Supplementary Material for:

Mind-Body Dissonance: A Catalyst to Creativity

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1) SUPPLEMENTARY TABLE

A summary of the key differences between MBD and other constructs that concern the inconsistency between internal states and external expressions.

	Requires bodily expressions	Requires contradictions/ oppositions	Exists in affective & non-affective domains	Relative presence of social/experimental pressure or other incentives
Mind-Body Dissonance	✓	✓	✓	✓
Personal Inauthenticity [a]	✗	✗	✓	✓
Expressive Suppression [b]	✗	✗	✗	✓
Emotional Dissonance [c]	✗	✗	✗	✓
Dishonesty [d]	✗	✗	✗	✓
Cognitive Dissonance [e]	✗	✗	✗	✗

[a] The experience where individuals believe they are not acting according to who they are, how they feel, or what they value (Gino, Kouchaki, & Galinsky, 2015)
[b] A form of response modulation that involves inhibiting ongoing emotion-expressive behavior (Gross, 1998)
[c] A discrepancy between expressed and experienced emotions in service of organizational display rules (Abraham, 1999)
[d] A form of unethical behavior that involves not telling the truth (Gino & Wiltermuth, 2014)
[e] The experience of simultaneously holding two cognitions that do not fit together, cognitions that are inconsistent or contradictory (Festinger, 1957)

2) SUPPLEMENTARY STUDY

An Atypicality Mindset and A Favorable Attitude toward Novelty and Ambiguity Mediate the Effect of MBD on Novel Association in Serial

This study built on Experiment 3 in three ways. First, it sought to conceptually replicate the mediation found in Experiment 3, while simultaneously testing an additional mediator in serial to show that the atypicality mindset triggered by MBD results in a more favorable reaction to novelty and ambiguity, which in turn promotes creativity. Second, this study measured perceived contradiction as a more direct manipulation check to confirm that, not only are participants able to carry out the mental experience and bodily expression instructions successfully, but MBD is indeed a contradictory experience. Finally, this study examined controlled processing as an alternative mechanism.[1] Like other emotion regulation and self-regulation processes, maintaining a contradiction between bodily expressions and internal states may be an effortful experience (c.f. Richards & Gross, 2000). Therefore, an alternative explanation for MBD's creativity effect may be that its effortfulness primes a controlled processing style (Gervais & Norenzayan, 2012), which has been shown to increase creativity under certain conditions (e.g., DeDreu, Baas, & Nijstad, 2008). Accordingly, this study also measured perceived effortfulness as a manipulation check to confirm that MBD is an effortful experience.

Method

Participants and design. One hundred and seventy-three Americans (83 males, 90 females, age 19 - 72, M_{age} = 37.17, SD_{age} = 10.41) were randomly assigned to a 2 (mental experience: happy, sad) X 2 (facial expression: happy, sad) between-subjects design in a

[1] The author would like to thank an anonymous reviewer for suggesting this alternative mechanism.

"pilot study" conducted on Amazon's Mechanical Turk (MTurk). The sample size was over the 171 suggested by a power analysis of a medium-size effect ($f = 0.25$) with 90% power and an alpha of 0.05 for two-way interaction effects in a 2 X 2 ANOVA.

MBD manipulation. Participants completed a multi-tasking task similar to the coordination task used in Experiments 2 and 3. For the mental experience manipulation, participants recalled an incident in which they felt either *happy* or *sad*, described it in detail, and explained why it made them happy or sad. For the facial expression manipulation, participants in the *happy-face condition* were instructed to "pretend that you are holding a marker pen between your teeth without touching the (non-existing) pen with your lips." Participants in the *sad-face condition* were asked to "pretend that two golf tees are attached to your forehead, right above the inner corners of your eyebrows, and try to make the tips of the (non-existing) tees touch each other by raising and bringing together the inner corners of your eyebrows." An example photo was provided in each condition.

Creativity. Next, participants completed the same RAT from Experiments 1 and 2.

Attitude toward novelty and ambiguity. After the RAT, participants answered seven questions assessing whether they reacted favorably to novelty and ambiguity "at this moment." For example, they indicated, "I like obscure or hidden symbolism" and "I'm drawn to situations which can be interpreted in more than one way." (1 = I strongly disagree, 7 = I strongly agree; $\alpha = .94$; adapted from the novelty subscale of the Multidimensional Attitude Toward Ambiguity scale; Lauriola, Foschi, Mosca & Weller, 2016).

Atypicality mindset. In addition, participants answered four questions assessing whether they embraced an atypicality mindset "when trying to solve the remote association problems." For example, they indicated, "being distinctive was __ important to me" (1 = not at all, 5 = extremely; α = .90; adapted from Lynn & Harris, 1997). This scale has been used as a state measure in previous research and has been shown to tap unconventional thinking and correlate strongly with the desire for unconventional products (Lynn & Harris, 1997; Zitek & Vincent, 2015).

MBD manipulation checks. Participants answered the same manipulation check questions as in Experiment 2 (1 = not at all, 5 = I had never felt so happy/sad before, r = .56, $p < .001$, CI_{95} = [0.45, 0.66]). As a second, more direct check on the manipulation of MBD, they also indicated how much their facial expression contradicted how they felt during the multi-tasking task (1 = not at all, 5 = a great deal).

Controlled processing. Participants were instructed to complete the cognitive reflection test (CRT; Frederick, 2005), which has been shown to be a valid and reliable measure of controlled processing even after previous exposures (e.g., Meyer, Zhou, & Frederick, 2018). The CRT consists of three math problems (e.g., "A bat and a ball cost $1.10 in total. The bat costs $1.00 more than the ball. How much does the ball cost?"). Each problem has intuitively compelling incorrect answers, and most participants can solve these problems if they engage in controlled processing. The number of problems solved correctly served as a measure of controlled processing.

Self-ratings of controlled processing. To ensure that any potential effect on the CRT was actually driven by controlled processing, participants were also asked to indicate the extent to which they explicitly engaged in controlled processing when

working on the CRT by completing the Rational-Experiential Inventory–10 item short version (REI-10; Epstein, Pacini, Denes-Raj & Heier, 1996). Items included, "I trusted my initial feelings about the problems" (reserve-scored) and "I preferred to do something that challenged my thinking abilities, rather than something that required very little thought" (1 = completely false, 5 = completely true, $\alpha = .67$).

Perceived effortfulness of MBD. Finally, participants were asked to indicate the extent to which the MBD manipulation task was effortful (1 = not at all, 5 = very effortful), assessing its potential as a priming procedure that activates controlled processing.

Results

Manipulation checks. The manipulation instructions were successful. First, a two-way ANOVA on positive emotions revealed a significant mental experience effect, $F(1, 169) = 159.38$, $p < .001$, $\eta^2 = .49$, $CI_{90} = [0.40, 0.56]$, a marginally significant facial expression effect, $F(1, 169) = 3.53$, $p = .062$, $\eta^2 = .02$, $CI_{90} = [0, 0.07]$, and a marginally significant interaction effect, $F(1, 169) = 3.76$, $p = .054$, $\eta^2 = .02$, $CI_{90} = [0, 0.07]$ (see Table 1 for all means and pairwise comparisons). Specifically, happy recalls ($M = 3.31$, $SD = .66$) resulted in more positive emotions than sad recalls ($M = 1.85$, $SD = 0.87$), $t(171) = 12.44$, $p < .001$, $d = 1.89$, CI_{95} [1.23, 1.69]. The happy expression was not significantly different from the sad expression ($p = .17$).

More importantly, as predicted, MBD led to a higher sense of contradiction. A two-way ANOVA revealed a significant interaction, $F(1, 169) = 8.22$, $p = .005$, $\eta^2 = .046$, $CI_{90} = [0.008, 0.11]$, in that participants in the MBD conditions ($M = 2.86$, $SD = 1.21$) reported greater contradiction than those in the MBC conditions ($M = 2.35$, $SD = 1.18$),

$t(171) = 2.84$, $p = .005$, $d = .43$, CI_{95} [0.16, 0.87]. There was also an unpredicted main effect of mental experience, $F(1, 169) = 4.11$, $p = .044$, $\eta^2 = .029$, $CI_{90} = [0.0003, 0.07]$, in that happy recalls ($M = 2.78$, $SD = 1.23$) led to greater contradiction than sad recalls ($M = 2.42$, $SD = 1.18$), $t(171) = 1.98$, $p = .05$, $d = .30$, CI_{95} [0.00023, 0.73], an effect largely driven by the happy-mind-sad-face versus sad-mind-sad-face comparison (see Table 1 for pairwise comparisons). The main effect of facial expression was not significant ($p = .97$).

Atypicality mindset. As predicted, those who experienced MBD embraced an atypicality mindset to a greater extent. A two-way ANOVA revealed a significant interaction effect, $F(1, 169) = 6.01$, $p = .015$, $\eta^2 = .034$, $CI_{90} = [0.004, 0.09]$. The main effects were not significant (ps > .22). Specifically, participants in the MBD conditions ($M = 2.21$, $SD = 0.98$) were more inclined to embrace an atypicality mindset than those in the MBC conditions ($M = 1.89$, $SD = 0.72$), $t(171) = 2.44$, $p = .016$ (equal variance not assumed), $d = .37$, CI_{95} [0.06, 0.58].

Direct and indirect effects on attitude toward novelty and ambiguity. Similarly, MBD led to more favorable reactions toward novelty and ambiguity. A two-way ANOVA revealed a significant interaction effect, $F(1, 169) = 5.03$, $p = .026$, $\eta^2 = .029$, $CI_{90} = [0.002, 0.08]$. The main effects were not significant (ps > .63). Specifically, those in the MBD conditions ($M = 5.59$, $SD = 1.41$) reacted more favorably to novelty and ambiguity than those in the MBC conditions ($M = 5.10$, $SD = 1.49$), $t(171) = 2.25$, $p = .026$, $d = .34$, CI_{95} [0.06, 0.93].

Controlling for MBD, an atypicality mindset also led to more favorable reactions toward novelty and ambiguity, $B = .73$, $SE = .12$, $CI_{95} = [0.50, 0.96]$, $t(173) = 6.26$, p

< .001,. More important, to test the prediction that the effect of MBD (happy-mind-happy-face & sad-mind-sad-face = 0, and happy-mind-sad-face & sad-mind-happy-face = 1) on the attitude toward novelty and ambiguity is mediated by an atypicality mindset, A PROCESS Model 4 analysis using 5,000 bootstrap re-samples of the data with replacement was performed (Hayes, 2017). As predicted, the indirect effect of MBD through an atypicality mindset was significant (point estimate = 0.23; 95% bias-corrected confidence internal of 0.06 to 0.45).

Direct and indirect effects on creativity. Finally, as in Experiments 1 and 2, MBD led to more correctly solved RAT items. A two-way ANOVA revealed a significant interaction effect, $F(1, 169) = 4.93$, $p = .028$, $\eta^2 = .028$, $CI_{90} = [0.002, 0.08]$. The main effects were not significant (ps > .69). Specifically, those in the MBD conditions (M = 8.85, SD = 4.05) solved more RAT items correctly than those in the MBC conditions (M = 7.58, SD = 3.43), $t(171) = 2.24$, $p = .027$, $d = .34$, CI_{95} [0.15, 2.40].

More important, to test the prediction that the effect of MBD on creativity is mediated by an atypicality mindset and a favorable attitude toward novelty and ambiguity in serial, A PROCESS Model 6 analysis using 5,000 bootstrap re-samples of the data with replacement was performed (Hayes, 2017; see all coefficients in Figure 1). As predicted, the indirect effect of MBD on creativity through both an atypicality mindset and the attitude toward novelty and ambiguity in serial (point estimate = 0.09; 95% bias-corrected confidence internal of 0.01 to 0.27) was significant. Reversing the two mediators in serial, the indirect effect first through the attitude toward novelty and ambiguity and then through an atypicality mindset was not significant (95% bias-

corrected confidence interval of -0.18 to 0.08), hence confirming the hypothesized direction of the mechanistic pathway.

Perceived effortfulness of MBD and controlled processing. Neither MBD nor mental experiences or bodily expressions affected the performance on the CRT (*p*s > .14) or the self-ratings of controlled processing on the REI (*p*s > .24), even though MBD was indeed perceived to be a more effortful experience than MBC. A two-way ANOVA revealed a significant interaction effect on perceived effortfulness, $F(1, 169) = 4.88$, $p = .029$, $\eta^2 = .028$, $CI_{90} = [0.002, 0.08]$. There was also a marginally significant main effect of facial expression, $F(1, 169) = 3.69$, $p = .056$, $\eta^2 = .021$, $CI_{90} = [0, 0.07]$. The main effect of mental experience was not significant ($p > .62$). Specifically, MBD ($M = 3.28$, $SD = 1.09$) was perceived to be more effortful than MBC ($M = 2.92$, $SD = 1.05$), $t(171) = 2.21$, $p = .028$, $d = .34$, CI_{95} [0.04, 0.68]. The sad expression ($M = 3.26$, $SD = 1.07$) was also perceived to be directionally more effortful than the happy expression ($M = 2.94$, $SD = 1.08$), $t(171) = 1.92$, $p = .057$, $d = .29$, CI_{95} [-0.009, 0.64].

In addition, mediation analyses did not find a significant indirect effect of MBD on creativity through CRT performance (95% bias-corrected confidence interval of -0.77 to 0.08), REI ratings (95% bias-corrected confidence interval of -0.58 to 0.10), or perceived effortfulness (95% bias-corrected confidence interval of -0.20 to 0.27).

Discussion

This study, conceptually replicating Experiment 3, confirmed that MBD's effect on creativity is driven by an atypicality mindset, which further enables a more favorable attitude toward novelty and ambiguity. Additionally, although this study revealed that

MBD was an effortful experience, no support was found for controlled processing as a mechanism through which MBD increases creativity.

Three limitations are worth noting when interpreting the above findings. First, this study was conducted online and therefore there was little control over how well the MBD manipulation instructions were carried out. Second, future research could manipulate controlled processing in a moderation-of-process design to further examine this alternative mechanism. Third, an alternative non-self-report measure of controlled processing, other than the CRT, may also provide more robust evidence on this alternative mechanism. To begin with, the CRT may be more suited as a trait measure. This is because, although some evidence suggests that CRT performance can be experimentally enhanced (Mata, Ferreira, & Sherman, 2013), it is also highly stable over time (Stagnaro, Pennycook, & Rand, 2018). Additionally, although recent research suggests that direct record of prior exposure does not positively predict CRT scores and that direct record and self-report of prior experience do not affect the CRT's ability to predict a variety of outcomes variables (Bialek & Pennycook, 2018; Meyer et al., 2018; Stagnaro et al., 2018), previous research showing that CRT performance may be affected by self-report of prior exposure continues to challenge the validity of the CRT (Haigh, 2016; Stieger & Reips, 2016). Finally, although there is evidence that participants on MTurk do not score significantly higher on the CRT than non-MTurk samples, they are more likely to use the Internet to look up answers, which continues to raise doubt about the CRT's validity with an online sample (Goodman, Cryder, & Cheema, 2012).

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Table 1

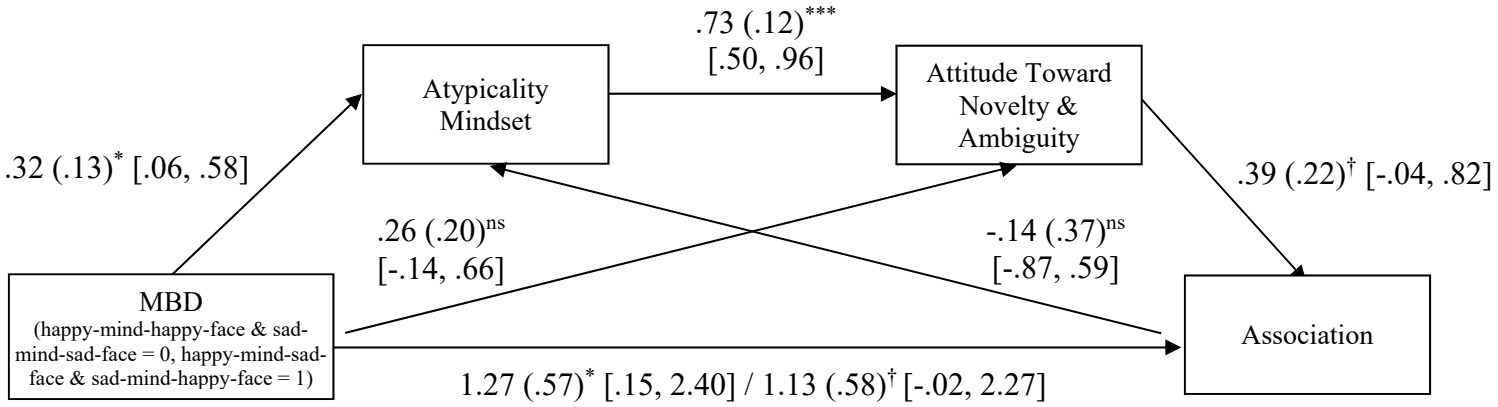
Means and Standard Deviations by condition.

	Positive Emotions	Contradiction	Atypicality Mindset	Novelty & Ambiguity	Association	Effortfulness	REI-10	CRT
Happy Mind	3.31[a]	2.52[ac]	1.91[a]	5.10[ab*]	7.50[a*]	2.73[a*†]	3.22[a]	1.91[a*]
Happy Face	(0.60)	(1.25)	(0.79)	(1.52)	(3.45)	(1.11)	(0.57)	(1.12)
Sad Mind	1.63[b]	2.16[a]	1.87[a]	5.09[a]	7.65[a†]	3.12[ab*]	3.15[a]	1.81[a]
Sad Face	(0.75)	(1.09)	(0.64)	(1.48)	(3.45)	(0.96)	(0.50)	(1.16)
Happy Mind	3.31[a]	3.05[b]	2.34[b]	5.50[ab]	9.00[a*†]	3.40[b]	3.06[a]	1.49[a*]
Sad Face	(0.72)	(1.17)	(0.93)	(1.51)	(4.24)	(1.16)	(0.52)	(1.20)
Sad Mind	2.07[c]	2.67[bc]	2.07[ab]	5.69[b*]	8.70[a]	3.16[ab†]	3.12[a]	1.72[a]
Happy Face	(0.94)	(1.23)	(1.01)	(1.31)	(3.90)	(1.02)	(0.54)	(1.16)

Note. Standard deviations are reported in brackets under the condition means. Means with different superscripts are significantly different at the $p < .05$ level, and those with * or † are significantly different at the $p < .10$ level (within the same column).

Figure 1

An atypicality mindset and the attitude toward novelty and ambiguity mediated the relationship between MBD and creativity in serial.



Note. The total and direct effects of MBD on creativity are presented, in that order. All coefficients are unstandardized. SEs are in parentheses, and 95% CIs are in brackets. † < .10, * $p < .05$, ** $p < .01$, *** $p < .001$. The indirect effect of MBD on creativity through an atypicality mindset and the attitude toward novelty and ambiguity in serial is significant (point estimate = 0.09; 95% CI [0.01, 0.27]).