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Embodied Metaphors and Creative "Acts"

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Abstract
Creativity is a highly sought after skill. To inspire people's creativity, prescriptive advice in the form of metaphors abound: We are encouraged to *think outside the box*, to consider the problem *on one hand, then on the other hand,* and to *put two and two together* to achieve creative breakthroughs. These metaphors suggest a connection between concrete bodily experiences and creative cognition. Inspired by recent advances on body-mind linkages under the emerging vernacular of embodied cognition, we explored for the first time whether enacting metaphors for creativity enhances creative problem-solving. In five studies, findings revealed that both physically and psychologically embodying creative metaphors promote fluency, flexibility, and/or originality in problem-solving. Going beyond prior research that focused primarily on the kind of embodiment that primes *preexisting knowledge*, we provide the first evidence that embodiment can also activate *cognitive processes* conducive for generating previously unknown ideas and connections.

Keywords
creativity, metaphors, problem-solving, flexibility, cognitive processes

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Abstract

Creativity is a highly sought after skill. To inspire people's creativity, prescriptive advice in the form of metaphors abound: We are encouraged to *think outside the box*, to consider the problem *on one hand, then on the other hand,* and to *put two and two together* to achieve creative breakthroughs. These metaphors suggest a connection between concrete bodily experiences and creative cognition. Inspired by recent advances on body-mind linkages under the emerging vernacular of embodied cognition, we explored for the first time whether enacting metaphors for creativity enhances creative problem-solving. In five studies, findings revealed that both physically and psychologically embodying creative metaphors promote fluency, flexibility, and/or originality in problem-solving. Going beyond prior research that focused primarily on the kind of embodiment that primes *preexisting knowledge*, we provide the first evidence that embodiment can also activate *cognitive processes* conducive for generating previously unknown ideas and connections.

(146 words)

Metaphors of creative thinking abound in everyday use. By thinking "outside the box"; by considering a problem "on the one hand, then on the other hand"; or by "putting two and two together", creativity presumably follows. Such prescriptive advice is no stranger within research labs, advertising teams, the halls of higher education, or other contexts where pioneering novel approaches to pressing problems are valued. In this article, we present five experiments that examine the psychological potency of these creative metaphors by investigating whether creative problem-solving is enhanced when people embody, that is, *literally* follow, these metaphors.

Our approach in investigating the power of creative metaphors is inspired by recent advances in understanding body-mind linkages under the emerging vernacular of embodied cognition. This perspective focuses on the notion that abstract concepts can become closely tied to concrete bodily experiences in the form of sensations and motor activities (Barsalou, 2008; Niedenthal, et al., 2005). A growing body of research supports this view by showing that people draw on their concrete physical experiences in constructing social reality. For example, holding a warm (vs. cold) beverage increases people's perceptions of a stranger as having a warm personality (Williams & Bargh, 2008) and of being closer to their significant others (IJzerman & Semin, 2009). Physical movements (backward, forward) appear to cue memories for past events or thoughts about future events (Miles, Nind, & Macrae, 2010). To account for these phenomena, the metaphor-enriched social cognition approach postulates that metaphors operate through a conceptual mapping process whereby source concepts are mentally associated with superficially dissimilar target concepts (Landau, Meier, & Keefer, 2010, see also IJzerman & Koole, 2010). The use of metaphors, therefore, may make knowledge from a source domain that is largely concrete and physical (e.g., temperature) more accessible in making sense of a target concept that is usually abstract (e.g., person perception; Lakoff & Johnson, 1999). As such, the

literal and abstract meanings of some conceptual metaphors may become intertwined to such an extent that the metaphors themselves achieve a physical reality of their own (Schubert, 2005).

Prior embodiment research has focused almost exclusively on the kind of embodiment that activates preexisting knowledge structures. To illustrate, the tactile sensation of warmth activates knowledge about relational closeness (Williams & Bargh, 2008*)*; making a fist activates gender stereotypical knowledge of being self-assertive among males (Schubert & Koole, 2009). This paper seeks to advance understanding by demonstrating for the first time that embodiment can not only prime existing knowledge structures, but also cognitive processes necessary for generating new ideas and knowledge. Thus, in line with the metaphor-enriched approach, we offer the first evidence whether embodiment, in this case, embodying creative metaphors, can give rise to novel ideas through facilitating the psychological process of creative problem-solving. We demonstrate that body, mind, and context interact to induce cognitive processes that can potentially enlarge one's knowledge repertoires, in addition to simply making preexisting knowledge more accessible.

Creativity is typically defined as the process of creating something both novel and useful (Amabile, 1996). Both convergent thinking and divergent thinking are important to creative problem-solving (Guilford & Hoepfner, 1971). *Convergent thinking* entails the search of the best single answer or the most creative solution (Dewhurst, Thorley, Hammond, & Ormerod, 2011; Nemeth, 1986; Simonton, 2003). *Divergent thinking* entails the generation of many ideas or alternative solutions to a problem (Guilford, 1967). Measures of divergent thinking involve at least three distinct components that are complementary but not highly correlated: fluency, flexibility, and originality (Cheng, Sanchez-Burks, & Lee, 2008; Guilford, 1959; Nijstad, De Dreu, Rietzschel, & Baas, 2010; Torrance, 1966). Fluency is the sheer number of ideas that a

person is able to generate for a problem. It is an important antecedent to creativity because the more ideas one generates, the more likely, by sheer chance, that he/she will reach a novel solution (Simonton, 1999). Flexibility refers to the extent to which ideas differ from each other or across multiple categories. Flexibility is indicative of divergent thinking if the generated ideas span multiple conceptual categories, disciplines or fields of inquiry. Originality refers to the extent to which an idea is novel in the context of previously known ideas. Two major approaches to evaluate originality are based on subjective judgment and objective statistical infrequency (Hocevar, 1979). Notably, good performance in both convergent and divergent thinking tasks demonstrate creative cognition as one has to overcome mental fixedness and be cognitively flexible in order to excel in these tasks.

We hypothesize that the embodiment of creative metaphors will promote creative problem-solving. To demonstrate the robustness and generalizability of our effects, we utilize creativity measures that assess convergent thinking (measured by the attainment of the correct solution) and divergent thinking (measured by fluency, flexibility, and originality). By employing different creativity measures across five studies, not only do we seek to show that the effects generalize to each component of the creative process, but we also demonstrate that the results are not due to artifacts associated with a given creativity measure.

Study 1

Across cultures and languages, such as English, Korean, Hebrew, and Chinese, creativity is thought to be enhanced with bilateral physical orientations such that better solutions arise by thinking about a problem on "one hand" and then "on the other hand." Our first experiment tested whether physical embodiment of the "two-hands" metaphor, by making the corresponding

hand gestures, facilitates the three components (fluency, flexibility, and originality) of the creative process pertaining to divergent thinking.

Method

Forty undergraduate participants (12 females) were asked to do two ostensibly unrelated studies simultaneously: While they were to generate novel uses for a university building complex during two trials, they also took part in a public speaking study that required them to lift and hold a hand outstretched as one might do while talking to a group from a stage. After viewing a video-recorded instruction that described the procedure and body posture, participants stood facing the corner of the room, where task instructions were attached on the wall either on both sides (experimental condition) or on only their right side (control condition).

During the first trial, participants read and verbalized answers to the question attached on the right side, while holding their right hand toward the wall with palm facing upward and left hand behind the back. During the second trial, control participants were asked to raise the same hand as they did during the first trial when generating additional ideas; participants in the experimental condition, however, switched hands by holding their left hand toward the wall and right hand behind the back. Notably, participants were not aware that they were to generate ideas to the same question twice until they began the second trial, when they were encouraged to generate as many unique solutions as possible. No time constraint was given for each trial. We audio-recorded participants' oral responses and had two independent raters code for fluency (number of ideas generated) and flexibility (number of unique categories that described their ideas, e.g., restaurant, gymnasium; inter-rater r=.67). We also calculated an objective originality score based on the frequency of each generated idea within the sample. Following Goncalo and Staw (2006)'s procedure, we counted the number of times each idea appeared in the sample,

subtracted that number from the entire sample size, and assigned this score to each particular idea. Scores for each idea were then added for each individual to derive originality scores. Participants who generated a greater number of original ideas received higher scores.

Results

With fluency as the dependent variable, a mixed design ANOVA with Condition (between-participants factor: one hand, two hands) and Trial (within-participants factor: Trial 1, Trial 2) showed a main effect of Trial, $F(1,38)=26.17$, $p<.001$, $\eta^2_p=.41$, with more ideas being generated in the first trial ($M=11.67$, $SD=6.04$) than the second trial ($M=7.20$, $SD=3.83$). As predicted, there was a significant Condition X Trial interaction, $F(1,38)=5.97$, $p=.02$, $\eta^2_p=.14$, showing a greater number of ideas generated in Trial 2 if participants were embodying "the other hand" ($M=8.17$, $SD=4.00$) rather than "the same hand" ($M=5.75$, $SD=3.15$), $t(38)=2.02$, $p=.05$, $\eta^2_p=.10$, with no differences between conditions in Trial 1, $t<1.20$. There was no Condition main effect, $F<1$.

Similar patterns were observed for flexibility and originality. There were Trial main effects on flexibility ($F(1,38)=78.42$, $p=.01$, $\eta^2_p=.67$; $M_{\text{first trial}}=7.03$, $SD=2.85$; $M_{\text{second trial}}=2.78$, $SD=1.59$) and on originality ($F(1,38)=20.70$, $p=.02$, $\eta^2_p=.35$; $M_{\text{first trial}}=1036.75$, $SD=578.31$; $M_{\text{second trial}}=673.18$, $SD=381.80$). Of import, there were significant Condition X Trial interactions on flexibility ($F(1,38)=4.28$, $p=.045$, $\eta^2_p=.10$) and originality ($F(1,38)=6.53$, $p=.02$, $\eta^2_p=.15$), showing greater idea flexibility ($M=3.08$, $SD=1.74$) and originality ($M=768.83$, $SD=404.45$) in Trial 2 among participants embodying "the other hand" compared to "the same hand" (flexibility: $M=2.31$, $SD=1.25$; originality: $M=529.68$, $SD=302.63$).

Study 2a

One reason why creativity can be sparked when we consider a problem from different sides is because accessing different alternatives helps overcome cognitive rigidity. This ability is well captured by the metaphor "thinking outside the box," a platitude often offered to inspire young scientists, industrial designers, and Hollywood scriptwriters alike. In this study and the next two, we tested whether enacting this metaphor in different manners increases creative problem-solving. Study 2a examined this embodiment effect on creative problem-solving with a convergent thinking task, whereas Study 2b examined the effect with a divergent thinking task.

Method

We had 102 undergraduates (52 females) participate in the study for US$7. We constructed a box out of PVC pipe and cardboard that measured 5' by 5', and could comfortably seat an individual. We placed the box in a laboratory and asked participants to complete a 10-item Remote Associates Test (RAT; Mednick, Mednick, & Mednick, 1964) while sitting either inside or outside the box, under a cover story about studying different work environments. We also included a control condition in which participants completed the task without the box.

The RAT requires individuals to conjure a fourth word (e.g., *tape*) that relates to each of three presented clue words (e.g., *measure*, *worm*, *video*). Notably, the RAT is a measure of convergent thinking, the ability to analyze relationships among remote ideas and come up with one correct solution (Dewhurst et al., 2011; Subramaniam, Kounios, Parrish, & Jung-Beeman, 2008; Taft & Rossiter, 1966). We predicted that by embodying the metaphor, participants who carried out the RAT while seated outside the box, that is, those who literally thought outside the box would be more likely to overcome cognitive fixedness and to gain the insight of correctly linking the three clue words, relative to those who sat inside the box and those who saw no box. To rule out potential alternative explanations related to the experience of being inside the box,

after the RAT, participants responded to four feeling items pertaining to safety, privacy, confusion, and comfort on a 1 (*strongly disagree*) to 5 (*strongly agree*) scale, as well as the 20-item Claustrophobia Scale (α=.86; Öst, 2007) by rating the degree of anxiety that they would experience in specific situations (1=*none*, 5=*very much*).

Results

As predicted, participants who completed the RAT while physically outside of the box generated more correct answers (M=6.73, SD=0.50) than both inside-the-box (M=5.08, SD=0.51) and control participants (M=5.43, SD=0.35), $F(1,99)=3.93$, $p<.05$, $\eta^2_p=.06$; planned contrast, $t(99)=2.52$, $p<.05$, $\eta^2_p=.06$. Including measures of feeling and claustrophobia as covariates did not alter the results, $F(1,47)=8.04$, $p<.01$, $\eta^2_p=.15$, and the covariates were not significant, $F<3.68$. Because the mean RAT scores did not differ between inside-the-box and control participants, this suggests that "thinking outside the box" contributes unique explanatory variance in fostering creativity (vs. "thinking inside the box" hampering creativity).

Study 2b

Whereas Study 2a asked participants to physically think inside or outside a box, Study 2b extended Study 2a by investigating whether physically embodying a box (by walking in a rectangular path) would yield consistent findings. Further, as Study 2a used a convergent thinking task, in Study 2b we followed up with measures of divergent thinking, as presumably out-of-the-box thinking is also conducive for generating many alternative ideas.

Method

We had 104 participants (66 females) complete the study for course credit and were randomly assigned to either a rectangular-walking, free-walking, or sitting condition. Participants were run one at a time and were told that the study examined how contemplating

solutions to problems would affect problem-solving. To justify the walking manipulations, we told participants in the walking conditions to leave the desk and walk in the lab so they could not immediately write down their solutions without contemplation. The tasks were two counterbalanced divergent thinking tasks that involved idea generations: Droodle task and Lego task (see below). In the rectangular-walking condition, after reading the instructions of the first task, participants spent two minutes contemplating their answers while they walked along a fixed rectangular path indicated by duct tape placed on the floor (about 6' by 8'); in the free-walking condition, participants walked freely away from the fixed path as they wished. After two minutes of walking, participants wrote down their answers and repeated the same procedure for the second task. Sitting participants remained seated while contemplating the solutions for two minutes before writing them down.

Droodle Task. Droodles are ambiguous, riddle pictures (Price, Lovka, & Lovka, 2002). Participants were presented two Droodle pictures with a descriptive caption for each (a sample Droodle contains two V-shape lines with shorter extensions at the top (looks like two chicken feet) sticking out from a hole, with the corresponding caption "A bird in a hole, upside down"). Participants were asked to generate a new caption for each picture. We were interested in participants' out-of-the-box thinking by assessing how much their newly generated captions deviated from the provided captions. Two independent judges coded the degree of deviation with a 0 to 9 scale, with a higher number representing greater deviation (inter-rater r=.62). The mean deviation scores averaged across judges' ratings represented the originality score.

Lego Task. Participants were presented with three Lego pictures, each was created with two to three Lego blocks. The task involved writing down up to eight objects represented by the Lego blocks (e.g., dinosaur, stairs). For each participant, we computed a mean dominance/rank

ratio that provided an originality measure based on the statistical infrequency of participants' ideas (e.g., Leung & Chiu, 2010; Ward et al., 2002), thus complementing the relatively more subjective originality rating in the Droodle task. A high dominance/rank ratio indicates low originality.

Results

Both the Droodle and Lego tasks provided an originality measure; in addition, in the Lego task we measured fluency and flexibility (inter-rater r=.70). As predicted, participants who walked freely were more likely to generate new captions that deviated from the provided ones (M=6.24, SD=0.94) than were those who physically embodied a box by walking along a rectangular path (M=5.68, SD=0.95) and those who did not walk (M=5.52, SD=0.96), $F(2,97)=5.34$, p=.01, η^2_p=1.00. Planned contrasts revealed that the originality score of participants in the free-walking condition differed from those in the fixed-walking and sitting conditions, $F(1,97)=10.23$, $p<.01$, η^2_p=1.00, whereas the fixed-walking and sitting conditions did not differ from each other, $F<.48$.

Consistently, in the Lego task, free-walking participants were less likely to list ideas that were readily generated by others (M=7.36, SD=2.84) than their rectangular-walking (M=9.32, SD=3.49) and sitting counterparts (M=8.36, SD=2.98), $F(2,101)=3.40$, p=.04, η^2_p=.06. Again, planned contrasts revealed that the ideas of free-walking participants were significantly more original than those of fixed-walking and sitting participants, $F(1,101)=5.22$, $p<.02$, η^2_p=.05, and the ideas generated by fixed-walking and sitting participants did not differ in their originality ratings, $F<1.63$. However, the fluency and flexibility scores obtained in the Lego task did not differ across conditions, Fs<.89[1].

Study 3

Thus far, our studies focused on how we actually move and comport our physical bodies to embody creative metaphors (i.e., *hard* embodiment). It is conceivable that embodied cognition can also be derived from the *psychological* representation of the body interacting with the world (i.e., *soft* embodiment; Leung & Cohen, 2007; Zajonc & Markus, 1984). This psychological representation of the body comes about as we form mental imagery of the way we conduct our bodies (Boroditsky & Ramscar, 2002; McGlone & Harding, 1998). We hypothesize that psychologically enacting creative metaphors through imagining bodily motions will result in a similar effect as physically enacting the metaphors. To investigate the soft embodiment of creative metaphors, we conducted Study 3 in *Second Life*, a popular 3D virtual world.

Method

Seventy-three participants (35 females) participated for S$5 (~US$3.8). Participants were told that the study examined perspective-taking in the virtual world. They were assigned an avatar of their gender and asked to imagine being the avatar in *Second Life*. After a practice trial in which they controlled the avatar to walk, participants were given a creativity task that required them to generate as many creative gifts as possible if they were to offer a gift to an acquaintance (Leung & Chiu, 2010). At this point, they walked the avatar and imagined themselves as the avatar thinking about gift ideas while walking. The avatar either walked freely or walked along a rectangular fixed path – very similar to the environmental setup in Study 2b, but in a virtual world (see Figures 1a and 1b). After virtually walking for three minutes, participants wrote down their gift ideas. Finally, they answered a question on the ease to which they could control the avatar walking (1=*extremely difficult*; 7=*extremely easy*). The two conditions did not differ on this rating, $t<.57$. We used the same coding procedure as the Lego task in Study 2b to

compute the dominance/rank ratio (an originality measure), a higher ratio denotes a gift idea that many participants readily generated in the sample. We also obtained fluency and flexibility scores (inter-rater r=.82).

Results

Although differences in fluency and flexibility did not emerge between conditions, Fs<.01, in terms of originality participants who virtually walked freely generated more unconventional gift ideas (e.g., magazine subscription; M=5.71, SD=2.63) than participants who virtually walked along a fixed path (e.g., CD/DVD; M=7.00, SD=2.78), $F(1,71)=4.17$, p=.045, η^2_p=.06. This finding suggests that when it is not feasible to physically assume a body comportment or change the way the body is situated in relation to the environment, "softly" embodying creative metaphors can also promote creative thoughts, at least for originality.

Study 4

Study 4 has two goals. First, it examined the effect of embodying another creative metaphor, "putting two and two together." Second, the study tested for the metaphor's discriminant consequence such that enacting this metaphor will facilitate creative problem-solving in the form of convergent thinking as opposed to divergent thinking. Specifically, we hypothesize that embodying the metaphor by *putting together* two objects will catalyze the ability to *converge* multiple ideas to produce the best solution. This ability is critical for solving convergent thinking tasks such as the RAT (Dewhurst et al., 2011; Taft & Rossiter, 1966) that require conceptual recombination to recognize seemingly distant relationships between individual problem elements in order to approach a solution (Subramaniam et al., 2008). In fact, when Mednick (1962) developed the RAT, he theorized that creative individuals could excel in this task because they could generate more and broader associations to the presented stimuli (see

also Dewhurst, et al., 2011; Rossmann & Fink, 2010). Therefore, it is reasonable to predict that the embodied act of recombination benefits convergent thinking by activating the cognitive process of forging broader associative links among given stimuli in order to arrive at the best solution. However, the same recombination act might not benefit divergent thinking – the capacity to divergently generate multiple ideas (vs. convergently integrate multiple ideas into one).

Method

Sixty-four participants (39 females) participated for course credit. Under a cover story for studying how task repetition affected problem-solving, participants were randomly assigned to enact either recombination or non-recombination gestures. In the recombination condition, we had round paper coasters cut into halves and stacked in two. Some half-pieces of the coasters were placed on the left stack and others on the right stack; participants had to simultaneously pull one piece from the left and the other piece from the right and put them together (recombine) in the middle. Hence, they enacted recombination gestures that involved integrating objects. We informed participants that the task simply required them to transfer coaster pieces from each side to the middle, and they would do this repetitively for about two minutes until they had finished transferring all pieces. In the non-recombination condition, participants transferred the half-cut coasters from one side (counterbalanced left or right) to the middle for two minutes. Subsequently, participants did two counterbalanced creative problems – a convergent thinking task (a 5-item RAT) and a divergent thinking task (Lego task).

Results

As predicted, participants embodying recombination gestures (M=2.78, SD=1.19) outperformed those embodying non-recombination gestures only in the convergent thinking

measure of the RAT (M=1.92, SD= 0.97), $F(1,62)=8.92$, p=.004, η^2_p=.13. We measured divergent thinking with total number of Lego ideas generated (fluency), number of distinct categories that characterized the ideas averaged across the three Legos (flexibility; inter-rater r=.76), and the grand dominance/rank ratios (originality). All divergent thinking measures did not differ between conditions, Fs<2.98.

General Discussion

Across five experiments studying different metaphors of creativity with different creativity measurements, we found convergent support for the psychological potency of embodying creative metaphors. In line with the metaphor-enriched social cognition perspective, this series of experiments provides evidence that prevalent metaphors of creativity tap an implicit wisdom about physical experience – creativity-implicating physical "acts" activate the abstract processes of overcoming mental fixedness and facilitating new connections among distant ideas that are conducive for creative problem-solving, as evidenced in higher competency in convergent and divergent thinking tasks. As such, the acts of alternately gesturing with each hand and of putting objects together may boost creative performance. Literally thinking outside or without physical constraints (e.g., walking outdoors, pacing around) may help eliminate unconscious mental barriers that restrict creative cognition. Further, consistent with the notion that our mental imagery of the way our bodies move instantiate an understanding of our place in the physical world (Cohen, Hoshino-Browne, & Leung, 2007; Cohen & Leung, 2009), our findings also explicate the significance of psychologically experiencing creativity-supporting bodily movements. Together, these possibilities of hard and soft embodiments of creative metaphors suggest that the connection between mind and body manifested in common metaphors is more than merely metaphorical.

One might reasonably ask whether embodying creative metaphors indeed facilitates creativity or whether our various control manipulations hamper creativity. The analyses suggest the former. The control conditions of gesturing (Study 1) and transferring coasters with one hand (Study 4) were not constraining given that we did not explicitly restrict participants to not use the other hand; in fact, these conditions with the use of one hand might even be less cognitively demanding. Even clearer conclusions can be drawn from Studies 2a and 2b. Whereas the outside-the-box condition (Study 2a) and the free-walking condition (Study 2b) promote creative problem-solving, the baseline creativity performance established by the no-box and sitting conditions did not significantly differ from the inside-the-box and fixed-walking conditions, respectively. This suggests that enacting creative metaphors is creativity-enhancing, at least for the metaphors examined in the present research.

Our studies provide the first experimental evidence showing the creative benefits of enacting creative metaphors that generally advise against cognitive fixedness. Recent research suggests that creative problem-solving can also be achieved through focused hard work and perseverance (Nijstad et al., 2010). Future research can extend this idea by examining whether embodying physical acts that entail a focused activity (e.g., a focused eye gaze) can similarly promote creativity.

In all, our findings move embodied cognition research in a new direction beyond merely applying it into the domain of creativity. Embodiment research thus far tends to document the role of the body's sensorimotor system in activating existing repertories of knowledge, thus facilitating the expression of certain thoughts and behaviors. We shed new light on this perspective by demonstrating that embodiment can potentially enlarge, not just activate, the repertoire of knowledge by triggering cognitive processes that are conducive for generating

creative solutions. In other words, our body-mind linkages attest not only to processes of knowledge activation, but also knowledge generation. Embodying creative metaphors appears to help ignite the engine of creativity.

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Figures

Figure 1a.

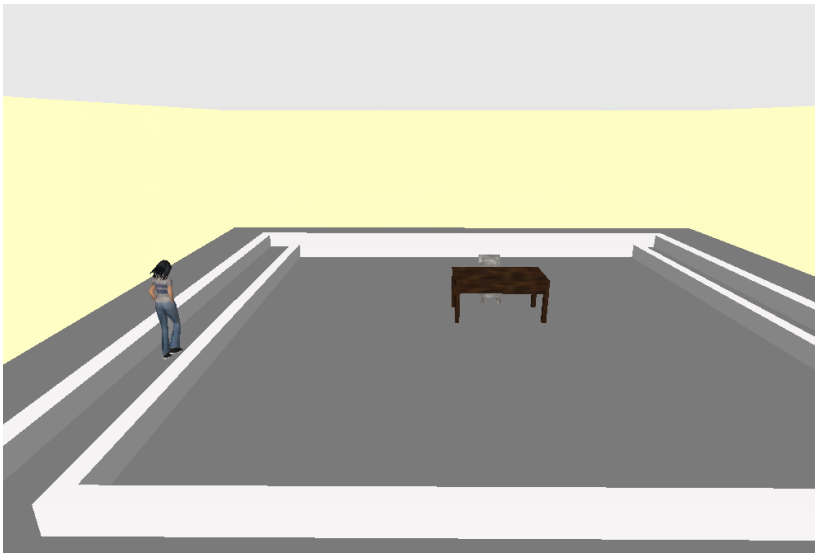

Figure 1b.

Endnotes

[1] Studies 2b and the next Study 3 showed an embodiment effect only on originality, but not fluency and flexibility. We can address this unexpected result in two ways. First, originality is the more central component to the notion of creativity, based on the logic that it is "theoretically possible to be creative without being flexible or fluent (e.g., if one generates only one creative solution), but it is impossible to be creative without being original" (Rietzschel et al., 2007, p. 857). Relatedly, after reflection we realize that our Lego task might have imposed a ceiling effect for the measures of fluency and flexibility, while still being an appropriate measure of originality. In the task, we asked participants to generate up to eight ideas represented by each Lego picture and participants across conditions generated an average of about five ideas ($M_{\text{free walking}}$=4.85, $M_{\text{fixed walking}}$=5.24, M_{sitting}=4.83) for each. Given this explicit ceiling, we hesitate to make strong inferences from these null effects. Most importantly, this methodological issue is not at all relevant to the originality measure that is based on the *statistical infrequency* of ideas (vs. *number* of ideas generated). Second, the originality effect emerged in Studies 2b and 3 might in fact be consistent with the investigated embodied state ("thinking outside the box"), with this metaphor emphasizing more importantly the capability to break set from conventions or to generate normatively infrequent responses (originality), than the capability to generate more responses (fluency) and to generate different categories of responses (flexibility). Together, results for both Studies 2b and 3 consistently showed that enacting the out-of-the-box thinking metaphor enhanced originality, as evidenced in three different originality measures of generating Droodle captions (Study 2b), Lego ideas (Study 2b), and gift ideas (Study 3). As for Study 1, the "two-hands" metaphor imparts the wisdom that individuals should break set (original), think more (fluent), and entertain diverse perspectives (flexible). And our Study 1 findings confirmed

that this embodied state increases the three components of divergent thinking. We, however, acknowledge that these are only some tenable explanations based on our deeper reflection of the findings.