Invited Paper

Idea Processor and the KJ Method

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Although outline processors are widely used in the States for creating large documents in text form, compact documents in chart form are much more appreciated in Japan, because large documents are expensive to make due to inefficient Japanese typewriter. For making such compact chart, the so-called KJ method may be used. This method was originally developed for anthropological field work, but it is so useful for idea generation that it is widely used in Japanese business society.

The KJ method itself is briefly described. The most serious problem when this method is carried out on a computer is how to get panoramic view of the whole chart and our trial for this problem is described. Our experience on using such a program is also described.

1. Introduction

Stimulated by the outcome of outline processor software developed in the United States such as Think Tank, MORE and Grand View, Similar software has been developed by Japanese software houses, namely, Plan-Up, IDOQ and Hyper X. However, different aspects can be seen in some of the Japanese outline processors (for example, Plan-Up) because of the differences in the social tradition of documentation.

In the western world, large documents in linear text form may economically be created by using a typewriter. Tree structure, which can be expressed as chapter, section and so on, was introduced for making large documents understandable. Outline processor are the programs which support the process of making this tree structure.

In Japan, until recently making large documents has been very expensive because Japanese typewriters were very inefficient compared to the western ones due to the large character set. Although this situation has been changed by the introduction of Japanese word processors, compact documents in two-dimensional chart form have been and still are appreciated by Japanese business society, because of this historical fact.

J. Kawakita developed a chart forming method [1] for his anthropological field work. This so-called KJ method after the inventor's initials (note that family name comes first in Japan) was so general for new idea generation that it was widely accepted in Japanese business society. One of the function of Plan-Up was designed with the intention of carrying out this method.

When doing creative works, record cards are often used. They are compact, easy to handle, and can be stored in a box. More important, a card system is flexible, easy to arrange and rearrange, and to group and classify. The KJ method describes how to carry out card handling for new idea generation.

Recently with the introduction of AI technology, the KJ method has drawn the attention of AI people as a method for knowledge acquisition, and several systems have been developed in this regard [2], [3].

Nishio and Yamada proposed a model for idea processing and a supporting environment for idea generation by using hypertext technology [4].

Sugiyama and Misue proposed a method for automatic drawing of area-net diagram in a readable way [5]. Yamaguchi, Fukui and Iwai developed an automatic document layout system which employs automatic extraction of document logical structure which consists of hierarchical and referential relations between logical units such as chapters, sections, paragraphs, figures and tables [6].

We have developed an editor system which implements the KJ method on a personal computer [7]. In the next section the KJ method itself is briefly described. Then, how the developed KJ editor has been realized is shown. The limitation of the system imposed by the size of the video screen is pointed out, but usefulness of the system is also shown.

2. The KJ Method

The KJ method was developed for idea generation. The method claims to establish an orderly system from chaos through its proper usage. Those who claim that the method is useless or inefficient often use it improperly in their own way.

The first step of the method is to write down on a card what has come to mind on the subject to be discussed. At this step, no judgement should be made on the importance of what is to be written, because what is important can only be established at the completion of the method. In fact, even trivial matters which come to mind should be recorded on a card.

The second step is to associate several cards into one

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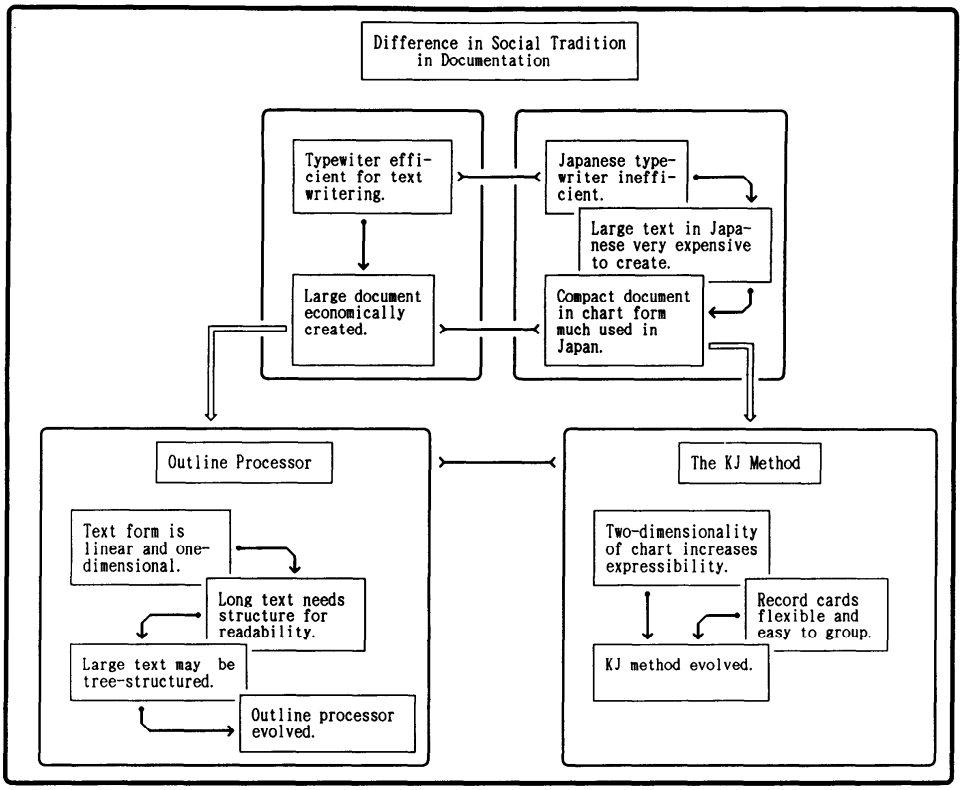

Fig. 1 A-type diagram generated by the KJ editor.

group. This grouping should be done subjectively by examining the content of the cards. Grouped cards may be labeled by a new card which represents the nature of the group. Then the groups may further be grouped in a hierarchical manner.

The third step is to arrange the card groups on a large piece of paper and to enclose each group by an outline to make clear the mutual relationships between the cards and groups. At this stage, the internal structure of the matters written on the cards which is invisible in the first step, becomes visible. The relationships include opposition, causality, and equality, and are marked by special lines. The result is called the A-type diagram (See Fig. 1.).

The fourth step is to write down an essay on the subject according to the A-type diagram just completed. This step is called B-type writing. It should be noted that the A-type diagram represents the subject spatially, and that the B-type writing represents the same information is a sequential order. Because of the difference in representation, while doing B-type writing, oversight in the A-type diagram may be found and some revision must then be made at that time. However, at this point if the cards are pasted on a piece of paper, this is not easy. This fact often make one hesitant in revising the diagram.

3. The KJ Editor

We have developed a program on which the KJ method can be carried out. On using this program, a video terminal display becomes a desk-top on which cards are arranged. A card may be generated any place in the display and a sentence can be written on it using a keyboard. The size of the card may be changed using a mouse. A generated card may also be picked and moved by the mouse.

The program was developed on a PC-9801 of NEC, the most popular personal computer in Japan. The size of the desk-top or the display is that of 200*150 Japanese or 400*150 alphanumeric characters and 250 cards may be arranged on it. (Width on a display and code length of a Japanese character is equivalent to those of two alphanumeric characters.)

The problem with card manipulation simulation on a computer is the size of the screen. We cannot use a big screen whose size is as large as a desk. However, a large desk is a must when tens of hundreds of cards are manipulated.

In order to solve this problem, we superimpose two screens on a video terminal. One is a bitmap screen that give the arrangement of cards, but individual card

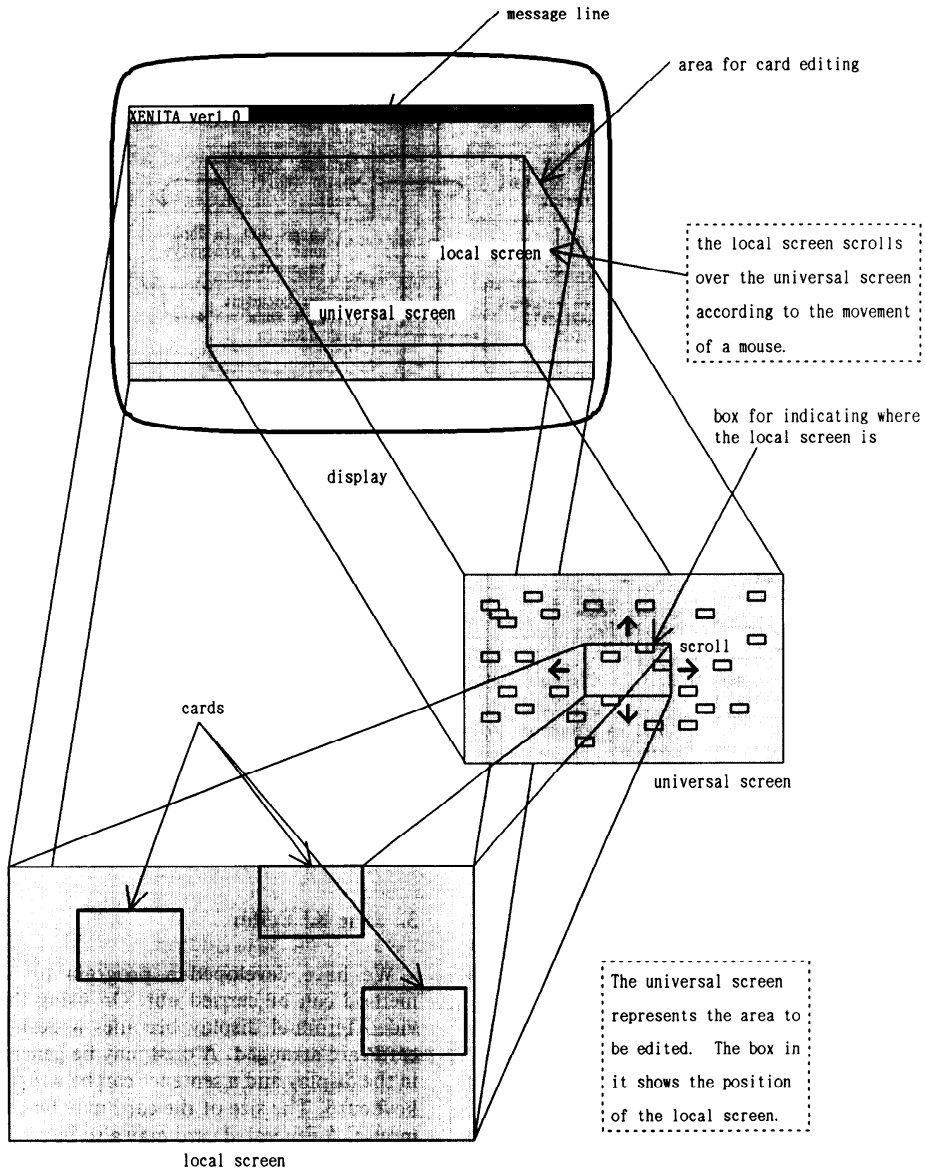

Fig. 2 Superposition of universal and local screens.

details are invisible. The other is a character screen that gives a close-up view of the card arrangement on the bitmap screen and written characters on individual cards there are visible and readable (see Fig. 2). We call the former the universal screen (200*150 characters in size) and the latter the local screen (40*23 characters in size). These two superimposed screens are of different color and can easily be distinguished.

The advantage of using a character display as a local screen is that it can be scrolled very fast. Also, another advantage is that when a card is picked and moved by the mouse, it can be moved around quickly, because rewriting of the character screen can be done very efficiently. On implementing this program, close care was taken for designing the data structure for realizing fast movement of cards [8].

A Japanese character is displayed on a screen by a 16*16 bit array on the terminal we use. On a bitmap display 16*16 bits must be transferred to the video memory to display a character. However, on a character display only 16 bits are needed to be transferred to the video memory and the character image can be constructed from the font memory. This means that the writing speed of character display is 16 times faster than

that of the bitmap display.

The disadvantage of the character display is that the displayed images are limited to those that can be generated by the font memory. Fortunately on Japanese personal computers, one hundred and eighty eight user defined fonts called GAIJI are available for supporting user-defined Kanji. We use these for drawing card edge lines, grouping lines and relationship lines.

4. Getting the Panoramic View

In the second step of the KJ method, related cards are grouped together. Association must be carried out between cards which may be scattered all over the universal screen. If it is done on a real desk, the user's eyes can be moved around freely. On the display terminal, however, the local screen must be moved around all over the universal screen according to the mouse's movement.

Although fast scrolling can be achieved by using a character display, human eyes cannot accept it if the scrolling is done at the fastest speed available, due to the nature of character display as described earlier. When scrolling is done very fast, we observe the same effect as that of seeing a close object from the window of a fast moving car.

On a desk when we move our eyes around, we do not see objects which are passed during the movement, although we are not aware of this. This effect is known as saccadic suppression [9]. We have measured efficiencies of card handling between hand manipulation and that of the KJ Editor [8] and found that this effect is most troublesome [10].

Because of this effect, although a panoramic view may be obtained logically by scrolling, it is less efficient than the eye movement over cards on a real desk-top. Therefore, we need a wide screen for getting panoramic view, but it is not available due to the limitation of the current technology.

Although panoramic view may not be comfortably obtained on a display terminal, several other advantages are available on the editor. For example, cards in a group can be moved together by picking and moving the group line. A hidden card of a piled group may be picked instantly. Among these advantages, editing facility is the most powerful one. If physical cards are grouped and arranged on a large piece of paper, they must be pasted. Once a card is fixed, re-arrangement is very troublesome. If this process is done logically on a computer, re-arrangement causes no trouble.

5. Applications of the KJ Editor

The KJ method was invented about twenty years ago and has been successfully used in business and management in Japan. In fact, many businessmen have been taking training courses of this method. Our editor may be used for training. The advantage of using a computer for training is that a CAI system may be constructed and that a record of user's action may easily be recorded and utilized for various instruction purposes. It can also be expected that new techniques, which are impossible in hand manipulation, may be found by taking advantage of the computer's abilities.

It is interesting that an inexpensive personal computer can provide a better man-machine interface than an expensive workstation on which only a bitmap display is available. One of the target usages of the personal computer we use is video games; these games require a good human interface. Our success is partly due to this fact.

One consequence of this good human interface for the KJ editor is that it is used not only for the KJ method but also for creating a schematic diagram in the form of arranged cards. In this case, getting a panoramic view is not necessarily important and the quick response and neat representation capability of the editor provide an attractive feature to the user. The dynamic process of making a card arrangement may be used as a tool to represent the concept to be explained, which suggests a new technique for presentation.

One of the applications we have in mind in addition to the above is to use it for making software specifications [11]. Once the specifications are made, how to define and develop them into a program has been studied (for example, [12]), but almost no technique has been available for how to create these specification from scratch.

In many software development situations, additional requirements are found for the specification after the completion of coding, and a large cost is paid to satisfy them. This is due to incomplete requirement analysis.

The KJ method is a very powerful tool for requirement analysis, and we are trying to construct a software development environment including the KJ editor, a program design chart editor, and provision for coding and documentation [11].

References

1. KAWAKITA, J. The KJ Method: Let Chaos Tell (in Japanese), Chuokoron-sha, Inc., Tokyo, 1986; The Original KJ Method (in English), Kawakita Research Institute, Tokyo.
2. SHINOHARA, Y. Development of a Knowledge Acquisition Support System 'CONSIST' (in Japanese), Economic Research Center Rep. No. Y86003, Research Institute of Electricity, Tokyo (1987).
3. FUSE, R., WAKINO, T. and SAWAI, S. Method of Knowledge Acquisition Support Tool 'KNOA' (in Japanese), *Proc. of Thirty Fifth General Meeting of IPS Japan* (1987), 1787–1788.
4. NISHIO, N. and YAMADA, H. A Model of Idea Processing and its Assisting Environment (in Japanese), *Proc. of Third Symp. on Human Interface*, Osaka (1987), 127–134.
5. SUGIYAMA, K. and MISUE, K. A Cognitive Approach to the Automatic Drawing of Area-Net Diagram (in Japanese), *Proc. of Fourth Symp. on Human Interface*, Tokyo (1988), 13–18.
6. YAMAGUCHI, K., FUKUI, M. and IWAI, I. Automatic Layout System Using Analysis of Document Architecture (in Japanese), *ibid.* 19–22.
7. KAWAI, K., KOYAMA, M. and OHIWA, H. A KJ Editor on Workstation: Computer Aided Idea Processor (in Japanese), Report No. OS86-50, Special Interest Group on Office Systems, *Institute of*

Electronics, Information and Communication Engineers (1986).
8. KOYAMA, M. The KJ Editor: a Supporting Tool for Idea Generation (in Japanese), *Thesis for Master of Engineering*, Toyohashi University of Technology (1988).
9. BOFF, K. R., KAUFMAN, L. and THOMAS, J. P. (Eds.), Handbook of Perception and Human Performance, John Wiley and Sons, New York (1988).
10. OHIWA, H. Keyboard and Display, Report No. SIG-HICG−8803−3 (12/8), Special Interest Group on Human Interface and Cognitive Model, *Japanese Society for Artificial Intelligence* (1988).
11. OHIWA, H., KAWAI, K., TAKEDA, N., KOYAMA, M. and SHIOMI, A. Software Tools for Fundamental Design of Software (in Japanese), *Proc. of Fourth Annual Meeting of Japan Society for Software Science and Technology*, Kyoto (1987), 383-386.
12. DEMARCO, T. Structured Analysis and System Specification, Prentice-Hall, Englewood Cliffs, New Jersey (1979).

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