Creative Cognitive Process of Art Making: A Field Study of a Traditional Chinese Ink Painter

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ABSTRACT: This study investigated the drawing processes of a Chinese ink painter through field observation, interviews, and a field experiment. Compared to many studies using a single method such as interview only, this multimethod study enabled us to capture the creative processes from various perspectives. We observed processes of drawing in a temple and asked the painter to draw 16 pictures in a field experiment (8 created from random lines that the audience drew and 8 created on blank paper). We found that (a) the painter seemed to gradually form a global image of the drawing as he drew each part one by one, (b) lines that the audience drew seemed to create new constraints for his drawing and forced him to create a new style of pictures, and (c) the painter moved his brush in the air before actually drawing lines on the paper. This hand movement seems to have one of the following functions: positioning (where to draw), rehearsal (how to draw), and image generation (what to draw).

How do artists create artwork? When artists were asked about how images and concepts in their artwork had been generated, the artists told us that they did not know what happened in their minds while they were creating the works, and some of them said, "New ideas and images suddenly fall from the sky." Therefore, artists have seemed to believe that artistic creations are mystic phenomena. In contrast, psychologists (e.g., Gruber, 1979; Weisberg, 1986) claimed that accumulation of creative activities was necessary for artists and scientists to generate new ideas and concepts. Citing experiences of various types of artists, composers, poets, and so on, Weisberg (1986) suggested that the creative leap is based on artists' existing works, and that ordinary cognitive processes underline the sudden emergence of images or concepts.

To test this claim, it is necessary to capture online processes while artists make artwork. Although there have been some studies with related interests, the great majority of psychological research on artistic creation has not focused on the artists' actual working processes in detail. For example, some studies have attempted to model the cognitive, affective, behavioral, and contextual factors associated with the making of a work of art (e.g., Cawelti, Rappaport, & Wood, 1992; Glueck, Ernst, & Unger, 2002; Jones, Runco, Dorman, & Freeland, 1997; Kay, 1991; Mace & Ward, 2002; Stohs, 1991). Also, studies of creative individuals in various domains have focused on their products and self-report to embrace their creative breakthroughs (e.g., Franklin, 1989; Gardner, 1993; Raina, 1997; Wallace & Gruber, 1989). Although these studies have focused on real artists, they have used techniques such as interviewing to understand what artists actually do during the creation, while neglecting online methods such as observation. Other studies of artists (e.g., Eindhoven & Vinacke, 1952; Israeli, 1981; Patrick, 1937) could not reveal creative cognitive processes in detail either. For example, Eindhoven and Vinacke (1952) compared the behavior of real artists versus nonartists during painting of an il-

lustration for a poem. They suggested that the artists restructured their final products more than nonartists did. However, these studies are relatively old, predating the information-processing revolution, which had since occurred in the cognitive psychology field. Thus, results of the studies remained conjectural because they could not capture whole processes of creation using presently available technology such as video cameras, and advanced analytical methods. More recently, Israeli (1981) studied artistic decision making through interviews, examination of sketchbooks, notes and finished works, and observation. Although this study characterized the types of decision making from episodes of each artist, it is unclear what cognitive processes underlie the generation of creative works. Thus, despite these efforts, creative cognitive processes are not yet well understood.

What kinds of creative cognitive processes can we find from online processes of an artist's creation? Through collecting and analyzing the online data of an artist at work, this study focused on the following general questions: (a) processes of image generation in an actual artist at work, (b) processes of transcending the artist's previous works, and (c) relationship between creativity and body movement.

First, how do artists generate their new ideas and images? Do artistic images and ideas suddenly come up in their minds? In the episodic studies of a famous artist, Pablo Picasso, Gardner (1993) and Weisberg (1986) both mentioned that Picasso drew a number of sketches in preparation for *Guernica* to create great artwork. In addition to the studies of artists, in the field of architectural design research, researchers have claimed that sketches are a good medium for reflective conversation with one's own ideas and imagery (e.g., Dorst & Dijkhuis, 1995; Goel, 1995; Goldschmidt, 1991; Schon, 1983; Suwa & Tversky, 1997). In other words, design is seen as a process in which each designer constructs his or her own reality by his or her own actions that are reflective, responsive, and opportunistic to the design situation. It seems that designers gradually form their images while drawing their sketches. From results across studies of famous artists and studies of architectural design, we may be able to predict that artists, especially painters, do not have entire images of their works at the beginning, but they gradually form their mental image through drawing objects.

Second, how do artists transcend their previous works when creating new artwork? If creation is based on artists' previous works as Weisberg (1986) claimed, it might be difficult for artists to create a new style of artwork. In experimental studies of creative thinking using undergraduates, researchers have shown that people tend to have difficulties in crossing the boundary of an ordinary concept to create new products (e.g., March, Landau, & Hicks, 1996; Smith, Ward, & Schumacher, 1993; Ward, 1994; Ward & Sifonis, 1997). These studies have focused on the effects of prior experiences and existing category information in the creative idea generation task. They asked participants to generate imaginary animals living on a planet somewhere else in the galaxy. The results showed that people tend to adopt attributes of animals living on earth. Thus, they claimed that people become constrained within the properties of existing examples in generating new ideas and concepts. In the case of artists, it seems that their previous artwork is a constraint toward creating a new style of work. How do artists manage conformity to transcend their previous artworks? This study focused on cognitive processes in transcending artists' previous works and overcoming conformity.

Third, what is the relationship between cognition and body movement? Do artists' body movements influence their minds? Creative cognitive processes are complicated. The processes combine a diverse collection of cognitive activities, such as mental activities and physical activities. In studies of embodied representation, researchers have argued that sensory-motor systems, such as body movement, could affect the cognitive processes (e.g., Barsalou, 1999; Prinz & Barsalou, 2000). It seems that artists' skills and body movements may be needed not only for substantializing their images and ideas in their minds, but also for generating their images and ideas while creating artwork. If so, it is necessary to observe online creative processes of artists at work to investigate the relationship between cognition and body movement.

In this exploratory study, we tried to answer these questions focusing on a fine artist. The authors present a field case study based on observations, interviews, and a field experiment with detailed cognitive analyses of the drawing processes of a Suibokuga (Chinese ink painting) painter. We conducted a case study because this methodology is one of the most useful means for understanding talented people. Consequently, it has been widely adopted not only in psychology, but also in diverse fields such as medicine, physiology, history of science, literature, and sociol-

ogy (see Wallace, 1989). This method has made particularly important contributions in the field of creativity psychology because of its ability to account for the uniqueness of talented individuals from the viewpoint of the whole person (e.g., Gruber, 1988, 1989; Gruber & Wallace, 1999; Miller, 1992; Raina, 1997; Rothenberg, 1990; Wallace, 1989; Wallace & Gruber, 1989). Whereas studies employing large sample sizes intend to test hypotheses and generalize theories, single case studies are best suited for gathering detailed information from unique individuals, and for generating new hypotheses.

Furthermore, in this study the authors enhanced the role of the case study by employing multiple means of observation. Such a multimethod approach is best suited to account for a phenomenon across several viewpoints (e.g., Brewer & Hunter, 1989; Denzin, 1989). This approach is based on the idea that a given phenomenon will be uncovered by deliberately combining various types of methods (e.g., questionnaire, experiment, interview, and so on) within one study. For example, Getzels and Csikszentmihalyi (1975, 1976) approached creativity from various perspectives by using several test batteries, such as IQ tests, creativity tests, personality tests, and observations and interviews during art-making processes. Although each method has limitations to capture the whole figure of the phenomenon, combing each method can effectively overcome the limitations.

Unlike laboratory experiments, field studies are difficult in terms of control of variables. Also, because this is a single case study, it may be difficult to generalize our findings to artists in general. However, through field studies, we can propose new hypotheses or offer useful insights with high levels of ecological validity as mentioned earlier. Especially in domains where very few previous studies exist, starting from field studies can be very useful to identify questions and hypotheses that might lead to further research projects.

Method

Participant

Mr. K is a Suibokuga (traditional Chinese ink paintings) painter in his early 60s with about 20 years of experience in this particular style of painting. With brush and Chinese ink (Sumi ink), Suibokuga painters draw landscapes, people, animals, plants, and so on. Suibokuga was developed in China during the Tang dynasty and introduced later to Japan as a part of Buddhist culture during the 13th century. Mr. K usually draws Sansuiga (which is a type of Suibokuga featuring Chinese landscapes of mountains and valleys) on fusuma (Japanese sliding doors) or folding screens in temples and shrines. In addition to many places in Japan, he has also exhibited his works at museums in China, France, and the United States (e.g., the Dallas Museum and Pittsburgh Children's Museum). He was also awarded a grand prize at Fusuma-e competition (Chinese ink painting on Japanese sliding doors) in Japan, 1987.

Period of Observation

This field study was conducted mainly from 1998 to 2001, with a follow-up interview in 2003. The present authors observed Mr. K's drawing processes, and collected substantial online data while he was drawing. We also investigated his drawing processes through a field experiment.

Data

There were two data sets in this field study: (a) process data of a fusuma drawing in a temple and (b) data from a field experiment.

In the temple, spending about 1½ hrs, the painter drew a picture of mountain and valley across four fusuma sliding doors. Two video cameras were set up on both sides of the fusuma doors to capture his drawing process. After he finished his drawing, he was interviewed about his drawing process.

Mr. K sometimes improvises his drawing in front of audiences by incorporating random lines that the audience drew onto blank paper, although he did not ask the audience to do so while drawing in this temple, because the master of the temple asked him not to do so. Therefore, in the field experiment, Mr. K was asked to draw eight pictures created from 15 random lines drawn by two experimenters (we call this the LINES condition) and eight pictures created on blank paper (we call this the BLANK condition) to capture the differences. The theme of the paintings was the four seasons. He was asked to draw two pictures of each season in each condition: spring, summer, fall, and winter. The order of task presentation was counterbalanced by condition,

whereas the order of the season for each task was randomized. The processes of his drawing were recorded with two video cameras. He drew three or four pictures in his studio in a day, and it took a total 5 days between June and December 2001 to complete the field experiment. Usually, it took him about 20 to 30 min to finish a picture. In the second day of the experiment, he thought a picture in the BLANK condition was not good enough, hence he drew another picture with the same theme once more in the final day. In the third day of the experiment, he reported that he could not concentrate on his drawing and drew just one picture.

Results and Discussion

The following three main features were identified through our field study:

1. The painter seemed to form a global image of the drawing gradually as he drew each successive element.
2. He drew pictures in fairly patterned ways. Lines that the audience drew, however, seemed to create new constraints for his drawing and forced him to create a new style of pictures.
3. He often moved his brush in the air before actually drawing lines on the paper. Based on our data analyses, the present authors describe three possible functions of these movements.

The authors describe each feature one by one in detail.

Processes of Drawing Images

Mr. K drew his paintings very smoothly and quickly. Although it may have looked as if he had already formed an image of the entire picture before starting to draw, our analyses of the drawing process and an interview with him revealed that he started drawing with local images. He then gradually formed a global image as he drew each part one by one.

When he was interviewed just after he finished drawing fusuma doors in the temple (See Figure 1), he noted,

Not the entire picture. Starting from here, the pine tree that I first drew, then there and this

bridge and here, then the cedar trees above the stairway. Then the roof of the hut. *I had an image of only those parts at the beginning.*[1]

It seems that he did not form the entire image before he started drawing. How did he draw so smoothly without forming the whole image or complete plans in his mind? We analyzed his drawing processes in detail to search further.

Figure 2 shows the process of his drawing on the fusuma doors of the temple. The circled numbers on the fusuma doors indicate where and in what order he drew while those on the tatami mats indicate where and in what order he moved.

The process was divided into five sections based on his movements. The first four sections were segmented when he moved backward to survey the entire picture for more than 1 min. The rest of his drawing processes were combined into one section, because he moved backward and forward frequently without long pauses. In the first section, he sat on a tatami mat and started drawing a tree on the left-most part of the fusuma door. After he drew the central part of the left fusuma doors for about 22 min, he stepped back to see the entire picture. Then he started drawing on the second door from the right, and paused to observe what he drew many times. When this part of the picture became more formed, he moved backward and looked at the picture occasionally. At almost the end of his drawing in the last section, he moved back and forth frequently, adding a few lines here and there. This analysis of his drawing processes and his interview in the temple suggests that he actually formed his plans for the painting gradually while he was drawing. Although this is a single case analysis, we observed that he drew on fusuma doors in the same manner on many other occasions.

Mr. K cannot look at the entire picture without stepping backward when he draws on such big fusuma doors. Although he can take in the entire picture when he draws on a small-sized paper, he still has to spend a certain amount of time planning and monitoring when he draws.

Therefore, the duration and timing of pauses in the data were measured from the field experiment to infer his planning and monitoring process while drawing. The drawing processes were divided into small cycles.

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[1]All the quotations from the painter were translated from Japanese by the authors.
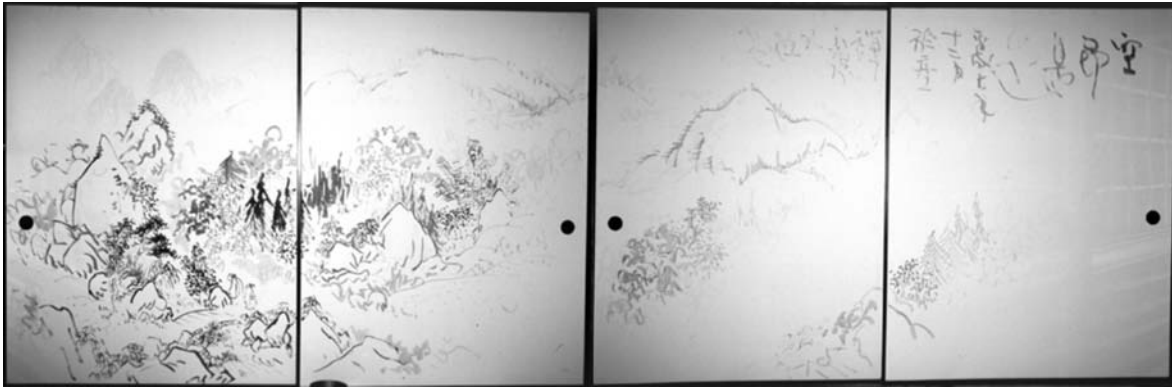
Figure 1. *Picture on fusuma doors at temple X. This painting was drawn by Mr. K on sliding doors in temple X, December 1998. The painter has the copyright of this painting. Mr. K grants the publisher of Creativity Research Journal the permission to reprint this painting.*

One cycle consisted of the period from his soaking the brush in the Chinese ink plate, lifting up, drawing on the paper, and soaking it in the ink plate again. We counted the distribution of pauses by length and found that the frequency drastically dropped beyond 9 sec. This suggests that there might be some functional differences in pauses shorter than nine seconds and those greater. The frequent occurrence of the shorter pauses probably indicates that he moved the brush from one place to another, or to the ink plate, and so on. The less frequent occurrence of pauses longer than 9 sec suggests that he might have spent time thinking about the pictures, planning, and monitoring his drawing processes.[2] Examining the video record confirmed this conclusion.

Table 1 shows the data from the field experiment. In counting pauses equal to or longer than 9 sec, there was about the same number of pauses in the first and the second half of his drawing in each condition, $t(7) = -2.37$, $p = .050$, and $t(7) = -1.80$, $p = .86$, respectively (two-tailed). This suggests that he planned and monitored his drawing through the entire process of drawing. There were more pauses in the LINES condition than in the BLANK condition, $F(1, 7) = 19.17$, $p < .01$. When we focused on the frequency of pauses just before draw-ing from random lines, there was about the same frequency of pauses as the difference between the two conditions, $F(1, 7) = 3.16$, $p = .12$. This probably means that he needed to think about local drawing plans to incorporate those random lines into his picture.

In summary, it appears that the painter plans and monitors through the entire process of drawing. He first forms a mental image of a small area (creates a local drawing plan), and gradually forms the entire mental image of the picture as he draws each object. This finding is consistent with the findings in design studies mentioned earlier.

Lines as Constraints

Analyses of the contents and patterns of Mr. K's drawing suggest that he drew pictures in a fairly patterned way. Through our observation, the authors found that he drew objects one by one. In the field experiment, he started to draw his paintings with a tree in 15 out of the 16 pictures.[3] Then rocks, houses, people and mountains followed (see Figure 3). We observed in many other occasions that he drew pictures in the same manner. It appears that he used certain strategies to draw particular objects in a relatively stable order throughout various situations. This is probably one of the reasons why he drew pictures so smoothly without forming the entire image before he started to draw.

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[2]Our criterion gained plausibility from experiments in previous studies. For example, Chase and Simon (1973), with perception and memory tasks in chess, presumed a long time interval while glancing at chess pieces placed on the board was needed to combine several chunks, and while a short time interval was needed to access to a single chunk. Thus, it is also reasonable to think that the difference in time interval reflects on the processes of thinking during drawing.

[3]The main coder identified the contents of all sixteen pictures created in the field experiment. After being taught the coding procedure and practicing coding independently, a second coder coded one picture. The inter coder reliability was 96%.
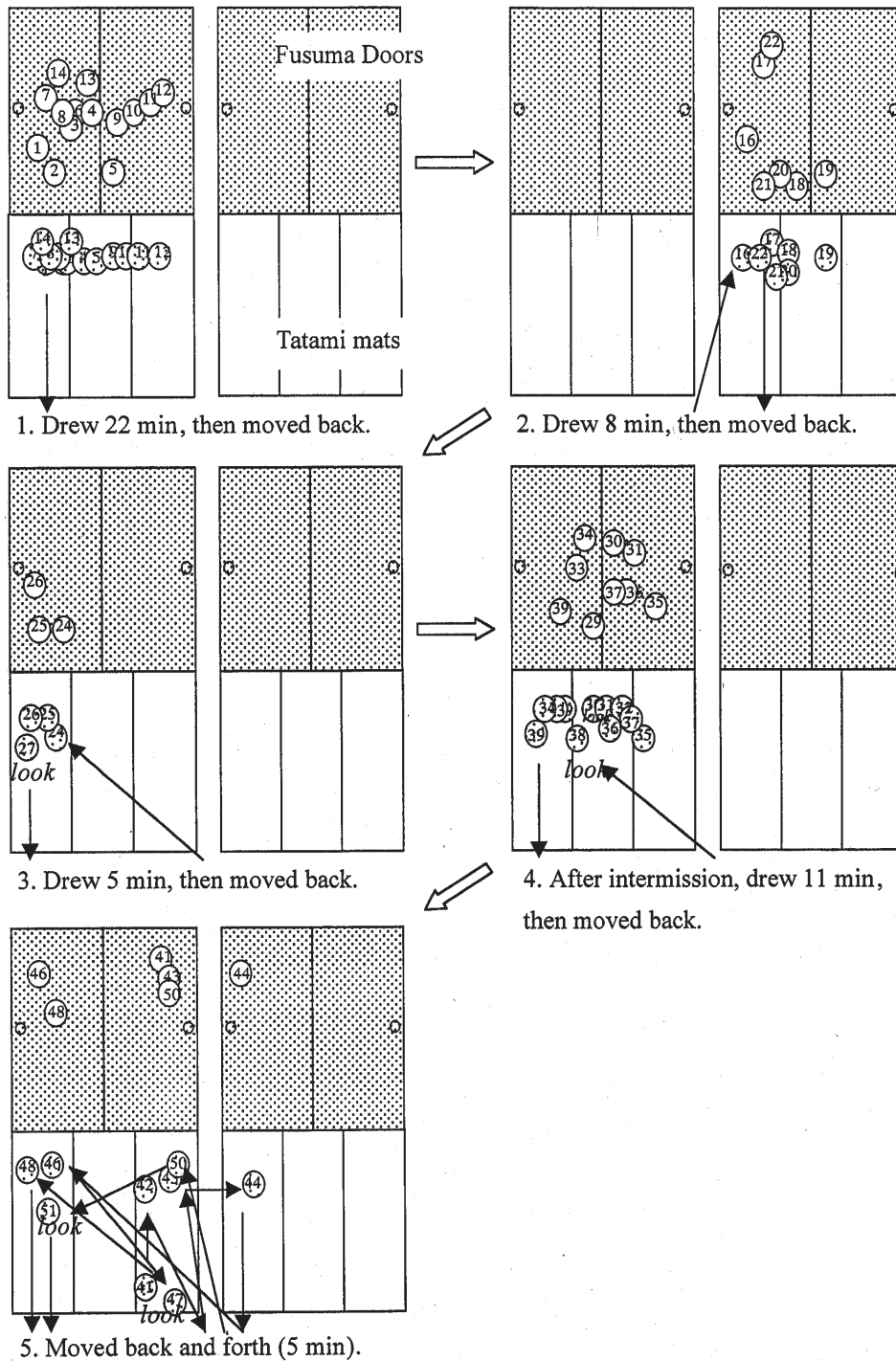
Figure 2. *Processes of drawing on the fusuma doors in temple X. Rectangles with dots represent fusuma doors (sliding doors), and lower rectangles represent tatami mats. The fusuma doors are in the vertical orientation, and the tatami mats are in the horizontal orientation. The circled numbers on the fusuma doors indicate where and in what order he drew. The circled numbers on the tatami mats indicate where and in what order he moved. Arrows represent directions that Mr. K moved on tatami mats during drawing fusuma doors.*

Table 1. *Mean Number of Pauses (9 or More Seconds) During Drawing*

Condition	Whole Drawing	First Half: Second Half	Before Drawing With Lines
BLANK	3.8	1.4 : 2.4	—
LINES	11.4	5.6 : 5.8	4.5

In an interview with Mr. K, he remarked, "All of the pictures that I created from random lines are more unique and nicer than those created in a traditional way." What are the differences in drawing between both conditions? We investigated the differences in time of drawing and the number of drawing cycles between pictures in the LINES condition and pictures in the BLANK condition (see Figure 4 and Table 2).

First, the mean time for drawing (except for the time of painting shadows or shading ink lines, which always occurs at the end of his drawings) was calculated in each condition. In the BLANK condition, the mean time for drawing was about 10 min ($M = 640.13$ sec, $SD = 170.91$ sec) and, in the LINES condition, it was about 18 min ($M = 1050.38$ sec, $SD = 199.40$ sec). The time for drawing in the LINES condition was significantly longer than that for the BLANK condition, $t(14) = 3.87$, $p < .01$ (two-tailed). We also counted the number of drawing cycles in each condition and calculated the mean number. The mean number of drawing cycles in the LINES condition was significantly higher than that in the BLANK condition, $t(14) = 3.91$, $p < .01$ (two-tailed). These results indicate that it took more time and more drawing cycles to create new pictures from random lines.

This suggests that preexisting lines somehow influenced his drawing. Therefore, we investigated how these lines were used in his drawing. There were 15 random lines drawn by the experimenters on each paper in the LINES condition. With an average of 9.3 out of 15 lines, he created new objects starting from these lines. In the other 5.7 instances he incorporated the lines into an existing object. Thus, the random lines most often triggered his drawing process and created new constraints on his drawing.

To determine whether there were differences in terms of quality between pictures in the LINES and BLANK conditions, 20 undergraduate students were asked to rate their impressions of the drawing using a semantic differential method.

The procedure was as follows: 20 undergraduates were presented pictures randomly with 12 word pair opposites. All words were adapted from adjectives used in a study of emotions when appreciating pictures (Ichihara, 1968), as well as insights gained through interviews with the painter. Participants were asked to rate the pictures based on a 7-point scale for each word pair.

Factor analysis with a principal factor solution was used to create scales across the word pair items. Three distinct factors with an eigenvalue above 1.0 were recovered and the ratio of variance contribution was 65%. These factors were rotated with Varimax and the factor loadings were calculated (see Table 3).

Four items were strongly correlated with the first factor, which we named *good composition*: modulated/nonmodulated; well composed/poorly composed; focused/unfocused; and well-balanced/ill-balanced ($\alpha = .82$). The second factor, which we named *liveliness*, was strongly correlated with the items: lively/dull; static/dynamic; energetic/nonenergetic; and powerful/powerless ($\alpha = .77$). The final factor, which we named *simplicity*, was strongly correlated with the items: clear cut/mixed up; simple/complex; relaxed/crowded; and light/heavy ($\alpha = .73$).

The present authors conducted a one-sample version of Hotelling's T^2 to compare students' rating scores of drawings from the two conditions (see Figure 5). The mean scores of good composition and simplicity in the BLANK condition were significantly higher than those in the LINES condition, $F\text{s}(1, 159) = 93.84$ and 28.48, respectively, $p\text{s} < .001$. This result indicates that pictures in the BLANK condition were well composed. Also, because there is fair amount of white space in these pictures, it creates the impression of a simple picture. Mr. K drew the BLANK pictures in the traditional Suibokuga style of paintings. On the other hand, the mean score of liveliness in the LINES condition was higher than that in the BLANK condition, $F(1, 159) = 4.15$, $p < .05$. This result indicates that pictures in the LINES condition were characterized by liveliness and dynamism. Thus, the character of LINES pictures is different from traditional Suibokuga paintings.

Mr. K also thinks that drawing from existing lines is more exciting than the traditional ways. When we interviewed him about why he wanted to draw from random lines, he answered:
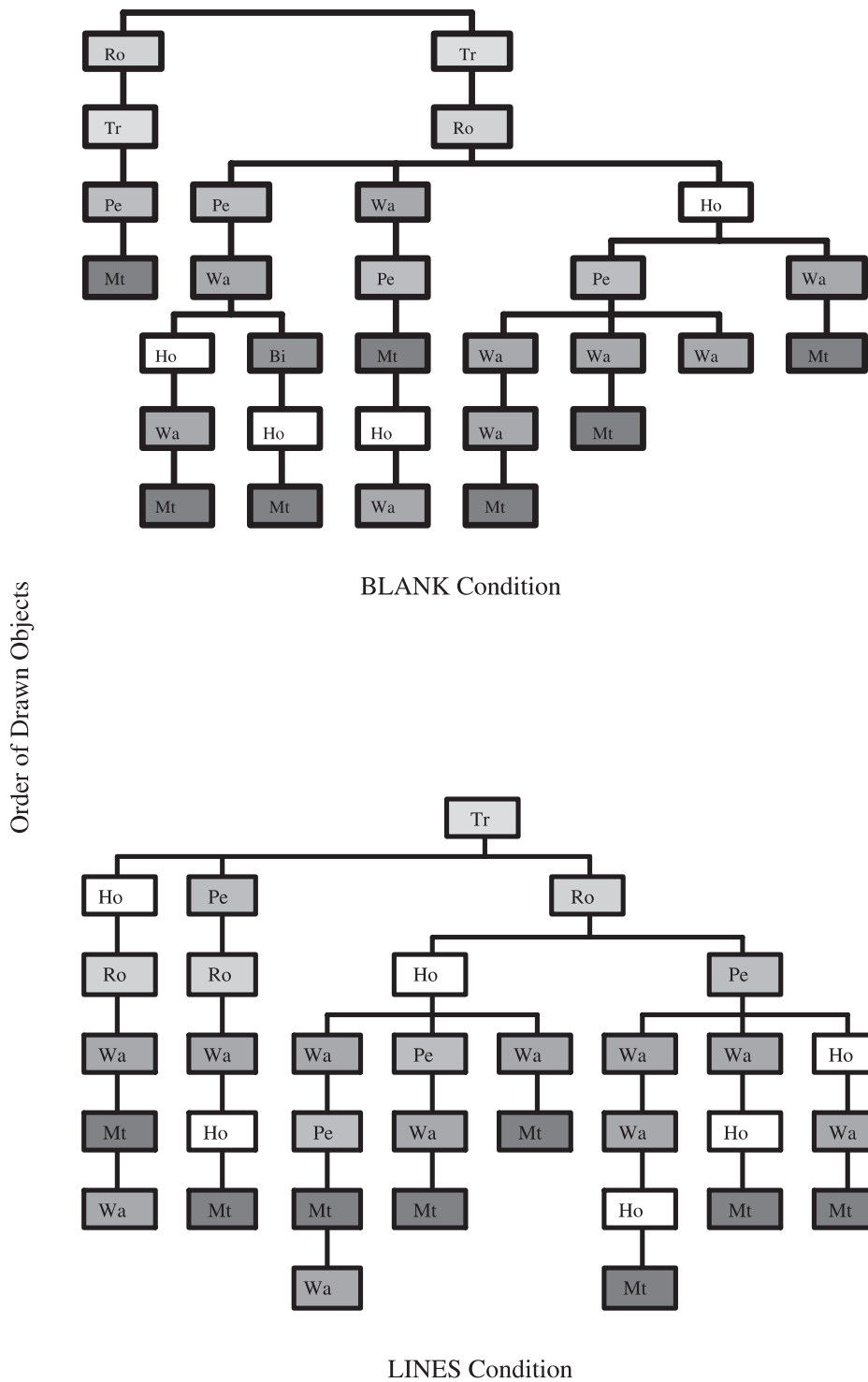
Figure 3. *Contents and order of the objects in the pictures in the field experiment. Tr = trees, Ro = rocks, Pe = people, Wa = water, rivers, lakes, boats, bridges, Ho = houses, Bi = birds, Mt = mountains.*

Figure 4. *Picture in the BLANK condition (upper) and picture in the LINES condition (lower). These paintings were drawn by Mr. K for the experiment. The painter has the copyright of these paintings. Mr. K grants the publisher of Creativity Research Journal the permission to reprint these paintings.*

Table 2. *Differences Between the BLANK Condition and the LINES Condition*

Measures	BLANK Condition		LINES Condition		
	M	*SD*	*M*	*SD*	*p* of *t* Tests
Time of drawing (sec)	640.13	170.91	1050.38	199.40	< .01
Number of drawing cycles	30.0	8.80	43.5	4.92	< .01
Time of one cycle (sec)	23.3	7.50	25.5	6.85	*ns*

Table 3. *Factor Loadings for the Impression of the Paintings*

Item	Good Composition I	Liveliness II	Simplicity III	Communality
Nonmodulated—Modulated	**.70**	.27	.05	.57
Unfocused—Focused	**.80**	.11	.13	.67
Ill-balanced—Well-balanced	**.80**	.11	.16	.67
Poorly composed—Well-composed	**.79**	.07	.15	.66
Dull—Lively	.13	**.86**	−.03	.75
Dynamic—Static	.06	**−.65**	.28	.50
Nonenergetic—Energetic	.20	**.85**	.13	.77
Powerless—Powerful	.42	**.62**	−.31	.65
Mixed up—Clear cut	.56	−.15	**.63**	.72
Complex—Simple	.29	−.16	**.62**	.49
Crowded—Relaxed	.37	.20	**.70**	.67
Heavy—Light	−.15	−.18	**.75**	.62
Proportionate variance contributions	.410	.319	.271	

Note. The factors were extracted using the principal-factor method and rotated by varimax rotation.

Creating from random lines, I have to incorporate the others' world into my world … I have to use them with my lines … Seriousness! I enjoy playing this game in earnest. There is not just myself. I get serious about drawing in this way. Yes. I am highly motivated with this way.
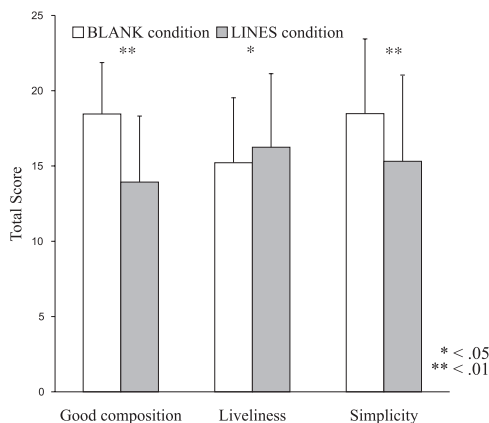
Thus, these lines seem to create new constraints for his drawing and force him to create new styles. This finding is important when we consider the nature of creativity. Previous studies have shown that people tend to adhere to the central properties of known con-

Figure 5. *Mean scores of three factors (good composition, liveliness, and simplicity) in BLANK (n = 160) and LINES (n = 160) conditions. Error bars represent 1SD.*

ceptual structures when trying to create new things (e.g., Ward, 1994; Ward & Sifonis, 1997). That is, people tend to have difficulty in crossing the boundary of an ordinary concept to create new products. However, as shown in this study, a professional artist seems to adopt a strategy for boundary crossing such as using others' lines, and Mr. K also developed an awareness of the importance of doing so for creating new styles.

Roles of Hand Movements in Drawing Processes

From our observations in this field study, the authors also noticed that Mr. K moved his brush in the air very often before he actually drew any lines on paper. This kind of hand movement is not unique to this painter. For example, Henry Matisse moved his brush in a similar way in the video, "Matisse: Voyage" (1987). The hand movement might have some important roles for drawing a picture.

Although researchers have not focused on such physical activity in studies of creative cognition, there is a study of hand movement to understand the relationship between cognition and body movement. Sasaki and Watanabe (1983) found that, when writing Kanji characters, Japanese people often moved their fingers in the air. They interpreted this phenomenon to mean that people use their body to remember Kanji Characters. Thus, it would be reasonable to hypothesize that moving in the air would have some important func-

tions, not only when writing Kanji characters, but also when drawing pictures.

The authors identified the timing of when Mr. K moved his brush in the air to investigate the role of the movement in his drawing. The cycles of drawing that we mentioned were divided into three sections to identify the timing of his brush movement in the air. The first section, *beginning* section, was from his soaking the brush in the Chinese ink plate until just before putting it on paper. The second section, *middle* section, was from his starting to draw until finishing. The final section, *ending* section, was from his lifting up the brush from the paper until just before soaking it in the ink plate. Then, the number of brush movements in the air was counted for each section.

The following coding scheme was used to identify brush movements. If the painter moved his brush more than once in a circle in the air, except for changing the posture of holding his brush or moving the brush from one place to another, the movement was identified as drawing in the air.

A main coder coded the drawing processes of all 16 pictures. After being taught this scheme and practicing coding independently, another coder coded one picture. The consistency between two coders was 90%. The percentage of intracoder consistency of the main coder was 96%.

Table 4 shows the mean number of drawing in the air movements, and the percentage in each condition. Although the frequency of drawing in the air in the LINES condition was higher than in the BLANK condition, the percentage of drawing in each section was about the same between the two conditions. In the beginning section, the percentage of the drawing in the BLANK condition was 60% and that in the LINES condition was 56%. In the middle section, the percentage of drawing in the BLANK condition was 35%, whereas that in the LINES was 36%. This indicates that Mr. K often drew in the air at the beginning and middle of drawing cycles. Thus, it would be reasonable for us to assume that drawing in the air has some im-

Table 4. *Percentage of Drawing in the Air in Three Different Sections*

Condition	Beginning Section (%)	Middle Section (%)	End Section (%)
BLANK	19.1 (60)	11.0 (35)	1.5 (5)
LINES	29.0 (56)	18.5 (36)	4.0 (8)

portant functions in drawing processes, because they occur before he actually draws on paper.

Next, we focused on the relation between pauses and hand movements. The percentage of pauses with hand movement in the BLANK condition was 59%, whereas that in the LINES condition was 86%. This suggests that he often moved the brush in the air to think about drawing plans to incorporate lines into his picture. Furthermore, in the LINES condition, the percentage of pauses with hand movement when he added onto others' lines was 97% and when he drew without adding lines to others' lines it was 59%. These results suggest that, by moving the brush in the air, he generated a mental image to facilitate incorporating others' lines.

To further investigate the function of the hand movement, the authors interviewed him about his drawing process while showing a video record of his drawing a Sansuiga picture. While watching a part of the videotape in which he was drawing in the air, he said to us,

> I might be checking how I feel when I touch the brush. Umm. Is this my habit? I always do this, don't I … I may move my hand in the air to rehearse my brush stroke … I always draw in the air before starting to draw on the paper. This seems to be my habit, doesn't it? Although I do not draw any actual objects on the paper, through drawing the form in the air, I can judge if the balance of the objects is OK. I have never realized my habit before you pointed it out. But, now I noticed it. Because I cannot redo the lines once it is put on the paper, I move my hand in the air before drawing. I knew I draw in the air. But, I have never thought about the reason of the hand movements. Since you asked me, I realized it. By drawing in the air, I probably judge how it is like if I draw a line around here.

This quotation tells us that he probably moves his hands to plan how to use his brush, and actually draw the image of objects in his mind. This is a quite reasonable candidate function of this hand movement. But, we need to be careful before making any conclusions on this issue based on the data from this field study. It would be, however, worth proposing some plausible hypotheses for future research. At this moment we propose the following three functions as plausible candi-

dates: First, by drawing in the air, the painter decides *where* to put the brush on the paper. We call this *positioning*. Second, the painter rehearses his brush movement so that he can draw smoothly. This is related to *how* to draw. We call this *rehearsal*. These two functions are related to implementing an image in the painter's mind onto the paper. Third, by drawing an object in the air, the painter generates a mental image of *what* he plans to draw next. We call this *image generation*. This function is related to generating an image based on what was drawn on the paper. If all of these functions take place in drawing, it would mean that body movements such as drawing in the air connect two essential activities in creative drawing: generation of image in one's mind and generation of image onto the paper.

General Discussion

In this article, we tried to answer the question, "How does an artist create his or her work?" We described three features of a Suibokuga painter's drawing processes.

Feature 1: The painter starts drawing with a local image of the picture. Then, he gradually forms a global image as he draws each part one by one.

Feature 2: Based on his knowledge and skills, he draws pictures in a fairly patterned way. However, random lines that the audience drew can create new constraints for his drawing and force him to create new style of pictures.

Feature 3: Drawing in the air seems important and may have the following functions: Positioning, rehearsal, and image generation.

In the rest of this article, we discuss three issues related to our findings.

On the Process of Artistic Creation

This study focused on a traditional art, Chinese ink painting (Suibokuga). Mr. K is an experienced artist in this field. He has an enormous amount of knowledge and skills in this painting style (see Takagi [Yokochi], 2001). The knowledge and skills, accumulated over years of expertise, enable him to create artwork fairly

quickly and smoothly. It seems that each brush of drawing evokes a local image of Suibokuga in Mr. K's memory. He creates his pictures combining those images based on certain rules that he learned from books or from his own experience. Like Monet, who painted series of water lilies for 30 years, the painter creates a series of artwork around the same concept. Although each work is a new creation, making similar artwork requires routines.

This is similar to the case of Jazz improvisation (e.g., Bailey, 1992; Johnson-Laird, 1988, 2002). Although playing improvisational Jazz may seem to require the constant creation of new musical patterns, Jazz players actually use limited patterns and combine them using certain rules to produce Jazz music.

This process is highly effective when producing certain kinds of artwork. However, artists often become bored while producing similar works repeatedly. When bored, artists want to try something new to stimulate their artistic motivation. In this Suibokuga painter's case, the method of asking the audience to draw random lines and then incorporating them into his own picture is one such example. Creation of new patterns in artistic works can emerge through artists' intentional manipulation of constraints in a creation process. The present authors found that, even in the case of traditional art, artists sometimes conduct this kind of manipulation intentionally.

We acknowledge that drawing processes could be different depending on the type of art. The authors are not claiming that all types of art have similar processes. In the processes of creating traditional Sansuiga pictures, the mental image of the picture is gradually formed as the actual drawing on the paper progresses. It is possibly because this kind of traditional painting is relatively well structured, and room for new patterns is fairly limited. A painter evokes images of objects to draw, based on a search of his memory triggered by the current status of the picture. We need further research to investigate how far this finding can be generalized to other types of artists.

On the Role of Body Movement

Artistic creation requires hands-on activities. Just having an image or a concept is not enough. To implement an image or a concept into actual artwork, an artist needs to use his or her body. Sasaki and Watanabe

(1983) suggested that people imagine the figure of Kanji characters by moving their hands in the air. They claimed that this hand movement has two types of cognitive functions: imagining the figure of Kanji characters and externalizing the processes of thought. This means that this hand movement controls processes of consciousness. Also, researchers of gestures have argued that gesture and body movement in a conversation advance speech (e.g., Kita, 2000; Krauss, Chen, & Chawla, 1996; McNeill, 1992). Body movement in artistic creation, such as moving a brush in the air, seems to play a similar role. By drawing in the air, the painter may decide where to put the brush on the paper, rehearse his brush movement so that he can remember how to draw, and generate a mental image of what he plans to draw next.

His body movement was also important for effective problem space search. When he drew the picture in the temple, he often went back and forth to coordinate his image and actual drawings on the paper. Also, he occasionally covered the picture in progress with his hands to narrow down the space of focus. That is, he limited the drawing space such as to make planning or monitoring the picture easier. It seems that he used his body to constrain his search for drawing plans and images. Thus, we could say that artistic creation is a highly embodied process.

On the Research Method

The interview data suggest that the painter was not fully aware of his hand movements as he was drawing. If we had only used interviews without analyses of video record of his drawing process, we could not have uncovered this phenomenon. Thus, this finding supports our claim that careful process analyses have unique roles in addition to questionnaire surveys or interviews to gain better understanding of artistic creation processes. As we mentioned, unlike laboratory experiments or questionnaire surveys, field studies are difficult in terms of control of variables and collecting sufficient data for statistical analyses. However, field studies have strong advantages in proposing new hypotheses or offering useful insights with high ecological validity. We think that potential role of constraints and body movements are two such findings. In future research, taking these advantages and disadvantages into consideration, it would be useful to adopt a multimethod approach, integrating interviews, video analyses, experiments, and so on, to study artistic creation processes.

In the study of problem solving, the think-aloud method has been used to reveal cognitive processes (e.g., Anzai & Simon, 1979; Okada & Simon, 1997), even in the study of creativity (e.g., Khandwalla, 1993; Ruscio, Whitney, & Amabile, 1998). Those studies uncovered the processes of creative thinking by using tasks, such as a divergent thinking task, and a collage-making task, that were relatively suitable for verbalizing thinking processes. In these cases, the think-aloud method was effective to collect rich process data.

However, Ericsson and Simon (1984) pointed out that visual thinking processes could be affected by thinking aloud in certain occasions, such as visual problem solving. In fact, Mr. K was not able to verbalize his thoughts well while drawing Sansuiga paintings when he was asked to do so. He said, "It is difficult to speak during drawing … It's so difficult … I may not be thinking consciously what and where to draw," and cleared his throat nervously to speak again and again. Studies of verbalization with visual cognitive tasks have indicated that verbal recall reduced access to nonverbal knowledge (e.g., Schooler, 2002; Schooler & Engstler-Schooler, 1990; Schooler, Fiore, & Brandimonte, 1997; Schooler, Ohlsson, & Brooks, 1993; Lloyd, Lawson, & Scott, 1995, Ward & Sifonis, 1997). Furthermore, Schooler, Fiore, and Brandimonte (1997) speculated that the negative effect of verbalization might be greater for nonverbal experts than verbal experts. As an expert of Chinese ink painting, it seems that his drawing activities are highly automatized so that he can create his pictures very smoothly and quickly. Therefore, it was very difficult for him to verbally talk about his processes while drawing. It was only when he failed to draw a part of his drawings that he was able to talk aloud.

Thus, in this study, right after his drawing a Suibokuga painting, and showing a videotape record of his drawing, we asked Mr. K to remember what he was paying attention to when drawing. Mr. K was interviewed about his drawing process each time he started drawing a new object. Although there is concern about reliability of the introspective reports (e.g., Ericsson & Simon, 1984), we used this introspective data to support and interpret the findings with the be-

havioral data from the observations and the field experiment.

Conclusion

Overall, using a multimethod approach, this study generated hypotheses regarding artistic creation processes, and found intriguing results. One of the features of drawing processes was found to be consistent with previous studies on architectural design processes (e.g., Dorst & Dijkhuis, 1995; Schon, 1983). As the design studies research indicated, we also discovered that the painter gradually formed mental images while creating artwork. In addition, this study also indicated the importance of the role of constraints and body movement (e.g., drawing in the air) for artistic creation. To uncover potential similarities and differences between traditional and contemporary arts in an effort to generalize our hypotheses, the authors are currently conducting further studies regarding creative processes of Japanese contemporary artists.

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