Proposal of an Idea Generation Support System Using Digital Photographs with Position Information

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Abstract - Digital cameras have come to be widely used. For example, we use digital photographs for blog articles, travel diaries, and to record memories. There are numerous opportunities to take digital photographs with several people. Photographs are used as entertainment or as field work data. We have developed GUNGEN-Photo. GUNGEN-Photo is an idea generation support system using digital photographs with position information. The system is performed with several people who use group operation of idea generation. We aim at new idea generation using photographs. We experimented with the system and evaluated it.

Keywords: Digital photograph, Position information, KJ method, Table top interface.

1 INTRODUCTION

Idea generation methods are of great importance. There are many idea generation methods [1], [2]. In addition, many systems have been developed to support them [3], [4], including those that use a Table Top interface [3], [5].

Digital cameras have come to be widely used. The acquisition of digital photography has become easy. We take pictures frequently when we discover interesting things during travel. Dispatching various information using digital photographs is enabled. For example, we use digital photographs in blog articles and SNS [6]. There are opportunities to talk about digital photography with various people [7]. Photographs are used as entertainment or field work data. It has become easy to dispatch information using photographs.

We have developed a system, "GUNGEN-Photo", which is an idea generation support system using digital photographs with position information by several people talking about photographs while meeting. This system seems to be one of the idea generation methods using photographs. We carried out an application experiment of idea generation using several people with this system. We tested taking a trip by this experiment. We began by writing each impression and an opinion in a caption for the photograph, which had been taken in town. We found new discoveries such as memories or the problems of the trip with them. Such discoveries may produce good ideas.

Chapter 2 explains the KJ method. In Chapter 3 we explain GUNGEN-Photo. Chapter 4 shows the experiment that uses this system. Chapter 5 describes the experiment results. Chapter 6 is a discussion, and chapter 7 is the summary.

2 THE KJ METHOD FOR PHOTOGRAPHS

This system is influenced by Kawakita's generation system, called the KJ method [2]. The KJ method was developed by Jiro Kawakita. The KJ method is one of the most famous idea generation methods in Japan. The KJ method is known as a method for establishing an orderly system from a chaotic mass of information. The method was originally developed for anthropological field-work to delineate relations that would lead to findings from gathered and stored data. The KJ method as applied to technical innovations involves the systematization and covering of brainstorming. The feature of the KJ method is cooperative work toward innovation. The KJ method is suitable for the tabletop interface [8]. The four steps of the KJ method are as follows.

(1) Label making (brainstorming step)

In the first step, participants write their ideas freely on tags (i.e. Post-it notes) according to the theme of the meeting. Then the tags are put on a table. The tags are referred to as labels. When participants write ideas, they should not criticize other's ideas, and they must propose their ideas without hesitation. This step corresponds to brainstorming, and deals with photographs and article making. (We call photographs PhotoLabel and articles CommentLabel here; both are referred to as *labels* in this system.) The PhotoLabel is a photograph which was taken at a particular location. The CommentLabel is a comment about photographs.

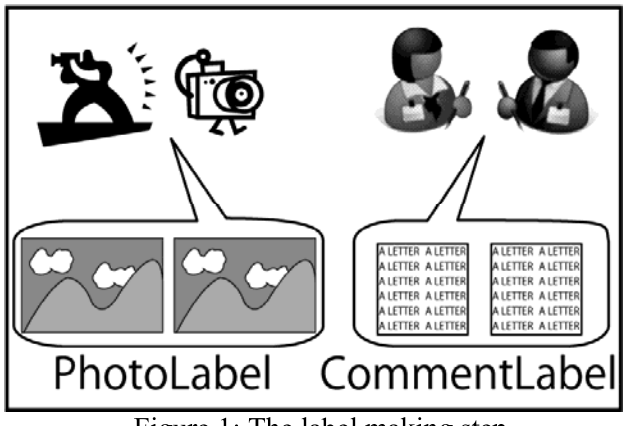

Figure 1: The label making step

(2) Grouping ideas

In the second step, participants examine their labels and group them into groups through discussion. The criterion for this grouping is not the category of ideas but their intuitive similarity. Each group is called an island and given a representative title (naming). The island is a technical term in the KJ method, and a set of similar ideas. This system performs grouping with both PhotoLabel and CommentLabel.

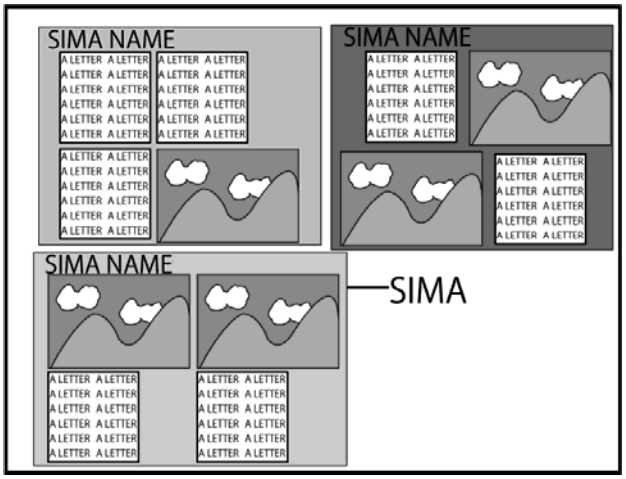

Figure2: The idea Grouping step

(3) Structuring groups

In the third step, participants look for an arrangement that express the mutual relations of the representative titles spatially. Then they connect the related representative titles together in a certain line. This system does not currently support this step.

(4) Writing a composition

In the last step, participants write a summary composition. They should not express their opinions but should write it based on the data itself. Our system is a process to make new ideas from PhotoLabel and CommentLabel.

These four steps are the working process of the traditional KJ method. The KJ method involves a great deal of communication (face-to-face meeting). Participants can carry out the KJ method by labels and a large sheet of paper (i.e. Japanese B0 size paper). A participant can easily point to an object (a label or an island) on the paper.

3 GUNGEN-PHOTO

We have developed GUNGEN-Photo. This system is an idea generation support system using digital photographs with position information. This system is performed with several people who use group operation of the idea generation. This system uses a DiamondTouch-Table. We can realize face-to-face communication by direct manipulation.

3.1 Composition of system

The system consists of the following hardware and software.

(1) Hardware
DiamondTouch-Table（65cm×87cm）[9]
CANON DATA PROJECTER X700
DELL (Intel (R) Core 2 Quad CPU Q9450 (2,66GHz))

(2) Software
DiamondTouchSDK2.1 (MERL)
Microsoft Windows XP Professional version 2002
JDK1.6.0-07(Sun Microsystems)
Eclipse SDK ver.3.4.1 (2000 lines program)

3.2 Operation of system

We shall now describe the main operation of the system.

(1) Initial screen

Figure 3 shows the initial screen of the system. Five kinds of buttons are shown in the tool window (from the perspective of the user, it is on the left of the screen.). If we click the comment card generation button (b), a label is generated. When the island making button (c) is clicked and it is in the ON state, the system displays the range of the island by appointing the range of the island that we generate with both hands. When the label or the islands delete button (d) is clicked and it is in the ON state, it can be deleted. When the island resize button (e) is clicked and it is in the ON state, the size of the island is changed by the hand pointing. If we click the position lining up button (f), and touch a PhotoLabel, we can arrange scattered PhotoLabels in a line. (c)~(f) buttons indicate change in ON and OFF.

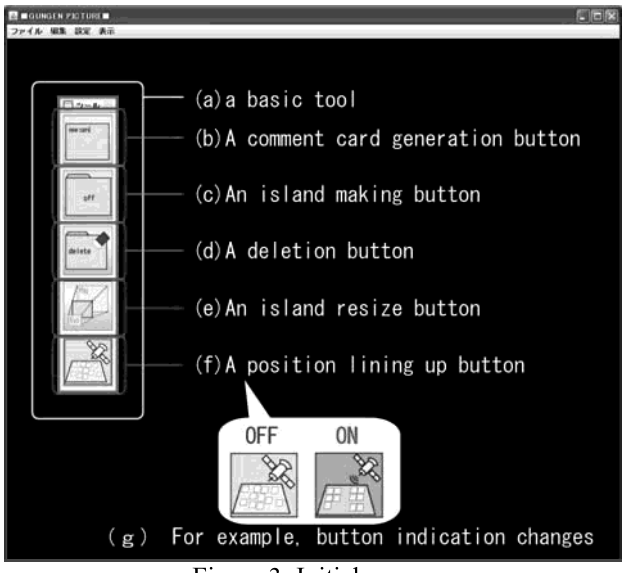

Figure 3: Initial screen

(2) Starting brainstorming

Figure 4 shows an example of the initial screen of brainstorming. After grouping PhotoLabels, we generate CommentLabels, and describe participant's ideas on the labels. If we click the CommentLabels and islands, we can input the characters and set color islands. The system has no flow control. We can operate each object simultaneously.

Figure 5 shows an execution screen of the system. Some CommentLabels are added to islands.

Figure 4: An example of the initial screen of brainstorming

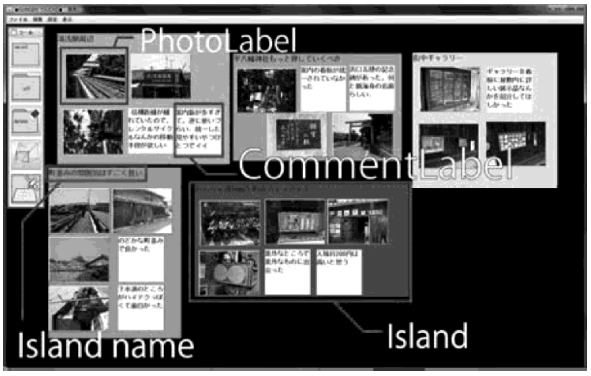

Figure 5: System execution screen

(3) Functions of system

We shall next explain functions except for the basic brainstorming tool. There is an expansion function for photographs. The photographs on the system are displayed as thumbnail images. Their sizes are 160pixel x 120pixel. This system makes the thumbnail image automatically when photographs are inputted. However, when a user needs to view a photograph in detail while working, the enlargement function can be used. If he or she touches a photograph when all buttons of the basic tool are off, the system enlarges the photograph to 480pixel × 360pixel. The size of the thumbnail images is 4 to 3. We decided the ratio from the aspect ratio of a digital photograph which we photographed with a general digital camera.

It is not easy for us to distinguish between photographs displayed in large quantities. We made the simple identification function of the photograph to assist the work of distinguishing between photographs. This is the lining up function of the photographs, which uses position information. An explanation of it is as follows. Figures 6 and 7 show examples of photographs aligned with this function. We choose one photograph from photographs displayed separately when the position lining up button is ON. As a result, a dialogue appears. We input distance information into a displayed dialogue in Figure 6. We can freely input the numerical value in a metric unit. Lining up is started when we push the start button of the dialogue. We line them up again with other photographs fulfilling a condition of the numerical value input mainly on the position information of the photograph that we chose. Figure 7 expresses the results of lining them up. There is no change in the photographs that do not fit that condition. When lining up is over, the position lining up button returns to OFF.

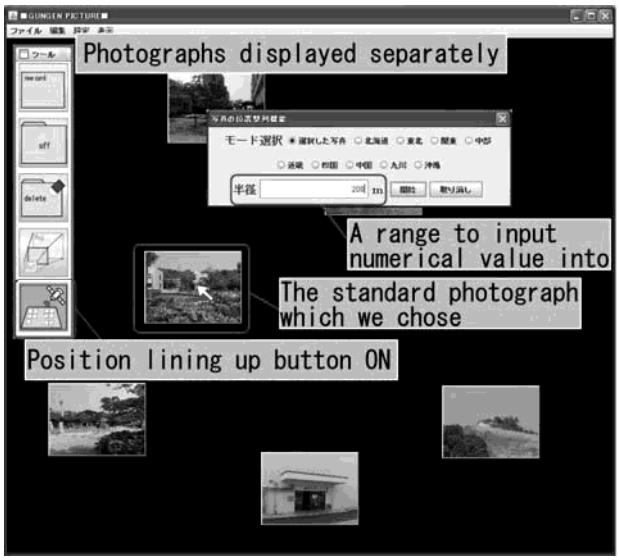

Figure 6: An example before using the position lining up function

Figure 7: After using the position lining up function

4 EXPERIMENT

We have carried out 2 experiments with GUNGEN-Photo. After the experiments subjects completed a questionnaire. The first experiment checked the effectiveness of identification by position information of digital photographs. In addition, we checked the grouping work of photographs with several people. One group consisted of four participants. Subjects were asked to take 20 pictures in Wakayama University. The camera the subjects used was a NIKON COOLPIX P6000. This camera can add position information to photographs automatically. We had subjects take photographs, then arrange them on GUNGEN-Photo.

40 photographs were used in this experiment, ten from each subject. Photographs were chosen at random. The number of participants was 16 and they were divided into four groups (Group A ~ Group D). All participants were students of Wakayama University and all belonged to the faculty of system engineering. The subjects perform grouping of all PhotoLabels by similarity. Once they give all islands names, the experiment is finished.

The second experiment was carried out to check the effect of the idea generation support system using digital photographs with position information by various people. The second experiment was performed by five groups (Group A ~ Group E). A group consisted of three people. The number of participants was 15. All participants were students of Wakayama University and belonged to the faculty of system engineering. We asked subjects to take pictures in the town of Yuasa in Wakayama Prefecture. We had subjects take photographs by group unit in experiment 2. We did not appoint a particular number of photographs. 40 photographs were used in this experiment, which were chosen freely by the subjects.. They carried out idea generation using digital photographs with position information of Yuasa town with several people on GUNGEN-Photo. At first we had subjects group the PhotoLabels. We call this work procedure 1. After grouping PhotoLabel, subjects made CommentLabels. We had subjects group both PhotoLabels and CommentLabels once again. Once the naming of the group was finished again, the experiment was finished. We call this work procedure 2.

5 EXPERIMENTAL RESULTS

5.1 Experiment 1 results

The results of experiment 1 are shown below. Table 1 shows the results of each experiment. The units of working time in Table 1 are minutes and seconds. A~B of Table 1 are group names. "AV" under the group name is the average of each parameter. The results of the questionnaire are shown in Table 2 and Figure 8 (five point scale evaluation).”5” is the highest score and “1” is the lowest. Each of the people in Figures 8 and 9 are the same. Table 2 is average of questionnaire on the position lining up function of the photographs. Figure 8 is the remark counts according to the subject of each group. The count of the remarks affects work in experimenting. The content of the remarks is not shown. Figure 9 shows questionnaire results concerning the merits of performing with various people according to the subject.

Table 1: The results of each group

	Working time	Number of remarks	Position lining up function	Image enlargement function	Number of islands
A	21m18s	299times	4times	13times	6units
B	47m22s	242times	3times	12times	7units
C	33m22s	235times	3times	9times	11units
D	25m20s	598times	5times	19times	6units
AV	31m51s	343.5times	4.3times	13.3times	7.5units

Table 2: The experiment 1 questionnaire

About the position lining up function the photograph	
1: Did you use the arranging photographs function?	4.4
2: Did you think that this function was useful?	4.2
3: Was this function a trigger to arrange photographs	4.0

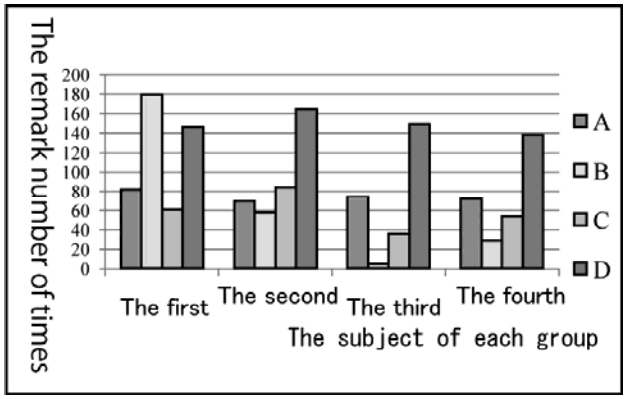

Figure 8: The remark counts according to the subject of each group

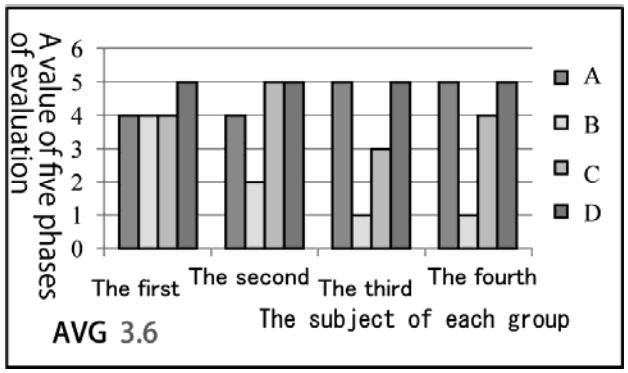

Figure 9: A questionnaire for the merit to perform with plural people

5.2 Experiment 2 results

The results of experiment 2 are shown below. Table 3 shows the results of experiment 2. “m” and “s” indicate minutes and seconds. Tables 4 and 5 show the average number of remarks of subjects during each work. We divided remark contents into 4 unlike experiment 1 (The contents of the remark were opinions, agreement, questions and answers). Tables 6 and 7 are the questionnaire results after finishing experiment 2. In Table 6,”5” is the highest score and “1” is the lowest. Table 7 shows description type questionnaire results.

Table 3: Results of experiment 2

The average number of islands when grouping PhotoLabels	8.2units
The average number of islands when making CommentLabels	8.2units
The numbers of CommentLabels	12.6units
The average working time of grouping PhotoLabels	18m19s
The average working time of making CommentLabels	27m16s

The number of islands in procedure 2 was the same as procedure 1. The number of comments was 0 to 4.

Table 4: The average number of the counts according to the type of subjects' remarks in procedure 1

Opinion	97.4
Agreement	47.4
Question	22.2
Answer	15.2
Total	182.2

Table 5: The average number of the counts according to the type of subjects' remarks in procedure 2

Opinion	180.4
Agreement	103
Question	23.6
Answer	20
Total	327

The number of remarks expressing "opinion" and "agreement" increased when making a CommentLabel. In contrast, "question" and "answer" hardly changed. Comparing procedures 1 and 2, the ratios of the agreement remark counts among remarks increased to 0.31 from 0.23.

Table 6: Questionnaire results of experiment 2

Do you think that there is a merit in operating with various people	4.7
Was the CommentLabel making function effective?	4.4

Table 7: Description type questionnaire results of experiment 2

The conversation becomes changed when we look back on comments while viewing photographs.
Viewing photographs stimulates lively Conversations and I can remember things I had forgotten.
We were able to think of at what point there was a problem while looking around the whole.
I want you to make the sensitivity of DT better.

5.3 Example of a CommentLabel

Figure 10 shows an actual example of a CommentLabel from experiment 2. The island name says "You should change the signboard at the gallery and you should arrange the detailed introduction in the gallery". It contains the comment "I do not attract attention. The sound of cars is unpleasant. I cannot observe it slowly. I wanted you to do a more detailed exhibition."

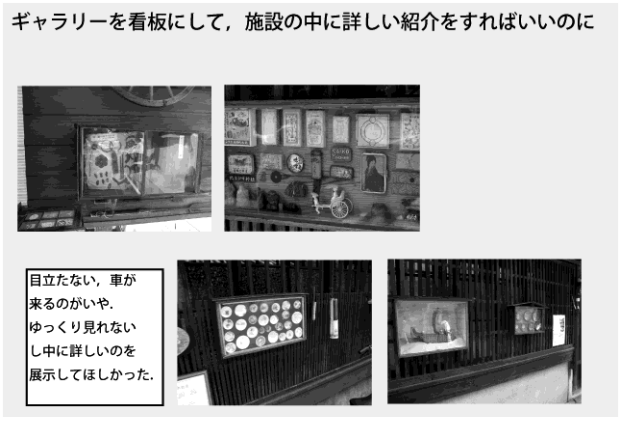

Figure 10: Example of a story that subjects made

6 DISCUSSION

6.1 The identification of photographs using position information

We now look at the frequency of use of the position lining up function in experiment 1. The use counts of the function were half in comparison with the number of islands. In addition, the evaluation average of item 1 of Table 2 was 4.4. We next discuss the effect of the function. We regard relations of the evaluation value of each subject for item 3 as item 1 of Table 2. We understood that the strong plus of 0.849 showed a correlation between the values of the two evaluations. Table 8 shows the discussion. Table 8 is a list of the correlation coefficients between each item in Table 1. Function practical use and the remark counts of the correlation coefficients are 0.939. This numerical value shows a very strong equilateral correlation. We believe that which promotes the activation of the argument is checked by the use of the function. The comparison of the working time of each group is - 0.713. This value shows a slightly strong negative correlation. We thought that shortening of the working time was possible if the use counts of the position

lining up function increases. In addition, the evaluation average was 4.2 (Table 2 (2)).

When we grouped the photographs which several people provided, we thought it possible to use digital photographs with position information for the identification of photographs.

Table 8: A list of the correlation coefficients between each item in Table 1

Item	Work time	Number of comments	Position lining up	Enlargement
Work time	1			
Number of comments	-0.49326	1		
Position lining up	-0.71314	0.93984	1	
Enlargement	-0.41957	0.93607	0.93048	1

6.2 Performing the grouping of photographs with several people

We next turn our attention to the number of remarks of each group and analyze the content of the remarks. Table 8 shows a correlation between the number of remarks and the number of times the enlargement function of photographs was used. As for this numerical value, a very strong equilateral correlation of 0.936 was identified. There was a remark "which group this photograph should be in". We discovered a correlation between the number of uses of the position lining up function and the number of remarks. The numerical value was 0.939, which we understood to be a very strong plus. We supposed that the argument became active when each function of the system indicated above was operated. Next, we looked at personal remarks between each group. A and D, which have small dispersion of remarks of subjects, have a short working time. In contrast, B, which has large dispersion of remarks of subjects, has a long working time. Figure 11 shows that we subtracted the personal remark counts from the average remark counts of each group. From Figure 9 and figure 11, there were many people who answered that it had “the merit of performing with several people” when the number of personal remarks was high. The correlation coefficient was 0.682.

The satisfaction of the subjects rises if they have lively arguments during the work of grouping PhotoLabels. We can suppose that working time is shortened because individuals speak equally.

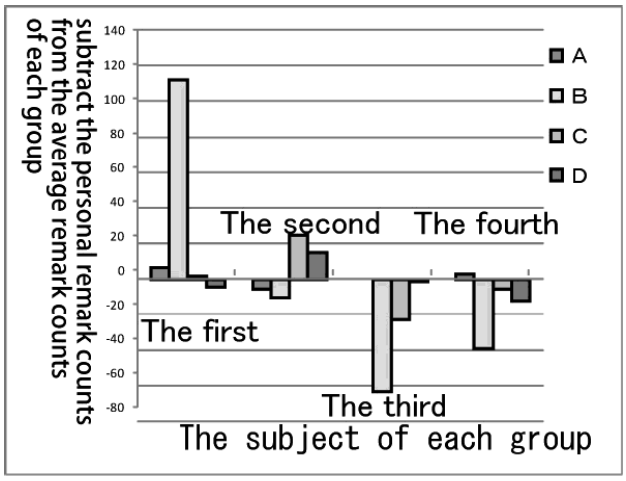

Figure 11: Subtract the personal remark counts from the average remark counts of each group

6.3 Making CommentLabels

We now describe the effect of the brainstorming that uses photographs with position information in article making in experiment 2. The evaluation value shows whether the CommentLabel function was effective (4.4). As for the CommentLabels, 1.5 (on average) were added for each island. Many ideas were proposed in CommentLabels. Some islands had no CommentLabels. In this case it is an island without a particularly strong impression. The number of cases of "an opinion and agreement" in each group increased by procedure 2, and opinions appeared more lively than in procedure 1. The ratios of the agreement remark counts among all remarks increased to 0.31 from 0.23. We supposed conversations arose between subjects by procedure 2.

6.4 Brainstorming using photographs with position information with several people

As for the number of islands, each group was the same as between procedure 1 and procedure 2. We thought that this is because procedure 1 involves choosing photographs at the time of making trip articles. However, there was only one example that was different in the photograph which was stored on an island. The total number of remarks for each group and item 1 of Table 6 correlate. The value was 0.6680 - about the same as experiment 1. In addition, we looked at the content of the remarks of each group by experiment 2 to examine which remarks were effective in procedure 2. The correlation coefficient value was highest for "opinions", at 0.5537. The other three items had almost constant values. Each value was 0.3129-0.3428. We can guess that merits for participants rise if numerous opinions appear at the time of making comment labels. Next, we compare procedure 1 in experiments 1 and 2. Members in each group unit could understand the meaning of all photographs, so the photograph lining up function was not used frequently.

7 CONCLUSION

We have developed GUNGEN-Photo. This system is an idea generation support system using digital photographs with position information to perform with the various people. We carried out 2 experiments on GUNGEN-Photo. The first experiment checked the effectiveness of identification by position information of digital photographs and grouping of photographs to perform with several people. The second experiment checked grouping of photographs to perform with several people (subjects took pictures by a group unit), effects of making CommentLabel and what kind of effect there was for idea generation. As a result, the following were understood.

(1) We can support the identification of photographs by position information.
(2) Many ideas were proposed in CommentLabels.
(3) As for the number of island, each group was the same in procedures 1 and 2 together. The number of islands was 8.2.
(4) The satisfaction of the subjects rises if they have lively arguments during the work of grouping PhotoLabels.
(5) The ratio of "agreement remark" counts among all remarks increased to 0.31 from 0.23 in procedure 2 (CommentLabel adding step).

In the future, we would like to improve our software for the idea generation support system using digital photographs with position information by various people, and it is our aim to establish it as entertainment.

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