

A study on intellectual tasks influenced by the embodied knowledge

Itsuki Takiguchi¹ and Akinori Abe²

¹ Graduate School of Humanities and Studies on Public Affairs, Chiba University, Japan

² Chiba University, Japan

moonbow.shooting@gmail.com

Abstract. I have an assumption that knowledge of the known intellectual task will similarly influence on the new one. By using origami performances, it was verified the existence of embodied knowledge of the known intellectual task made the performance of unknown similar tasks better. Experiments were carried out as the origami performance of folding cranes and phoenixes. The performance of folding phoenixes consists of the common part of folding cranes and folding phoenixes, and the unique part of folding phoenixes. As a result of comparing execution time of the folding cranes with that of folding phoenixes, the following three observations were obtained. 1) If they had the embodied knowledge of folding cranes, they could finish the task of folding phoenixes more quickly than those who do not have the embodied knowledge. 2) Significant differences due to the presence or absence of the embodied knowledge were observed only in the performance of the common part. 3) Once if they have experienced to fold cranes, it was possible to complete the task of folding phoenixes even if they did not have the embodied knowledge of folding cranes. As shown in the above results, the embodied knowledge of folding cranes influenced only on common part of folding cranes and folding phoenixes. In the common part of folding cranes and folding phoenixes, only differences due to the presence or absence of experiences were observed, and no difference was found due to the proficiency in experience. The reason for the increase in the efficiency of the new intellectual task similar to the known intellectual task by the embodied knowledge is that only efficiency was increased as a whole because the efficiency of their common part was increased. Thus we cannot conclude that experiences have played some roles in the unique part. In addition, as shown in the above results, once they have experienced to fold cranes, they will be able to obtain the knowledge of how to fold the cranes.

Keywords: embodied knowledge, intellectual task, origami performance

1 Introduction

When we look at the various actions from our morning getting up to sleeping at night, it can be said that they are various kinds of task and accumulation of actions. In such tasks, even if it is intellectual tasks that are somewhat complicated, such as cooking, sports, creative activities, if they are always doing them, we can perform their intellectual task without any problems. This is thought to be because we have knowledge gained as experiences for those intellectual tasks, that is, intuition and feeling in task, movement, hand working, etc. by experiencing something.

On the other hand, when executing a new task, it is impossible to task as it is because it does not have that experience. In order to solve this problem and execute new task, we think that we are promoting understanding of new task by using know knowledge of known task like that. Therefore, it can be said that existing experiences are applied for understanding and execution of new task.

In Maruyama (2015), that study purposed the elucidation of image formation process of folding using Origami “Yakkosan of hanging display” that transforming of “Yakkosan”. That study did not focus on influence of skills and knowledges on the tasks.

In this study, the degree of influence on the time to complete the intellectual task A in existence of the intellectual task B in some new intellectual task A and similar intellectual task B has been influenced I will examine it using intelligent task called Origami. In this paper, we focus on influence of embodied knowledge on new tasks.

2 Experiment 1

2.1 Purpose

We examine the influence of embodied knowledge on intellectual task using the intellectual task of folding origami.

2.2 Method

(1) Participant

16 college students (6 men, 10 females) participated. Both were undergraduates enrolled at the Faculty of Literature, Chiba University.

(2) Procedure

We asked the participants to fold two types of origami, crane and phoenix, and photographed the situation from the front with a video camera. After that, we output the captured image of the action underway to the personal computer and asked questions while confirming with the participant. The experiment time was 70 minutes. The method of recording the experiment and setting of the experiment time were made with reference to the problem of breaking the "Yakkosan of hanging display" of Maruyama (2015). Tasks are presented in the order of crane and phoenix. Presenting

the sample (Figure 1, Figure 2) on each participant, fold the same thing, and telling the staff to present the hints in stages if there is a request from the participant, we tackled the issue.

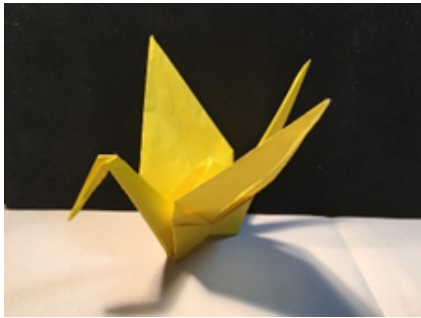


Figure 1 Crane sample



Figure 2 Phoenix sample

2.3 Result

Based on the shot image, the crane is the task time from the beginning of folding to the completion, Phoenix starts from the folding stage to the stage of "Tsuru no Kiso" (see Figure 3) which is a common part between crane and phoenix (Hereinafter referred to as "process α "), the stage from "Tsuru no Kiso" to completion (Hereinafter referred to as "process β "), the total working time from the beginning of creation to completion, were measured.

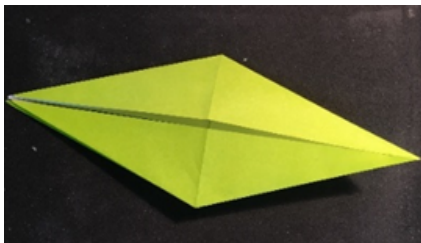


Figure 3 Tsuru no Kiso

We divided the result of measurement into a group that knows how to fold a crane (hereinafter referred to as group A), a group that does not know how to fold a crane (hereinafter referred to as group B), and classified it into each process as follows. It is a graph (Figure 4).

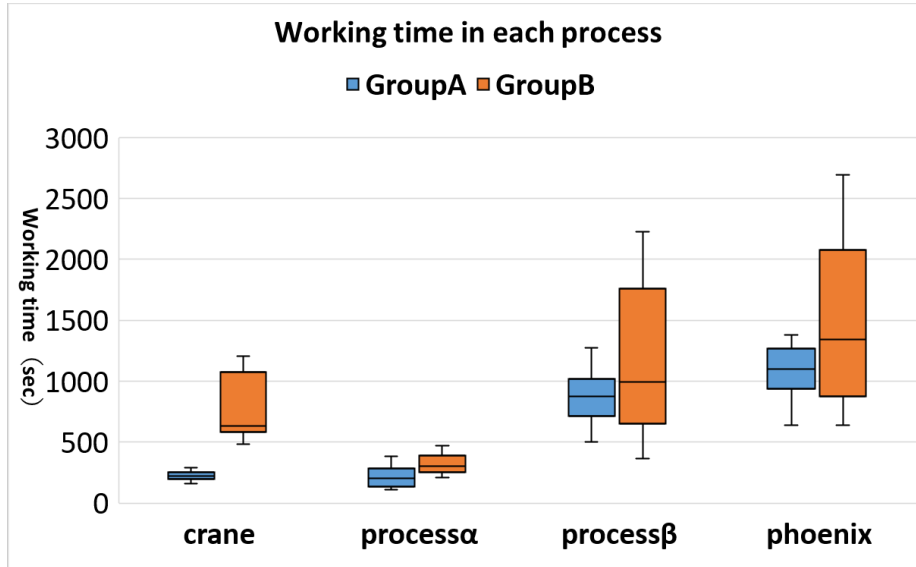


Figure 4 Working time in each process of Experiment 1

Based on the obtained results, Wilcoxon ranked sum test of crane and phoenix task hours for Groups A and B resulted in a significant difference between Group A and Group B only in crane task hours. It was seen. ($Z = -3.254$, $p\text{-value} = 0.0002498$)

Also, in the question after the end of the assignment, there was a difference in answers among the groups on questions about cranes, such as "Where are the difficulties in folding a crane?" "Was there a part you care about folding a crane?" Regarding the question "What is the difficulty in folding a crane?", all the participants in group A responded that "there were no difficulties", whereas in group B, "it was difficult to form a crane head and tail", "It was difficult to grasp the whole form", "I did not know how to fold itself", etc.

For the question "Was there a part you care about folding a crane?", Group A answered, "I did not care about it" and "I folded carefully as closely as possible to the sample". In Group B, responses such as "I was careful not to make a wrong fold".

For the question about phoenix, there were no characteristic differences in responses among the groups.

2.4 Discussions

From Experiment 1, it was possible to obtain a result that significant difference was observed between Group A and Group B only in the working hours of crane in Groups A and B. From this result, it can be said that group A completed the task of crane significantly more quickly than group B. On the other hand, this also indicates that there was no significant difference in task time between groups A and B except for the working time of crane. This means that the hypothesis that experiential

knowledge tasked well for similar tasks, even if it is a new task, the more time it takes to complete the task as the more task experiences like that task are done It is against. In considering the reason for such a result, paying attention to the working time of the crane between the groups A and B and the working time of the process α , the task contents of the crane and the process α are almost equivalent Despite the significant difference in the working time of the crane, it is understood that the significant difference is not seen in the process α . Regarding questions after the end of the assignment, as for the questions about cranes, group A is not the way the folds are folded or the contents of the task themselves, but most of them answer about the completeness of the task, but group B is a crane In the question about phoenix, no difference was found between groups, whereas the group that existed at the time of crane It can be said that the difference between Phoenix is no longer present.

Based on these facts, it seems that during the experiment, after the completion of the cranes task on Group B, there seems to be an influence that changed from the state before task execution. To verify the cause of the influence, looking at the group B in figure 4, we can see that the task time of the stroke α is shorter than the working time of the crane. For this reason, in Group B, we gained the experience of cranes that we did not have before because we made the task of folding a crane, so in process α , which is like crane, group A and significant It seems that task time has been shortened to the extent that there is no difference. Therefore, in Experiment 1, it is suggested that all participants became participants having experience of cranes at the time of the task of phoenix.

2.5 Further issues

From the analysis of the results obtained in Experiment 1, in Experiment 1 it was suggested that all participants had cranes experience knowledge at the time of performing the phoenix task, so to test the hypothesis. It is necessary to have participants who do not have cranes experiences perform the task of phoenix without having to acquire experience knowledge. Therefore, experiments are carried out using similar participants, and the tasks are carried out in the order of Phoenix cranes rather than Crane, Phoenix in order. Since it is thought that all participants can perform the task of Phoenix without acquiring new experiences, it is necessary to perform a new experiment in which the order of the experiment 1 and the task are exchanged.

3 Experiment 2

3.1 Purpose

In experiment 1, because of performing tasks in the order of cranes and phoenix, all the participants experienced experiencing folding the crane at least once at the beginning of folding phoenix. In other words, it is thought that all participants had acquired

experience of cranes. Verify the influence of existing experience of cranes on Phoenix without changing the order of tasks to acquire new experiences.

3.2 Method

(1) Participant

Twenty college students (8 men, 12 women) participated. Both were undergraduates enrolled at the Faculty of Literature, Chiba University.

(2) Procedure

We asked the participants to fold two types of origami, phoenix and crane, photograph the situation from the front with a video camera, then output the picture taken about the action underway to the personal computer, asking questions while checking with the participant went. The experiment time was 70 minutes. The method of recording the experiment and setting of the experiment time were made with reference to the problem of breaking the "husband of a hill decoration" of Maruyama (2015). The order of presenting the assignment is in the order of phoenix and crane. Tell us about presenting the sample (Figure 1, Figure 2) about each participant and folding the same thing, presenting the hint stepwise if there is a request from the participant We tackled the issue.

The difference from Experiment 1 is that the order of presenting the tasks was changed from the order of crane, phoenix to phoenix, crane in the order, and the rest is the same as Experiment 1.

3.3 Result

As in Experiment 1, the process α of the phoenix, the process β , and the total working time were measured. As for cranes, because there were many participants who were unable to carry out the task due to the relationship of experiment time, we did not use it for this analysis. The result is divided into a group that knows how to fold the crane (hereinafter referred to as group C), a group that does not know how to fold the crane (hereinafter referred to as group D) (Figure 5).

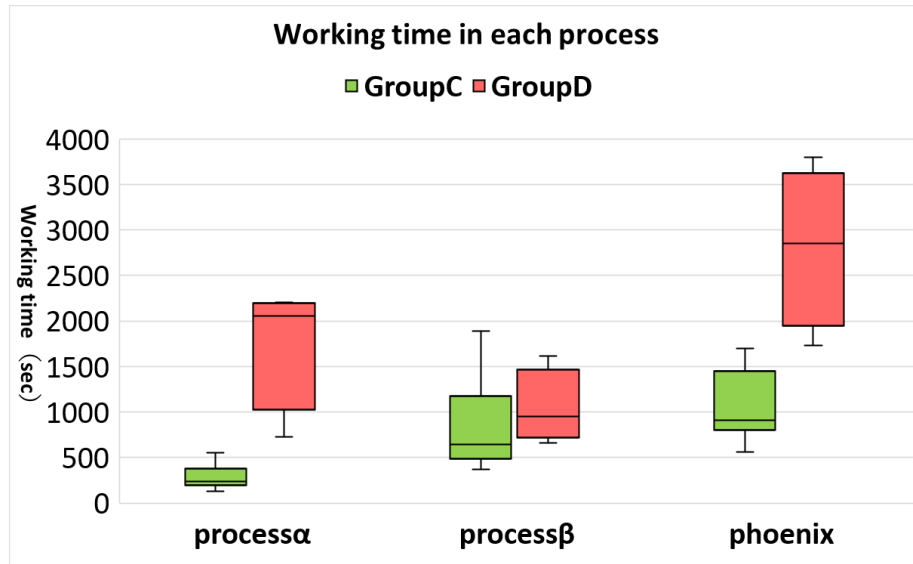


Figure 5 Working time in each process of Experiment 2

Based on the obtained results, Wilcoxon rank sum test was conducted for each working process of Phoenix against Groups C and D. As a result, significant difference was observed in Step α . ($Z = -3.0237$, $p\text{-value} = 0.0004128$)

There was also a significant difference in the working time of the entire phoenix. ($Z = -2.9292$, $p\text{-value} = 0.0008256$)

In the question after the end of the assignment, in group C, "I felt that phoenix was the same folding way as a crane halfway" "I think each part of the crane corresponds to each part of phoenix" I felt the similarity between the phoenix and the crane "such as" I felt the similarity of the crane. " In Group D, only answers about Phoenix such as "I did not know where to fold from the beginning", "Phoenix parts could not be formed successfully" such as the difficulty in folding phoenix were obtained.

3.4 Discussions

From Experiment 2, it was found that significant differences were found in the working time of process α , phoenix in Groups C and D. From this result, it can be said that Group C completed the process α , phoenix significantly more quickly than Group D. This means that the hypothesis that experiential knowledge tasked well for similar tasks, even if it is a new task. The less time it takes to complete the task as the more task experiences like that task have been performed.

Also, in the question after the task was completed, in group C, responses were mentioned referring to the similarity between crane and phoenix, whereas answers to phoenix were not obtained in group D at all in response to crane only the result was obtained. From this result, it is possible to point out the Phoenix has a common part of

crane in case of having experience of cranes. Having experience of cranes helps understanding of phoenix. This also supports the hypothesis that it is effective to task on new task to have experiences like new task.

4 Discussions

Based on the data obtained in Experiment 1 and Experiment 2, comparison of data between experiments is a group that does not know group A and group C which are groups knowing how to fold cranes, group C I went to group B and group D. Wilcoxon rank sum test was conducted for each task time among groups for each, and significant differences were found in the working time of process α between groups B and D. ($Z = -2.5584$, $p\text{-value} = 0.009524$) From this result it can be said that group B was able to finish the task significantly more quickly than group D. The above result shows that group B who experienced once to fold a crane did not experience folding cranes at all at the beginning of the experiment even if it did not know the same way to fold a crane. It also shows that the time to completion of the process α , which is a similar part between Phoenix and Crane, was significantly faster than Group D. For this reason, the reason there was no significant difference between Group A and Group B in the phoenix task of Experiment 1 is that the participants in Group B were acquiring cranes experience at the beginning of Phoenix's task. It can be said that the consideration in Experiment 1 to be reinforced. Based on the results of comparison between the above experiments and the results obtained respectively in Experiment 1 and Experiment 2, the results obtained in this study are summarized as follows. 1) If they had the embodied knowledge of folding cranes, they could finish the task of folding phoenixes more quickly than those who do not have the embodied knowledge. 2) Significant differences due to the presence or absence of the embodied knowledge were observed only in the performance of the common part. 3) Once if they have experienced to fold cranes, it was possible to complete the task of folding phoenixes even if they did not have the embodied knowledge of folding cranes. All of these results support the hypothesis in this research that it is effective to task on new task to have experiences like those for new task.

On the other hand, as shown in 2), the experiences of cranes tasked effectively only in parts like cranes in the task of Phoenix, and in the part with low relevance to crane, existence of cranes experience but did not give a significant difference. In other words, existing experiences are affecting only the part of new task which is like the existing task, which can be executed significantly by the existing experience, and similarity with the existing task will be diminished at all. It can be said that existing experiences do not have a significant influence at all. Even if it seems that having experience knowledge of a certain task tasks effectively for other task, this tasks effectively for similar parts in the task, so task can also be said to be effective and it can be thought that it is not that experiential knowledge was applied to the whole task but experiential knowledge only affects the corresponding one.

In addition, as shown in 3), the influence of existence or nonexistence of experiential knowledge on task time is significant, but there is a big difference in task time among people with experience there was no significant difference in task time between those who were considered experienced at the time of the experiment and those who had experience before. This is because the presence or absence of experience is the most important factor for the task time of the intellectual task of folding origami, how much knowledge has experience, when to acquire experience such experiences. It can be thought that elements in intellectuals may not have much influence.

If it is assumed that only the presence or absence of experience has influence on the working time of origami, regarding the mastery of the movement touched in Suwa (2015), we have accumulated the experience of how to fold how much task time, it can be said that there is no effect even if it gets experience knowledge. Then, what part of the influence due to the difference in experiences appears? Considering elements other than the task time of folding an origami, verify the difference in the part relating to the completeness of the task such as the politeness of folding or the small degree of reworking. It is thought that it can be done. In such parts, there may be differences among people with experience.

In Suwa (2015), as an ideal form of meta-cognition of the body, "Relationship of equality, neither language nor body is the main," "Linking the stable feeling of ourselves to the feeling" And by creating the relationship between the words and the words by yourself, we will spin our original words to drive the body. " Focusing on this "spinning your own original language to drive the body", even those who have experience knowledge that did not see significant difference in working time, such experience knowledge. There is a possibility that a significant difference may appear in terms of verbalization towards.

In the present study, the participants of the participants to verbalize the participants are the self-evaluation of the task, the difficulty of the task and the similarity between the tasks, and the similarity between tasks, consciousness, understanding and task process for the movement itself of folding origami. I do not make language of parts such as understanding. Also, there was no difference in self-evaluation among participants in self-assessment of tasks by participants. However, there was a difference such as the fact that the participants were nearly equal in completeness of the tasks, which one was doing well, which was beautifully done, and it is certain that comparing the tasks. It can be said that there is a difference in its perfection degree.

In this study, since the evaluation to the task was only the self-assessment of the participant himself or herself, we did not externally evaluate the completeness of the task, but from this it is possible to externally objective by evaluating, it can be considered that differences in empirical knowledge between each participant can be confirmed numerically as a difference in evaluation.

5 Conclusions

In this study, for a certain new intellectual task, we examine the influence of knowledge of existing intellectual task like that on new intellectual task, using intelligent task called origami task time, and obtained the following two conclusions.

- 1) If you have experience knowledge of existing intellectual task like that for new intellectual task, you could do the task significantly more quickly than if you did not have experience, but existing experiences influence. What is in the new task is limited to parts like existing task.
- 2) Regarding working time in intelligent task of folding origami, the presence or absence of experience is the most important factor, and the elements in experience knowledge have no influence on working time.

For the further development of this research based on the above conclusion, the following problems can be considered.

First, there is an improvement of the hint of the folding method used in the experiment. In the experiment, we presented hints in the form of presenting hints in order as requested from participants, but the meaning of hint presentation is to present to guide the next stage to present task. However, in presenting hints, it is possible that the hint provided information to the participant more information than guiding the next step. I can not completely deny the possibility that participants themselves hindered their task because of misinterpretation of presented hints. To solve this problem, it is conceivable to propose experiments that do not use hints when performing similar experiments. When using hints, we devised a hint that gives participants information other than information on guidance to the next stage, so that seeing hints will not affect unnecessarily the performance of the participants alternatively, rather than doing the presentation of hints at the request of the examinee, it is necessary to control the influence of the hint by presenting in order by time.task.

Second, in this study, experiments were conducted on a single experience and a single new intellectual task, but in actual daily scenes, there are a plurality of tasks like a certain task, because there is experience knowledge, we think that expansion of the object is necessary to conduct research on the experience as knowledge and its influence on intellectual task. With respect to the extension of the object, it is given to each task for multiple experiences considered to be related to a certain task, for each task in the case where a single experiential knowledge is affecting a plurality of task a study of the influence that can be considered.

In the case of targeting multiple experiences, it can be said that it is necessary to verify which part of the task affects each of the experiences and verify each other's influence among the experiences. When there are overlapping parts between experiences in multiple knowledge experiences, it is thought that as for the overlapping part, more experience is gained than in the case where each experience has knowledge, it is thought that further development will be given to this research by conducting research such as verifying that fact.

Finally, it is important to verify the influence other than task time on intellectual task by experiential knowledge. In this study, experiments were carried out focusing on task time only on the influence on experience intellectual task given by experienced

knowledge, but no differences in experiential knowledge were found among experienced persons in working hours. However, if it is origami, there are differences in experiential knowledge in terms of the completeness of the task, such as the precision of folding, politeness, or the skill of the task itself of folding origami, the awareness and understanding of task. In addition, this is described in Suwa (2015) It seems that there is great correlation with the promotion of proficiency in behavior by comprehension by the connection between the experience in the metacognition method and the word (concept).

From these facts, to verify the influence of experiential knowledge on intellectual task, it is necessary to focus on experiential knowledge itself and to look at the difference within experienced knowledge in more detail. Therefore, if this research is expanded, self-evaluation and objective evaluation of intellectual tasks, comparison of evaluations among the participants and participants, letting the participant orally describe the process of intellectual task, task It is considered effective to make linguistic to intellectual tasks, experiences, such as asking explanations about points and task content.

References

1. 諏訪正樹: 一人称研究だからこそ見出せる知の本質, 一人称研究のすすめ 知能研究の新しい潮流, 株式会社近代科学社, 2015. .
2. 丸山真名美: 私たちは,どのように折り紙を折っているのか?(12):完成物から「折り」イメージ形成のプロセス分析, 日本教育心理学会総会発表文集(57), 日本教育心理学会, 2015. .
3. Michael. J. Crawley, 野間口謙太郎・菊池泰樹 (訳): 統計学 : Rを用いた入門書, 共立出版株式会社, 2008.
4. Masaki Suwa, Metacognitive Verbalization as a Tool for Acquiring Embodied Expertise(<Special Issue>Skill Science), Journal of Japanese Society for Artificial Intelligence 20(5), 525-532, 2005-09-01
5. 深見悦司: おりがみ大全集, 成美堂出版, 2000.
6. 村上秀俊: 総計解析スタンダード ノンパラメトリック法, 朝倉書店, 2015.