The Effect of Using Photographs in Idea Generation Support System

Tomohiro Kokogawa[*], Yuji Maeda[*],
Takahiro Matsui[**], Junko Itou[**], and Jun Munemori[**]
[*]NTT Service Integration Laboratories, kokogawa.tomohiro@lab.ntt.co.jp
[**]Wakayama University, munemori@sys.wakayama-u.ac.jp

Abstract

We have developed a system called "GUNGEN-PHOTO", in which photographs are used to support idea generation. It consists of a collaborative workspace and personal workspaces and includes two main functions, "photograph expansion" to effectively extract ideas from photographs, and "outside comment addition" to add comments from personal workspaces. These functions expected to increase the number of ideas generated. We conducted experiments on idea generation under the themes called "improvement" and "discovery", and found that more ideas were generated when photographs were used than when only text was used. We also found there were no significant differences in the quality of group titles between them.

1. Introduction

With the spread of digital cameras and mobile phones with cameras, the practical use of digital photographs has increased, and sharing them with other people has become easier. The use of digital photographs includes leisure uses such as snapshots for articles in travel blogs, and photographs documenting the research data of field work. The competition of products and services has intensified recent years, and therefore, companies have to develop original products or services and quickly put them on sale. Idea generation methods for developing creative ideas effectively are attractive for meeting these challenges to gather variety of opinions and summarize them. Various idea generation methods [1]-[4] and support systems [5]-[7] have been proposed.

The KJ method [2][1] is one such method and is also referred to as an "affinity diagram", which is included in the Seven Management and Planning Tools [4] used in total quality control. The KJ method was developed by Jiro Kawakita and is based on the thesis of problem solving and teamwork. The typical process use in the KJ method is as follows: (1) data (ideas, opinions, issues, etc.) are gathered with a specific theme, and each idea is jotted down each of them as a comment label; (2) they are organized into groups based on the natural relationship between each label, and each group is given a title; (3) each group is allocated spatially to a diagram (affinity diagram) according to the natural relationships among groups, and (4) concluding sentences are added to express what the diagram means.

Conventional idea generation methods, including the KJ method, mainly use text data to generate ideas. Some studies have attempted to use sketching or photographs for idea generation [8]-[10], which are expected to provide more information than text-only data. However, such approaches only use sketching and photographs as supporting data in idea generation, not as a practical tool to actively improve some part of idea generation process output, such as the increase of generated idea at (1) in the KJ method.

In this study we developed the system called "GUNGEN-PHOTO", which supports idea generation with photographs. The system has two original functions that we developed to generate new ideas from photographs: a "photo expansion" function to show the details of photographs and to clarify what is in the photographs, and an "outside comment addition" function to add comments (new ideas) at any time from outside the shared display, to increase the number of ideas without impeding other members' viewing capabilities. We applied these functions in an evaluation of the system, and we investigated the use of photographs affected to the quantity and quality of idea generation.

2. Related work

Young classified the purpose of an idea processing support system as three levels [5]: a secretarial level (reducing the miscellaneous tasks of users to focus on the main work), a framework-paradigm level (providing a new paradigm by adding a conceptual stimulus), and a generative level (generating unexpected ideas automatically).

Ohashi et al. developed a KJ method support system called "GUNGEN-TOUCH" that enables face-to-face communication in meetings by using a table-top interface [6]. They implemented semi-automatic idea grouping and turning the direction of the labels in order to reduce the workload necessary with the KJ method. In addition, they compared each work task in their method with those in conventional "paper-based" operation, and found significant differences between them. In experiments they achieved a level of operability compared that of a paper-based method and also reduced the operation time.

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[1] The KJ method is a registered trademark of Kawakita Research Institute.

However, only text data could be input, and only one person could input generated ideas at a time because of the restriction of the interface (single touch-panel screen with multiple user).

Ajiki et al. developed idea generation consistent support systems called "GUNGEN-SPIRAL II" and "Quiccamera" [7]. GUNGEN-SPIRAL II enables the KJ method to be carried out as a Web application, which enables idea generation using multiple gadgets such as PCs or smart phones with standard Web browsers. "Quiccamera" makes it possible to edit and input photographs from smart phones into GUNGEN-SPIRAL II as idea labels. However, they treat photographs in the same way as input handwritten text, so and there is no special function to manipulate each photograph as a label.

Tse et al. developed the KJ method support system called "the Designers' Environment" that allows multi-user multi-mode interaction with gestures, voices, and pen-tablet PCs [8]. Ideas that are generated can be input via the keyboard or by handwriting on the pen-tablet PC. In addition, the system allows ideas to be grouped and cards or groups to be deleted by combining gestures and voices as commands. However, gestures and voices are easily confused whether they are performed as commands, or simply as human communication in discussions. Although photographs can be used as input data in the system, they are treated just as support documents, not as idea cards.

Van der Lugt introduced "Brainsketching" to create ideas by sharing sketches each other [9]. This was an attempt to improve idea generation by getting new stimuli from sketches other members drew. However, the experimental results showed that the idea generation was not affected very much by other people's sketches.

Nishimoto et al. introduced "BrainResketching" as a method to generate new design concepts [10]. To close the gap between subjective views or concepts among people, the system prompts "thinking from another person's viewpoint", which leads to reconstruction of their sketches based on the design idea of another person. This method shows that it is useful to get another person's viewpoint when generating new ideas.

Wang et al. studied idea generation using photographs and developed the "Idea Expander" [11][12]. In group brainstorming experiments with multinational users, they investigated the effect on ideas generated by showing photographs related to the topic of the group chat. The results indicated that idea generation patterns with photographs were related to the cultural (national) background of the participants [12]. However, they weakly suggested that the number of ideas increased quite a bit [11], but they did not include the effect on the paradigm, for example whether the quality of ideas improved.

As can be seen from the above, most of the proposed idea generation support systems only support the "secretarial" level by providing an automatic process or easier usability to reduce workloads. Some studies have tried to show the effect of using sketching or photographs on idea generation. However, they have not considered the effect on the overall idea generation process, and whether the use of photographs increased the quantity or quality of generated ideas by supporting the "framework-paradigm" level.

3. GUNGEN-PHOTO

We developed "GUNGEN-PHOTO" as an idea generation support system using photographs in order to support the "framework-paradigm" level. In this chapter we explain the system design and functions of "GUNGEN-PHOTO".

3.1 System design

The purpose of the system is to support idea generation at the "framework-paradigm" level. We used photographs as a creativity stimulus to increase the quantity and quality of generated ideas. In addition, we improved the overall usability of the system at the "secretarial" level in order to reduce the degree to which the miscellaneous tasks hinder idea generation. The features of our proposal are as follows.

1. Photograph expansion on collaborative workspace
    To effectively use photographs as a creative stimulus, the photographs have to be looked at impartially by group members in order to avoid strong subjective views by the person who prepared the photographs. We prepared a large workspace (called a "collaborative workspace"), which enables multiple users to collaborate face-to-face in this idea generation method. Each user can see, manipulated, and comment on the overall photographs and generated ideas in the collaborative workspace. We adopted the DiamondTouch Table [13] as the collaborative workspace on a table-top interface. With its electrostatic touch panel that can distinguish each user operation simultaneously, the DiamondTouch Table can be operated with multiple fingers, similarly to paper-based operation.
    In addition, we adopted a function to temporarily expand a specific photograph, in order to share its details with all group members, and to focus their discussion theme on it.

2. Outside comment addition on personal workspace
    The collaborative workspace is controlled by one PC, which limits one keyboard operator at a time to input generated ideas as text. To enable free operation by group members, we implemented another workspace that can be operated (text written as generated ideas) individually, which is

called a "personal workspace". By dividing the workspace into collaborative and personal ones, group members can share their overall views on photographs and generated ideas while they input their generated ideas at any time without impeding other members' operation of the collaborative workspace. We chose iPads[2] as the personal workspace terminal, which can be operated intuitively in the same way as the collaborative workspace (DiamondTouch Table).

3.2 Function

GUNGEN-PHOTO is based on GUNGEN-TOUCH [6]. Before the start of this idea generation method, photographs are collected in the server of GUUNGEN-PHOTO and copied into the control PC of the DiamondTouch Table. When starting the method, all input photographs are shown on the DiamondTouch Table as the collaborative workspace. Participants discuss these photographs and input comments via their iPad personal workspaces. The input comments are also shown on the DiamondTouch Table as text comment labels. After completing the idea generation task, all photographs and comment labels are exported to the server. Figure 1 shows an overview of GUNGEN-PHOTO. The keyboard is used to input text directly to the DiamonTouch Table. It is only used to input the title of generated groups.

Figure 1. Overview of GUNGEN-PHOTO.

The GUI design of GUNGEN-PHOTO is shown in Figure 2. Each item is operated by fingers via the touch panel. The size of each photograph is 160 x 120 pixels, which can be expanded to 480 x 360 pixels to see the details in the photograph. Group members can naturally take notice of the photograph on the DiamondTouch Table, and easily focus their discussion theme on the

photograph. Figure 3 shows an example of an expanded photograph.
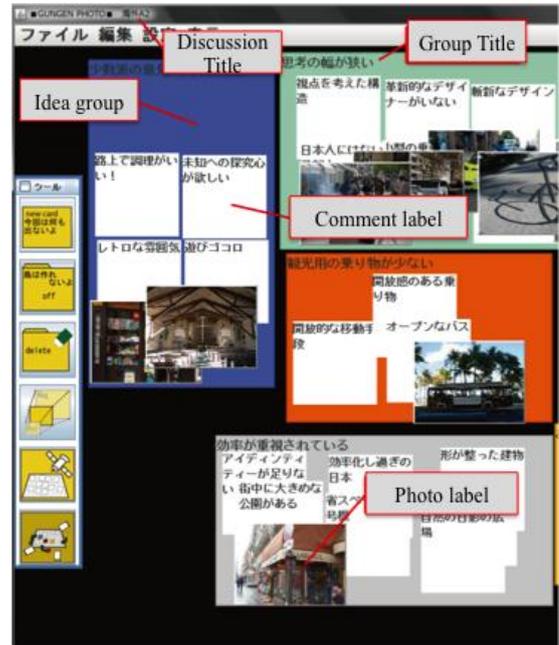
Figure 2. User interface design of GUNGEN-PHOTO.

Figure 3. Photograph expansion.
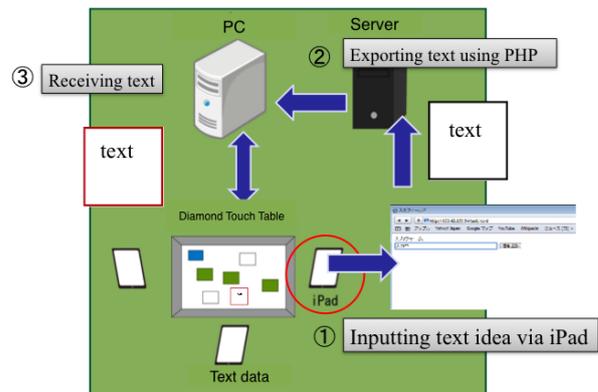
Figure 4. System flow of inputting comments via iPad.

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2 http://www.apple.com/ipad/
   iPad is a registered trademark of Apple, Inc.

Comment labels can be individually input via the iPads each time, without hiding the view of the collaborative workspace (DiamondTouch Table) via an input menu such as a software keyboard. The input text on each iPad is sent to the server and to the control PC of the DiamondTouch Table as comment labels. The system flow of inputting comment labels is shown in Figure 4.

4. Experiments

4.1. Use cases

Two idea generation theme use cases were selected to investigate the effect of using photographs to improve idea generation. One theme was "improvement" for existing things, and the other was "discovery" to figure out undiscovered knowledge.

1. "Improvement" theme
   One of the most useful applications of the KJ method is to improve management and planning in business environments. This method is expected to improve idea generation for more specific problems at the office by focusing on partially known subjects appearing in photographs, such as persons (employees), scenery (office environment), and objects (office equipment). We can imagine their condition, comportment or usage, and get new ideas to improve them.
2. "Discovery" theme
   The main purpose of the original KJ method is to discover the essential facts from data collected in a field study. We can enjoy looking at photographs taken in places we had never visited, thinking about the places shown in the photographs and forming opinions about them. In addition, we can get new discovery ideas by sharing these opinions with other people.

4.2. Experimental results

The experiments were conducted with three groups (A, B, C) of participants (nine persons), each of them made up of three students from Wakayama University. The participants sat in chairs around a DiamondTouch Table (Figure 1), and we provided an iPad to each of them as his /her personal workspace terminal.

The idea generation theme of the "improvement" experiment was "How to improve the environment of Wakayama University", and that of "discovery" was "Good features of overseas facilities or cultures". There were 12 variations in our experiments (three groups, two themes, and two data conditions: using text only or using photographs), and we randomly changed their order.

Before the experiments using photographs, each group selected 20 photographs from ones beforehand prepared

(107 photographs taken at Wakayama University for the "improvement" theme, and 841 photographs taken in foreign countries (Vietnam, France, Portugal, UK, China, and the USA) for the "discovery" theme.

Table 1 lists the results of the experiments. "Comments" indicates the number of generated ideas (comment labels). "Groups" indicates the number of groups generated in an affinity diagram via the KJ method. "T" represents the experiments with text only (without photographs), and "P" represents those with photographs. "Imp-" means the "improvement" theme in each group (A, B, and C), and "Dis-" means the "discovery" one.

After the experiments, the contents of each comment and group were evaluated by a different group of four students on a score from 1 to 5 (the higher the score, the better the quality). The result of average score is shown in Table 2.

Table 1. Results of experiments.

Text/Photo	Comments		Groups	
	T	P	T	P
Imp-A	26	58	8	10
Imp-B	20	46	5	5
Imp-C	29	22	8	5
Dis-A	16	35	5	7
Dis-B	21	49	5	6
Dis-C	30	42	5	6

Table 2. Results of evaluation scores of generated comments and groups.

Text/Photo	Comments		Groups	
	T	P	T	P
Imp-A	3.6	3.4	3.5	3.1
Imp-B	3.9	3.0	3.1	3.2
Imp-C	3.4	2.9	3.2	2.6
Dis-A	3.4	2.9	3.4	3.1
Dis-B	3.3	2.9	2.9	3.1
Dis-C	3.4	2.6	3.2	3.2

Table 3. Results of satisfaction ratings via experiments.

Questionnaire	Rating
(1) About photograph view	
Could you easily view the photos?	4.2
Could you easily expand the size of the photos?	4.3
(2) About text input	
Was it easier to type text with the iPad than with a keyboard?	4.0
Was this function useful?	4.6
Could you easily operate this interface?	4.1
(3) About interfaces	
Could you easily use the control panel?	4.0
Could you easily expand /reduce the size of idea groups?	3.8
Could you easily move photos, idea groups or comment labels?	3.3

Table 3 shows the result of satisfaction ratings about questioners described by participants after experiments as score 1 to 5 (the upper score, the better quality).

Examples of random comments given in the questionnaire are as follows.

(1) About photograph view

- It was hard to see the details in some of the dark photos.

- The initial size of photos should be smaller.

- The size of photos should be larger.

(2) About text input

- The predictive transform of the iPad was useful for inputting text.

- Inputting text takes some getting used to.

- Inputting data via the iPad was more useful compared with keyboard input to the DiamondTouch Table.

(3) About interfaces

- The enlarged photos should be sent to each iPad.

5. Discussion

5.1 Utility consideration of the system

The questionnaire results in Table 3 show that the satisfaction rates of the expanded photographs and the text input via personal workspaces were high (their scores were higher than 4). In addition, other ratings about the interface were over 3.3. This means that the implemented functions were fully useful to operate photographs in our system, in order to evaluate the effect of photographs in idea generation.

5.2 Evaluation of the quantity of generated ideas

The total number of generated comment labels using photographs was 1.8 times (51 labels in "improvement", 59 labels at "discovery", and 110 labels in total) greater than that with text only. The t-test result shows a p value of 0.01, which means there were significant differences between them at the significance level of 5%, although there was no significant difference in the number of groups (p value is 0.76).

5.3 Evaluation of the quality of generated ideas

Table 2 indicates that all the average evaluation rates of comments using photographs were smaller than that with text only. The t-test result shows that the p value is 0.002, which means there were significant differences between them, whereas there is no significant difference in the average evaluation rate of groups between them (p value is 0.26). This shows that using photographs to generate ideas caused the average quality of comments to decrease; however, the results of the final ideas described by groups in the affinity diagram did not always decrease.

When photograph were used, the total number of comments with higher quality also increased, whereas the average quality of comments decreased. Thus, the quality was maintained in the final results of idea generation.

In our experiments, the average number of comment was 42 in both "improvement" and "discovery" with 20 photographs. About 20% of the comments generated presented different viewpoints on the same photographs. The results of comment labels with various viewpoints are given in Table 4.

Table 4.   Comment labels with various viewpoints.

Classification	Comments	
	Improvement	Discovery
Different kinds of comments to the same object in the photograph..	14	14
Comments on different objects in the same photograph	10	7
Both of the above	3	5

Figure 5. Example of photograph that prompted different kinds of comments on the same object.

Figure 6. Example of photograph that prompted comments on different objects.

The examples of "different comments on the same object in the photograph" for Figure 5 are as follows.

- It is clear that they were concerned about the environment because the French fries were not in

a cardboard container.
- It seems to be easy to eat because the French fries were on a plate.

Examples of "comments on different objects in the same photograph" in Figure 6 are as follows.
- There was a traffic jam in the morning because there was only one toll gate (focused on road with the toll gate).
- It is too bothersome to insert the pass into the card scanner (focused on the card scanner at the toll gate).

We also examined the contents of each comment label.

In the higher-rated comments with photographs, a trend was observed that the comments were about specific objects shown in the photographs. In the "improvement" theme in particular, these comments pointed out a concrete problem or solution, such as "There was a traffic jam because there was only one tollgate".

The lower-rated comments with photographs, pointed to a trend to have just impressive comments, especially in the "discovery" theme, such as "Too long". These comments are hard to understand without their target photographs. Such comments should reduce the average ratings of the idea quality. However, in the idea generation process these comments were discussed with their target photographs, so they did not contribute to reducing the quality of the overall results (the quality of generated groups).

6. Conclusion

We proposed the idea generation support system called "GUNGEN-PHOTO" to examine the effect the use of photographs had on the idea generation process. "GUNGEN-PHOTO" is a system implemented with two workspaces: a collaborative workspace to show and discuss overall photographs and comments, and personal workspaces to input generated ideas as comment labels throughout the discussion. We evaluated the quantity and quality improvement of this idea generation method by comparing the number of ideas generated with and without photographs.

The results of experiments showed that the number of ideas generated with photographs was significantly higher than that with text only.

The results also showed that the average quality of generated comment labels was significantly reduced with photographs; however, there was no significant difference in the final quality of idea generation methods (based on the names of generated groups) using photograph and text only.

In addition, we examined two types of different viewpoints on the same photograph; different kinds of comments on the same object in a photograph, and different comments on different objects in a photograph.

The results suggest that the use of photographs in idea generation could contribute to improving the entire idea generation process.

For further study we plan to analyze in more detail the differences in idea generation improvement between the "improvement" and the "discovery" theme.

7. References

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