Creative Process of Improvised Street Dance

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Abstract

This paper presents findings from our empirical study of the creative process of improvisation, which has rarely been the subject of research in cognitive science. In this study, battle scenes in street dance were selected as an example of improvised performances. We conducted an experiment to investigate real-time cognitive processes. The results indicated three features: 1) Dancers mainly used well-practiced patterns, and discovered new patterns of dance; 2) In the process of discovering new patterns, dancers often utilized errors in their performance; 3) The processes of discovery were different in the performance of one dancer (solo scene) and the performance of two dancers (battle scene). In solo performance, dancers discovered new patterns by concentrating on their patterned dance. In battle performance, dancers discovered new patterns by utilizing stimuli from the situation (e.g. the music, their opponent) and using errors as an opportunity to loosen the constraints of their well-practiced patterns.

Keywords: Improvisation; Street dance; Personal discovery; Utilizing errors; Battle scenes

Introduction

Improvisations such as jazz or improvisational dance or drama are complicated human activities which seldom become research subjects in cognitive science. However, improvisations are thought to be the origin of many activities in the arts (see Bailey, 1980). The moment when a person gains new ideas is considered to be related to improvisational patterns (Pressing, 1984). Based on these suggestions, improvisations are thought to be a core element in human creativity.

Features of improvisational activities

Most previous studies dealing with improvisation have investigated jazz music (e.g., Mendonça & Wallace, 2004; Tayanagi, 2010; Weisberg et al., 2004). Mendonça & Wallace (2004) investigated the duo performance of jazz musicians, and suggested that musicians use some fixed patterns in improvisation. They also suggested that a musician utilizes the music of the other musician as a guideline for his own musical performance.

Weisberg et al. (2004) examined records of the improvisations of professional jazz musicians, and suggested that they often utilized specific formulas (50-90% of each performance) in their performances.

Tayanagi (2010) investigated the literature and the biographies of professional jazz musicians theoretically, and claimed that accepting inevitable errors in performance and utilizing these errors is very important for innovation and the production of new patterns in jazz music. This suggestion is consistent with the claim of Pressing (1984).

Bailey (1980) investigated the cognitive process of improvisation by interviewing professional musicians in many genres of music. Based on anecdotal evidence, he suggested that there are differences in music between improvisations by one person and improvisations by multiple persons.

From these suggestions, we could summarize the features of improvisations as follows. 1) Performers use fixed-patterns. 2) Performers utilize the errors which are inevitably generated to make new patterns. 3) The number of person participating in the improvisation makes some difference.

Personal discoveries of new ideas in improvisations

In this study, we investigated the process of improvisational activities, paying special attention to "personal discoveries". "Personal discovery" is defined as the discovery of new ideas, expressions or techniques occurring in creative activities, which the performers (creators) did not envisage prior to these activities. This concept mostly focused on the cognitive process of creators, and from this point of view, personal discovery is strongly related to Psychological Creativity (creativity which results in processes or products that are new and useful to the creators themselves), as Boden (1991) suggested. The personal discovery in dance is a movement which may not be new in a general sense, but is new to the dancer performing it. Many researchers have suggested that unpredicted findings like personal discoveries play important roles in creating new products or making scientific discoveries (e.g., Dunbar, 1993; Suwa & Tversky, 1997). In the case of improvisations, personal discoveries also play important roles when creating new products, expressions or techniques which performers did not envisage in advance (Bailey, 1980). In this sense, improvisation involves personal discovery as its core.

Breakdance as an improvisational activity

This study deals with the battle scenes of breakdance (a major genre in street dance) as an example of improvisation. Breakdance first appeared in Manhattan in the late 1970s, and has spread widely around the world. This dance consists of four patterns: entry (dance in a standing position), footwork (dance performed on the floor), power moves (dance with acrobatic movements like rolling), and freeze (dance poses held in acrobatic positions) (OHJI, 2001). In the battle scenes, dancers stand facing one another and perform their improvisational dance for 30-40 seconds in turns. Dancers in break dance have to perform while listening to unfamiliar music, communicating with an opponent, and responding to the dance of the opponent. Hence, the battle scenes of breakdance are highly improvisational. Therefore, it is appropriate to use battle scenes as the object of research into improvisational activities.

Purposes of this study

This study investigates the cognitive processes of dancers in battle scenes of breakdance, which are considered to be an example of an improvisational activity. Specifically, we focus on three questions based on the findings of previous studies: 1) How often are fixed patterns of dance used? In previous studies, it has been hypothesized that fixed patterns are used in improvisation more than 50% of the time. 2) Do dancers utilize the errors which are inevitably generated in improvisational dance to find new patterns of dance movements? If so, how do they utilize these errors? 3) Are the improvisational activities of a solo dancer different from the improvisational activities of multiple dancers? In order to answer these questions, we conducted an experiment with dancers.

Methods

Participants

Fourteen semi-expert dancers participated in this experiment (mean age 24.5 (*SD*=3.8), mean experience 6.5 years (*SD*=4.4)). The level of skill of the dancers was evaluated from the following two aspects: the acquisition and use of the basic skills required for the four patterns of dance, and the acquisition and use of advanced skills relating to power moves (highly skilled movements). The evaluation was conducted by the first author using a videotape recorded during the experiment. As a result of this evaluation, we found that all the subjects had advanced levels of skill in addition to the basic skills of breakdance and were able to perform various patterns of movements in breakdance.

Procedure

In this experiment we set two conditions, the solo scene condition and the battle scene condition. The only difference between the solo scene and the battle scene was that there was no opponent (dance partner) and so no dance by an opponent in the solo scene. This solo condition was set to investigate question 3, relating to differences arising from the number of persons. Both scenes used the same music (Bomb the Bass, "Megablast"). The experiment was conducted in one room of the gymnasium of the university. The room size was 14.4 x 14.5 meters. The performances were recorded on video.

This experiment consisted of three different sessions: 1) Preparative session (explanation of experimental procedure and warm up); 2) Performance session; 3) Post-performance session (dancers' reflections on their own movements and thoughts during the dance performances).

1) We explained to the participants the outline of this experiment, i.e., the design of the experiment (two independent variables, solo scene and battle scene), and the resting time between the two sections. Then, we told the subjects to take about 30 minutes to warm up.
2) Each dancer performed the solo or the battle scene. For each scene, the dancers performed for about 30-40 seconds and then took a 30-40 seconds interval (in the solo scene, they just waited without dancing, and in battle scene, they watched the opponent dancing). They repeated this set three times. Music was continually playing during each scene. Just before the performance, we explained to the dancers the details of each scene (three sets of dances and intervals), and asked them to perform naturally as in a usual battle scene. For the solo scene, we instructed the dancers to perform as if it were a battle scene, pretending there was an opponent.
3) We asked the dancers to reflect on their dance performances and report their thoughts during the dance (Figure 2). First, the dancers watched videos of their dance performances, and they segmented their dance movements into meaningful units. Then the dancers evaluated each dance segment using a creativity score (novelty and dexterity), and reported what they were thinking while dancing each segment.

We conducted these three sessions for one scene (solo or battle), took a break of about an hour, then repeated sessions 2 and 3 for the other scene. The order of the scenes was counterbalanced.

Outline of analyses

In this study, we analyzed the processes of improvisation with three sets of data: 1) Creativity score of dancers (self-evaluation); 2) Self-report of cognitive process by dancers (report of thoughts): 3) Categorization of dance movements based on the usage of the four types of movements (categorization of dance movements).

1) We used the data from the creativity scores of dancers. Through the use of these data, we aimed at investigating the features of dance movements from the dancers' own viewpoints. The objects of the creativity score (novelty[1] and

[1] This consists of 3 rating scores: Dance 1) is well practiced; 2) is not well practiced, but has been performed before; 3) has never been performed. We used these scores because in the preliminary interviews with other dancers, the dancers told us that to judge the

Table 1. Mean number and percentage of dance movements corresponding to each novelty score (sum of three trials)

Scene	*Score 1 (well-practiced)*	*Score 2 (not well-practiced, but has been performed before)*	*Score 3 (has never been performed)*
Solo	8.2(4.64) 66%	3.1(2.88) 25%	1.1(1.41) 9%
Battle	8.1(4.95) 66%	3.0(1.66) 25%	1.1(1.29) 9%

Table 2. Mean number and percentage of dance movements corresponding to each dexterity score (sum of three trials)

Scene	*Score 1 (very poor)*	*Score 2 (poor)*	*Score 3 (moderate)*	*Score 4 (good)*	*Score 5 (very good)*
Solo	1.64(1.60) 13%	3.36(1.22) 27%	4.64(3.05) 37%	2.29(2.27) 18%	0.57(0.94) 5%
Battle	2.00(2.18) 16%	3.50(2.03) 29%	4.29(2.92) 35%	2.00(2.25) 16%	0.43(0.85) 3%

dexterity[2]) were based on previous studies of creativity (e.g., Finke et al., 1992).

We summed up the data of the creativity scores and conducted statistical analyses. In addition, we identified dance movements with high creativity scores (2 or 3 for novelty and 4 or 5 for dexterity), and analyzed the data. These high-scoring dance movements reflect the dancers' personal discoveries, because they reported the new and useful movements that they had "discovered". By analyzing them, we were able to investigate the features of "personal discoveries" in each scene.

2) We used the answers to the question, "What were you thinking while you were dancing these particular movements?" in the report on cognition. In the analyses, we categorized the focus of consideration of the dancers while dancing and classified each statement according to the category. By analyzing what the dancers were giving their consideration, we were able to investigate the points about which the dancers thought deeply in each scene. In addition, we identified the statements about high-scoring dance movements which were thought to reflect their personal discovery, and analyzed them using these categories. By analyzing them, we were able to investigate the focus of consideration of the dancers when generating new patterns.

3) We used the data from the performances of the dancers (dance movements in performance sessions), and categorized them into the four types of breakdance. By comparing the number of movements of each type between the solo scene and battle scene, we were able to investigate the nature of dance movements in each scene objectively.

Results and Discussion

Before analyzing the details of the data, we compared the basic features of both scenes (the time of performance, the number of dance segments). We conducted a paired *t*-test on these data and found that there was no statistical difference between the two scenes (solo: 95.4 (23.26) [3] seconds, battle: 86.3 (16.52) seconds, t (13) =1.68, p=.12) (solo: 12.5 (5.07), battle: 12.2 (4.93), t (13) =0.75, p=.75) [4]

Creativity score of dancers

Novelty score (Table 1)

Using a sign test, we conducted a contrast analysis of each novelty score (score 1 - score 3) in the solo scene and the battle scene. As a result, we found that there were no differences between the two scenes (the *p*-values of scores 1, 2, 3 were p=.79, p=.58, p=1.00). Then we examined the number and percentage of each novelty score in each scene to determine which scores frequently appear. As shown in Table 1, there were high degrees of appearance of score 1 in both scenes. The percentages of score 1 are 66% in mean rate in both scenes. These results show that dancers mainly use well-practiced, somewhat patterned dance movements in improvisational activities.

Dexterity score (Table 2)

Using a sign test, we conducted a contrast analysis of each dexterity score (score 1 - score 3) in the solo scene and the battle scene. As a result, we found that there were no differences between the two scenes (the *p*-values of scores 1, 2, 3, 4, 5 are p=.79, p=.58, p=1.00, p=1.00, p=.63). Then we

practice level, a 3-point rating was much more suitable than a 5-point rating.

[2] This consists of five rating scores: Dance is: 1) very poor; 2) poor; 3) moderate; 4) good; 5) very good).

[3] In this study, we used the mean score which sums up the three trials in the performance session in each scene.

[4] These data have high degrees of *SD* and are thought to be out of Gaussian distribution. We conducted a sign test to eliminate the influence of individual differences. Analyses show the same results as the *t*-test (time of performance: p=.12, number of dance movements: p=.75). The reason why high degrees of *SD* appear seems to be as follows. Each dancer performs a trial using a subjective time scale acquired through his/her dance experience. Each one may have a different subjective time span. The sizes of chunks of dance that dancers think of as a dance unit may differ individually. Based on this supposition, we employed a statistical test that utilizes the comparison of each individual (like a sign test).

Table 3. Definition of the categories and mean number (sum of three trials)

Higher category	*Lower category*	*Definition*	*Solo*	*Battle*
A: Consideration of their own dance	a: Well-practiced dance movements	Dancers consider well-practiced dance	3.1 (2.57) 27%	2.4 (2.03) 21%
	b: New patterns	Dancers give consideration to new patterns of dance	0.6 (0.93) 4%	0.5 (0.76) 4%
	c: Dance composition	Dancers give consideration to the composition of their dance	1.6 (1.09) 10%	0.8 (0.70) 6%
B: Consideration of information about the situation	d: Music	Dancers give consideration to the music	2.5 (2.14) 19%	2.6 (2.34) 23%
	e: Opponent (partner)	Dancers give consideration to their partner	0.2 (0.43) 2%	1.7 (1.20) 14%
	f: Physical position	Dancers give consideration to their physical position	1.4 (1.28) 10%	2.1 (1.46) 16%
C: Consideration of other factors	g: No specific consideration	Dancers give no consideration to anything specific	2.3 (1.98) 21%	1.5 (2.35) 11%
	h: Other factors	Dancers give consideration to other factors	0.9 (1.10) 7%	0.5 (0.65) 5%

examined the number and percentage of each dexterity score in each scene. The results showed that scores 2 and 3 frequently appeared in both scenes. Hence, we are able to suggest that dancers mainly use dance movements which show similar dexterity to well-practiced dance movements.

Dance movements corresponding to personal discoveries

We identified high creativity scoring dance movements (2 or 3 for novelty and 4 or 5 for dexterity) and examined their rates of appearance in both scenes.

The results show that there are 14 high-scoring dance movements (8% of all the dance movements) in the solo scene, and 17 high-scoring dance movements (10% of all the dance movements) in the battle scene. Even in the short-time performances (80-100 sec.) in this experiment, dancers found new patterns and made personal discoveries. The result that there are high-rated uses of patterned dance movements indicates that dancers in improvisation mainly use patterned dance movements and gradually find new patterns through improvisation. To compare the rate of appearance between each scene, we conducted a sign test and found that there was no statistical difference (p=.51).

Consideration of dancers in performances

Analyses of statements about all dance movements (Table 3)

The κ coefficient was calculated by the first author and a researcher who did not know the purpose of this study, using about 20% of all the data, 70 dance movements, to check the reliability of the rating. The κ coefficient was 74.1%, which guarantees the reliability of the ratings. Using a sign test, we conducted a contrast analysis to compare the number of each category in the solo and the battle scenes. The results show that there were statistical differences in c) Consideration of dance composition, e) Consideration of the opponent, f) Consideration of the dancer's own physical position (p=.039, p=.003, p=.065). In the solo scene, dancers often think about the composition of whole dance movements. In contrast, in the battle scene, the dancers consider information about the situation (opponent, physical position).

We also compared the numbers and percentages in each category in each scene to determine frequently appearing categories. As shown in Table 3, in the solo scene, a) Consideration of well-practiced dance movements, d) Consideration of the music, g) No specific consideration, and in the battle scene, a) Consideration of well-practiced dance movements, d) Consideration of the music, e) Consideration of opponent, f) Consideration of the physical position appeared more frequently than other categories. Thus, we conclude that in the solo scene, dancers think about well-practiced dance movements or the music, and construct performances considering the whole composition of their dance movements. In contrast, in the battle scene, dancers consider the situation (music, opponent, physical position) more closely than their own movements. The reason why these differences were shown was as follows. Since in the solo scene with no opponent, dancers did not have to communicate with the opponent, they could concentrate on their own performance. However in the battle scene, dancers need to communicate with the opponent and to deal with changes in the situation (OHJI, 2001), so they concentrated on information about the situation. We describe the details of these processes below.

Analyses of statements about dance movements corresponding to personal discoveries

Table 4. Example statement about the process of personal discovery in a solo scene

S171: Why did you rate this dance as novelty score 2?
G173: What should I say? I did an uprock in this dance. Usually, I don't perform this movement a lot.
S172: Is that this movement? (Watching the video).
G174: Yes. Because of this movement, I rated this dance as score 2.
S173: Why did you suddenly sit down? When you performed this movement, what were you thinking?
G175: I thought that in trial 1 or 2, I had danced in a standing position a lot, and I didn't do a move like sitting down. So I did this sitting movement in trial 3.
S174: So was this a movement which you tried to do intentionally?
G176: Yes, I decided on it just before the movement.

Table 5. An example statement about the process of personal discovery in a battle scene

S141: Do you usually find new patterns in a battle scene?
B144: I usually don't use only fixed patterns. When performing, I just think what techniques (movements) I should use next. So, that was it. I just wanted to do a short one. I also thought that I would use free and flexible dance movements in the rest of the performance. I'm always ready for freeze movements anytime when it's necessary.
S142: So, do you dance with flexible combinations of movements when you dance freely?
B145: Yes, I always use flexible combinations, maybe. However, even in those combinations, I might have a tendency to use some particular combinations of fixed patterns.
S143: What do you think about this dance in terms of your tendency?
B146: This dance is not in keeping with that tendency. It goes against the tendency. T (the opponent) might have thought that this dance looked great.
S144: Why do you think you performed dance in this way?
B147: Hmm, my physical position after doing Trax[5] in that situation was probably a little different from the usual one. I didn't think of anything when performing.
S145: You didn't think of anything during the performance, but the physical position was different from usual.
B148: It's different, but maybe the music is one of the factors that caused it.

In this section, we focus on the objects of consideration of dancers in personal discoveries by analysing the data of high creativity score dance movements. Because of the low number of corresponding dance movements, we could not find a statistical difference between the two scenes. However, the results suggest that c) Consideration of composition, d) Consideration of the music, and g) No specific consideration frequently appeared in the solo scene (numbering 4 dance movements, 5 dance movements, 4 dance movements, out of a total of 14 dance movements). In the battle scene, d) Consideration of the music, e) Consideration of the opponent, f) Consideration of physical position frequently appeared (respectively, 8 dance movements, 3 dance movements, 4 dance movements, out of a total of 17 dance movements). From these results, we conclude that dancers consider their dance movements and make personal discoveries in the solo scene, while dancers in the battle scene consider information about the situation more closely and make personal discoveries.

Besides these implications, two statements (Table 4, 5) about personal discoveries suggest that in the solo scene, dancers considered the context of each dance movement, and intentionally made new patterns of dance movements. In contrast, in the battle scene the dancers tried to consider the situation, and deal with changes in the situation. However, they were able to make use of only limited patterns of well-practiced dance movements. Failure in dynamical dance movements such as power moves (one of the four core patterns in breakdance) leads to a loosening of the restrictions of the patterned dance movements, and the dancers are able to find new patterns.

Differences between the solo scene and the battle scene

We investigated the reasons why differences between the solo scene and the battle scene existed. One participant clearly mentioned how the two scenes differed (Table 6). In the solo scene, which had no opponent, dancers tended to perform well-practiced dance movements, not to fail and to arouse the audience, and they concentrated on their own performance. In contrast, in the battle scene, the dancers had to consider the improvisational communications with their opponent, which were thought to be an important factor in the battle scene, and they tried to think about the information (music, opponent) and to perform dynamical, impressive dance movements such as power moves.

Features of dance movements in each scene

We conducted a contrast analysis to compare the features of dance movements in solo and battle scenes in terms of the frequency of the four types of movement. The results of the sign test show that there were statistical differences in entry (dance movements in a standing position) (solo scene: 42.4 (22.18) seconds, battle scene: 33.3 (12.18) seconds) and power moves (dance with acrobatic movements like rolling) (solo scene: 15.1 (13.5) seconds, battle scene: 17.5 (10.55) seconds) (p=.057, p=.092). These results suggest that dancers perform dynamical movements (like rolling or

[5] One of the dance movements which is categorized as a power move.

Table 6. An example statement about the difference between the two scenes

M94: In the battle scene, I usually compose my dance movements, taking the situation of the place into account, while watching the dance of opponent. But in the solo scene, since I'm used to performing in public, I use well-practiced and skilled dance movements.
S94: You use mainly well-practiced dance movements?
M95: Yes, it was so in the solo scenes. In the battle scene, I wanted to pay more attention to my partner.
S95: What do you think makes this difference between the two scenes?
M96: Partners are an essential part in battle scenes. Communication with the partner is important and an interesting aspect of the battle scene. A dancer who is good at that communication looks cool, I think. In the solo scene, however, to be applauded is important, and I want to give a skilled performance to accomplish it. So I tend to use well-practiced dance movements.

jumping) more frequently in the battle scene. This result matches with the inference of the previous section, which suggested that dancers considered the opponent and tended to perform dynamical dance movements more frequently in the battle scene.

General Discussion

This study has investigated the cognitive processes of dancers in improvisational activities such as the battle scene of breakdance, focusing on personal discoveries. The results have shown the following three findings. 1) Dancers mainly used fixed patterns of dance movements (about 60-70% of the whole dance) and gradually found new patterns of dance movements in improvisational activities. 2) By failing in dynamical movements, they were able to loosen the constraints of fixed patterns of dance movements, and found new patterns. 3) The processes of personal discovery (finding new patterns) varied with the presence of an opponent (partner). With reference to point 3, the following two processes have been revealed. In the absence of an opponent, the dancers thought about their own dance movements, and found new patterns by considering carefully the composition of their dance movements. In presence of an opponent, dancers considered the information about the situation (such as the music, opponent), and tended to perform dynamical dance movements more frequently. Then, when failing in these dynamical movements, they had to continue their performance from the present physical position that was different from their dominant (fixed) patterns, and they were able to find new patterns that were beyond fixed patterns.

This study has contributed new and clear findings about the features of improvisation based on the findings of previous studies (e.g., Mendonça & Wallace, 2004; Pressing, 1984; Tayanagi, 2010). Through a concrete example, we describe the process by which dancers utilized errors to make new movement patterns, relaxing the constraints of their fixed patterns. In addition, we have focused on the original aspect of "the differences between improvisational activity of one person and that of multiple persons". The fact that there are differences between solo and collaborative activities has been suggested in many domains, especially in the domain of creativity (e.g., Okada & Simon, 1997, in scientific discovery). However, there has been no clear suggestion of these differences in the domain of improvisation. This study contributes original insight into the domain of improvisation.

In order to acquire more detailed understandings of improvisation, further studies are needed to solve problems such as the problem of generalization and research method.

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