Interaction between Action and Cognition in Creativity:
Perception and Action-based Imagination (PAI) Framework

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Abstract

The close connection between the action of the body and creativity has long been discussed in artists' anecdotes. In recent years, the importance of this connection has been gaining attention in psychology and cognitive science. However, studies investigating how the body influences creativity are limited. This study proposed a framework for the above mechanism and investigated its validity through experiments. We proposed a framework called Perception and Action-based Imagination (PAI) based on studies of creativity and embodied cognition theories. This framework suggests that creation proceeds through the cycle of imagination generation based on perceptual information and the acquisition of rich perceptual information through imagination implementation. Then, we conducted an experiment using the famous creativity task to design a toy by combining multiple parts. We prepared the following three conditions: the participants designed the toy with manipulation of the parts 1) by their bodies. 2) in their mind, not by their bodies, while seeing the parts. 3) in their mind only (not by their bodies), without seeing the parts. The results showed that high product creativity evaluations were obtained in the first condition with body manipulation, that the participants paid more attention to the possibility of part fabrication in the above condition, and that the above condition's effect in the creativity evaluations was partially explained by the focus of the possibility of part fabrication.

Keywords: creativity; artistic creation; action; embodied cognition; PAI framework; mediation analysis

Introduction

Artists generate fascinating artworks while actively interacting with the environment through their bodies. This leads one to question as to what influences these bodily actions have on creativity. This study proposes a framework to explain the above mechanism and investigate the process experimentally.

Many famous artists have described the close connection between the actions of the body and creativity. For example, the Swiss painter Paul Klee, who created a unique style that does not belong to either Expressionism or Surrealism, paid particular attention to the line and the movement that generates it. He described the series of movements that generate the line as a "journey to a better place of cognition." He argued that artistic creation proceeds through the cycle of artistic movements, including the hands and eyes, and the renewal of the motif's cognition. Furthermore, Merleau-Ponty, who paid special attention to "ambiguity" in Cézanne's paintings, focused on our connection to the world through the bodies and discussed how these are connected to cognition. As the above instances and critiques suggest, bodily action is considered to be closely related to artistic creation and creativity.

However, the studies that addressed and investigated this relationship are limited. Most studies on creativity in psychology and cognitive science have focused on personality (Amabile, 1988) and higher cognitive functions (Finke, Ward & Smith, 1992) based on the historical, cultural, and religious backgrounds of Western Europe. While these studies have provided important insight into creativity, people gradually recognized the limitations of this framework that focuses solely on individuals' higher cognition (Batey, 2012). An attempt to reconsider creativity as a complex phenomenon in which various factors, such as the body, environment, and other people, can play significant roles, has become active recently (Glăveanu, 2013; Okada & Ishibashi, 2017; Sawyer, 2009). A representative example is the 5A approach (Glăveanu, 2013), which captures creativity as the interaction of the five critical factors: actor (creator), action, artifact (product), audience (other creators/audience), and affordance. Although this framework theoretically proposed the importance of the above interaction, it has not explained the process and mechanism in detail; how the action of the body influences the individual's cognition and creative process. This study proposes the influence and mechanism of bodily action on creativity and investigates them through experiments.

One of the few studies that focused on the connection between action and creativity is Yokochi and Okada (2005). Their study involved several days of fieldwork to create an expert Chinese-ink painter. They suggested that the painter drew an image in the air before his actual drawing called "kusho" and expanded his drawing image by this process. We can speculate that the artist acquired visual and somatosensory feedback during the above "kusho" process and used it to expand his image. Abe (2010) also conducted an experiment using a specific object (a plastic bendable board) whose possible manipulations changed depending on the participant's palm size. The results suggest that the divergent thinking test scores of that board change depending on the possible board manipulation. The participants obtained visual and tactile feedback by manipulating the objects and

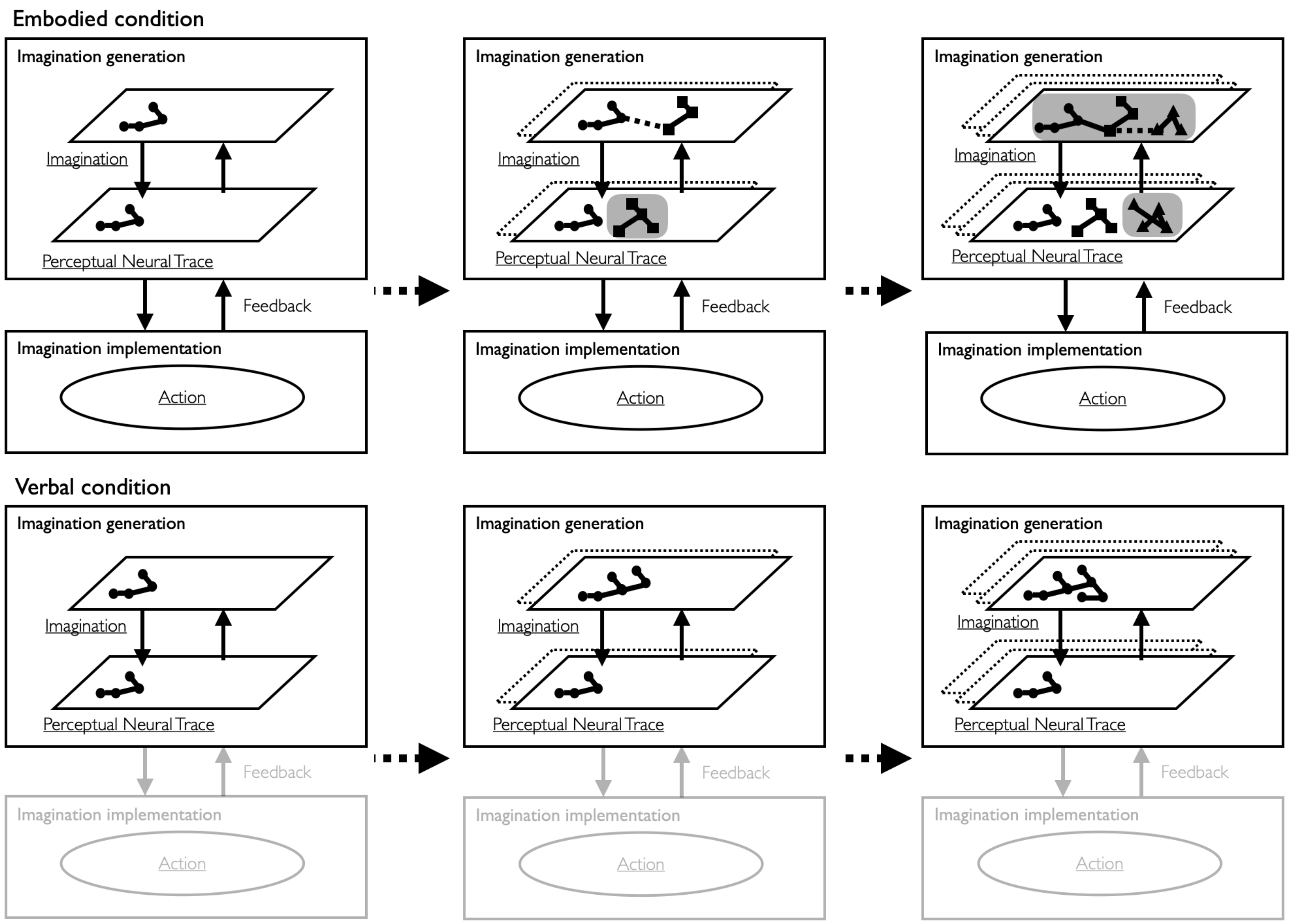

Fig. 1. The PAI framework that this study proposes. As structured imagination theory proposes, imagination is strongly influenced by both memory and knowledge. Perceptual feedback by bodily action changes the memory and the knowledge that was activated and applied to the imagination.

actively using the above feedback to generate their imaginations. Based on these findings, it can be assumed that the acquisition of rich perceptual information through bodily action has a strong influence on imagination generation.

Why does the acquisition of rich perceptual information influence the process of creative imagination? The present study investigated this question by referring to structured imagination in creativity studies, and to knowledge activation in embodied cognition. Structured imagination is a theory that describes the characteristics of imagination, which is an important component of creation (Ward, 1994, 2000; Ward & Sifonis, 2007). It proposes that our imagination generates imaginary things based on our memories and knowledge. It also suggests that sometimes it can be difficult for us to create highly novel products because our memories and knowledge strongly constrain imagination. In fact, some experiments suggested that animals on extraterrestrial planets imagined by participants frequently reflected the characteristics of amimals on Earth (e.g., eyes, mouth, limbs, body symmetry, Ward, 1994; Ward & Sifonis, 1997).

What factors are important for creative imagination beyond the above constraints? In this regard, we propose the importance of perception and bodily action and refer to embodied cognition theory. Although there are various interpretations of knowledge in embodied cognition theory (e.g., Barsalou, 1999; Clark, 1999; Wilson, 2002), one common understanding is that knowledge is strongly related to perception and action. Some of our knowledge can be stored as a sum of neural traces activated during perceptual processing (Barsalou, 1999). In addition, the retrieval of that knowledge occurs as a process of activation/reactivation of the above perceptual neural traces called simulation (Barsalou, 2009; Clark, 1999; Wilson, 2002).

Psychology and neuroscience have shown that perceptual and motor processing are closely linked to knowledge activation (i.e., recall from memory) and information processing. Furthermore, several studies have suggested that it facilitates knowledge activation and recognition. For example, some studies using PET have suggested that the areas involved in motor planning (left premotor cortex and the left middle temporal gyrus) are more strongly activated during the recognition of tools like hammer than that of animals (e.g., Beaucamp et al., 2002; Chao et al., 1999; Martin et al., 1996). Similarly, it has been suggested that the processing areas for gustatory perception (the right insula and the left orbitofrontal cortex) are strongly activated during the recognition of food pictures than during the recognition of landscape pictures (Simmons et al., 2005). Notably, the above activation of perceptual and motor processing areas is not a byproduct of knowledge activation and recognition. In contrast, TMS (Transcranial Magnetic Stimulation) experiments have shown that perceptual and motor processing areas' stimulation facilitates the recall and recognition of related memory (Pulvermuller et al., 2005). These findings suggest that the memory of various objects such as tools and food is stored as a distributed network that includes somatosensory, tactile, gustatory, and other perceptual processing areas. Further, they suggest that information processing, such as recall and recognition of memory, occurs through interaction with the perceptual and motor experiences of these objects.

Based on these findings and theories, we propose a framework called Perception and Action-based Imagination (PAI) to describe the influence and mechanism of bodily action on people's creation (see also Shimizu & Okada, under review). The upper part of Fig. 1 shows an outline of this framework. First, as previous studies, like that of the Chinese-ink painter show, creation in reality is considered to proceed in a cycle of imagination generation and imagination implementation (e.g., Glăveanu, 2013; Yokochi & Okada, 2005). In this cycle, the creator's action has a strong influence on imagination generation strongly constrained by the knowledge and memory related to the task. For example, manipulating an object with the body during the generation of imagination will facilitate the acquisition of various perceptual information included in that object, and activate the corresponding neural traces. This activation will lead to recall of different memory being closely linked to these neural traces and facilitates their use in imagination generation (Abe, 2010). Further, implementing the generated imaginations through bodily action is also expected to enable the acquisition of rich perceptual feedback related to the surrounding environment (activation of perceptual neural traces). This activation promotes the recall of connected memory and its use in imagination regeneration (Yokochi & Okada, 2005). The above memory recall brought about by perception and action and its use in imagination generation has an essential function in creation. It will facilitate the unexpected combination of remote memory and promote the novel imagination in cognitive processes. These processes may not often occur when people do not manipulate objects or implement their imaginations using their bodily actions. This cycle of imagination generation using the knowledge activated by the perceptual information and acquisition of rich perceptual information through imagination embodiment is important in the creation. By repeating the above cycle, the creator may generate their unique works deeply rooted in their body features, the surrounding environment, and past perceptual experiences.

This PAI framework was also proposed by our study for an expert dancer in parallel (see, Shimizu and Okada, Under review). The above study investigated whether this framework could explain the expert dancer's creation process through a case study. However, that study had several caveats; it dealt with the dance domain where the bodily action is an expression medium. It is a case study treating only an expert, and its generalizability has not been sufficiently investigated. Further, it did not identify the mechanism in detail because various influences of action on cognition are assumed. The current study solves the above problems. While applying the same experimental paradigm proposed in that study, this study deals with a more general creativity task and conducting an experiment with a large number of participants. Further, by using mediation analysis, we aim to identify the important influences that bodily action has on people's creativity.

Methods

Experimental Design

The experiment included the following three conditions about a procedure of product generation, 1: Verbal condition, in which the participants generated the product without physical manipulation based on verbal stimuli, 2: Visual condition, in which they generated the product without physical manipulation based on visual stimuli and 3: Embodied condition, in which they generated the product with physical manipulation based on visual, tactile, and somatosensory stimuli.

Participants

Forty-seven undergraduate and graduate students from the University of Tokyo participated in this experiment (19 males, 28 females). Their mean age was 21.57 (*SD* = 1.89) years. We included forty-five participants in the analysis, excluding two participants who participated in a noisy environment and deviated from the experimental instructions. The details of the participants in each condition are as follows. Verbal condition: 15 participants (six males, nine females) with mean age 21.53 (*SD* = 1.51) years, Visual condition: 15 participants (six males, nine females) with mean age: 21.27 (*SD* = 1.62) years, Embodied condition: 15 participants (six males, nine females) with a mean age of 21.87 (*SD* = 2.45) years.

Procedure

We used a modified version of the product generation task used by Finke, Ward, and Smith (1992) in this experiment. In this task, the participants combine three figural parts to generate a novel industrial product. The participants generated a toy for children, and they conducted this task three times. In each task, the three parts used were different. Task 1: Hemisphere, square plate, and a pair of wheels; Task 2: cone, cube, and rectangle; Task 3: cylinder, sphere, and ring. To prevent the spread of COVID-19, we conducted this experiment using an online conference system, Zoom (Zoom

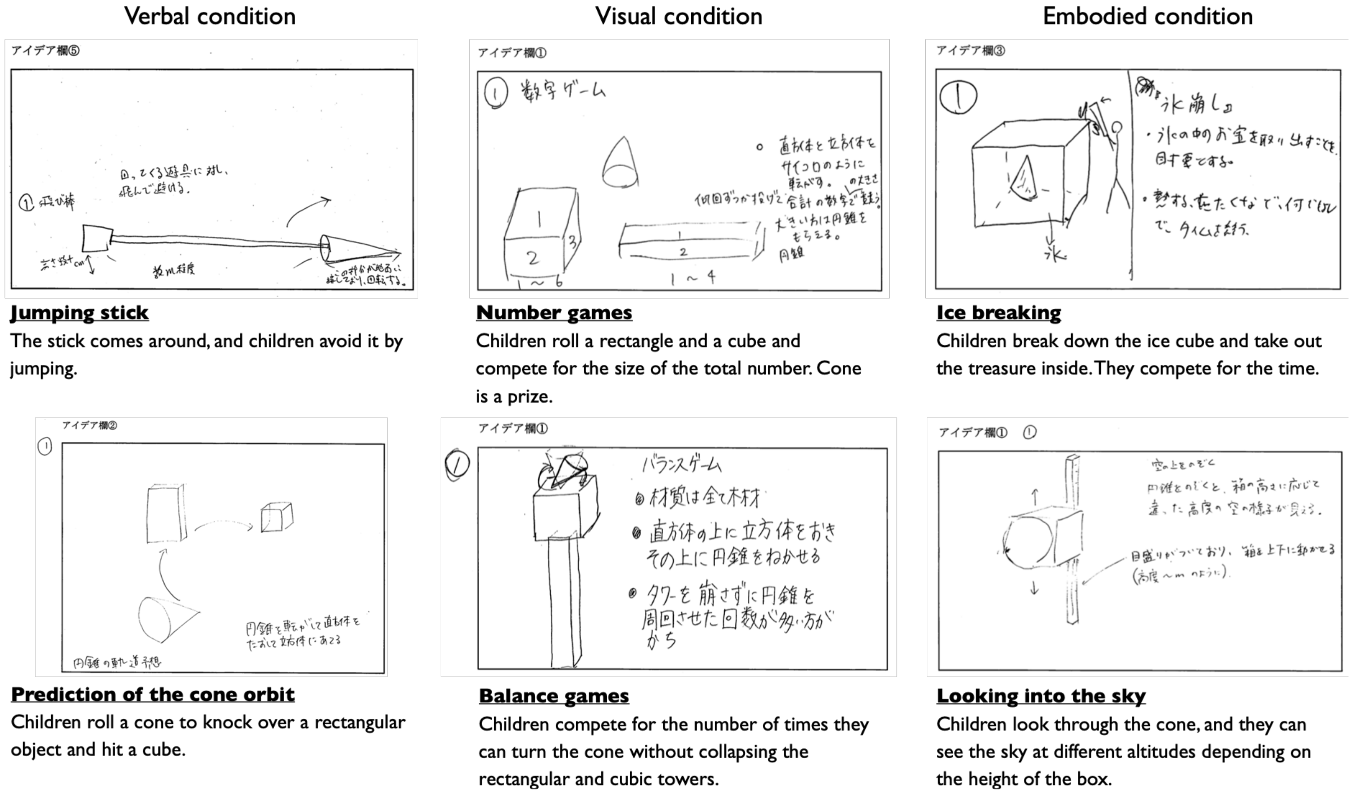

Fig. 2 Toys that the participants generated in each condition. We listed the toys with high novelty scores.

Video Communications, Inc.). The parts were sent to the participants' homes with sufficient disinfection.

The outline of the procedure is as follows: 1: The outline of the experiment was explained orally and in the response sheet. The participants also provided their consent to participate in the experiment by signing their names on the sheet. 2: The three parts to be used in each task were explained. 3: The participants worked on each task for 10 minutes. The ways to work on the task were different among the conditions. In Verbal condition, the parts were not handed out. The participants generated their products by imagining and manipulating the parts in their minds. The details of the parts were written in the response sheet and explained verbally. They could freely check this explanation during the experiment. In Visual condition, the parts were handed out. The participants generated their products by manipulating the parts in their minds while looking at the parts. In Embodied condition, the parts were handed out. The participants generated the products by manipulating the parts physically. In this condition, we recommended that the participants touch the parts. The participants wrote their products on the response sheet in pictures and letters. 4: Immediately after completing each task, we asked the participants what they had in mind when they generated the products, and they reported what they had been thinking about before coming up with the products. The participants repeated the second to fourth process three times (three tasks). Finally, we concluded the experiment with a debriefing on the experimental purpose. This experiment was conducted in accordance with the Declaration of Helsinki and with the permission of the Ethical Committee of the University of Tokyo.

Analysis

Creative Evaluation of the Products We obtained creativity evaluation for the generated products and compared that evaluation across the conditions. First, we prepared the items of this evaluation by referring to previous studies such as creativity rating (novelty and usefulness) of Finke et al. (1992), the Creative Product Semantic Scale (novelty, feasibility, and elaboration) of Besemer and O'Quin (1999), and the importance of the surprise by Kaufman and Sternberg (2010), and our pilot study. The following items were included in the evaluation: 1) novelty (how novel the toy is); 2) physical enjoyment (how much physical fun children have when they play with the toy); 3) intellectual enjoyment (how much intellectual fun children have when they play with the toy); 4) physical learning (how much children can learn physically when they play with the toy); 5) intellectual learning (how much children can learn intellectually when they play with the toy); 6) feasibility (how feasible is the toy); and 7) surprise (how surprised you were at the idea of the toy). Note that the second to fifth items correspond to usefulness as a toy. In addition, the average value of the overall items was included.

To evaluate the products of these items, we used a method similar to that of Finke et al. (1992). The first author and two graduate students (one male, one female), who were working on creativity research and did not know the purpose of this experiment, worked on the evaluation ratings individually. In the ratings, the order of the products was randomized. We compared the evaluations among the conditions using ANOVA and multiple comparisons. We calculated the intraclass correlation coefficient for the mean of the three raters (ICC [2, k]; Shrout & Fleiss, 1979). The result showed that ICC (2, k) was .36 ($p < .001$). Considering that previous studies on creativity evaluation have not reported sufficient high agreement rates (Getzels & Csikszentmihalyi, 1976; Sobel & Rothenberg, 1980), it is difficult to say that this value is significantly low. Therefore, we used the mean value of the three raters as the product score.

Cognitive process Next, we analyzed what people were considering at the time of product generation, which was obtained in the fourth procedure. First, we transcribed their verbal reports and checked the details. We treated the report for each product as a unit of analysis. Then, the first author generated the following categories in a bottom-up manner based on the contents that the participants frequently mentioned in the reports: 1) part feature; 2) possibility of part fabrication; 3) parts combination; 4) part analogy; 5) memory of the past; and 6) part material. We then classified the reports into each category and calculated the frequency of the category for each participant. We compared each category's frequency among the conditions and identified the cognitive process observed frequently in each condition. We applied the Mann–Whitney U test for the analysis because the normality distribution assumption was not satisfied in this kind of frequency data. At present, we have not been able to obtain the ratings from multiple people for category classification. We plan to add this analysis and check the inter-rater reliability in the future.

Mediation Effect of the Cognitive Process Finally, we investigated the degree to which the above cognitive processes explained the condition's influence on creative evaluation. A mediation analysis was conducted with the condition as the explanatory variable, creativity evaluation as the objective variable, and cognitive process as the mediator variable (Baron & Kenny, 1986). We included the evaluation items and cognitive categories that showed statistical significance among the conditions in the above two analyses in this mediation analysis.

Results

Creative Evaluation of the Products

Fig. 3 shows the results of the creativity evaluation. We can observe that Embodied condition was higher than Visual and Verbal conditions in terms of novelty, physical enjoyment, physical learning, and overall evaluations. Similarly, in intellectual enjoyment and intellectual learning, Embodied and Visual conditions suggested higher values than Verbal condition.

The statistical tests showed consistent results. One-way ANOVA showed significant differences among conditions for several evaluation items (novelty: $F\ (2, 42) = 4.89$, $p < .05$, $\eta 2 = .19$; intellectual enjoyment: $F\ (2, 42) = 3.47$, $p < .05$, $\eta 2$

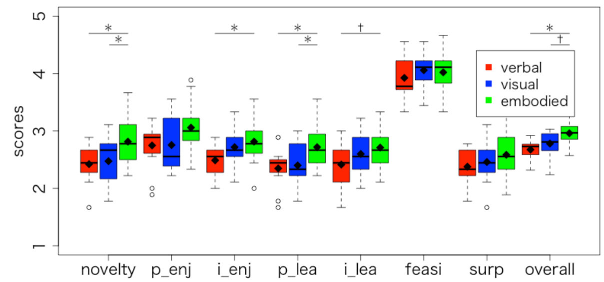

Fig. 3 Creative evaluation score of the product ∗: $p < .05$, †: $p < .10$

$= .14$; physical learning: $F\ (2, 42) = 5.04$, $p < .05$, $\eta 2 = 0.19$, intellectual learning: $F\ (2, 42) = 2.59$, $p < .10$, $\eta 2 = 0.11$, overall: $F\ (2, 42) = 7.12$, $p < .01$, $\eta 2 = 0.25$). Therefore, we conducted multiple comparisons between conditions for these items (adjusted by the Bonferroni method). The results showed significant differences or marginally significant differences between Embodied condition and the other two conditions (Visual and Verbal conditions) for novelty, physical learning, and overall rating (novelty: $p < .05$, $d = .88$, $p < .05$, $d = 1.12$; physical learning: $p < .05$, $d = .90$, $p < .05$, $d = 1.13$, overall: $p < .10$, $d = .81$, $p < .01$, $d = 1.41$). For intellectual enjoyment and intellectual learning, significant differences or marginally significant differences were observed between Embodied and Verbal conditions (intellectual enjoyment: $p < .05$, $d = 1.13$; intellectual learning: $p < .01$, $d = .87$). These results suggest that toys that are more novel and promote physical learning were generated in Embodied condition. In addition, they indicated that toys that promote intellectual learning were frequently generated in Embodied and Visual conditions. However, there were some items such as feasibility that did not show any difference among conditions. Differences among conditions, such as physical manipulation of the parts, are thought to have selectively influenced the product features.

Cognitive Process

Fig. 4 shows the results of the cognitive process. We can observe that Embodied condition showed a higher frequency than the other two conditions for 1) part feature, 2) possibility of part fabrication, and 4) part analogy. On the other hand, for the 3) parts combination, Verbal condition suggested higher values than Visual and Embodied conditions.

Mann-Whitney's U test revealed generally consistent results (adjusted for multiple comparisons by the Bonferroni method). Significant differences were identified between Embodied and Visual conditions, and between Embodied and Verbal conditions for 1) part feature and 2) possibility of part fabrication [1) part feature: $U = 55.50$, $p < .05$, $r = .47$; $U = 54.50$, $p < .05$, $r = .47$, 2: possibility of part fabrication: $U = 48.00$, $p < .05$, $r = .52$; $U = 39.00$, $p < .01$, $r = .60$] On the other hand, no significant differences were indicated for 3) parts combination and 4) part analogy. These results suggest that in Embodied condition, the participants generated their

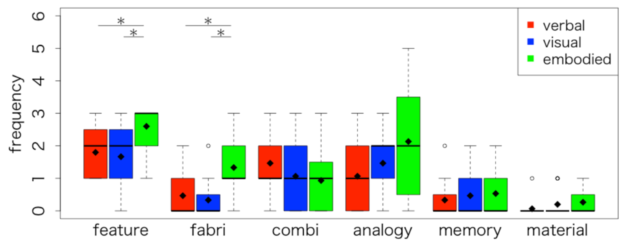

Fig. 4 Category's frequency of the cognitive process＊: p < .05

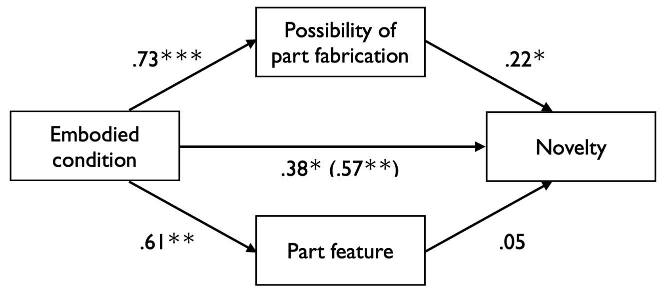

Fig. 5 Result of mediation analysis on product's novelty. ＊＊＊: p < .001, ＊: p < .01, ＊: p < .05

products with more attention paid to the part features and the various possibilities of the part fabrication.

Mediation Effect of the Cognitive Process

Fig. 5 shows a part of the mediation analysis results (with the novelty evaluation as the objective variable, part feature, and possibility of part fabrication as the mediator variable). This figure indicates that the overall standardized effect of Embodied condition was $\beta = .57$ ($p < .01$), the standardized direct effect was $\beta = .38$ ($p < .05$), the standardized indirect effect of part feature was $\beta = .03$ ($p = .62$), and the standardized indirect effect of the possibility of part fabrication was $\beta = .16$ ($p < .05$). We calculated the 95% confidence interval for the possibility of part fabrication using bootstrap (bias correction method, sample size: 10,000). The result indicated a significant mediation effect, which did not include 0 (95% CI [0.03-0.33]).

These results suggest that the increase in the novelty evaluation in Embodied condition can be explained to some degree by the cognitive process, such as the possibility of part fabrication. In Embodied condition, the participants physically manipulated the parts and acquired various perceptual feedback such as visual, tactile, and auditory feedback. These kinds of feedback gave them various perspectives to fabricate the parts and increased their attention to the fabrication possibilities. We assumed that this process led to the generation of products with novel features. However, there are some direct effects that cannot be fully explained only by this indirect effect. It is necessary to further investigate the background of creativity facilitation in Embodied condition.

Discussion

The experiment in this study suggested the following three results. 1) Scores of the creativity evaluation such as novelty (other than feasibility) increased in Embodied condition; 2) More attention was paid to the possibility of part fabrication in Embodied condition. 3) Increase in creativity evaluation scores in Embodied condition can be partially explained by the focus on the possibility of part fabrication.

Based on these results and the condition settings, we can consider that in Embodied condition, the participants acquired various perceptual feedback such as visual, tactile, and auditory feedback through physical manipulation. They found various parts fabrication possibilities based on this feedback and gained a novel perspective for generating products. On the other hand, in Verbal condition, the participants could not obtain the feedback mentioned above, and it was difficult for them to find new perspectives to generate products. As a result, the creativity evaluation scores in Verbal condition were lower than those in the other conditions. In fact, in Visual condition, creativity evaluations such as novelty, physical enjoyment, and physical learning were lower than those in Embodied condition. On the other hand, the same differences were not observed for intellectual enjoyment and intellectual learning. These results of Visual condition may be due to the fact that the participants could not obtain tactile and somatic feedback sufficiently in this condition. They could probably not explore the fabrication possibility based on these kinds of feedback, which are considered to facilitate the generation of product imaginations related to physical perspectives.

These results and interpretations show the important functions and mechanisms of action in creativity. This function and mechanism are consistent with the PAI framework proposed in the introduction. This study's significance and novelty is that it proposed and investigated the detailed influence mechanism of bodily action on people's creativity.

Many issues remain to be addressed. First, we need to check the influence of cognitive loads. In the Embodied condition, the cognitive load was lower than in the other conditions because the participants could manipulate the parts. This lower cognitive load might have enabled the generation of novel products. It will be necessary to carefully investigate whether the product evaluation suggested in this study is due to cognitive load or to perceptual feedback by bodily action. We need to set and compare the conditions where the cognitive load is kept at the same level. We also need to investigate the physical manipulations performed in Embodied condition. In this experiment, we recorded the participants' behavior using Zoom's recording function. We are currently analyzing the behaviors and identifying the part manipulations that facilitate the exploration of the possibility of part fabrication. Further analysis to identify the relationship between these specific part manipulations and the cognitive process as well as the creativity evaluation will be important. It will also be necessary to conduct experiments that include the part manipulation identified above as an experimental factor. Through this experiment, we can investigate the causal relationship between manipulation and creativity evaluation. Furthermore, the identification of perceptual feedback that encourages creativity is considered important. In this experiment, the participants acquired various perceptual feedback, including tactile, auditory, and somatosensory feedback. However, we could not detect which one had a critical function. We consider that the feedback which has an essential function largely depends on the characteristics of the task, the participant, and has domain dependence. We need to clarify the details of these functions to investigate the influence of bodily action on creativity.

Acknowledgments

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References

Abe, K. (2010). Interaction between body and environment in creative thinking. *Cognitive Studies, 17*(3), 599-610. (Written in Japanese)

Amabile, T. M. (1988). A model of creativity and innovation in organizations. *Research in organizational behavior*, *10*(1), 123-167.

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. Journal of personality and social psychology, 51(6), 1173.

Batey, M. (2012). The measurement of creativity: From definitional consensus to the introduction of a new heuristic framework. *Creativity Research Journal*, *24*(1), 55-65.

Barsalou, L. W. (1999). Perceptual symbol systems. *Behavioral and brain sciences*, *22*(4), 577-660.

Beauchamp, M. S., Lee, K. E., Haxby, J. V., & Martin, A. (2002). Parallel visual motion processing streams for manipulable objects and human movements. *Neuron*, *34*(1), 149-159.

Besemer, S. P., & O'Quin, K. (1999). Confirming the three-factor creative product analysis matrix model in an American sample. *Creativity Research Journal*, *12*(4), 287-296.

Chao, L. L., Haxby, J. V., & Martin, A. (1999). Attribute-based neural substrates in temporal cortex for perceiving and knowing about objects. *Nature neuroscience*, *2*(10), 913-919.

Clark, A. (1999). An embodied cognitive science?. *Trends in cognitive sciences*, *3*(9), 345-351.

Finke, R. A., Ward, T. B., & Smith, S. M. (1992). Creative cognition: Theory, research, and applications.

Glăveanu, V. P. (2013). Rewriting the language of creativity: The Five A's framework. *Review of General Psychology*, *17*(1), 69-81.

Kaufman, J. C., & Sternberg, R. J. (Eds.). (2010). *The Cambridge handbook of creativity*. Cambridge University Press.

Martin, A., Wiggs, C. L., Ungerleider, L. G., & Haxby, J. V. (1996). Neural correlates of category-specific knowledge. *Nature*, *379*(6566), 649-652.

Okada, T., & Ishibashi, K. (2017). Imitation, inspiration, and creation: Cognitive process of creative drawing by copying others' artworks. *Cognitive science*, 41(7), 1804-1837.

Pulvermüller, F., Hauk, O., Nikulin, V. V., & Ilmoniemi, R. J. (2005). Functional links between motor and language systems. *European Journal of Neuroscience*, *21*(3), 793-797.

Sawyer, R. K., & DeZutter, S. (2009). Distributed creativity: How collective creations emerge from collaboration. *Psychology of aesthetics, creativity, and the arts*, *3*(2), 81.

Shimizu, D., & Okada, T. (Under review). Perception and Action-based Imagination: Influence of the body and action on people's creativity.

Simmons, W. K., Martin, A., & Barsalou, L. W. (2005). Pictures of appetizing foods activate gustatory cortices for taste and reward. *Cerebral Cortex*, *15*(10), 1602-1608.

Yokochi, S., & Okada, T. (2005). Creative cognitive process of art making: A field study of a traditional Chinese ink painter. *Creativity Research Journal*, *17*(2-3), 241-255.

Ward, T. B. (1994). Structured imagination: The role of category structure in exemplar generation. *Cognitive psychology*, *27*(1), 1-40.

Wilson, M. (2002). Six views of embodied cognition. *Psychonomic bulletin & review*, *9*(4), 625-636.

Wu, L. L., & Barsalou, L. W. (2009). Perceptual simulation in conceptual combination: Evidence from property generation. *Acta psychologica*, *132*(2), 173-189.