Langer, 2006), which is conducive to creativity (Baas et al., 2008; Nijstad, De Dreu, Rietzschel, & Baas, 2010). Consequently, mindfulness may be both directly and indirectly related to creative thinking (Davis, 2009; De Dreu, Baas, & Nijstad, 2008), and to creative achievement (Langer, 2014).

A wide body of research has indeed shown that meditation training enhances creative thinking and creative performance as well as improves the ability to solve insight problems (Colzato et al., 2012; Ding, Tang, Deng, Tang, & Posner, 2015; Ding, Tang, Tang, & Posner, 2014; Ostafin & Kassman, 2012; Ren et al., 2011) and facilitates creative elaboration (Zabelina, Robinson, Ostafin, & Council, 2011). Experienced meditators also outperform others in verbal fluency and are better at finding novel solutions to a given problem (Grenberg, Reiner, & Meiran, 2012). Importantly, meditation has a positive effect on creativity regardless of the length of practice (Jedrczak, Beresford, & Clements, 1985), which means that even short meditation can effectively stimulate creative abilities (Ding et al., 2014).

However, although the findings of several studies support the positive link between mindfulness and creativity, some inconsistencies exist. For example, while meditation was clearly demonstrated to improve verbal fluency, flexibility, and originality (Justo, 2009), longitudinal examination of groups practicing transcendental meditation for

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five months did not show any significant gains in verbal creativity, but did reveal a significant improvement in figural flexibility and originality (Travis, 1979). Such inconsistencies may be attributed to a number of moderators, among them the type of meditation (Colzato, Szapora, Lippelt, & Hommel, 2014), and the multidimensional character of mindfulness (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006; Baas, Nevicka, & Ten Velden, 2014). Mindfulness is a complex phenomenon, composed of a set of different skills: the ability to pay attention to various stimuli (observation), the ability to focus with full awareness (acting with awareness), the ability to give a nonevaluative verbal description of the observed phenomena (description), and the ability to avoid immediate evaluation (Baer et al., 2006). These skills may be differentially related to creativity — for example, while open-monitoring meditation (so-called targeting observation) may tend to increase creative thinking, focused-attention meditation (aimed at acting with awareness) may be either unrelated to creativity (Colzato et al., 2012), or may even impede performance on creativity tasks (Baas et al., 2014; Zedelius & Schooler, 2015). Additionally, phenomena contrary to mindfulness, such as disinhibition and mind-wandering, predict creative thinking and creative achievement (Baird et al., 2012; Carson, Peterson, & Higgins, 2003; Eysenck, 1995; Schooler, Reichle, & Halpern, 2004; Zabelina, O'Leary, Pornpattananangkul, Nusslock, & Beeman, 2015; Zedelius & Schooler, 2015). Thus it is possible that the facets of mindfulness may moderate the mindfulness–creativity association.[1]

Despite inconsistencies, both the general pattern of empirical results as well as theoretical arguments (Langer, 2014) provide a rationale to hypothesize a positive association between mindfulness and creativity. Although empirical studies do not always confirm this link (e.g., Domino, 1977; O'Haire & Marcia, 1980), the higher statistical power of meta-analysis enables a more robust estimation of this relationship. It also allows us to explore the role of potential moderators.

The scarcity of published studies makes it impossible to investigate all of the theoretically relevant moderators. However, it is possible to examine the role of study design (correlational versus experimental studies showing the influence of meditation on creativity), the creativity aspects measured (insight problem solving versus divergent thinking), as well as the aspects of mindfulness measured. Both existing theories (Fink, Slamar-Halbedl, Unterrainer, & Weiss, 2012) and previous research (Zedelius & Schooler, 2015) lead to the expectation that the attention aspect of the mindfulness – measured, for example, by the Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003) – will be significantly less strongly (or even negatively — see Baas et al., 2014) related to creativity than other aspects of mindfulness.

1. Method

1.1. The selection of studies

We performed a literature search in the Google Scholar, PsycInfo, Ebsco, and Scopus databases as well as at ResearchGate.net and Academia.edu. The first stage involved a search for articles by means of the following keywords: creativity and mindfulness, creativity and meditation, creative problem solving and mindfulness, and creative problem solving and meditation. In the second stage, we scanned the databases for all the authors of the publications found. In the last stage, the query involved an analysis of the references from each of the papers. The first author found and analyzed 33 articles. The third author conducted an independent review of all the identified articles. This meta-analysis includes papers published in peer-reviewed journals and based on quantitative research; we excluded theoretical or review papers (e.g., Horan, 2009; Mooneyham & Schooler, 2013), and those in which only one of the main variables (creativity or mindfulness) was directly measured (e.g., Langer, Russell, & Eisenkraft, 2009). We also excluded publications that concerned constructs closely related to, but not identical with creativity, such as openness to experience or cognitive flexibility (e.g., Moore & Malinowski, 2009).

We included articles devoted to both trait and state mindfulness (Bishop et al., 2004). In the case of experimental studies, we did not exclude any of the types of meditation (e.g., focused attention or open-monitoring). One study that lacked a control group or baseline level of creativity was excluded from the analysis (Colzato et al., 2014). This procedure resulted in 20 independent samples and 89 correlations obtained in a total sample of 1549 participants.

1.2. Data analysis

We applied three-level meta-analysis (Cheung, 2014a; Cheung, 2014b) in the metaSEM package (Cheung, 2014a) for the *R* environment (*R* Development Core Team, 2013). Level 1 describes the participants in studies, Level 2 describes effects within studies, and Level 3 describes the studies themselves. Three-level meta-analysis allows us to give unbiased estimates of standard errors, Level 2 (within-study) variance, and Level 3 (between-study) variance. Three-level meta-analysis has an advantage over traditional random-effect meta-analysis (which should be considered a two-level model) because averaging the effects, which is necessary in random-effects models, reduces the statistical power of the analysis.

We converted all the obtained effects (i.e., mean differences between experimental and control groups in experimental designs) to Pearson's *r*, applying widely used formulas (Lipsey & Wilson, 2001). All correlations were corrected for unreliability: they were divided by the square root of the reliabilities of the variables (Hunter & Schmidt, 1990). When reliability estimates were not provided, we used average reliabilities. For comparison purposes, Table 1 contains both reliability-corrected and uncorrected correlations. All studies and correlations are included in the online supplementary material.

2. Results

We processed data in three-steps. First, we estimated overall effect sizes for the relationship between mindfulness and creativity. Second, we fitted three three-level models to assess the role of potential moderators. Finally, we performed an analysis of publication bias to examine whether selective reporting may have influenced the results.

2.1. The overall relationship

The effect sizes obtained using three-level meta-analysis are presented in Table 1.

The correlation between mindfulness and creativity was estimated at $r = .22$ ($r = .18$ without correction for attenuation). This correlation is significant but heterogeneous. We found more between-study than within-study variability, which means moderators are more likely to exist between than within studies. Despite this heterogeneity, our main hypothesis finds support — creativity does correlate with mindfulness significantly, with a "small-to-medium" effect size (Cohen, 1992; Lipsey & Wilson, 2001).

2.2. Moderator analysis

In the first model testing the role of moderators, we included: (1) study design, coded: 0 = *correlational*, 1 = *experimental*; (2) creativity measurement, coded: 0 = *self-reported*, 1 = *test*; (3) the aspect of creativity, coded: 0 = *achievement*, 1 = *potential*, and (4) gender (the percentage of females). This model was not characterized by a significantly improved fit compared to the baseline model, $-2LL(df = 6) = 5.93$, $\Delta\text{-}2LL(\Delta df = 3) = 6.57$, $p = .09$, and none of the moderators were significant, $p > .05$. Consequently, the effect was stable across

[1] We are grateful to the anonymous reviewer for bringing this to our attention.

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Table 1
Overall effect size obtained using three-level meta-analysis.

Model	No. of studies	No. of effects	*N*	Effect size (*r*)	95% CI	*p*
Unreliability-corrected	20	89	1549	.220	.095, .344	<.001
Unreliability-uncorrected	20	89	1549	.183	.078, .289	<.001
Model summary	Level-2 $s^2 = .029$ ($SE = .007$), $p < .001$, $I^2 = .30$					
	Level-3 $s^2 = .061$ ($SE = .026$), $p = .02$, $I^2 = .63$					
	$Q(df = 88) = 1027.37$, $p < .001$, $-2LL(df = 3) = 12.50$					

correlational and experimental studies as well as studies with creativity assessed via test or self-reported measures.

In the second step, we tested the role of the measure of mindfulness. The Kentucky Inventory of Mindfulness Skills (KIMS), which was used most often across the studies (35 times) served as a reference category, while the MAAS, Integrative Mind-Body Training (IBMT), the Five Facet Mindfulness Questionnaire (FFMQ), OM Meditation, Transcendental Meditation, and "other" types of meditation were introduced as dummy variables. This model was better fitted than the baseline, $-2LL(df = 9) = -1.125$, $\Delta\text{-}2LL(\Delta df = 6) = 13.63$, $p = .03$, and, consistently with our predictions, MAAS scores resulted in significantly weaker relationships with creativity than KIMS scores ($B = -0.31$, $SE = 0.14$, $p = .03$).

In the third step, we reduced all the analyzed effects to those focusing on creative abilities (68 correlations from 18 studies, with the average effect size of $r = .20$, $SE = 0.07$, $p = .004$) and examined whether the type of creative abilities moderated the obtained effects. Insight problem solving skills served as a reference category, while other aspects of creativity were introduced as dummies. The model was fitted significantly better than the baseline model, $-2LL(df = 8) = -0.29$, $\Delta\text{-}2LL(\Delta df = 5) = 25.01$, $p < .001$, with all predictors except composite divergent thinking being statistically significant (Table 2).

We applied our final model to simultaneously test the role of creative thinking skills (0 = *divergent thinking*, 1 = *insight*), the type of mindfulness (0 = *other*, 1 = *MAAS*), and the interaction of the two. This model was fitted better than the baseline, $-2LL(df = 6) = 15.26$, $\Delta\text{-}2LL(\Delta df = 3) = 9.46$, $p = .02$ (Table 3). MAAS remained the only predictor of the mindfulness–creativity relationship; neither insight nor the *Insight* × *MAAS* interaction was significant.

2.3. Publication bias

We used two methods to assess the risk of publication bias. The first one was the analysis of the funnel plot (Duval & Tweedie, 2000). The second one involved the application of *p*-curve analysis (Simonsohn, Nelson & Simmons, 2014). The funnel plot was symmetric (Fig. 1), without a pattern showing that smaller studies yielded higher effect sizes. The trim-and-fill method (Duval & Tweedie, 2000) suggests adding four more studies, which would reduce the observed effect to $r = .135$ (95% *CI*: .03, .24). However, in the case of high heterogeneity, this method is considered too restrictive (Peters, Sutton, Jones, Abrams, & Rushton, 2007).

To examine the publication bias using a more recent technique, we performed a *p*-curve analysis (Simonsohn, Nelson & Simmons, 2014; http://www.p-curve.com/). The *p*-curve analysis focuses only on statistically significant effects and serves to check whether "just significant effects" (i.e., slightly lower than $p = .05$, or between $p = .04$ and $p = .05$) are not overrepresented in the analyzed studies. Such overrepresentation may stem from publication bias, but also from "cherry-picking," "*p*-hacking," or other questionable research practices (Simonsohn, Simmons & Nelson, 2014). The *p*-curve analysis did not provide any evidence of the file-drawer effect — a majority of studies provided significant results, and there was no overrepresentation of "just-significant" ones (Fig. 2).

The continuous test for a right-skewed curve – showing that studies contain evidential value – was statistically significant ($z = -5.31$, $p < .001$), while testing for the left-skewed studies (i.e., those that exhibit evidence of *p*-hacking) did not bring significant results ($p > .999$).

3. Discussion

Although famous creators are sometimes absentminded, creativity seems to require mindfulness. Indeed, this meta-analysis showed that creativity and mindfulness are significantly related, with a "small-to-medium" effect size (Cohen, 1992). Although this effect was not moderated by the design of the studies, it tended to be stronger when creativity measurement had the form of insight tasks rather than divergent thinking tasks. When the aspects of creative thinking skills were regressed on the general effect together with the mindfulness type, the only statistically significant relationship was the one with the awareness aspect of the mindfulness (measured by the MAAS scale), generating lower effect size. We found no serious evidence of publication bias or *p*-hacking, which allows us to conclude that this estimation is both accurate and robust.

From the theoretical standpoint, the relationship we obtained fits well into the postulated role of mindful mind in creative thinking and behavior (Langer, 2014). However, the moderators that we were able to include in our analyses also shed light on the theoretically important questions about the nature of this relationship. First, we were unable to find any differences between correlational and experimental studies — in both types of studies the effect size of the association was the same. We perceive this null finding as important, as it shows not only that creativity and mindfulness correlate with each other, but also, more importantly, that developing mindfulness during meditation increases

Table 2
Moderator analysis — multilevel model estimating the effects of different aspects of creative abilities (insight = reference category).

Predictor	Estimate	*SE*	95% CI	*p*
Intercept	0.45	0.11	0.24, 0.66	<.001
Fluency	−0.52	0.12	−0.76, −0.29	<.001
Flexibility	−0.34	0.13	−0.59, −0.09	.007
Originality	−0.47	0.12	−0.70, −0.24	<.001
Elaboration	−0.57	0.16	−0.88, −0.26	.001
Composite divergent thinking	−0.22	0.16	−0.54, 0.09	.17
Within-study variance	0.02	0.006	0.005, 0.03	.005
Between-study variance	0.13	0.06	0.02, 0.25	.02

Table 3
Moderator analysis — multilevel model estimating the effects of the type of creative abilities and the type of mindfulness.

Predictor	Estimate	*SE*	95% CI	*p*
Intercept	0.31	0.07	0.18, 0.44	<.001
Insight (*other* = *0*)	0.005	0.16	−0.31, 0.32	.98
MAAS (*other* = *0*)	−0.73	0.23	−1.17, −0.28	.002
Insight × *MAAS*	0.47	0.29	−0.11, 1.04	.11
Within-study variance	0.04	0.01	0.02, 0.06	<.001
Between-study variance	0.03	0.02	−0.004, 0.07	.08

Note. This model is based on 68 correlations from 18 studies dealing with creative abilities.

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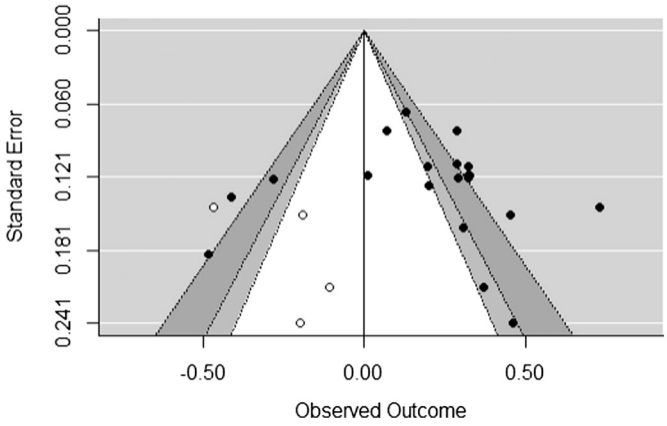

Fig. 1. Publication bias analysis — a funnel plot.

creativity as well. Therefore, there are good reasons to believe that there is not only correlation, but also causation in the mindfulness–creativity link. Putting these findings together – i.e., showing a correlational as well as causal link between mindfulness and creativity understood as potential (comprising cognitive and self-concept aspects) – may have important consequences for the educational psychology of creativity and for the practice of creative education. It was demonstrated previously that the kind of creativity training that promotes not only awareness and imagination but also mindfulness-related skills is effective (Karwowski & Soszyński, 2008). It is very likely that such mindfulness-based interventions, especially ones based on open-monitoring meditation, may be beneficial for creative abilities as well as for creative self-concept.

The relationship between mindfulness and creativity was significantly lower when research concerned the awareness aspects of mindfulness. The awareness aspect of mindfulness can be contrasted with disinhibition and mind-wandering, which have been previously reported to be linked with creativity (Schooler et al., 2004). Previous studies reported that the awareness of irrelevant environmental clues, as well as shifting attention from one object to another can lead to insight and play an important role in the creative process (Baird et al., 2012; Carson et al., 2003). Similarly, the inability to effectively filter irrelevant sensory information may lead to creativity in real world settings (Zabelina et al., 2015). At least two previous studies (included in this meta-analysis) showed that high awareness is negatively associated with creativity (Baas et al., 2014; Zedelius & Schooler, 2015). Indeed, the effect of the relationship between attention-based mindset and creativity was significantly weaker than in the case of other aspects of mindfulness. It is likely that different aspects of mindfulness, such as open-monitoring abilities and awareness, play a role at different stages of the creative process. It is worth to explore this issue in future research.

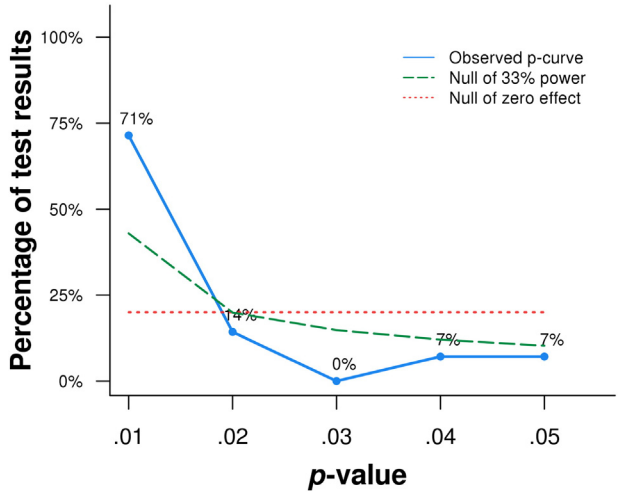

Fig. 2. P-curve analysis results.

3.1. Limitations and future research

It is necessary to consider a number of limitations while interpreting the results of this meta-analysis. First, due to the small number of studies, it was impossible to analyze all potential moderators of this relationship. Consequently, future research on the creativity–mindfulness link should differentiate between various aspects, levels, and forms of creativity as related to mindfulness. It is especially important to examine whether the observed relationship between mindfulness and self-reported creativity stems to a greater extent from creative self-concept variables (Karwowski & Lebuda, in press) or from past creative activity or achievement. Although this meta-analysis demonstrates the link between mindfulness and creativity mainly at the little-c creativity level (Kaufman & Beghetto, 2009), there are arguments to believe that mindfulness may also play a role in the case of professional creators in different domains (Langer et al., 2009). Similarly, it is important to explain how mindfulness works in general and how its different types work at different stages of the creative process, when problems are defined and when solutions are generated, elaborated, and assessed.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.paid.2015.09.040.

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[2] Asterisk indicates studies included in the meta-analysis.

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