# Deliberate Practice Revisited: Complexity and Creativity in the Practice Process in Breakdance

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**Abstract**

This study investigated the longitudinal process of practice by an expert dancer in breakdance. We examined the ability of the concept of "deliberate practice" (Ericsson, Krampe, & Tesch-Römer, 1993) to provide a full account of the practice process of an expert dancer. We conducted a fieldwork study to observe the practice of expert dancers under natural conditions, and analyzed data gathered from video and interviews for the progress of a dancer's proficiency at a particular skill with respect to the following three points: number of rotations in the skill, contents of the skill, and purposes of the skill practices. Results indicated that the practice process involved not only refining the quality of the skill, but also two other activities: the exploration of new and original skills utilizing the characteristics of that skill, and choreographing that skill so that it could fit into his full performance. The practice process of experts is a complicated and creative one, which cannot be sufficiently explained by the concept of "deliberate practice" alone.

**Keywords:** breakdance; deliberate practice; skill acquisition and learning; creativity; fieldwork

## Introduction

### Deliberate practice

How do experts in domains of physical expression, such as dance, develop original and outstanding performance? Many studies in cognitive science have focused on practice in various domains like chess, music, and sports, and identified processes important to developing expertise (Ericsson, Krampe, & Tesch-Römer, 1993; Oura, 1996; Schön, 1983). Among the identified processes, "deliberate practice" has been identified as the most important to improving one's skills (Ericsson, Krampe, & Tesch-Römer, 1993). Ericsson and Lehman (1996) pointed out that, often alongside immediate feedback from coaches or teachers, people gradually develop expertise through engaging in many years of practice that is carefully structured with the aim of progressively mastering appropriate tasks. They named this "deliberate practice". Many researchers have studied deliberate practice in various domains such as games, sports, education, and piloting (Macnamara, Hambrick, & Oswald, 2014). For example, using multiple regression analysis, some studies have shown that deliberate practice has high accountability with respect to predicting the grades or ranks of learners (e.g., Charness, Tuffiash, Krampe, Reingold, & Vasyukova, 2005).

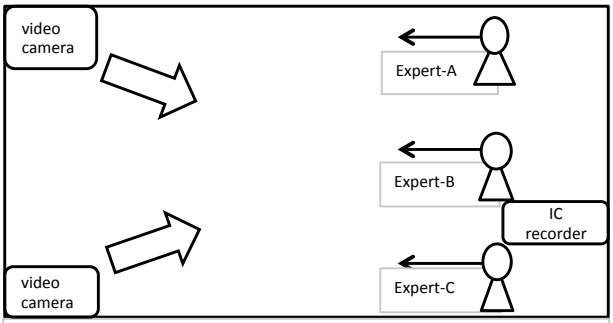
On the other hand, only a few studies cast doubt upon this concept regarding its generality. For example, Macnamara, Hambrick, and Oswald (2014) classified various domains treated in studies of deliberate practice based on predictability of the environment surrounding the task and investigated the accountability of deliberate practice. The study showed that in domains of low predictability (like team sports and piloting), deliberate practice poorly accounted for performance, with limited effect size. In addition, as discussed by Oura (1996) and Schön (1983), experts tend to acquire flexibility and adaptability in skill usage by reflecting and monitoring their practice as well as by gathering feedback to revise their solutions in environments with highly variable task demands requiring creative solutions. These studies suggested that in domains that have low predictability and need creative solutions, deliberate practice does not completely account for the process of developing expertise. As such, there seems to be different types of practice involved in low-predictability and creative domains.

### Goal of This Study

In order to capture such a process, we investigated the practice of expert dancers in the domain of breakdance, in which low predictability and the need for creative solutions are core features, using a longitudinal fieldwork method.

Breakdance is very popular in many countries these days. In breakdance, dancers need to perform impromptu, taking into consideration many uncertain factors such as co-dancers, audience, judges, and music played and changed by DJs (Shimizu & Okada, 2013a). Furthermore, criteria for evaluation are highly subjective and in competition settings are left in the judges' hands. Under such dynamic conditions, expert dancers need to create original and fascinating performances.

To capture such dynamic practice processes, we used a fieldwork method, involving participant observation and interview, especially focusing on the process of the




note: → shows the direction of dancers' eyes, ⇒ shows the direction of video cameras.

Figure 1. Layout of the scene of participant observation.

development of a particular skill. Although laboratory experiments would certainly be advantageous for controlling the conditions of observation, we thought that the laboratory setting was not suited to our goal. To account for the flexible and creative nature of expert practice in breakdance, we needed to observe expert practice sessions in a highly natural setting.

## Methods

### Participant observation

We conducted participant observation from July to November 2011 (14 practice sessions were observed resulting in about 40 hours of observation). The subjects of observation were three dancers who have won 1st to 4th prize in a breakdance battle tournament in Japan, each having about eight to nine years of experience in breakdance. Their practice sessions were recorded by two video cameras and an IC recorder (see Fig.1). In this study, we focused on footage of Expert-A, who practiced a particular skill many times (a total of 197 times).

### Interview of Expert-A

We also conducted a follow-up structured interview with Expert-A in March 2014 over about three hours. In the interview, Expert-A watched 197 video records of his practice of the particular skill and answered two questions in response to each records; one referred to the contents of each skill performance, and the other referred to the purposes of each skill practice. We recorded his interview with video cameras and an IC recorder.

### Coding by Expert-B

Furthermore, to code the content of the observational data of the skills of Expert-A, we asked another expert dancer (Expert-B) to view the video records for about three hours in May 2014. Like the interview of Expert-A, Expert-B watched the 197 video records of the practice of Expert-A, and identified the contents of the skill each time it was performed. We recorded his coding with video cameras and an IC recorder.

Figure 2. Pictures in which Expert-A performed I. N. with three rotations.

### Explanation of the skill

The skill we focused on in this study is called "Inside Ninety" (abbreviated "I.N." in this study, see Fig. 2). In this skill, established in the late 20th century, a dancer rotates their body in a one-handed handstand. Expert-A described that he was confident about his proficiency in this skill, especially in terms of ability to perform the number of rotations desired.

### Analyses

In this study, we analyze the process of skill practice from three points of view to investigate the flexible and creative nature of expert practice: 1) number of rotations in the skill, 2) contents of the skill performance, and 3) purpose of the skill practice. Some studies regarding skill practice emphasize that to fully capture the varied and complicated process of skill acquisition, indicators concerning only proficiency or smoothness of the skill are not sufficient (e.g., Haibach, Daniels, & Newell, 2005). We think that by analyzing the contents and purposes of the skill performances, the creative nature of expert practice can be uncovered.

**Number of rotations in the skill** We counted the number of rotations performed as part of the skill in each of the 197 video records as an indicator of the degree of skill acquisition. The first author, who has ten years of experience in breakdance, coded the number of rotations in each of the 197 videos with half-rotations as the minimum unit.

**Contents of the skill performances** Next, we investigated the contents of the skill in each trial to analyze its variations and development. Our previous study on breakdance skill practice (Shimizu & Okada, 2013b) showed that another dancer practicing a particular skill as part of a full performance tried to change various aspects of the skill, such as the preparation, main, and terminal parts of the skill. Based on these findings, we divided the I.N. into three parts (the point before the rotation, the point of rotation, and the point after the rotation), and identified the contents of each part. Firstly, the first author checked all 197 videos of Expert-A's practices and coded the contents of each performance of the skill. Then, he compared that data with the coding of

Table 1. Categories for the contents of the skill performances

| Number | Names | The contents before the rotation | The contents while rotating | The contents after the rotation | Number of practices |
|---|---|---|---|---|---|
| 1 | Basic style 1 | Footwork[a]⇒New York[a] | I.N. | Landing⇒Dropping[a]⇒Footwork | 25 |
| 2 | Variation before rotation 1 | Footwork⇒Jumping to the side⇒Closing both feet | I.N. | Landing | 1 |
| 3 | Basic style 2 | Toprock[a]⇒New York | I.N. | Landing | 102 |
| 4 | Variation after rotation 1 | Toprock⇒New York | I.N. | Landing on left elbow⇒Windmill[a] | 6 |
| 5 | Variation after rotation 2 | Toprock⇒New York | I.N. | Sliding right hand⇒Air baby[a] | 1 |
| 6 | Variation after rotation 3 | Toprock⇒New York | I.N. | Freeze with hand attached to back of feet[a] | 3 |
| 7 | Variation after rotation 4 | Toprock⇒New York | I.N. | Landing on left elbow⇒Windmill⇒Shoulder spin[a] | 3 |
| 8 | Variation after rotation 5 | Toprock⇒New York | I.N. | **Jumping on both hands⇒Landing[b]** | 4 |
| 9 | Variation after rotation 6 | Toprock⇒New York | I.N. | **Jumping on both hands⇒Max[a]⇒Landing** | 6 |
| 10 | Variation while rotating 1 | Toprock⇒New York | **I.N.⇒I.N. while jumping on one hand** | Landing | 6 |
| 11 | Variation before rotation 2 | Footwork⇒Jumping to the side⇒Landing on right elbow⇒Jumping up⇒Closing both feet | I.N. | Landing | 4 |
| 12 | Variation while rotating 2 | Toprock⇒New York | **I.N. while bending both feet⇒I.N. while passing through left foot** | Landing | 14 |
| 13 | Variation while rotating 3 | Toprock⇒New York | **I.N. while bending both feet** | Landing | 9 |
| 14 | Variation while rotating 4 | Toprock⇒New York | **I.N. while extending both feet** | Landing | 3 |
| 15 | Variation while rotating and after rotation 1 | Toprock⇒New York | **I.N.⇒I.N. while bending both legs** | Jumping on both hands⇒Max⇒Landing | 1 |
| 16 | Variation after rotation 7 | Footwork⇒New York | I.N. | Freeze while extending both legs | 1 |
| 17 | Variation while rotating and after rotation 2 | Toprock⇒New York | **I.N.⇒I.N. while bending both legs** | **Jumping on one hand⇒Landing** | 1 |
| 18 | Variation before rotation 3 | Donkey[a]⇒New York | I.N. | Landing | 5 |
| 19 | Variation before rotation 4 | Footwork⇒New York⇒Rotating by jumping⇒Closing both feet | I.N. | Landing | 2 |

a: Names of various movements in breakdance. As with number 4, 5, 7, 9 and 18, Expert-A actively combined I.N. and other movements in practice.

b: Bold and underlined items are contents with a close relationship with each other.

Expert-B to confirm coding consistency (consistency rate of 97.5%). Thus, we were able to capture the contents of the skill performances objectively. We then integrated similar categories and generated 19 coding categories (see Table 1).

**Purposes of the skill practices** We analyzed the purposes of Expert-A's skill practices to identify the intentions directing the practice. Similar purposes gathered from the interview data of Expert-A were integrated, generating five coding categories (see Table 2). We checked the reliability of our coding by asking a graduate student who

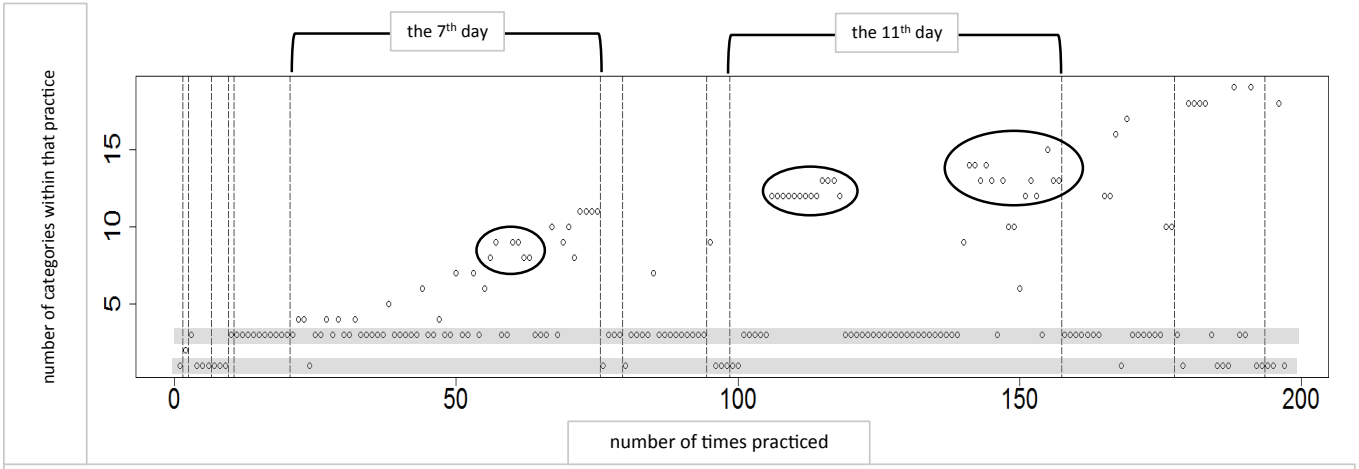



Figure 4. Longitudinal plot of the number of categories of the contents each time the target skill was practiced. The categories highlighted in gray indicate basic style 1 and basic style 3. The dotted lines drawn parallel to the vertical axis indicate the day number out of the total days of observation (1st-7th). The 7th day and 11th day are indicated at the top. The bold circles contain practices where Expert-A actively made reference to previous variations.

Figure 3. The variation of the skill performed by Expert-A（containing 12 categories of content variation). Expert-A bent his legs and rotated while holding his right foot with his left hand. While rotating, he put his left foot through the space between his left hand and right foot.

did not know the purpose of this study to code the data. The κ coefficient was 0.88 (consistency rate of 92.1% between the first author and the graduate student). However, the validity of this data is somewhat limited because the interview for Expert-A was conducted only after much time had passed since participant observation. Therefore, we mainly focused on the analysis of the contents of the skill performance, while trying to show the validity of this analysis by checking for consistency between the contents and the purpose of the skill performance.

## Results and Discussion

### Number of rotations in the skill

The maximum number of rotations improved gradually. For example, while only achieving 1 and 0.5 rotations in the 1st and 2nd practice respectively, Expert-A achieved 2.5 rotations in the 35th practice and 3 rotations in the 133rd practice. This shows that Expert-A indeed developed proficiency at this skill

Table 2. Categories for the purpose of the skill practices

| Number | Names of categories | Number of practices |
|---|---|---|
| 1 | Refinement of the quality of I.N. | 51 |
| 2 | Creating variations of I.N. | 92 |
| 3 | Confirming variations of I.N. | 12 |
| 4 | Choreographing I.N. to fit into the full performance | 30 |
| 5 | Both Category 1 and Category 2 | 6 |
| 6 | Other | 6 |

### Contents of the skill performances

We show the coding categories of the contents of the skill performances in Table 1[1]. This table shows that Expert-A conducted 17 variations of the skill. Furthermore, Expert-A changed various aspects of the skill, such as the point of rotation, and the specific contents before and after rotations (see Fig. 3). These results indicate that Expert-A conducted divergent and explorative practices to create many variations utilizing the established skill, “I.N.”.

Fig. 4 shows the number of times the skill was practiced (i.e., over time) on the horizontal axis (1st-197th) and the number of categories of the contents of each skill performance on the vertical axis[2]. This figure tells us that

[1] Expert-A stated that number 1 and number 3 were his basic (i.e. default) styles of the skill.

Table 3. Relationships between the contents of the skill performances and the purposes of the skill practices

| Contents \ Purposes | Refinement of the quality of I.N. | Creating variations of I.N. | Confirming variations of I.N. | Choreographing I.N. to fit into the full performance | Both of Category 1 and Category 2 | Other |
|---|---|---|---|---|---|---|
| Basic style 1[a] | 1 | 1 | 0 | **22** | 0 | 1 |
| Variation before rotation 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| Basic style 2 | **48** | 40 | 2 | 2 | 5 | 5 |
| Variation after rotation 1 | 0 | 6 | 0 | 0 | 0 | 0 |
| Variation after rotation 2 | 1 | 0 | 0 | 0 | 0 | 0 |
| Variation after rotation 3 | 0 | 1 | 1 | 0 | 1 | 0 |
| Variation after rotation 4 | 0 | 3 | 0 | 0 | 0 | 0 |
| Variation after rotation 5 | 0 | 4 | 0 | 0 | 0 | 0 |
| Variation after rotation 6 | 1 | 5 | 0 | 0 | 0 | 0 |
| Variation while rotating 1 | 0 | 4 | 2 | 0 | 0 | 0 |
| Variation before rotation 2 | 0 | 0 | 0 | 4 | 0 | 0 |
| Variation while rotating 2 | 0 | 14 | 0 | 0 | 0 | 0 |
| Variation while rotating 3 | 0 | 3 | 6 | 0 | 0 | 0 |
| Variation while rotating 4 | 0 | 3 | 0 | 0 | 0 | 0 |
| Variation while rotating and after rotation 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| Variation after rotation 7 | 0 | 0 | 0 | 1 | 0 | 0 |
| Variation while rotating and after rotation 2 | 0 | 1 | 0 | 0 | 0 | 0 |
| Variation before rotation 3 | 0 | 4 | 0 | 1 | 0 | 0 |
| Variation before rotation 4 | 0 | 2 | 0 | 0 | 0 | 0 |
| Total numbers of practices | 51 | 92 | 12 | 30 | 6 | 6 |
| Total numbers of variations in the contents | 4 | **15** | 5 | 5 | 2 | 2 |

a: The categories highlighted in gray are basic style 1 and basic style 2.

Expert-A gradually created many types of variations while simultaneously refining the basic style.

Furthermore, with respect to the chronology of the practice sessions, Expert-A started to make more variations after the 7th day. Also, as Expert-A engaged in further practice (see the 7th day and 11th day), he created many variations with reference to the variations he generated during preceding practices (see circled items in Fig. 4 and bold items in Table 1). These results indicated that Expert-A started to create many variations only after having sufficiently practiced the skill (in his case, after 7 days), and he created the new variations actively referring to previous variations.

### Purposes of the skill practices

We show the coding categories of the purposes of the skill practice in Table 2. Expert-A had multiple purposes intended for each practice, such as divergent practice (creating many variations utilizing the characteristics of the skill), convergent practice (refining the quality of the skill), and integrative practice (arranging the skill to fit into his full performance). This result is consistent with the results from the observations regarding skill content in the previous section, which indicated that Expert-A created many variations of the skill.

### Relationship between the contents of the skill performances and the purposes of the skill practice

As shown in Table 3, the data suggested that when Expert-A intended to refine the quality of the skill (convergent practice), he used basic style 2, whereas when his purpose was to integrate the skill into his full performance, he used basic style 1. When Expert-A sought to create many variations, he conducted 15 kinds of variations (see variations in the contents in Table 3). These results showed that the purposes and contents of the skill practices were related.

## General Discussion

This study investigated the practice process of an expert in a domain that has low predictability and requires creative solutions. We selected breakdance as the domain of study, and conducted longitudinal fieldwork. Based on our results, we uncovered two points.

[2] We adapted the Problem Behavior Graph (PBG) in Newell & Simon (1972) to create Fig. 4.

1: First, the expert engaged in not only convergent practice to refine the quality of the skill, but also divergent practice to create many variations utilizing the characteristics of the skill, and integrative practice to choreograph the skill to fit into his full performance.

2: Second, divergent practice was started only after prolonged practice. Furthermore, when the expert conducted divergent practice, he actively referred to and utilized the previous variations he had created.

These findings tell us that in a domain with low predictability and a need for creative solutions, the expert dancer engaged in fairly complicated and creative practices. He not only repeated and refined the existing skill, but also paid attention to the relationships between that skill, his knowledge, and other skills, allowing him to create new skills. This practice process cannot be fully accounted for by the concept of "deliberate practice", which emphasizes repetitive practices that are carefully structured and often provided by teachers or coaches. Since exploration of new ideas and new skills is essential in expert practices in creative domains, deliberately structured practices cannot be prepared in advance. An expert's practice in such a creative domain needs to be personally developed in situ with an explorative approach in order to generate a creative performance. This point of view is consistent with the discussion of Kapur (2008), which emphasizes the importance of explorative attempts and variability of contents in the practice process to become an adaptive expert explained by Hatano & Inagaki (1986). The importance of variability in the contents of practice is also supported by a constraints-led approach, which accounts for the skill acquisition process in various domains from a dynamical systems model (e.g., Chow, Davids, Hristovski, Araújo, & Passos, 2011). Further research is needed to generalize and integrate our findings with those in related domains.

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## References

Charness, N., Tuffiash, M., Krampe, R., Reingold, E., & Vasyukova, E. (2005). The role of deliberate practice in chess expertise. *Applied Cognitive Psychology, 19*, 151-165.

Chow, J. Y., Davids, K., Hristovski, R., Araújo, D., & Passos, P. (2011). Nonlinear pedagogy: Learning design for self- organizing neurobiological systems. *New Ideas in Psychology, 29,* 189-200.

Ericsson, K. A., & Lehman, A. C. (1996). Expert and exceptional performance: evidence of maximal adaptation to task constraints. *Annual Review of Psychology*, *47*, 273-305.

Ericsson, K. A., Krampe, R. T., & Tesch-Römer, C. (1993). The role of deliberate practice in the acquisition of expert performance. *Psychological Review*, *100*(3), 363-406.

Haibach, P. S., Daniels, G. L., & Newell, K. M. (2004). Corrdination changes in the early stages of learning to cascade juggle. *Human Movement Science, 23,* 185-206.

Hatano, G., & Inagaki, K. (1986). Two courses of expertise. In H. Stevenson, H. Azuma, & K. Hakuta (Eds.), *Child Development and Education in Japan*. New York: Freeman.

Kapur, M. (2008). Productive failure. *Cognition and Instruction, 26*(3), 379-424.

Macnamara, B. N., Hambrick, D. Z., & Oswald, F. L. (2014). Deliberate practice and performance in music, games, sports, education, and professions: a meta-analysis. *Psychological Science,* 1-11.

Newell, A., & Simon, H. A. (1972). *Human problem solving*. Englewood Cliffs, NJ: Prentice-Hall.

Oura, Y. (1996). Expertise. In Hatano, G. (Eds.), *Learning and Development*. Tokyo: University of Tokyo Press.

Schön, A. D. (1983). *The Reflective Practitioner: How Professions Think in Action.* New York: Basic Books.

Shimizu D., & Okada, T. (2013a). Improvised creative process of street dance. *Cognitive Studies*, *20*(4), 421-438.

Shimizu, D., & Okada, T. (2013b). Physical Skill and Idea Interaction in the Creation of New Dance Movements. *34th Annual Meeting of the Cognitive Science Society,* Berlin, Germany.