What type of hints can vitalize the brainstorming session?

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Abstract: A lot of supporting tools for vitalizing brainstorming sessions have been proposed. Some of them show the participants hints for discussions, e.g. keywords and images, to the members. The author’s research group also has proposed a supporting system for vitalizing brainstorming sessions, in which related images of ideas thrown in the session are shown for the participants as hits. However, the effects of this type of hint had not been investigated yet. Thus, experiments were conducted to show the effects. In the experiments, effects of three types of hints, (1) relevant words of the words used in ideas presented in the discussion, (2) images retrieved by using words used in ideas presented in the discussion as keywords, and (3) images retrieved by using relevant words of the words used in ideas presented in the discussion as keywords, were compared. As a result, it became clear that the third type of hints can increase number of utterances and diversity of the subjects in discussions.

Keywords: KJ-method, Idea creation, Group discussion

1. INTRODUCTION

Brainstorming method is widely used in group meetings in companies, educational institutions, communities, etc. because of the facile introduction [1]. KJ-method is one of the most popular methods used in brainstorming sessions [2]. In KJ-method sessions, each idea thrown out by the participants is written on a small card. By organizing and grouping the posted cards, participants can find relationships between submitted ideas during the discussion, and it helps them to submit more ideas and conclude the discussion.

Although KJ-method is a powerful tool, several weak points also have been pointed out. For instance, participants have to throw out their ideas as much as they can, but generating many ideas is not so easy for ordinal participants. Moreover, in brainstorming sessions, creating unique and novel ideas is requested for the participants, but it is also hard for ordinal participants.

To solve such problems, many supporting systems have been proposed. Some of them show the participants some hints for discussions, e.g. keywords and images. The author’s research group also has proposed a supporting system for vitalizing brainstorming sessions that shows relevant images about ideas presented in the discussion as hits [3]. However, the effects of these hints had not been investigated.

Thus, in order to compare the effects of the following three types of hints, experiments were conducted.

(1) Relevant keywords: related words of the words used in ideas presented in the discussion
(2) Relevant images: images retrieved by using words used in ideas presented in the discussion as keywords
(3) Semi relevant images: images retrieved by using related words of the words used in ideas presented in the discussion

Figure 1 illustrates each hint.

Figure 1: Results of multidimensional scaling method

In this paper, the results are shown and discussed.

2. BACKGROUND

Several systems for supporting idea creation have been proposed.
What type of hints can vitalize the brainstorming session?

Interaction Design Keywords: KJ-method, Idea creation, Group discussion

Watanabe et. al. proposed a tool to help the users meet new information which relates their interests [4]. The users make notes on cards on their PC screen same way as writing notes on sticky notes. When a user makes a note on a card, the card appears on the screen and move slowly for a direction. As two cards touch together on the screen, a new card appears on the screen. In the new card, information that is retrieved by using the two keywords on the original cards is described. This system shows the users relevant information about the users’ idea for activating the users’ imaginations.

Kang et. al. have developed a mobile application, called Category Camera, for supporting to create new idea in group meetings after fieldworks [5][6]. The users can put labels on photographs easily after taking them by using this mobile application. The labels help users to classify the photographs in the discussion phases. In this system, keywords associated with images are used as hints for creating new idea.

It is known that visual stimulate is one of the important types of hint for idea creating [7]. The author’s group also has proposed a supporting system for vitalizing brainstorming sessions by using relevant images of thrown ideas in the session [3]. This system is designed as to activate discussions with KJ-method. Members of a discussion describe their ideas on cards on the screen. Then, images retrieved by using relevant words of important words used in the ideas described on the cards, we call them semi relevant images, appear on the screen. Here, it must be emphasized that not the words used in the ideas but relevant words of them are used as keywords for retrieving images. As a result, diverse kinds of images are obtained and they can extend users’ imaginations.

All of these three systems use relevant keywords for providing hints for the users. The first two systems use keywords whereas the last system uses relevant images as hints for discussions. Thus, we discuss types of hints for discussions from two standpoints; keyword or image, and keywords used in ideas or relevant keywords of words used in ideas.

3. EXPERIMENTS

Experiments have been conducted in order to investigate the effects of hints displayed during group discussions.

The following three types of hints were given for the participants:

- **Type 1**: Relevant keywords; relevant words of the words used in ideas presented in the discussion

- **Type 2**: Relevant images; images retrieved by using words used in ideas presented in the discussion as keywords

- **Type 3**: Semi related images; images retrieved by using relevant words of the words used in ideas presented in the discussion

Numbers of utterances and presented ideas in the discussions were counted to evaluate the activation levels.

The participants are 16 students from an engineering course of a Japanese national university. 12 of them are the 1st grade of graduate school students and the others are 4th grade of under graduate school students (average 22.18 years old, SD 0.79). The participants were divided into 4 groups, Group A, B, C and D. Each group was asked to conduct discussions under two conditions as described in the section 3.1.

In the experiments, kizAPI [8] was used for generating relevant words, and Bing search [9] was used for obtaining relevant images.

### 3.1 Procedure of the experiments

The procedure of the experiments is shown below:

1. Instructions of brainstorming method and the experiments for the participants
2. Exercise of brainstorming method (5min)
3. Break (3 minutes)
4. Group discussion 1 (10 minutes)
5. Break (3 minutes)
6. Group discussion 2 (10 minutes)

The following two topics were discussed in the experiments:

- **Topic 1**: How to let children who do not like vegetables eat them.
- **Topic 2**: If your group has extra income of 5,000JPY, how to use it?

<table>
<thead>
<tr>
<th>Table 1: Combinations of topics and hints for each discussion</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group</strong></td>
</tr>
<tr>
<td>Discussion 1</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Discussion 2</td>
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<td></td>
</tr>
</tbody>
</table>

Table 1 shows the combinations of topics and types of hints shown in the discussions. In order to reduce the effects of order, the orders
were changed for each group.

3.2 Results
Table 2 and Table 3 show the number of idea thrown out and the number of utterances told in the discussions.

<table>
<thead>
<tr>
<th>Hint type</th>
<th>Group</th>
<th>Ideas</th>
<th>Utterances</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>B</td>
<td>9</td>
<td>200</td>
</tr>
<tr>
<td>2</td>
<td>C</td>
<td>14</td>
<td>178</td>
</tr>
<tr>
<td>3</td>
<td>A, D</td>
<td>15, 15</td>
<td>225, 107</td>
</tr>
</tbody>
</table>

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<tr>
<th>Hint type</th>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A</td>
<td>17</td>
<td>260</td>
</tr>
<tr>
<td>2</td>
<td>D</td>
<td>9</td>
<td>136</td>
</tr>
<tr>
<td>3</td>
<td>B, C</td>
<td>10, 7</td>
<td>266, 207</td>
</tr>
</tbody>
</table>

4. DISCUSSION

4.1 Number of utterances
It is difficult to find some trend from Table 2 and 3. Therefore, in order to investigate the effects of each type of hints, the number of utterances after displaying hints is counted for each condition, and they were compared. First, each discussion was divided into 60 periods as each period has 10 seconds. Then the utterances in 5 periods from the next period in which a hint was displayed were counted, and the average was calculated for each condition. Table 4 shows the results.

<table>
<thead>
<tr>
<th>Hint type</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topic 1</td>
<td>4.50</td>
<td>2.83</td>
<td>3.94</td>
</tr>
<tr>
<td>Topic 2</td>
<td>4.20</td>
<td>2.50</td>
<td>4.50</td>
</tr>
</tbody>
</table>

As a result of Kruskal-Wallis test, Marginally significant differences were found among the average numbers of Topic 1 (p<0.10). For the Topic 2, despite significant difference could not be found, the p-value is close to the threshold value (p=0.137).

From the results, it is expected that hints obtained form relevant keywords of submitted ideas is better than hints obtained from words used in presented ideas for vitalizing discussions.

4.2 Variety of topics in a discussion
In order to investigate diversity of the discussions, the utterances data were analyzed by using multidimensional scaling method. The process is shown below:
1. Obtain sets of words construct each sentence by using Japanese morphological analysis tool, ChaSen [10].
2. Eliminate words, which do not express the contents of discussions, i.e., Articles, numeral and preposition [11].
3. Make N-dimension vectors, N stands for the numbers of words used in all of the utterances. If the word is used in a sentence, then the element corresponding the word is 1, otherwise 0.
4. Project all sentences into a 2-dimensional space by using multidimensional scaling method.

The results are shown in Figure 2. The red circles in the figures indicate clusters of utterances. Utterances in a same cluster include many same words. Thus, we can think that if there are more clusters more wide varieties of topics have been discussed in the discussion. The table 5 shows the number of clusters under each condition.

<table>
<thead>
<tr>
<th>Hint type</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topic 1</td>
<td>6</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Topic 2</td>
<td>5</td>
<td>3</td>
<td>6</td>
</tr>
</tbody>
</table>

We can see from Figure 2 and Table 5 that there are most clusters in the results of discussions with the hints of type 3, meanwhile there are least clusters in the results of discussions with hints of type 2. From the results, it is expected that relevant image is the most useful type of hint for make discussion topics widely.

4. CONCLUSION
In this paper, the effects of hints displayed in brainstorming sessions have been discussed based on the results of experiments.

Three types of hints, (1) relevant words of the words used in ideas presented in the discussion, (2) images retrieved by using words used in ideas presented in the discussion as keywords, and (3) images retrieved by using relevant words of the words used in ideas presented in the discussion as keyword, were compared. As a result, it is revealed that the third type of hints can increase number of utterances and variety of topics in
discussions.

In this paper, only the types of hints shown in brainstorming sessions were discussed. However, it is predicted that the timing of giving such hints is also significant for idea creating, so it should be investigated in the future.

In the experiments, relevant words and images were obtained by using open APIs. It is also predicted that the effects of hints depends on the retrieving algorithms. The relationship between mechanisms of retrieving them and the activation level of brainstorming sessions also must be investigated in the future.

ACKNOWLEDGMENTS

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REFERENCES