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GROUNDING CREATIVE GIFTEDNESS IN THE BODY

Many definitions of giftedness exist (Kaufman & Sternberg, 2007; 2008). While these theories differ in important ways, such as their dimensionality, their emphasis on creativity, or their focus on developmental and environmental factors, they all emphasize the importance of conscious, deliberate, learning and the assessment of giftedness using tests that require explicit thought.

This emphasis is curious, considering the advances in cognitive science over the past 25 years that suggests humans have multiple modes of thought (Kaufman, 2011; Epstein, 2003; Evans, 2008, Evans & Frankish, 2009; Stanovich & West, 2002). Indeed, dual-process theories of cognition are becoming increasingly necessary for explaining a wide variety of cognitive, personality, social, developmental, and cross-cultural phenomenon (Evans & Frankish, 2009).

Dual-process theories of cognition typically differentiate between Type 1 processes and Type 2 processes (Evans, 2008). Type 1 processes are faster (relative to Type 2 processes), more influenced by context, biology, and past experience, and aid humans in mapping and assimilating newly acquired information into preexisting knowledge structures. An advantage of Type 1 processes over Type 2 processes is that the former require little conscious cognitive effort and free attentional resources for computationally complex Type 2 reasoning. The advantage of Type 1 processes can also become disadvantagous under certain circumstances. When thinking is dominated by Type 1 processes, task representations are highly contextualized. This contextualization can lead erroneous judgment and rash decision making.

Type 2 processes have traditionally played an important role in theories of giftedness, particularly theories that include general intelligence as a key component to intellectual giftedness. Indeed, Stanovich (2009) links Type 2 processes to psychometric intelligence. In contrast to Type 1 processes, Type 2 processes involve deliberately controlled, effortful, and intentional cognition. Theories of giftedness have most likely emphasized Type 2 processes because individual differences in Type 2 processes are more easily observed and measured (although see Kaufman et al., 2009 for the existence of individual differences in implicit learning). The hallmark of Type 2 processes is the ability to decontextualize task representations (Stanovich & West, 1997), that is to say, it enables agents to transfer and apply even specific cognitive skills to a variety of task domains.

While no dual-process theory of giftedness currently exists, there are a few theories of intelligence that emphasize the dual-process nature of human cognition

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(Anderson, 2005; Kaufman, 2011). According to Anderson's (2005) theory of the minimal cognitive architecture underlying intelligence and development, knowledge is acquired through two different "processing routes", with central processes ("Route 1") being tied to individual differences and input modules being tied to cognitive development ("Route 2"). Route 1 is constrained by the speed of basic processing mechanisms, and explains why domain specific abilities are correlated, producing a general intelligence factor. Route 2 is tied to dedicated information-processing modules, such as perception of three-dimensional space, syntactic parsing, phonological encoding, and theory of mind. This route is tied to cognitive development as these modules undergo developmental changes in cognitive competence across the lifespan.

A more recent theory of intelligence— The Dual-Process (DP) Theory of Human Intelligence—integrates research on psychometric intelligence with modern dual-process theory and the latest experimental research on the cognitive unconscious (Kaufman, 2011). According to the theory, both controlled and spontaneous thought processes are important contributors to human intelligent behaviors. Controlled cognitions are goal directed and consume limited central executive resources, whereas spontaneous cognitions aren't constrained by the same limited pool of attentional resources. An assumption of the theory is that both controlled and spontaneous cognitive processes to some degree jointly determine all intelligent behaviors, although in varying degrees. Spontaneous forms of thinking can involve insight, imaginative play, daydreaming, implicit learning, and reduced latent inhibition. According to the theory, intelligence is defined as the ability to flexibly switch between modes of cognition depending on the task demands.

These dual-process theories of intelligence have important implications for the identification and nurturance of giftedness. Since current methods of identifying giftedness have focused on the explicit route to cognition, many implicit gifts may remain unidentified. Further, if individual differences are more evident in Type 1 processes compared to Type 2 processes, then more people may be worthy of the label "gifted" if they are able to express more Type 1 processes. In fact, the whole idea of "giftedness" may lose much of its meaning if it is found that all people have a lot more potential than is being demonstrated by current methods of identification. We contend that spontaneous processes provide a critical foundation for creative giftedness more generally and that these processes draw from one's everyday sensoriperceptual experiences more than traditionally thought.

If it is true that spontaneous processes play a constitutive role in the creative process, then how might they be identified? Many approaches to such "unconscious" creative processes are referred to as types of *incubation*, a preconscious process that enables agents to process information and problem solve while "taking a break" and attending to other stimuli (Dodds, Smith, & Ward, 2002). However, the incubation process is still quite murky, and it remains somewhat mysterious exactly *how* its automatic processes operate (Olton, 1979; Smith & Blankenship, 1991). One strategy for adding clarity to this discussion is to consider what *types* of information people process while they are thinking creatively. Are they thinking in purely symbolic terms or are they thinking with perceptually rich information like images? While it is both academically and intellectually very interesting to explore the automaticity underlying one's biologically endowed input modules and the domain-general and domain-specific processes on which they operate, consideration should be given to the representational states that are activated during creative cognition. Put simply, to what extent are these representations being carried by propositional, symbolic, and amodal information as opposed to the sensorimotor and perceptual analogues that are carried by the brain's modality-specific patterns of activation? For example, as Watson and Crick were exploring genetics on barroom napkins, were they thinking in pictures, words, propositions, textures, etc.? Borrowing from Gödel's logic (Byers, 2007), it seems unlikely that creative cognition is simply a set of symbolic algorithmic computations but instead a complex product that is often the result of hidden, and perhaps random, cognitive patterns. What is at stake here is whether bodily, perceptual information plays a significant role in such kinds of cognition.

Representational states can occur at both conscious and preconscious levels, so they offer a useful starting point for understanding the utility of spontaneous processing. Recent research in *grounded cognition*, an approach that focuses on the sensoriperceptual nature of one's cognitive architecture, has shown that one's everyday embodied[1] experiences play fundamental roles in the representation and processing of various concepts. According to this view, nearly all of one's conceptual representations are made of sensorimotor *experiences* that are stored in one's cognitive system in the form of *perceptual symbols* (Barsalou, 1999, 2008, 2010).

Later, when individuals represent and process information about a concept, the most relevant stored perceptual symbols are retrieved and re-activated so that the initial experience is (somewhat) simulated, at least from the brain's perspective. Quite literally, representation involves a re-presentation of those same embodied experiences that have co-occurred with the target concepts. Other cognitive scientists have advocated for similar views, but from disciplines ranging from linguistics to developmental science and philosophy to cognitive psychology (Clark, 1997; Glenberg, 1997; Lakoff & Johnson, 1980; Prinz, 2002; Thelen & Smith, 1994). Grounded cognition researchers maintain that these perceptual simulations are what form the core of one's representational system, and many of these simulation-based processes occur spontaneously and beneath conscious awareness.

What is most important and relevant to the present discussion is the fact that people are often *unaware* of these effects- that is to say, they do not realize that they are incorporating their rich sensoriperceptual experiences into their cognitions. For example, in social cognition research, Williams and Bargh (2008) showed that participants who experienced physical warmth (holding a warm vs. iced cup of coffee) were more likely to judge unknown target individuals as more caring, generous, etc. than participants who experienced physical coldness. Literal warm feelings engendered figurative warm feelings. In moral psychology, Eskine, Kacinik, and Prinz (2011) found that participants made harsher moral judgments when they were induced with gustatory disgust (a bitter beverage) relative to gustatory delight (a sweet beverage) or a control condition (water), and similar effects have been shown in other sensory modalities like vision and olfaction (Schnall, Haidt, Clore, & Jordan, 2008). In language processing research, Stanfield and Zwann (2001) showed that participants processed pictures faster when they had the same orientation as the sentences they previously read. Therefore, after reading that *John put the pencil in the cup*, participants were faster to respond to vertical rather than horizontal pictures indicating the action.

These results suggest that spontaneous, implicit perceptual simulations prime participants to recognize vertical orientations over horizontal orientations. Finally, research in neuropsychology revealed that verbal labels automatically activate corresponding sensoriperceptual states. Hauk, Johnsrude, and Pulvermüller (2004) conducted an fMRI study to investigate whether simply reading action words referring to the face, arms, and legs (lick, pick, or kick) would similarly excite the corresponding regions in the motor cortex unique to each body part responsible for those actions. Their results did indeed demonstrate somatotopic activation in the motor and premotor cortex and suggest that sensoriperceptual information is a critical ingredient in these "linguistic" representations.

A comprehensive review of all of the evidence for grounded cognition would outstrip this discussion, but suffice it to say that there are convergent findings from various psychological sub-disciplines supporting this view. The critical point here is that much of cognition occurs in a Type 1, automatic format. From an evolutionary perspective, this is an economical use of one's cognitive resources and frees up more space for the Type 2 processes that have traditionally been used to explain giftedness. Although it is a reasonable approach to assume that *only* higher-order cognitive processes are involved in creativity, there is also lots of evidence to suggest just the opposite- namely, that the dynamic interplay between numerous "lower-level" perceptual symbols can help explain the creative mind (Kaufman, 2011). We now turn to some of the literature supporting the view that Type 1 processes play a crucial role in helping us understand creative giftedness and how it applies to educational contexts.

A BODY OF KNOWLEDGE: EXPLORING EMBODIED EDUCATION

If our representational states are supported (at least in part) by sensoriperceptual experiences, then educational pedagogies that add experiential components should facilitate creativity, help identify giftedness, and encourage learning more generally. This approach gives students additional tools to help them understand concepts and potentially expand upon, or combine, them creatively.

Acting out while reading. In order to determine the effects of bodily experience on learning in the classroom, Glenberg, Gutierrez, Levin, Japuntich, and Kaschak (2004) explored whether object manipulation facilitated reading comprehension in first- and second-graders. All participants received the same three scenarios (a farm scene, a house scene, and a garage scene), which included five short texts of seven to nine sentences each. Participants were assigned to three conditions: manipulation, read-only, or no-practice control. In the manipulation condition, participants were asked to manipulate toys specific to each scene (a car for the garage scene) at key points in the text. The read-only participants were able to look at the toys but did not manipulate them. Finally, the control participants simply read the passage and had no access to the toys.

Over several sessions, Glenberg et al. tested each participant individually using both free- and cued-recall tests to determine reading comprehension. Results showed that the manipulation group significantly outperformed both the read-only and control groups in their recall of the stories. In fact, these trends were found even when participants *imagined* manipulating the toys. In a separate experiment, similar effects were revealed when children read in groups of three (Glenberg, Brown, & Levin, 2007). In the experimental condition, children (ages ranging from six to eight) took turns reading a passage while manipulating compatible toys, whereas control participants simply reread the passage. Following the readings, all participants were given a 10-item forced choice ("Yes" vs. "No") test that determined their comprehension and memory for the text's action sequences, temporal order of events, and spatial information in the story. As predicted, children who manipulated toys outperformed those who only read.

The objection could be raised that these effects are unique to students with normal language abilities. Perhaps sensorimotor perceptual states simply add an extra layer of information to the linguistic information already provided by the text. This view suggests that the text provides the foundation for comprehension on which perceptual symbols are merely hinged. However, for those with academic learning difficulties, the relationship between the text and their own bodily movements might be unclear, particularly if their text comprehension is tenuous. A stronger test for the significance of perceptual information in language comprehension would target students with learning disabilities. If students with text comprehension difficulties *still* benefit from embodied experiences, then it suggests that perceptual information carries more meaning than traditionally thought. Using a similar methodology employing manipulation, visual-only, and control conditions, Marley, Levin, and Glenberg (2007) tested elementary level Native Americans with documented academic learning difficulties. Their results were even stronger than those found in similar previous studies. Here, *both* the manipulation and visual-only groups significantly outperformed the control group in free- and cued-recall tasks. Taken together, this research indicates that accessing perceptual information facilitates reading comprehension and memory in students.

Although these findings spotlight the importance of perceptual symbols in cognition, they do not show indubitably that Type 1 processes are responsible for enhancing their cognitive abilities. In these cases, their perceptual states are taught, focused, and enacted quite deliberately. To demonstrate that Type 1 processes play a role in creative cognition, evidence for *implicit* perceptual states are needed – that is to say, those states that naturally occur without any conscious awareness.

A helping hand: The ubiquity of gestures. Gestures are not only unintentional, automatic, and spontaneous, they are also extremely difficult to suppress and control. Telling a story without gestures can be nearly impossible for many, and they seem to facilitate and direct the flow of conversation in a natural way. Given their ubiquity and automatic nature, gestures seem like an obvious result of Type 1 processes. But do they affect the educational experience? Although gestures clearly play a role in everyday discourse, research suggests that they can aid in education as well, even for abstract concepts like mathematics.

In order to show that gesturing can produce changes in thought, Goldin-Meadow, Cook, and Mitchell (2009) taught children gestures to help them learn how to solve a mathematical equation. Roughly half of the students were taught specific gestures to help them arrive at the answer, whereas the other half simply received verbal instructions. The teacher then delivered a lecture (without gestures) describing how to solve the equations. Students who received previous gesture training were asked to gesture while they listened to their teacher's lecture, while the other students who received previous verbal instructions were as to produce the words again. All students then took the same test on the newly learned equations, and their results revealed that the students who gestured *while* listening to the lecture performed significantly better than those who only gave verbal reports.

In a similar vein, Broaders, Cook, Mitchell, and Goldin-Meadow (2007) directed one group of children to gesture while explaining how they solved a math problem, whereas the other group was explicitly told not to. After a lesson and test of similar material, the gesturing group significantly outperformed the non-gesturing group. More interestingly, students also employed gestures that they had not encountered before, which expressed correct, yet unlearned, procedures for solving the equations. The researchers argued that gesturing helps activate implicit knowledge in learners. Thus, on the one hand, gestures provide a glimpse into the hidden cognitive happenings of one's mind, and, on the other hand, might also be useful for helping instantiate new, creative cognitions.

Problem solving often goes hand-in-hand with creativity simply because challenging problems often require creative solutions. People often speak of "seeing the answer", "seeing what another means", or "looking for the solution". In this sense, visual imagery seems tied to creative problem solving. To test this relationship, Chu and Kita (2011) explored the extent to which gesturing facilitated problem solving in a spatial task. Using Shepard and Metzler's (1971) three-dimensional objects, participants were unknowingly video recorded while they attempted to mentally rotate the objects. The gestures were counted, and the results indicated that participants gestured significantly more during difficult mental rotations relative to simpler mental rotations. In another experiment, participants were asked to solve similar mental rotation problems, but they were assigned into one of three conditions: gesture-encouraged, gesture-prevented, and gesture-allowed. During the first block of trials, participants performed according to their designated condition. However, to determine whether the gestures became internalized practice, the subsequent blocks prevented gesturing in *all* groups. Results showed that the gesture-encouraged group outperformed both of the other groups during the first block *and* in the subsequent blocks, indicating that with practice one's sensorimotor experiences with gesture can become internalized to facilitate future spatial problem solving. In their last experiment, Chu and Kita (2011) compared the gesture-encouraged and gesture-allowed groups in three different spatial tasks (object rotation, paper folding, and visual patterns), with the gesture-encouraged group outperforming the gesture-allowed group overall.

Together, these results not only suggest that cognitive information can be offloaded onto one's body, but that embodied experiences can be stored and later activated as a result of task demands, which is consistent with Barsalou's (1999) theory of perceptual symbol systems. Therefore, complex problems can be made more tractable when embodied cues are both used and stored so that they become part of the representational state associated with the target problem.

Thus far we have reviewed empirical findings showing how embodied states can influence cognitive processing. By simply manipulating objects, children's reading comprehension and thinking skills can be significantly improved, especially for those with learning difficulties. However, the nature and training involved with those experiments seem committed to Type 2 processes. On the other hand, gesture research focuses on the utility of one of our most implicit, Type 1 embodied processes. Although we described only a small portion of the extant literature on gesture, the results clearly show how automatic processes can affect abstract conceptual development, promote new ideas, and aid in problem solving. But what about *creative* problem solving? As described earlier, traditional views of creativity spotlight controlled, deliberate thought as the creativity's central cognitive component. However, recent research suggests that automatic and preconscious processes play an influential role here as well.

Thinking outside the box, literally. In a clever series of experiments, Leung et al. (in press) directed participants to embody various creativity metaphors to determine the effects of preconscious processes on creative cognition. Their first study borrowed from the common metaphor *"on the one hand, then on the other hand,"* which focuses on thinking about a problem from the left-right bilateral orientation as opposed to front-back. Noting that bilateral hemispheric activation was found to increase creativity in previous research (Shobe, Ross, & Fleck, 2009), participants were either asked to gesture with *both* hands (experimental condition) or only *one* hand (control condition) while generating novel uses for a university building complex. In order to facilitate gesturing in a natural way, participants faced a wall and were told that this study was investigating public speaking. Hence, they would be asked to use their hands in specific ways "as one might do while talking to a group from a stage." In the experimental condition, task questions were attached to the wall on both sides of the participant, and they were directed to read and answer the task questions on their right side while holding their hand toward the wall, palm facing upward and then repeat the same procedure on their left side using their left hand. In the control condition, participants read and answered only from their right side. Two measures of divergent thinking were used (*fluency*- number of ideas generated and *flexibility*- number of unique categories generated), and the results showed that the experimental group significantly outperformed the control group on *both* measures of divergent thinking, thus confirming the researchers' hypothesis that using "the other hand" increases creativity.

In their next study, Leung et al. explored the creativity metaphor, "*putting two and two together,*" which suggests that creativity is the result of recombination- an idea that will be reviewed in more detail later. Disguised as a study testing the effects of task repetition on problem solving, participants were assigned to one of two groups. In the recombination (experimental) condition, participants were asked to take round paper coasters (that had previously been cut in half) and recombine them for around two minutes. In the non-recombination (control) condition, participants simply took the cut pieces of coaster and transferred them from their right side to the left or left side to their right (counterbalanced). All participants were then given a commonly used measure of creativity (Remote Associates Test (RAT) Mednick, Mednick, & Mednick, 1964). Here, participants are given three words (e.g., *falling, actor,* and *dust*) and are asked to think of a fourth word that relates to the previous three (*star*). Results revealed that the recombination group significantly outperformed the non-recombination group.

Thinking outside the box is another common creative metaphor. To test whether there is more to this expression than mere language convention, Leung et al. assigned participants to complete the RAT while literally sitting in a five feet by five feet cardboard box or not. To ensure that sitting in the box itself did not influence their results, participants also reported on the extent to which they felt safe, comfortable, private, confused, and claustrophobic. Results showed that the out-of-the-box group outperformed the in-the-box group on the RAT, and that these results were not accounted for by the feeling measures, which were treated as covariates.

Leung et al. report additional studies, but the overall message seems clear: seemingly unrelated and preconscious aspects of one's embodied experiences *can* in fact influence one's creative cognitions. These results provide a powerful insight into the nature of insight itself. On this view, one's embodied, sensoriperceptual states are as important to the creative mind as controlled deliberation.

If Type 1 and Type 2 processes both operate on creative cognition, then how might they be implemented *together* in an educational context? It turns out that there has been a growing current of researchers, teachers, and administrative educationalists who advocate for exactly this blend of action and rationalism.

ACTIVE AND EXPERIENTIAL LEARNING

> "Tell me, and I will forget. Show me, and I may remember. Involve me, and I will understand.
>
> –Confucius

Active and experiential learning are not new ideas. John Dewey (1938) argued for integrating concrete experiences with concepts and actions with observations, and Jean Piaget (1936/1963) similarly contended that children's physical experiences with their environments can fundamentally influence their intellectual growth. More recent versions of their dictates have arisen over the years, specifically in what is now referred to as *place-based learning*, which can be broadly defined as a pedagogical style that draws upon students' knowledge and unique experiences within their local communities to ground course content (Smith, 2007). This pedagogical style incorporates both active learning (Bonwell & Eison, 1991) and experiential learning (Kolb, 1984; Ng, Van Dyne, & Ang, 2009) techniques, which both postulate that physical engagement should be juxtaposed with more classical styles of lecture and instruction. These two pedagogical styles (i.e., physical engagement and classical lecture) can be likened to dual-process theory such that the perceptual experiences accrued through physical engagement represent Type 1 processes, whereas the linguistic and otherwise symbolic information students encode during classical lecture represent Type 2 processes.

Regardless of the moniker one uses, all of these approaches to education and pedagogy focus on the importance of incorporating physical activity into the classroom. Grounded theories of cognition would predict that students who are physically engaged with content would be more likely to encode, retrieve, and manipulate that information than students who are not. More importantly, and more relevant to the present discussion, students who interact with content should be more likely to engage in *creative* acts than students who do not because the former students have more information (perceptual, embodied, Type 1 information *and* symbolic, higher-order, Type 2 information) with which to work.

Bonawitz, Shafto, Gweon, Goodman, Spelke, and Schulz (2011) found exactly that. In one study, they tested the effects of different pedagogical styles in a non-educational context, specifically a children's museum. The experimenters approached preschoolers with one of four different pedagogical styles as they gave them a novel toy to play with. In the pedagogical condition, the experimenter said, "Look at my toy! This is my toy. I'm going to show you how my toy works. Watch this!" (p. 325). The experimenter then explicitly demonstrates to the child one of the toy's major functions (the squeaker function). There were three different non-pedagogical conditions. In the *interrupted* condition, the experimenter introduced the toy like above, but then interrupts herself by saying, "I just realized I have to stop because I forgot to write down something over there. I have to go take care of it right now!" (p. 325). In the *naïve* condition, the experimenter told the child, ''I just found this toy! See this toy?" (p. 325). Then, by "accident," the experimenter "discovered" one of the toy's functions (the squeaker), repeats it, and says, "Huh! Did you see that?" (p. 325). Finally, in the baseline condition, the experimenter tells the child, ""Wow, see this toy? Look at this!" (p. 325), and then puts it back on the table. The children were then given the toy to play with for as long as they liked. However, if they stopped interacting with the toy for a period of five consecutive seconds, then the experimenter prompted the end of the session by saying, "Are you done?" (p. 326). The length of play time, number of unique actions performed, the total play time with the demonstrated function of the toy (the "squeaker" function), and the extent to which children discovered the *other* major functions of the toy (the light, music, and mirror functions) were noted.

Overall, the results showed that most of the children in the pedagogical condition *failed* to discover any of the toy's other major functions (i.e., they only played with the squeaker function that was taught to them by the experimenter), whereas children from all three of the non-pedagogical conditions discovered most of the toy's other functions. Further, children in the pedagogical condition played with the toy for significantly less time than those in the non-pedagogical conditions. Together, these results suggest that explicit pedagogical instruction can be detrimental to students' creative exploration and discovery and that implicit, sensoriperceptual experiences can contribute to cognitive development.

Other education researchers have also shown how embodied information can motivate conceptual development. For example, Owen and Siakaluk (2011) used embodied information (i.e., physical height) to teach the analysis of variance (ANOVA) statistical technique to undergraduates and found that students were better able to understand and conceptualize abstract properties of ANOVA (between- and within-groups variance) better than students who did not use embodied information to ground the content. Schwarzmueller (2011) similarly used a multi-modal active learning strategy to engage students with course content. Here, students were directed to engage in various activities that drew from multiple sensory modes ranging from writing papers to class discussions and interactive group work to inquiry-based research. Results showed that students who were exposed to these experiential learning techniques outperformed a control class on pre-post quizzes testing specific course content. Finally, Gier and Kreiner (2009) tested the effects of adding discussion based questions to traditional PowerPoint lectures to enhance active learning. They showed that students who engaged in the active learning component (relative to the baseline group who only received PowerPoint lectures) performed significantly better on quizzes and examinations.

CONCLUSION

In sum, research in active and experiential learning suggests that conceptual development, discovery, and creative cognition in general are enriched by physical *interacting* with content in a manner that uses multiple modal domains. Again, this is consistent with, and indeed predicted by, theories of grounded and embodied cognition, which hold that sensoriperceptual experiences not only become incorporated into one's conceptual representations but that they also *motivate* conceptual development (Barsalou, 1999, 2010; Glenberg, 1997; Lakoff & Johnson, 1980).

With respect to dual-process theories, these embodied states are ideal candidates for the implicit, automatic, and spontaneous bodily states that naturally accompany cognition in real-time and in educational contexts. We argue here that researchers and educators should focus on creating rich sensory and perceptual experiences for their students that can be used as a foundation for understanding abstract course content. Accordingly, these basic lower-level experiences might be used to scaffold deeper conceptual representations (Williams, Huang, & Bargh, 2009). In this way, this approach complements Simonton's (2004) stance on conceptual combination. According to this view, the manner in which various pre-existing concepts are organized plays a significant role in creativity. Creative ideas thus emerge as a byproduct of various unique combinations of pre-existing concepts, a process that is moderated by Darwinian chance, genius, and other factors. Grounded cognition's contribution points to the fascinating possibility that basic embodied states are stored as patterns of activity in the brain that are available for the *same* conceptual combination processes that have traditionally been reserved for "ideas" or "concepts" typically fashioned from Type 2 processes. Thus, embodied states might be more important ingredients to creative and gifted minds than previously thought.

This process of creative conceptual combination, however, need not be conscious, and when coupled with Type 1 processes like sensoriperceptual states, it becomes clear how creative cognition benefits from embodied experience, as evidenced in the previously discussed research. Creative giftedness is clearly a complex phenomenon, yet our everyday, mundane physical experiences might play a more significant role than previously thought, and future research and practice should consider the grounded cognition literature and its implications for higher-order cognition. As Henri Poincare famously pointed out, "The mind uses its faculty for creativity only when experience forces it to do so."

NOTE

[1] The now popular view, *embodied cognition,* is a species of grounded cognition (Barsalou, 2008). While the former focuses on the role and influence of specific bodily states on cognition, the latter focuses more broadly on both the stored (offline) and immediate (online) sensorimotor and perceptual states that operate on one's conceptual systems.

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