Specific Mindfulness Skills Differentially Predict Creative Performance

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Abstract

Past work has linked mindfulness to improved emotion regulation, interpersonal skills, and basic cognitive abilities, but is unclear about the relation between mindfulness and creativity. Studies examining effects of mindfulness on factors pertinent to creativity suggest a uniform and positive relation, whereas work on specific mindfulness skills suggests that mindfulness skills may differentially predict creativity. To test whether the relation between mindfulness and creativity is positive and uniform (the uniform hypothesis) or differentially depends on particular components of mindfulness (the differential hypothesis), we conducted four studies in which mindfulness skills were measured, extensively trained, or manipulated with a short, incidental meditation session. Results supported a differential relation between mindfulness and creativity: Only the ability to observe and attend to various stimuli consistently and positively predicted creativity. Results regarding other mindfulness skills were less consistent. Implications for theory and practice are discussed.

Keywords

mindfulness, meditation, creativity, flexibility

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Mindfulness, a state of conscious awareness resulting from living in the moment (Brown & Ryan, 2003; Kabat-Zinn, 1994), received increasing attention in recent years from researchers as well as practitioners. Much of its popularity can be attributed to the beneficial effects mindfulness has on emotion regulation as well as interpersonal and cognitive abilities. For instance, mindfulness associates with improved stress regulation (Sedlmeier et al., 2012; Shapiro, Carlson, Astin, & Freedman, 2006), communication skills (DeKeyser, Raes, Leijssen, Leysen, & Dewulf, 2008), empathy (DeKeyser et al., 2008), self-esteem (Brown & Ryan, 2003; Carson & Langer, 2006), positive affect (Jain et al., 2007; Jha, Stanley, Kiyonaga, Wong, & Gelfand, 2010), well-being (Carmody & Baer, 2008; Feldman, Hayes, Kumar, Greeson, & Laurenceau, 2007; Sedlmeier et al., 2012), and reduced fear of being judged by others (Carson & Langer, 2006). Mindfulness has also been linked to improved cognitive functioning, including enhanced working memory capacity and intelligence (Chiesa, Calati, & Serretti, 2011; Jha et al., 2010; Sedlmeier et al., 2012), sustained attention to objects and enhanced task concentration (Lutz, Slagter, Dunne, & Davidson, 2008; Shapiro et al., 2006), the ability to switch perspectives (Carson & Langer, 2006; Feldman et al., 2007), and the inhibition of distracting and irrelevant thoughts and feelings (Shapiro et al., 2006).

Notably, several of the aforementioned affective and cognitive factors, including positive affect (Baas, De Dreu, & Nijstad, 2008), working memory capacity (De Dreu, Nijstad, Baas, Wolsink, & Roskes, 2012), and cognitive flexibility (De Dreu, Baas, & Nijstad, 2008), are integral to driving creativity—the production of ideas, insights, or products that are both novel and appropriate (e.g., Amabile, 1996; De Dreu et al., 2008). Thus, it is surprising that the relationship between mindfulness and creativity has hitherto not been directly examined, particularly because mindfulness can be trained and as such could be used as an effective tool to enhance creativity in different domains. Based on findings outlined above, the story seems relatively straightforward: We would expect a uniform and positive link between mindfulness and creativity. However, mindfulness is a multifaceted construct, composed of different components and skills, including the ability to observe and attend to various stimuli (Observation) and the ability to focus attention with full awareness (Act with awareness [AWA]; Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006; Grossman, 2008). Therefore, alternatively, it is plausible that the relationship between mindfulness and creativity is not uniform but rather depends on the specific mindfulness component activated.

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Although many mindfulness studies use measurements and trainings that preclude clear comparisons between different components of mindfulness (Sedlmeier et al., 2012), some work does indeed suggest that these specific components differentially predict basic cognitive processes influencing creativity. In particular, the ability to observe has been associated with increased cognitive flexibility (Chambers, Gullone, & Allen, 2009; Greenberg, Reiner, & Meiran, 2012), distributed attentional focus (Davidson & Lutz, 2008; Valentine & Sweet, 1999), and the inhibition of automatic responding (Schmertz, Anderson, & Robins, 2009)—all cognitive mechanisms that constitute key drivers of creative cognition (Chermahini & Hommel, 2010; De Dreu et al., 2008). Conversely, AWA is especially associated with restrictive attentional focus (Davidson & Lutz, 2008) and reduced mind wandering (Hasenkamp, Wilson-Mendenhall, Duncan, & Barsalou, 2012; Mrazek, Smallwood, & Schooler, 2012), which may be detrimental for creative idea generation (Baird et al., 2012; Sio & Ormerod, 2009). While no research to date has directly examined the relationship between mindfulness and creativity, the few creativity studies on transcendental meditation practices that mostly aim at enhancing levels of AWA by focusing attention on a mantra show mixed findings: some studies showing a positive relationship and others showing weak or no relationships (Cowger & Torrance, 1982 vs. Domino, 1977; O'Haire & Marcia, 1980). Moreover, a recent study by Colzato, Ozturk, and Hommel (2012) showed meditation trainings predominantly facilitating the ability to observe led to more creativity than meditation trainings focusing on elevating levels of AWA.

Based on previous findings, we thus identify two competing predictions regarding the relation between mindfulness and creativity. First, based on prior research showing that mindfulness improves positive affect and basic cognitive functioning, we should expect a uniform and positive relation between mindfulness and creativity. Alternatively, taking into account the multifaceted nature of mindfulness and extant research on its separate components, we should expect a differential relation between mindfulness and creativity, with the nature of the relation being contingent on the specific components. In this study, we set out to uncover which prediction is supported by empirical evidence. Following a discussion of mindfulness and its underlying components, we review available evidence on the link between mindfulness and cognitive processes relevant to creativity. Finally, we will present results of four studies testing whether mindfulness facilitates creativity and, if so, whether it does so uniformly or differentially depending on mindfulness' specific components.

Mindfulness

Mindfulness has originated from Buddhism (Kabat-Zinn, 1994) and is characterized by non-judgmental, sustained, and alert awareness of experiences in the present moment, including physical sensations, affective states, and thoughts (Grossman, 2008; Kabat-Zinn, 1994). In a mindful state, people calmly and clearly pay attention to ongoing mental content without thinking about or evaluating ongoing mental phenomena that unfold over time (Grossman, 2008; Sedlmeier et al., 2012). Put differently, people merely observe their passing thoughts, feelings, and sensations. Being mindful can be contrasted with mind states in which people are preoccupied and easily distracted, act on automatic pilot, and do not pay attention to the present moment (Brown & Ryan, 2003).

Prior research has shown that mindfulness skills are not static but rather can be developed through the regular practice of meditation (Grossman, 2008; Kabat-Zinn, 1994; Sedlmeier et al., 2012). Of the various existing meditation techniques, focused-attention and open-monitoring meditation represent two commonly practiced and researched techniques (Lutz et al., 2008). Focused-attention meditation entails voluntarily focusing attention on a chosen object in a sustained fashion. Meditators practicing this technique direct and sustain their attention on a selected object (e.g., breathing or a specific body part). They closely monitor mind wandering and distracting thoughts, feelings, and bodily sensations, and once they become aware of the distractor, they disengage their attention from the distractor and shift their attention back to the selected object. The second style, open-monitoring meditation, involves non-judgmental monitoring of experiences in the present moment. In contrast with focused-attention meditation, it has no explicit focus on a particular object. Meditators monitor their physical sensations, affective states, and thoughts in a non-evaluative way and non-reactively become aware of automatic cognitive and emotional interpretations of their experiences.

Virtually, all meditative practices, including mindfulness meditation, involve a combination of techniques, for example, starting with focused attention on breathing, as well as an emphasis on practicing awareness (Carmody & Baer, 2008; Kabat-Zinn, 1994; Lutz et al., 2008; Sedlmeier et al., 2012). During a typical mindfulness meditation exercise, people are asked to focus their attention on an object and observe it carefully with an open attitude of curiosity and acceptance, while refraining from evaluation and self-criticism (Kabat-Zinn, 1994). The target object may refer to an ordinary activity (e.g., breathing or walking), or to environmental stimuli (e.g., sounds, smells, or sights). If participants notice their attention wandering into thoughts, memories, or emotions, they are asked to simply observe these, note their mind has wandered, and then resume attending to the target of observation. Labeling the current experience as, for instance, "emotion," "planning," or "pleasure" is often used as a tool to return to a mindful state (Baer et al., 2006).

Ultimately, mindfulness meditation results in a set of distinct mindfulness skills (Baer et al., 2006; Carmody & Baer, 2008; Kabat-Zinn, 1994): (a) *Observation*, the ability to carefully observe, notice, or attend to internal (e.g., bodily sensations, thoughts, emotions) and external phenomena (e.g., sounds,

smells)—this skill is mostly targeted with open-monitoring meditation; (b) *Act with awareness*, the ability to fully engage in current activities with undivided attention, or focus on one thing at a time with full awareness—this skill is targeted with focused-attention meditation; (c) *Description*, the ability to verbally describe observed phenomena in a non-evaluative way and without conceptual analysis (e.g., in many mindfulness interventions, participants are instructed to briefly label arising thoughts and fantasies and continue attending to the present moment); and (d) *Accept without judgment*, the ability to accept or being non-evaluative about present-moment experience (e.g., refraining from applying evaluative labels such as right/wrong and allowing reality to be as it is).

Several instruments exist to measure mindfulness, but they vary in the breadth of the specific mindfulness skills they capture. For example, in the Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003), respondents rate how often they have experiences of acting on automatic pilot and not paying attention to the present moment (items are reverse scored). As such, MAAS focuses on the mindfulness skill "Act with awareness" (Baer et al., 2006). To assess the full range of mindfulness skills, Baer et al. (2006) developed the Kentucky Inventory of Mindfulness Skills Scale (KIMS). In the present research, we are interested in examining how these different mindfulness skills relate to creativity, something we turn to in the next section.

Mindfulness, Meditation, and Creativity

Creativity is defined as the production of outcomes (e.g., ideas, drawings, and musical improvisations) that are both novel and appropriate (e.g., Amabile, 1996; De Dreu et al., 2008). Although numerous measures of creativity exist, the most commonly used instruments are ideation tasks and self-report questionnaires (Runco, 2004; Simonton, 2012). Ideation tasks are open-ended assessments of an individual's ability to generate multiple alternative solutions (Baas et al., 2008). For example, participants are asked to come up with as many creative uses for a brick as possible. Independent coders rate ideas generated by participants for fluency (number of non-redundant ideas; Guilford, 1967; Torrance, 1966) and originality (the extent to which ideas are unusual and novel; Guilford, 1967; Torrance, 1966). In addition, creativity is often assessed with self-reported inventories about an individual's creative behavior, personality, and activities (Baas et al., 2008; Simonton, 2012). For example, participants are asked to indicate how often they come up with original solutions for problems (Janssen, 2001) or to indicate whether others recognized them for their creative achievements (Carson, Peterson, & Higgins, 2005). Self-report measures of creativity often correlate substantially with more "objective" indicators of creative output, such as expert ratings of creativity and creative performance on ideation tasks (Carson et al., 2005; Furnham, Batey, Anand, & Manfield, 2008; Janssen, 2001; Simonton, 2012).

The direct link between mindfulness and creativity has heretofore not been studied. However, extant work in other domains suggests a positive relationship between mindfulness skills and creativity. Aggregated self-report mindfulness scores and meditation practices simultaneously targeting all mindfulness skills have been linked to cognitive and affective processes known to drive creative performance. First, mindfulness is associated with the ability to switch perspectives (Carson & Langer, 2006; Moore & Malinowski, 2009) and, in turn, greater flexible switching among perspectives has been associated with enhanced creativity of ideas (Ashby, Isen, & Turken, 1999; De Dreu et al., 2008). Furthermore, mindfulness training has been associated with enhanced working memory capacity (Chiesa et al., 2011; Jha et al., 2010), which relates positively to creative outcomes (De Dreu et al., 2012). Mindfulness has also been linked to positive affect (Jain et al., 2007; Jha et al., 2010), which constitutes one of the most robust predictors of creativity (Ashby et al., 1999; Baas et al., 2008). Finally, mindfulness has been associated with more authentic behavior and reduced fear of being judged by others (Carson & Langer, 2006), and fear of being judged by others relates negatively to creativity (Nijstad, De Dreu, Rietzschel, & Baas, 2010). Taken together, these previous results suggest that mindfulness meditation and self-reported mindfulness skills uniformly and positively relate to creativity.

However, there is also research pointing to the possibility that the relationship between mindfulness and creativity might not be uniform and may in fact be differentially contingent on individual components of mindfulness. Specifically, work allowing clear differentiation between the ability to attend to various stimuli (Observation) and the ability to focus attention with full awareness (AWA) suggests Observation is more strongly related to creativity than AWA. In contrast to AWA, which restricts focus to a particular target, the ability to observe entails an unrestricted awareness of arising feelings, thoughts, and sensations, and distributed attentional focus (Davidson & Lutz, 2008; Valentine & Sweet, 1999). Consequently, Observation has been associated with increased cognitive flexibility (Chambers et al., 2009; Slagter et al., 2007), greater ease to apply alternative approaches to complex problems (Greenberg et al., 2012), and inhibition of automatic responding (Schmertz et al., 2009). These cognitive mechanisms allow people scoring high on Observation to switch from one thought to another, consider different approaches to a problem, and overcome dominant (and usually less creative) responses—all key drivers of creative cognition (Chermahini & Hommel, 2010; De Dreu et al., 2008).

AWA, however, entails engagement of attentional processes to focus and sustain attention on an intended thought, sensation, or object, and to monitor and shield potentially distracting thoughts and feelings (Lutz et al., 2008; Vago & Silbersweig, 2012). This strong top–down attentional control leads, among other things, to a restrictive attention explicitly focused on one object (Davidson & Lutz, 2008) and reduced

mind wandering (Hasenkamp et al., 2012; Mrazek et al., 2012), which may be detrimental for creative idea generation (Baird et al., 2012; Sio & Ormerod, 2009). Thus, while both measurements and trainings of Observation and AWA skills have been related to some factors associated with enhanced creativity, including positive affect and enhanced working memory capacity (Colzato et al., 2012; Jha et al., 2010), compared with AWA, Observation may be more strongly related to creativity because it also facilitates cognitive flexibility.

In line with this, studies on transcendental meditation practices that mostly aim at enhancing levels of awareness by focusing attention on a mantra show mixed findings, with some studies showing a positive relationship and others showing weak or no relationships (Cowger & Torrance, 1982 vs. Domino, 1977; O'Haire & Marcia, 1980). Moreover, in an interesting study, Colzato and colleagues (2012) showed that open-monitoring meditation (predominantly targeting Observation) increased creative thinking, whereas focused-attention meditation (predominantly targeting AWA) had no effects. All in all, these findings suggest that specific mindfulness skills may differentially relate to creativity. Mindfulness skills resulting from open-monitoring meditation (e.g., Observation) may relate more strongly to creativity than those resulting from focused-attention meditation (e.g., AWA).

Overview of Studies

As outlined above, studies examining the effects of aggregated mindfulness skills on factors pertinent to creativity propose a positive relationship between mindfulness and creativity across individual components of mindfulness (the uniform hypothesis), whereas work focusing on the effects of individual mindfulness skills or meditation practices that solely targeted a particular skill suggests that mindfulness skills may differentially predict creativity, with Observation being more strongly related to creativity than AWA (the differential hypothesis).[1] We tested these two competing predictions in four studies where mindfulness skills were measured (Studies 1-4), extensively trained over a longer time period (Study 3), or manipulated with a short, incidental meditation session (Study 4). Creativity was assessed with ideation tasks (Studies 1, 2, and 4) and self-reported creative behavior (Studies 2 and 3).[2]

Study 1

Study 1 examined the association between the mindfulness skill AWA and creative ideation. According to the uniform hypothesis, a positive relation was expected, whereas according to the differential hypothesis, no or even a negative relation was predicted. We further measured participants' Big five personality traits and intelligence to examine whether potential significant correlations between AWA and creativity could be attributed to other variables.

Method

Design and participants. Undergraduate students (N = 58, 71% female; M_{age} = 20.14, SD = 4.14) participated for partial fulfillment of a course requirement.

Procedure and creativity task. The study was conducted as part of several mass testing sessions, with the Mindfulness Scale, Personality Scales, and creativity task administered weeks apart in different sessions. Participants were seated in large lecture halls behind personal computers that displayed materials and recorded responses. Experimenters supervised testing sessions in which participants were not allowed to talk and were required to work individually.

AWA. AWA was measured with MAAS (Brown & Ryan, 2003). This 15-item scale measures the general tendency to be attentive to and aware of present-moment experiences in daily life. On Likert-type scales (1 = *almost always* to 6 = *almost never*), respondents rated how often they have experiences of acting on automatic pilot and not paying attention to the present moment. Items include, "I find myself doing things without paying attention." To obtain a measure of AWA, all items were reverse scored and summed together (α = .82).

Intelligence and Big Five. General Intelligence was assessed with the 36-item Raven Advanced Progressive Matrices (RAPM; Hamel & Schmittmann, 2006; M_{IQ} = 112, SD = 11.45, range = 80-144). The measure was reliably assessed (Guttman's split half correlation = .83).

The Big Five personality factors Extraversion, Agreeableness, Openness to Experience, Neuroticism, and Conscientiousness were assessed with the 70-item "vijf persoonlijkheids-factoren test" (Elshout & Akkerman, 1975), 14 for each factor. Each item consists of a short description, for example, "cultured, reads a lot and has widely reaching intellectual interests." Participants indicate on 7-point scales how well this description fits them (1 = *not at all* to 7 = *very*). Reliability was good, ranging from α = .74 to α = .88.

Creative ideation. Participants were given 4 min to type as many creative ways to use a brick as possible (Guilford, 1967). One trained and independent coder counted the number of non-redundant ideas generated per participant (fluency). To obtain measures of rated originality, the same coder rated each idea for originality, being defined as "an idea that is infrequent, novel, and uncommon" (1 = *not original* to 5 = *very original*). A second coder rated 120 ideas to get a reliability assessment. Interrater agreement (Intraclass Correlation Coefficient [ICC] = .72, $p < .001$) was good. We averaged originality ratings across all ideas an individual generated to correct for possible differences in fluency. To validate and triangulate this originality measure, we also derived a measure of infrequency by assessing how often

Table 1. Descriptive Statistics for Study 1.

	M	*SD*	1	2	3	4	5	6	7	8	9
1. Act with awareness	63.98	12.00									
2. Rated originality	2.08	0.38	−.26†								
3. Infrequency of ideas	75.62	11.88	−.44**	.68**							
4. Fluency	11.13	5.39	−.35**	.34*	.43**						
5. Extraversion	65.47	11.01	.05	.08	−.02	.21					
6. Agreeableness	74.00	8.04	.10	−.10	−.05	−.07	.43**				
7. Conscientiousness	63.98	11.26	.28*	−.35**	−.37**	−.12	.05	.35**			
8. Neuroticism	45.42	12.99	−.41**	.16	.26†	.11	−.15	−.27*	.08		
9. Openness	64.44	11.45	.21	.02	−.12	−.03	.34*	.17	.11	−.30*	
10. General intelligence	112.19	11.45	−.19	.11	.17	.22	−.21	−.12	−.10	.18	−.03

Note. $N = 56$.
†$p < .06$. *$p < .05$. **$p < .01$.

ideas were mentioned by other participants in this study. We assigned a percentage score to each idea (e.g., if 23% of the participants mentioned an idea, it received score 23)—the higher the number assigned to an idea, the less original (more frequent) it is. Therefore, we subtracted percentage scores from 100 to get an infrequency score—the higher the number assigned to an idea, the more original (less frequent) it is.

Results

Two participants were outliers (>3 *SD*s from the regression line in the link between AWA and the creativity indicators) and removed from further analyses.

Descriptive statistics. Table 1 shows means and standard deviations, along with zero-order correlations for all study variables. AWA was associated with decreased originality, infrequency of ideas, and fluency. Furthermore, although AWA was associated negatively with neuroticism and positively with conscientiousness, separate regression analyses of the creativity indicators with AWA as predictor and neuroticism and conscientiousness as control variables produced highly similar results with identical conclusions.[3]

Discussion and Introduction to Study 2

Study 1 shows that the mindfulness skill AWA was associated with decreased rather than increased creativity, thus providing support for the differential hypothesis. However, in addition to AWA (captured by MAAS in Study 1), mindfulness also consists of additional components, including Observation, Description, and Accept without judgment (henceforth AWJ). These different dimensions are captured by KIMS (Baer et al., 2006; Dekeyser et al., 2008). According to the uniform hypothesis, a positive relation between all mindfulness skills and creativity was expected, whereas according to the differential hypothesis, no or a negative relation was predicted for AWA, whereas a positive relation was predicted for Observation. Study 2 tested these contrasting predictions by linking creativity indicators to the different dimensions of KIMS. In addition to an ideation task (similar to Study 1), creativity was measured using self-reported creative behavior and self-reported number of creative achievements.

Method

Design and participants. Undergraduate students ($N = 225$, 64% female; $M_{age} = 19.96$, $SD = 1.73$) participated for partial fulfillment of a course requirement.

Procedure and creativity tasks. The study was conducted as part of several mass testing sessions, with the Mindfulness Scale and creativity measurements administered weeks apart in different sessions (see Study 1).

Mindfulness skills. Mindfulness skills were measured with KIMS (Baer et al., 2006). This 39-item scale consists of four subscales with items rated on 5-point Likert-type scales (1 = *never or very rarely true* to 5 = *almost always or always true*). Sample items include, "When I'm doing something, I'm only focused on what I'm doing, nothing else" for AWA; "When I take a shower or bath, I stay alert to the sensations of water on my body" for Observation; "I can easily put my beliefs, opinions, and expectations into words" for Description; and "I criticize myself for having irrational or inappropriate emotions" for AWJ (reverse scored). Reliability of the entire scale ($\alpha = .74$) and subscales ($\alpha = .72$ to $\alpha = .86$) was good.

Intelligence. We examined whether potential significant correlations between mindfulness skills and creativity could be attributed to general intelligence. It was assessed with RAPM (see Study 1), producing an average IQ of 113 ($SD = 10.98$, range = 71-144).

Cognitive flexibility. As potential mediator, we measured participants' cognitive flexibility with eight items using 7-point

Likert-type scales (1 = *not at all* to 7 = *very much*; α = .77); for example, "I am able to think flexibly."

Creative achievements and behavior. *Creative achievement* was assessed with the Creative Achievement Questionnaire (Carson et al., 2005), a self-report measure for recognized and concrete creative achievements in 10 domains (e.g., visual arts, sciences, music) that has good test–retest reliability. Each domain includes eight statements ranked with a score from 0 ("I have no training or recognized talent in this area") to 7 ("I have won a national prize in this field"). The highest ranks for each domain are summed together to yield a creative achievement score. *Creative behavior* was assessed with eight items (Janssen, 2001). Participants rated how often they engaged in eight creative behaviors described in the items; for example, "I often come up with original solutions for problems" (1 = *never* to 7 = *always*; α = .91).

Creative ideation. Participants typed as many creative ways to use a tin can and a rope as possible (Baas, De Dreu, & Nijstad, 2011; Guilford, 1967). They were given 2 min for each topic. For each topic, one trained and independent coder counted the number of non-redundant ideas generated per participant (fluency). In addition, ideas for each topic were rated for originality (1 = *not original* to 5 = *very original*). A second coder rated 120 ideas for each topic to get reliability assessments. Interrater agreement for both topics was excellent ($ICC_{\text{tin can}}$ = .90, $p < .001$; ICC_{rope} = .86, $p < .001$). For each topic, we averaged originality ratings across all ideas an individual generated. Because fluency ($r = .57$, $p < .001$) and originality ($r = .32$, $p < .001$) for both topics were positively correlated, we standardized scores and averaged them in indices for fluency and originality.

Results

Four participants were classified as outliers (>3 *SD*s from the regression line in the link between the specific mindfulness skills and creativity indicators) and removed from further analyses.

Descriptive statistics and regressions. Table 2 shows means and standard deviations, along with zero-order correlations for all study variables. The creativity indicators were reliably correlated, providing evidence of convergent validity. Cognitive flexibility was positively related to the creativity scores. Except for fluency, the observation mindfulness skill was reliably associated with increased creativity and flexibility.

Moreover, we conducted regression analyses in which we regressed the creativity indicators and flexibility on the four mindfulness skills (Table 3). Of the four skills, Observation was the only reliable predictor of creative achievements, creative behavior, and originality. No reliable predictors were identified for fluency (*p*s > .201).[4] Flexibility regressed significantly on Observation, Description, and AWJ.

Mediation. Findings of Study 2 thus far show that individual differences in the specific mindfulness skill Observation are linked to enhanced flexibility, creative achievements, self-reported creativity, and originality of ideas. Flexible thinking is an important mechanism leading to creative outcomes (De Dreu et al., 2008). To test whether flexibility mediates the link between Observation and creativity, we conducted regression analyses. Indeed, we found that flexibility regressed significantly on Observation, β = .183, $t(218) = 2.74$, $p = .007$. When we regressed creative achievement on Observation scores after controlling for flexibility, the effect of Observation dropped to non-significance, from β = .136, $t(218) = 2.02$, $p = .044$, to β = .098, $t(217) = 1.46$, $p = .146$; the effect of flexibility remained significant, β = .208, $t(217) = 3.11$, $p = .002$. When we regressed creative behavior and originality on Observation scores after controlling for flexibility, the effect of Observation dropped but remained significant, for creative behavior from β = .240, $t(218) = 3.64$, $p < .001$, to β = .133, $t(217) = 2.46$, $p = .015$; for originality from β = .235, $t(212) = 3.52$, $p = .001$, to β = .202, $t(211) = 2.98$, $p = .003$; the effect of flexibility was significant, for creative behavior, β = .586, $t(217) = 10.85$, $p < .001$; for originality, β = .160, $t(211) = 2.36$, $p = .019$. This implies that flexibility may play a mediating role. To examine this, we tested the indirect effect of Observation on the creativity measures through flexibility by generating bootstrap confidence intervals (CI; N_{boot} = 5,000; Preacher & Hayes, 2008). The analyses indicated that the indirect effect was statistically significant at the .05 level (for creative achievement, $B_{\text{boot}} = .254$, standard error $[SE]_{\text{boot}} = 0.131$, 95% CI [0.052, 0.576]; creative behavior, $B_{\text{boot}} = .159$, $SE_{\text{boot}} = 0.07$, 95% CI [0.038, 0.309]; and originality, $B_{\text{boot}} = .042$, $SE_{\text{boot}} = 0.023$, 95% CI [0.009, 0.105]). Put differently, flexible thinking associated with the mindfulness skill Observation explained the variance in original ideation, self-reported creative behavior, and self-reported creative achievements.

Discussion and Introduction to Study 3

Providing further support for the differential hypothesis, findings from Study 2 showed that specific mindfulness skills were differentially related to creativity as manifested by creative idea generation and self-reported creative behavior. Observation was associated with enhanced creativity, Description and AWJ were not associated with creativity, and inconsistent with findings from Study 1, results from study 2 showed that AWA was not associated with creativity. Moreover, mediation analyses showed that Observation was associated with enhanced creativity because of increased cognitive flexibility. In Study 3, we set out to provide causal evidence for the mindfulness–creativity link using a longitudinal design in which mindfulness was manipulated with an extensive 8-week mindfulness training. One notorious difficulty with extensive mindfulness practices is that virtually all practices involve a combination of open-monitoring and focused-attention techniques (Kabat-Zinn, 1994; Lutz et al., 2008; Sedlmeier et al., 2012). Nevertheless, some common mindfulness programs predominantly focus on one

Table 2. Descriptive Statistics for Study 2.

	M	*SD*	1	2	3	4	5	6	7	8	9	10
1. Aggregated mindfulness	3.06	0.68										
2. Observation	3.06	0.68	.41**									
3. Description	3.38	0.65	.65**	.15*								
4. Act with awareness	2.83	0.56	.47**	−.23**	.12							
5. Accept without judgment	3.73	0.80	.54**	−.31**	.20**	.25**						
6. Creative achievements	7.07	4.55	.13*	.15*	.07	−.01	.04					
7. Creative behavior	4.57	1.00	.21**	.24**	.11	.00	.04	.34**				
8. Fluency	−0.01	0.87	.09	.07	.04	.03	.04	.24**	.24**			
9. Originality	0.01	0.82	.10	.24**	.05	−.06	−.07	.20**	.26**	.19**		
10. Flexibility	4.81	0.70	.37**	.18**	.27**	.06	.23**	.23**	.61**	.16*	.20**	
11. Intelligence	112.86	10.98	.01	−.06	.01	−.06	.13†	.17**	.08	−.01	.08	.11

Note. *N* range between 214 and 221.
†$p < .06$. *$p < .05$. **$p < .01$.

Table 3. Regression of Creative Achievements, Creative Behavior, Originality, and Flexibility on Mindfulness Sub-Skills (Study 2).

	Creative achievement			Creative behavior			Originality			Flexibility		
Mindfulness sub-skill	β	*t*	*p*	β	*t*	*p*	β	*t*	*p*	β	*t*	*p*
Observation	.173	2.35	.020	.271	3.76	<.001	.234	3.15	.002	.246	3.58	<.001
Description	.025	0.36	.722	.045	0.66	.512	.010	0.13	.894	.174	2.63	.009
Act with Awareness	.001	0.02	.988	.031	0.45	.653	−.004	−0.05	.957	.033	0.50	.618
Accept without judgment	.084	1.14	.258	.102	1.40	.162	.005	0.07	.943	.262	3.79	<.001

skill. For example, in Transcendental meditation practices, participants are mostly trained to maintain their focus on an object in a sustained fashion (Lutz et al., 2008). Accordingly, these programs are predominantly focused on facilitating AWA skills. In *Vipassana* meditation practices, meditation sessions often start with focused-attention meditation to prepare practitioners for the second, and more important stage, in which open-monitoring meditation is trained that predominantly results in enhanced observation skills.

In Study 3, participants completed a mindfulness course predominantly focused at enhancing Observation. We compared effects of the mindfulness course with a control group. Because the course was predominantly focused on enhancing levels of Observation, based on both the differential and uniform hypotheses, we expected an increase in creativity as a result of the mindfulness training. However, according to the uniform hypothesis, this increase should be mediated by an overall increase in mindfulness skills, whereas according to the differential hypothesis, this increase should be mediated specifically by an increase in observation skills.

Method

Design and participants. Eighty-four undergraduate students voluntarily took part in this study. Ten participants (11.9%) failed to complete the questionnaires on the second measurement, leaving 74 participants (77% female; M_{age} = 23.77, *SD* = 3.76). Participants who completed an 8-week course on meditation and mindfulness (n = 39) were compared with control participants with similar educational and demographic backgrounds (n = 35). The target variables mindfulness skills and creative behavior were measured before the start and during the final week of training.

Procedure and mindfulness training. Participants who subscribed to the mindfulness course were approached to take part in this study. This course consisted of weekly training sessions combining focused-attention and open-monitoring meditation techniques with an emphasis on the latter. During the meditation sessions, which formed the core of the course, participants learned to become aware of their thoughts, feelings, and bodily sensations. These aspects of the training predominantly map onto Observation (Baer et al., 2006). They were asked to independently carry out daily meditation sessions of 20 to 30 min in the morning and evening to practice. In addition, they were asked to conduct daily activities of 30 min, such as running and yoga, in which they were mindful and aware of what they were doing (mapping predominantly onto AWA). Finally, they recorded these activities and their own development in a personal diary (mapping predominantly onto Describing). Before the course started, participants received questionnaires to fill out. The same questionnaires were administered in the final course week. Participants in the control condition were students at different universities. They were approached to

participate and were asked to fill out the questionnaires at the same points in time as participants involved in the mindfulness training.

Mindfulness. Mindfulness was measured with KIMS (see Study 2). Reliability of the entire scale ($\alpha_{\text{pre-test}} = .80$, $\alpha_{\text{post-test}} = .83$) and sub-skills was good ($\alpha = .71$ to $\alpha = .88$).

Creative behavior. Creative behavior was assessed with eight items (Janssen, 2001, see Study 2). Reliability was good ($\alpha_{\text{pre-test}} = .82$, $\alpha_{\text{post-test}} = .92$).

Mindfulness training experience. With two items, we asked participants how much experience they had with meditating and mindfulness ($r_{\text{pre-test}} = .63$, $r_{\text{post-test}} = .87$).

Results

Data treatment and group differences. Some participants failed to complete all items within the scales. Missing values for those items were replaced with the mean of the (sub)scale for that participant (cf. Downey & King, 1998).

Before running analyses, we verified whether participants in the mindfulness group and control group differed in age, gender, educational background, and mindfulness experience on the pre-test. Independent *t* tests showed no group differences for age, $t(72) = -0.609$, $p = .544$; mindfulness experience, $t(72) = 0.999$, $p = .321$. Chi-square tests revealed that groups did not differ on gender, $\chi^2(1) = 0.282$, $p = .595$, or educational background, $\chi^2(21) = 22.67$, $p = .362$.

Descriptive statistics. Table 4 shows means and standard deviations, along with zero-order correlations for all study variables. Aggregated mindfulness skills (pre-test and post-test) were associated with enhanced creative behavior. This was mainly due to scores on the Observation scale and, to a lesser extent, to scores on the Description subscale. AWA and AWJ were not associated with creative behavior. Moreover, we conducted regression analyses in which we regressed creativity on the four mindfulness components. Of the four subskills, Observation was the only consistent predictor of creative behavior on the pre-test, $\beta = .357$, $t(69) = 3.18$, $p = .002$; Description: $\beta = .174$, $t(69) = 1.41$, $p = .163$; AWJ: $\beta = -.01$, $t(69) = -0.10$, $p = .920$; AWA: $\beta = .222$, $t(69) = 1.88$, $p = .064$, and post-test, $\beta = .429$, $t(69) = 3.97$, $p < .001$; Description: $\beta = .189$, $t(69) = 1.74$, $p = .087$; AWJ: $\beta = .04$, $t(69) = 0.36$, $p = .721$; AWA: $\beta = .098$, $t(69) = 0.86$, $p = .396$.

Manipulation check. We submitted mindfulness experience to a 2 (mindfulness vs. control) × 2 (block: pre-test vs. post-test) mixed-model ANOVA with the second factor within subjects. The main effects of block, $F(1, 72) = 160.77$, $p < .001$, $\eta_{\text{partial}}^2 = .691$, and condition on self-reported mindfulness experience, $F(1, 72) = 99.98$, $p < .001$, $\eta_{\text{partial}}^2 = .581$, were qualified by a significant interaction, $F(1, 72) = 171.39$, $p < .001$, $\eta_{\text{partial}}^2 = .704$. Mindfulness experience increased in the mindfulness condition from $M = 1.73$ to $M = 4.41$, $F(1, 72) = 351.05$, $p < .001$, but not in the control condition, $M_{\text{pre-test}} = 1.50$ versus $M_{\text{post-test}} = 1.46$; $F < 1$.

Mindfulness skills. To test whether the training increased mindfulness skills, we submitted aggregated mindfulness skills to a 2 (mindfulness vs. control) × 2 (block: pre-test vs. post-test) mixed-model ANOVA with the second factor within subjects. The main effect of block on mindfulness skills, $F(1, 72) = 14.91$, $p < .001$, $\eta_{\text{partial}}^2 = .172$, was qualified by a significant interaction between condition and block, $F(1, 72) = 29.19$, $p < .001$, $\eta_{\text{partial}}^2 = .288$. Table 5 shows that mindfulness skills increased in the mindfulness condition, $F(1, 72) = 45.36$, $p < .001$, but not in the control condition, $F(1, 72) = 1.1$, $p = .292$. Similar interaction patterns were observed for the mindfulness subscales Observation, $F(1, 72) = 30.22$, $p < .001$, $\eta_{\text{partial}}^2 = .296$ (Figure 1A); Description, $F(1, 72) = 8.87$, $p = .004$, $\eta_{\text{partial}}^2 = .110$; and AWA, $F(1, 72) = 6.74$, $p = .011$, $\eta_{\text{partial}}^2 = .086$; only the interaction between condition and block for AWJ was not significant, $F(1, 72) = 0.427$, $p = .516$, $\eta_{\text{partial}}^2 = .006$ (Table 5). Thus, in line with the focus of the training on Observation, the strongest increase in mindfulness skills was seen for Observation as evidenced by the effect size.

Creative behavior. We submitted creativity ratings to a 2 (mindfulness vs. control) × 2 (block: pre-test vs. post-test) mixed-model ANOVA with the second factor within subjects. The marginal main effect of block, $F(1, 72) = 2.97$, $p = .089$, $\eta_{\text{partial}}^2 = .040$, was qualified by a significant interaction between condition and block, $F(1, 72) = 22.68$, $p < .001$, $\eta_{\text{partial}}^2 = .240$. Figure 1B shows that creative behavior increased in the mindfulness condition, $F(1, 72) = 22.22$, $p < .001$, and unexpectedly decreased in the control condition, $F(1, 72) = 4.38$, $p = .040$.

Mediation. To test for mediation, we performed regression analyses of the changes in creative behavior and aggregated mindfulness skills. The increase in mindfulness skills regressed significantly on condition (mindfulness condition = 0, control condition = 1, $\beta = -.54$), $t(72) = -5.40$, $p < .001$. When we regressed increase in creative behavior on condition after controlling for change in mindfulness skills, only the effect of condition was significant, $\beta = -.457$, $t(71) = -3.73$, $p < .001$. Thus, overall change in mindfulness did not predict change in creative behavior, $\beta = .060$, $t(71) = 0.487$, $p = .628$. This is in accordance with our previous findings that showed that specific mindfulness skills are differentially related to creativity.

Indeed, when testing for the Observation subscale, the increase in Observation ratings regressed significantly on condition, $\beta = -.54$, $t(72) = -5.50$, $p < .001$. When we regressed increase in creative behavior on condition after controlling for change in Observation, the effect of condition

Table 4. Descriptive Statistics for Study 3.

	Pre-test				
	1	2	3	4	5
1. Aggregated mindfulness					
2. Observation	.46**				
3. Description	.74**	.12			
4. Act with Awareness	.60**	−.01	.38**		
5. Accept without judgment	.55**	−.22†	.32**	.18	
6. Creative behavior	.41**	.33**	.29*	.09	.20
	Post-test				
	7	8	9	10	11
7. Aggregated mindfulness					
8. Observation	.58**				
9. Description	.52**	.15			
10. Act with Awareness	.58**	.12	−.01		
11. Accept without judgment	.62**	−.11	.22	.33**	
12. Creative behavior	.44**	.45**	.28*	.12	.10

Note. $N = 74$.
†$p < .06$. *$p < .05$. **$p < .01$.

Table 5. Means (*SD*s) for Mindfulness Skills on Pre-Test and Post-Test as a Function of Condition (Study 3).

	Condition			
	Mindfulness	Control	Mindfulness	Control
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
	Pre-test		Post-test	
Aggregated mindfulness	3.01 (0.32)	3.19 (0.31)	3.33 (0.38)	3.14 (0.28)
Observation	3.02 (0.54)	3.11 (0.58)	3.49 (0.43)	2.98 (0.62)
Description	3.05 (0.60)	3.44 (0.53)	3.27 (0.64)	3.29 (0.49)
Act with awareness	2.76 (0.47)	2.87 (0.50)	3.10 (0.45)	2.93 (0.52)
Accept without judgment	3.24 (0.61)	3.44 (0.73)	3.37 (0.71)	3.47 (0.74)

dropped but remained significant, from $\beta = -.489$, $t(72) = -4.76$, $p < .001$, to $\beta = -.355$, $t(71) = -2.96$, $p = .004$; the effect of change in Observation was also significant, $\beta = .25$, $t(72) = 2.07$, $p = .042$. This implies that growth in Observation skills may play a mediating role. To examine this, we tested the indirect effect of condition on change in creative behavior through growth in Observation skills by generating bootstrap CIs ($N_{boot} = 5{,}000$; Preacher & Hayes, 2008). Analyses indicated that the indirect effect was statistically significant at the .05 level ($B_{boot} = -.237$, $SE_{boot} = 0.123$, 95% CI [−0.541, −0.048]). Put differently, the increase in Observation skills due to mindfulness training partly explained the increase in creative behavior.

Finally, when we regressed increase in creative behavior on condition after controlling for changes in all four mindfulness sub-skills, the effect of condition dropped but remained significant, $\beta = -.390$, $t(68) = -3.42$, $p = .001$; change in Observation, $\beta = .25$, $t(68) = 2.26$, $p = .027$, and Description, $\beta = .20$, $t(68) = 2.02$, $p = .048$, were positive predictors and, consistent with findings from Study 1, change in AWA a negative predictor, $\beta = -.37$, $t(68) = -3.71$, $p < .001$.

Discussion and Introduction to Study 4

Supporting the differential hypothesis, findings from three studies thus far showed that specific mindfulness skills differentially predicted creativity. Observation was the only consistent predictor of creativity, and an increase in Observation skills due to mindfulness training positively predicted an increase in creative behavior. Although Description and AWJ did not predict creativity (Studies 2 and 3), growth in Description skills positively predicted increases in creative behavior (Study 3). Findings regarding AWA were inconsistent: It negatively predicted creativity

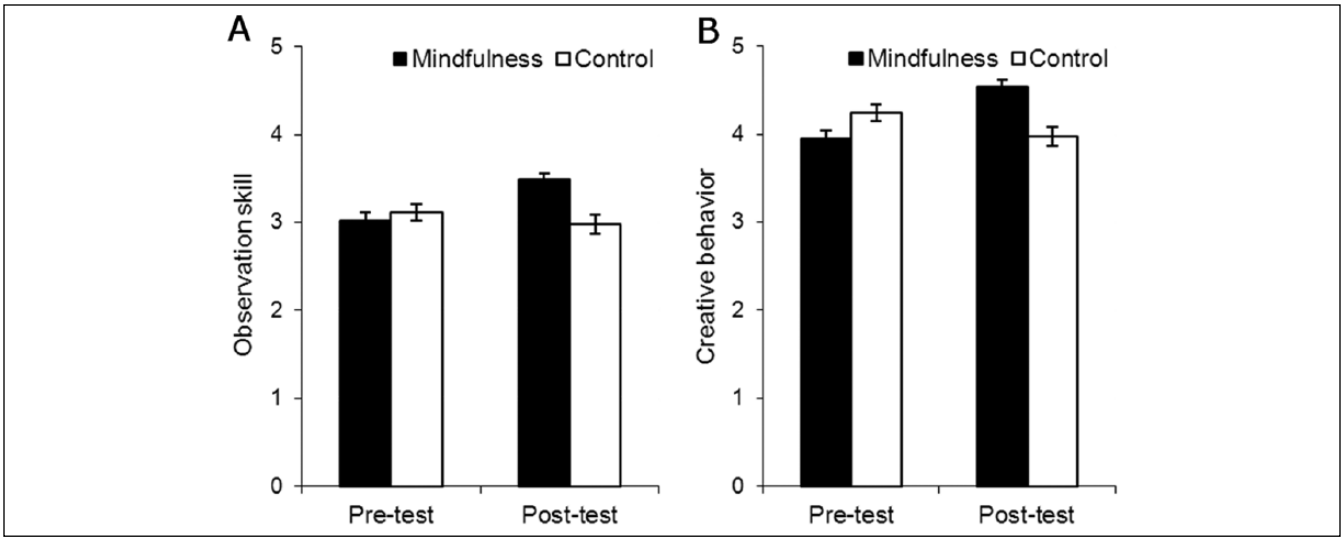

Figure 1. Change in observation skills and creative behavior as a function of mindfulness training (Study 3).
Note. (A) Participants' Observation skills as a function of Mindfulness training for pre-test and post-test (displayed ± *SE*). (B) Participants' creative behavior (measured on a 7-point Likert-type scale) as a function of Mindfulness training for pre-test and post-test (displayed ± *SE*).

(Study 1), was not associated with creativity (Studies 2 and 3), and an increase in AWA negatively predicted an increase in creative behavior (Study 3).

Although the extensive mindfulness training in Study 3 most strongly targeted Observation, it did not solely focus on one specific component but also led to an increase in Description and AWA. Therefore, we are cautious to draw conclusions about the causal role of Observation and AWA in predicting creativity. To address this issue, in Study 4, we directly manipulated either the Observation or the AWA facets of mindfulness. Moreover, Study 3 used a self-report measure of creativity. Although this measure reliably correlates with more objective measures of creativity (Study 2; Furnham et al., 2008; Simonton, 2012), in Study 4, we measured creativity with an idea generation task (see Studies 1 and 2). Finally, we measured participants' mood and motivation as potential mediators (Baas et al., 2008).

Method

Design and participants. Undergraduate students (N = 114, 68% female; M_{age} = 22.20, SD = 4.08) participated for partial course fulfillment or €5. Participants were randomly assigned to one of two conditions (Meditation: Observation vs. AWA). Creativity was measured as before (Study 1).

Procedure and manipulation. Participants, seated in individual cubicles equipped with computer and headphones, signed informed consent, provided demographic information, and filled out KIMS. Hereafter, participants put on their headphones and listened to a 17-min mindfulness meditation fragment that was based on transcripts of meditation manipulations by Colzato et al. (2012). In the Observation meditation condition, a male voice guided participants in a step-by-step manner to pay attention to the present moment and to become aware of their feelings, thoughts, and bodily sensations. In the AWA meditation condition, a male voice guided participants in a step-by-step manner to focus and sustain their attention on their own breathing. Following the manipulation, participants indicated how they felt and generated unusual uses for a brick for 4 min. Finally, participants answered some questions and were debriefed.

Measures

Mindfulness skills. Mindfulness skills were measured as before (see Study 2). Reliability of the entire scale (α = .78) and subscales was good (α = .80 to α = .87).

Creative ideation. Fluency, originality, and infrequency of ideas were coded as before by the same reliable and independent coder (see Study 1).

Mindfulness manipulation check. Participants rated on Likert-type scales (1 = *not at all* to 5 = *very much*) the extent to which they were aware of their thoughts, feelings, and sensations (Observation check), and the extent to which they focused their attention on breathing (AWA check). Moreover, to rule out the possibility that one meditation exercise was more difficult to perform than the other, participants rated the extent to which they were able to perform the meditation instructions (1 = *not at all* to 5 = *very much*; five items, α = .83).

Moods and motivation. Participants filled out an affect grid before and after the meditation exercise (Russell, Weiss, & Mendelsohn, 1989). Participants indicated their level of

arousal and positive affect by placing a single mark in a grid defined by a *y*-axis defining arousal (ranging from extreme low to extreme high arousal) and an *x*-axis defining positive affect (ranging from extreme negative affect to extreme positive affect). Moreover, participants rated the extent to which they were motivated to do the meditation exercise (1 = *not at all* to 5 = *very much*; five items, α = .91) and the creativity task (1 = *not at all* to 7 = *very much*; four items, α = .88).

Results

Three participants were outliers on multiple dependent variables and removed from further analyses. Moreover, due to a technical error, self-report data of three participants were not saved; analyses regarding manipulation checks, mood, and motivation were performed on the remaining participants.

Manipulation check. ANOVA showed main effects of condition on mindfulness checks. Participants in the Observation condition reported more awareness of their thoughts, feelings, and sensations (M = 3.91, SD = 0.77) than those in the AWA condition (M = 3.51, SD = 0.81), $F(1, 106) = 6.789$, $p = .010$, $\eta_{partial}^2 = .060$. Conversely, participants in the AWA condition reported greater focus on breathing (M = 4.18, SD = 0.72) than those in the Observation condition (M = 3.57, SD = 0.89), $F(1, 106) = 15.677$, $p < .001$, $\eta_{partial}^2 = .129$. Moreover, ANOVA showed no differences between conditions in the ability to perform the meditation exercise, $F < 1$, $p = .788$. Thus, we can conclude that our manipulation was effective in enhancing the Observation and AWA facets of mindfulness.

Creativity. We submitted fluency, originality, and infrequency to one-way ANOVAs with condition as between-subjects factor. Whereas the effect of condition on fluency was not significant, $F < 1$, we did obtain significant effects for originality, $F(1, 109) = 5.41$, $p = .022$, $\eta_{partial}^2 = .047$, and infrequency of ideas, $F(1, 109) = 5.45$, $p = .021$, $\eta_{partial}^2 = .048$. Participants in the Observation condition were more original (M = 2.28, SD = 0.31) and generated more infrequent ideas (M = 86.17, SD = 4.00) than those in the AWA condition ($M_{originality} = 2.14$, $SD = 0.29$; $M_{infrequency} = 84.27$, $SD = 4.57$).[5]

Mood and motivation. Participants' motivation and mood were measured as potential mediators. We submitted motivation to perform the meditation exercise and creativity task to one-way ANOVAs. No significant differences between conditions were obtained, Fs < 1, $p > .720$. This implies that participants' motivation does not play a mediating role.

Positive affect and arousal ratings were submitted to 2 (Observation vs. AWA) × 2 (block: pre-test vs. post-test) ANOVAs with the latter factor within subjects. Main effects of block showed that participants experienced more positive affect and less arousal after the meditation exercise ($M_{positive\ affect} = 518.44$, $SD = 60.29$; $M_{arousal} = 579.38$, $SD = 46.50$) than before the exercise ($M_{positive\ affect} = 477.13$, $SD = 55.82$; $M_{arousal} = 530.06$, $SD = 45.91$), $F_{positive\ affect}(1, 106) = 46.63$, $p < .001$, $\eta_{partial}^2 = .306$; $F_{arousal}(1, 106) = 81.36$, $p < .001$, $\eta_{partial}^2 = .434$. The main effects of condition were not significant (Fs < 1). Whereas the interaction between condition and block was not significant for positive affect ratings, $F(1, 106) = 2.35$, $p = .129$, $\eta_{partial}^2 = .022$, the interaction was significant for arousal ratings, $F(1, 106) = 4.01$, $p = .048$, $\eta_{partial}^2 = .036$. Simple effects showed that the decrease in arousal was larger in the Observation condition (from M = 584.06 to M = 523.55), $F(1, 106) = 59.64$, $p < .001$, $\eta_{partial}^2 = .360$, than in the AWA condition (from M = 574.87 to M = 536.35), $F(1, 106) = 25.09$, $p < .001$, $\eta_{partial}^2 = .191$. To test whether change in arousal mediated the effect of condition on originality and infrequency of ideas, we conducted regression analyses. Change in arousal regressed significantly on meditation condition, β = −.191, $t(106) = -2.00$, $p = .048$. When we regressed originality and infrequency of ideas on condition after controlling for decrease in arousal, the effect of condition remained significant, for originality: β = −.187, $t(105) = -1.95$, $p = .054$; for infrequency: β = −.218, $t(105) = -2.25$, $p = .026$; the effect of decrease in arousal was not significant, for originality, β = .147, $t(105) = 1.53$, $p = .128$; for infrequency, β = .052, $t(105) = 0.54$, $p = .592$. These results imply that arousal, positive affect, and motivation do not play a mediating role.

General Discussion

The beneficial effects of mindfulness meditation and concomitant mindfulness skills are abundant, including improved stress regulation, communication skills, psychological well-being (DeKeyser et al., 2008; Sedlmeier et al., 2012), working memory capacity, and task concentration (Lutz et al., 2008; Shapiro et al., 2006). However, past work has ignored the effects of mindfulness on creativity and the possibility that distinct mindfulness skills differentially affect creative performance. To address these issues, four studies tested two competing hypotheses derived from the literature: (a) Mindfulness uniformly and positively predicts creativity versus (b) Distinct mindfulness skills differentially predict creativity. Our studies clearly support the differential hypothesis. Of the four measured mindfulness components, only Observation was consistently linked with enhanced creativity (Studies 2 and 3); although Description and AWJ did not predict creativity (Studies 2 and 3), growth in Description skills positively predicted increases in creative behavior (Study 3); AWA was not or negatively associated with creativity (Studies 1-3). Moreover, an extensive 8-week mindfulness course predominantly focusing on training observation skills led to increased creative behavior that could be partly explained by increases in Observation skills, whereas increases in AWA were associated with reduced creativity (Study 3). Clear manipulations of Observation and AWA showed that Observation meditation led to more original

ideas than AWA meditation (Study 4). Finally, the link between Observation and creativity could be partially explained by increased cognitive flexibility (Study 2), but not by intelligence (Study 2), mood, or motivation (Study 4). In this section, we explore implications for theory and practice, and highlight avenues for future research.

Mindfulness and Creativity

We identified two possibilities regarding the link between mindfulness and creativity. One line of research suggested a positive and uniform relation because mechanisms pivotal for creativity, including flexible thinking, positive affect, and improved working memory, are facilitated by mindfulness meditation and aggregated mindfulness skills (Lutz et al., 2008; Sedlmeier et al., 2012). However, other work examining different mindfulness skills suggested that specific mindfulness components might in fact differentially predict basic cognitive processes influencing creativity. This work predominantly focused on measurements and trainings of Observation and AWA and showed that some creativity enhancing factors, including working memory capacity and positive affect, were positively influenced by both these skills. However, only ability to observe has been associated with increased cognitive flexibility (Chambers et al., 2009; Slagter et al., 2007), reduced cognitive rigidity (Greenberg et al., 2012; Schmertz et al., 2009), and less restrictive attentional focus (Davidson & Lutz, 2008)—all cognitive mechanisms that are essential drivers of creativity (Chermahini & Hommel, 2010; De Dreu et al., 2008). Moreover, open-monitoring meditation, associated with Observation, led to more creativity than focused-attention meditation, associated with AWA (Colzato et al., 2012).

Our findings provide strong evidence for a differential relation between mindfulness and creativity. Of the four mindfulness skills, only ability to carefully observe, notice, or attend to a variety of internal and external phenomena consistently predicted enhanced creativity in our studies. Thus, our research underscores the importance of acquiring more knowledge about the differential effects of the components of mindfulness, with the ultimate goal of informing extant theories to better understand the direction of and mechanisms underlying the effects of these different components (cf. Grossman, 2008; Sedlmeier et al., 2012). To better understand why mindfulness skills would differentially predict creativity, we review possible explanations for the obtained associations between specific mindfulness skills and creativity.

Regarding the particularly strong positive relation between Observation and creativity, past work has shown that compared with AWA, the ability to observe has been associated with increased cognitive flexibility (Chambers et al., 2009; Slagter et al., 2007), which is considered a key driver of creativity (De Dreu et al., 2008). In support of this explanation, we found that Observation was indeed associated with flexible thinking, and flexibility mediated the positive relation between Observation and creativity (Study 2).

However, flexibility only partially mediated the relation between Observation and creativity, which suggests that alternative mechanisms exist. This is also evident from findings in Study 2 where mindfulness skills Description and AWJ were both associated with enhanced cognitive flexibility but did not predict greater creativity. Of the four mindfulness skills, Observation is most strongly related to openness to experience (Baer et al., 2006), a personality trait characterized by a preference for variety and exploration, and among the most robust predictors of creativity (Baas, Roskes, Sligte, Nijstad, & De Dreu, 2013; Feist, 1998). Thus, the positive relation between Observation and creativity could be explained by the former's strong association with openness to experience. Another possibility is that of the four mindfulness skills, Observation is particularly associated with the ability to pick up relevant information in the inner and external world (Carson & Langer, 2006). Indeed, creativity of ideas is influenced by the nature of the knowledge (e.g., its uncommonness and appropriateness) retrieved from individuals' long-term memory or taken from the outside world (Amabile, 1996; Baas et al., 2013). Future research may test whether these possibilities may additionally explain the relation between Observation and creativity.

The relation between AWA and creativity is less consistent. In Study 1, AWA was negatively associated with creativity. In study 2, AWA did not predict creativity. In Study 3, zero-order correlations showed no reliable relation between AWA and creativity, whereas increases in AWA negatively predicted creative behavior. Finally experimentally induced AWA led to lower original ideation than experimentally induced Observation. However, because a control condition was absent, it is not possible to infer whether this effect is due to Observation increasing creativity, AWA decreasing creativity, or both. To understand these mixed findings, it is important to note that creative outcomes may result from different cognitive processes, some of which are harmed by AWA, such as having broad attentional scope, mind wandering, and flexible thinking (Colzato et al., 2012; Mrazek et al., 2012). However, other cognitive processes underlying creativity may be facilitated by AWA, including increased working memory capacity and in-depth survey of only a few categories or perspectives (De Dreu et al., 2012). Whether creativity is harmed, unaffected, or even facilitated by AWA may depend on the extent to which these different cognitive processes may flourish. For example, the relationship between sustained and focused attention and creativity depends on time-on-task (staying longer within a category): Only after unoriginal ideas have been generated, more original ideas within that category are examined (Nijstad et al., 2010). Some creativity tasks, such as idea generation tasks, capitalize more on flexibility, especially when limited time is available for idea generation (Colzato et al., 2012; Nijstad et al., 2010). Future work should further examine under which

conditions AWA promotes or prevents creativity or when null findings are to be expected.

With regard to Description and AWJ, both these mindfulness components appear to be unrelated to creativity (Studies 2 and 3), although growth in Description skills positively predicted increases in creative behavior (Study 3). These results suggest that Description and AWJ are less important in predicting creativity, and it may be more fruitful for future research to explore their role for other dependent variables. For example, Description, the ability to verbally describe observed phenomena without conceptual analysis and evaluation, may be particularly important for emotional intelligence (Baer et al., 2006), which benefits from identification and expression of feelings in social contexts (DeKeyser et al., 2008). AWJ, the extent to which people accept or are non-evaluative about present-moment experience, may, however, be particularly relevant for improving the regulation of stressful situations because it is associated with diminished avoidance temperament (Baer et al., 2006; DeKeyser et al., 2008). Past work has further shown that especially in the presence of others, evaluative and self-critical thinking are associated with reduced creativity (Amabile, 1996; Nijstad et al., 2010). Thus, although AWJ appears less important in *stimulating* creative cognition, it may provide an important *buffer against* negative effects on creativity in evaluative contexts.

Avenues of Future Research

Future work investigating the differential relation between specific mindfulness skills and creativity is needed to discover the underlying mechanisms. We discussed and found evidence for the possibility that Observation may predict creativity because it associates with flexible thinking, but not of its association with intelligence, mood, or motivation. New studies are needed to replicate this finding and find evidence for other mechanisms mentioned above. A final avenue for future research is to analyze the effects of specific mindfulness skills on other dependent variables besides creativity that also rely on basic cognitive processes. An interesting possibility is to examine their effects on analytical problem solving. Analytical performance benefits from focused attention on the problem material and requires deductive reasoning and close analysis to draw correct conclusions (Khemlani & Johnson-Laird, 2012). Because out of the four mindfulness skills, AWA associates most strongly with attentional focus (Baer et al., 2006), we would predict particularly strong positive correlations with analytical problem solving.

Conclusion

Mindfulness meditation and concomitant mindfulness skills have been associated with long lists of beneficial effects on emotion regulation, interpersonal abilities, and basic cognitive functioning. In addition to these beneficial effects, our findings suggest that mindfulness may also be related to creativity, a much desired result of more complex cognitive functioning. Crucially, however, the positive link between mindfulness and creativity depends on the specific mindfulness component involved. A state of conscious awareness resulting from living in the moment is not sufficient for creativity to come about. To be creative, you need to have, or be trained in, the ability to carefully observe, notice, or attend to phenomena that pass your mind's eye.

Appendix

Confidence Intervals (CI), Observed Study Power, and Sample Sizes Needed to Replicate the Relation Between AWA and Creativity (Experiment 1) and OBS and Creativity (Experiments 2-4).

		B	*t*	*p*	95% CI[a]	Study power	Required *N*[b]
Experiment 1	AWA–aggregated creativity[c]	−0.028	−3.52	.001	[−0.04, −0.01]	0.94	37
Experiment 2	OBS–creative achievements	1.012	2.26	.025	[−0.09, 2.23]	0.62	339
	OBS–creative behavior	0.353	3.65	<.001	[0.17, 0.55]	0.95	132
	OBS–originality of ideas	0.293	3.52	.001	[0.14, 0.45]	0.94	137
	OBS–cognitive flexibility	0.189	2.74	.007	[0.04, 0.35]	0.78	229
Experiment 3	OBS–creative behavior pre-test	0.477	2.96	.004	[0.20, 0.75]	0.84	67
	OBS–creative behavior post-test	0.796	4.30	<.001	[0.45, 1.19]	0.99	33
Experiment 4	AWS[0] vs. OBS[1]–originality	0.131	2.33	.022	[0.02, 0.24]	0.63	164
	AWS[0] vs. OBS[1]–infrequency	1.904	2.33	.021	[0.36, 3.36]	0.64	162

Note. Analyses involving OBS were done without controlling for the other mindfulness skills. AWA = Act with awareness; OBS = Observation.
[a]Based on 5,000 bootstrap samples.
[b]At $p < .05$ and power = 0.80.
[c]Fluency, originality, and infrequency were *z*-transformed and averaged.

Authors' Note

To gain a better understanding of the magnitude of the observed primary effects (the link between Act with awareness [AWA] and creativity in Study 1 and between Observation and creativity in Studies 2-4), we generated bootstrap confidence intervals (CI; N_{boot} = 5,000; Preacher & Hayes, 2008). Moreover, using the G*Power software (Faul, Erdfelder, Lang, & Buchner, 2007), we calculated the observed power for each effect (post hoc) and the number of participants required to obtain a reliable literal replication of the effects at power = 0.80, with $p < .05$ (a priori). Results can be seen in the Appendix Table.

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Notes

1. Based on extant literature, clear predictions regarding the effects of the remaining mindfulness skills (Description and Accept without judgment [AWJ]) could not be made. Their effects on creativity were therefore examined on an explorative basis.
2. The appendix shows confidence intervals (CI), observed study power, and sample sizes needed to replicate our findings, and Online Appendix 2 shows materials used to operationalize the primary variables.
3. With neuroticism as control variable, we obtained negative associations between Act with awareness (AWA) and fluency ($\beta = -.38$, $t = -2.646$, $p = .011$), rated originality ($\beta = -.26$, $t = -1.800$, $p = .078$), and infrequency of ideas ($\beta = -.42$, $t = -3.116$, $p = .003$). With conscientiousness as control variable, we obtained negative associations between AWA and fluency ($\beta = -.35$, $t = -2.602$, $p = .012$), rated originality ($\beta = -.20$, $t = -1.517$, $p = .135$), and infrequency of ideas ($\beta = -.38$, $t = -3.085$, $p = .003$).
4. Controlling for intelligence scores, results were highly similar, yielding identical conclusions. Regression analyses with the four sub-skills as predictors identified only Observation as a significant predictor of creative achievements ($\beta = .181$, $t = 2.49$, $p = .014$), creative behavior ($\beta = .275$, $t = 3.82$, $p < .001$), and originality ($\beta = .239$, $t = 3.22$, $p = .001$).
5. Effects remained significant when controlling for the four sub-skills, for originality: $F(1, 102) = 4.64$, $p = .034$; for infrequency: $F(1, 102) = 7.35$, $p = .008$.

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