

Supplemental Material for
When the muses strike: Creative ideas of physicists and
writers regularly occur during mind-wandering

HLM Equations from Results section in Text.

Level-1: $\text{Prob}(\text{IDEA CONTEXT} = 1 | B) = P$
 $\log[P/(1-P)] = P_0 + P_1 * (\text{IMPASSE})$

Level-2 Model

$$P_0 = B_{00} + r_0$$

$$P_1 = B_{10} \quad [\text{Equation 1}]$$

Level-1 Model

$$\text{IDEA QUALITY} = P_0 + P_1 * (\text{CONTEXT}) + e$$

Level-2 Model

$$P_0 = B_{00} + r_0$$

$$P_1 = B_{10} \quad [\text{Equation 2}]$$

Level-1 Model

$$\text{IDEA QUALITY CHANGE} = P_0 + P_1 * (\text{CONTEXT}) + P_2 * (\text{PHENOM.}) + P_3 * (\text{CONTEXT} * \text{PHENOM.}) + e$$

Level-2 Model

$$P_0 = B_{00} + r_0$$

$$P_1 = B_{10}$$

$$P_2 = B_{20}$$

$$P_3 = B_{30} \quad [\text{Equation 3}]$$

Supplementary analyses comparing Writers to Physicists.

To test group differences we conducted the analyses detailed in the main text (see above equations) and included a moderating variable that distinguished writers from physicists on both the intercept (B_{00}) and slope (B_{10}) terms. Overall the writers and physicists showed remarkably similar pattern of effects in terms of our hypotheses and the associations among variables (i.e., the results reported in Table 3 of the main text).

There were, however differences between the two groups in base rates and means of the outcome variables. Specifically, in Study 1, writers rated their ideas on average as more creative and important [difference in intercepts (i.e., means) = 1.07 and 1.01, respectively, $p_s < .001$] than physicists at the time they were generated. However, physicists' creativity ratings on their ideas increased at the follow-up [B (difference between Time 1 and Time 2) = $+.65$, $p < .001$] whereas writers' ratings of creativity decreased in average over time, although this change was not significantly different from zero [$B = -.07$, $p = .48$]. Writers' ratings of the importance of their ideas decreased significantly over time [$B = -.82$, $p < .001$]; and physicists' ratings of idea importance also declined over time but this change was not significantly different from zero [$B = -.16$, $p = .29$]. Writers were more likely to report an idea occurred during mind-wandering [$B = .15$, $p < .001$] and experience an "a-ha" moment [$B = .14$, $p = .01$] than physicists.

As in Study 1, in Study 2 writers rated their ideas as more creative and important than physicists [difference in intercepts = 1.03 and 1.05, respectively, $p_s < .001$] at the time they were generated. However, unlike Study 1, both physicists' and writers' creativity ratings on their ideas increased over time [B (difference between Time 1 and Time 2) = $+.36$, $p < .01$]) and the two groups did not differ significantly in their rates of increase ($p > .50$). In addition, similar to Study 1, in Study 2 both writers' and physicists' ratings of the importance of their ideas decreased significantly over time [M (difference between Time 1 and Time 2) = $-.37$, $p < .01$]), however unlike Study 1, the two groups did not significantly differ from one another in this decline over time ($p > .25$). Writers were more likely to report an idea occurred during mind-wandering [$B = .15$, $p < .001$] and experience an "a-ha" moment [$B = .16$, $p = .025$] than physicists.

We turn now to examination whether physicists differed from writers in the pattern of hypothesized associations as reported in Table 3 of the main text. In Study 1, writers rated their

ideas that occurred during mind wandering as marginally significantly less important (but not less creative) than while working ideas on the day they were generated [$B = -.57$, $p = .063$] but there was no difference in writers' ratings of these ideas at Time 2 [$B = .17$, $p = .684$]. In Study 2, the pattern reversed such that physicists rated their ideas that occurred during mind wandering as significantly less important (but not less creative) than while working ideas on the day they were generated [$B = -.59$, $p = .015$] but significantly greater in importance at Time 2 [$B = +1.81$, $p < .001$]. In short, mind wandering ideas did not differ from while working ideas in creativity for either writers or physicists across both studies. In addition, no reliable pattern of differences between writers and physicists was observed for importance ratings across time or studies.

In Study 2, while writers rated “a-ha” ideas as more creative than non-a-ha ideas [$B = 1.04$, $p < .001$] physicists did not [$B = .25$, $p = .418$]; this difference was not observed for importance ratings nor was it observed in Study 1 for either creativity or importance ratings. Finally, in Study 1, the pattern for “a-ha” ideas to decline more in their creativity ratings over time was significant for writers [$B = -.87$, $p < .001$], and in the same direction but not statistically significant for physicists [$B = -.19$, $p = .316$]. Again, no differences in “a-ha” versus non “a-ha” ideas were observed between the groups on changes in creativity ratings over time in Study 2 nor were any differences observed on importance ratings changes over time in either Study 1 or Study 2. Writers and physicists did not differ significantly in any of the other patterns of data reported in the main text (see Table 3), which collapsed across writers and physicists.

Supplementary analyses using alternative definition of mind wandering.

In the main text we used a very conservative definition of mind wandering as exclusively entailing ideas that were generated when people were not working and not thinking about the topic. A slightly more liberal definition of mind wandering that is nevertheless consistent with

previous daily experience research on mind wandering is to compare ideas that were generated while working to those generated while doing something else. Accordingly, in these supplemental analyses we defined an idea as occurring while-working if participants answered the question “What were you doing when the idea occurred to you?” with either “actively pursuing the project” or “working on another work-related project or idea” and we defined ideas as occurring during mind wandering if they responded to this question with “doing something unrelated to work (e.g., paying a bill)”. In Study 1, while-working ideas made up 72% reported ideas, 28% occurred during mind wandering and a nearly identical distribution was found in Study 2, with 72.3% reported to occur while-working and 27.7% while mind wandering. Thus, on average across the two studies, participants reported that over 25% of the most significant ideas of the day were formed during episodes of mind wandering.

Below is a Table (SOM-R Table 1) detailing the results of the HLM analyses using this new, but more traditional definition of mind-wandering. As can be seen, the pattern of results is almost identical to those reported in the main text.

SOM-R Table 1: Ideas coded as while-working if participants answered the question “What were you doing when the idea occurred to you?” with either “actively pursuing the project” or “working on another work-related project or idea”. Ideas coded as mind wandering if they responded to this question with “doing something unrelated to work (e.g., paying a bill)”

Outcome	Predictor	Coefficient (Standard Error)	t-value (d.f.)	<u>p-value</u>	odds ratio	95% Confidence Intervals ^a
Mind wandering	Impasse					
Study 1		0.64 (0.19)	3.46 (479)	.001	1.91	1.32, 2.75
Study 2		0.67 (0.27)	2.49 (235)	.013	1.95	1.15, 3.31
Importance	Mind wandering					
Study 1		-0.16 (.11)	1.45 (645)	.147	N/A	-0.37, 0.06
Study 2		-.09 (.13)	0.71 (342)	.481	N/A	-0.34, 0.17
Creativity	Mind wandering					
Study 1		-0.03 (.13)	0.27 (640)	.785	N/A	-0.29, 0.23
Study 2		0.00 (.15)	0.003 (342)	.997	N/A	-0.29, 0.30
Import. Change	Mind wandering					
Study 1		-0.13 (.15)	0.85 (600)	.394	N/A	-0.42, 0.16
Study 2		0.13 (.26)	0.48 (238)	.633	N/A	-0.38, 0.54
Creativity Change	Mind wandering					
Study 1		-0.19 (.17)	1.08 (606)	.281	N/A	-0.52, 0.14
Study 2		0.18 (.24)	0.77 (241)	.443	N/A	-0.28, 0.66
Mind wandering	“a-ha” moment^c					
Study 1		0.42 (.18)	2.35 (643)	.019	1.52	1.07, 2.16
Study 2		0.40 (.23)	1.74 (341)	.083	1.49	0.95, 2.34

Import. Change	Mind wandering/ “a-ha” moment Interaction ^d					
Study 1		-0.13 (.33)	0.41 (595)	.684	N/A	-0.78, 0.52
Study 2		0.03 (.45)	0.08 (234)	.938	N/A	-0.86, 0.92
Creativity Change	Mind wandering/ “a-ha” moment Interaction					
Study 1		-0.43 (.27)	1.56 (601)	.120	N/A	-0.96, 0.10
Study 2		-0.68 (.38)	1.79 (239)	.075	N/A	-1.43, 0.07

Complete List of Variables Collected in Daily Form: Study 1 and Study 2

* = variable analyzed for the current paper

How would you describe your mood today?

Excited
Inspired
Happy
Irritable
Distressed
Nervous
Troubled
Energetic

Today, I felt happier or more cheerful than usual.

Today, I felt more self confident than usual.

Last night, I needed less sleep than usual.

Today, I talked more than usual.

Today, I was more active (either socially, sexually, at work, home, or school) than usual.

Overall, please rate how you feel your close relationships and connections with other people were today

Please rate how strongly you agree or disagree with the following statements

Someone close to me (romantic partner, close friend, or family member) made me feel wanted or accepted today.

-Someone close to me was inattentive or unresponsive towards me today.

-Someone close to me criticized something I said or did today.

-Today, I felt uncomfortable sharing my private thoughts and feelings with those close to me.

-Today, I worried that my partner, a friend, or a family member did not care about me as much as I cared about him or her.

How much time did you spend at work today (e.g., at your office, in your work space at home)?

How much time did you spend specifically working on problems pertaining to your creative interests?

To what extent were you excited about the projects you focused on today?

To what extent did you feel stressed about your work and/or projects pertaining to your creative interests?

How much time did you spend in physical exercise?

How many hours did you sleep last night?

Did you nap during the day?

Did you meditate?

Did you have any ideas today that you think might represent a meaningful advance on any project?

What time of day did the idea occur?

*What were you thinking about when the idea occurred to you?

*What were you doing when the idea occurred to you?

What situation were you in when the idea occurred to you?

-In conversation?

-In a talk?

-In a presentation?

-Reading?

-Attending to other media (ie, film, television, internet)?

Was it a conversation directly bearing on the topic on which you had the idea?

Was it a talk directly bearing on the topic on which you had the idea?

Was it a presentation directly bearing on the topic on which you had the idea?

Was it reading directly bearing on the topic on which you had the idea?

Was it media directly bearing on the topic on which you had the idea?

To what extent did the surrounding environment contribute to your idea?

Did the generation of this idea at all involve napping, sleeping, dreaming, falling asleep, waking up, etc.?

*What was the state of the problem/project that you had an idea about?

*Would you say the idea felt like an "a-ha!" moment?

*How important do you think this idea is?

*How creative do you think this idea is?

How significant of an advance would this idea represent if it proves to be useful?

How confident are you that this idea will prove useful in your work?

To what extent do you feel motivated to continue working on this idea?

To what extent did you feel the following immediately after having the idea?

-Inspired

-Competent

-Fatigued

-Relieved

-Desire to tell others about the event

Did you tell your partner, friend, colleague, or a family member about your idea?

The person I told about this idea reacted positively and enthusiastically.

Complete List of Variables Collected in Follow-up Survey for each idea

* = variable analyzed for the current paper

How well do you remember this idea?

What were you thinking about when the idea occurred to you?

What were you doing when the idea occurred to you?

*How creative do you feel the idea was?

*How important has the idea proven to be overall?

How useful has the idea proven to be for the specific project you intended it to be used for?

How useful has the idea proven to be for any other project(s) besides the one you intended it to be?

How useful has the idea proven to be overall?

To what degree have you continued to build on this particular idea?

How often have you re-visited this idea?

To what degree have you received positive reactions from others regarding this idea?

Please read each statement and check any and all that apply (Physicists ONLY).

- I have talked about this idea informally with colleagues.
- I presented this idea at a symposium/talk/conference.
- I am preparing a manuscript that includes this idea for publication.
- I published a paper with this idea.
- I have a patent or patent application for this idea.
- I have gained financially from this idea.
- My career has advanced as a result of this idea.
- This idea has been covered by the popular media.
- Although I have not used this idea as written, it was the basis for another idea which is incorporated into a work in progress or completed work.
- Although I have not used this idea, I am likely to return to it someday.
- I have not used this idea and have abandoned it completely.
- Other outcomes, please specify:

Please read each statement and check any and all that apply (Writers ONLY).

- I have talked about this idea informally with colleagues.
- I have presented or pitched this idea to a publisher, director, producer, etc.
- I incorporated this idea into a work (e.g., essay, script, story) that is in progress.
- I incorporated this idea into a finalized or completed work (e.g., essay, script, story).
- This idea has been published, sold, or performed.
- I have gained financially from this idea.
- My career has advanced as a result of this idea.
- This idea has been covered by the popular media.
- Although I have not used this idea as written, it was the basis for another idea which is incorporated into a work in progress or completed work.
- Although I have not used this idea, I am likely to return to it someday.
- I have not used this idea and have abandoned it completely.
- Other outcomes, please specify.