

## The Design of a Pen-based Interface 'SHOSAI' for Creative Work

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### 1. INTRODUCTION

Recently computer systems have come to be used for creative work such as writing documents. This is because they are helpful to users in preparing documents, editing, searching for words and so on. As an environment for supporting creative work, however, they are incomplete. One reason is that they do not help the thinking process for tasks such as thinking over the contents, restructuring them and brushing them up, etc., which are essential in creative work. Worse still, thinking is obstructed by chores needed to manipulate the computer. Therefore, many users work on paper with a pen for the creative thinking processes, and they must then input the results into computers after completing this process.

Recently there has been a boom in pen computing, which employs *pen interfaces* with a display-integrated tablet as the human-computer interface. With a pen computer a user can interact with the computer through handwriting. Handwriting interaction is suited to interfaces for creative work, because handwriting can be carried out while thinking. Therefore, it can be expected to help make a computer system which solves the previous problems. However, present pen computers do not exploit pens' merits sufficiently, probably because almost all the applications are designed for a mouse and even applications for pens are made compatible with a mouse.

This paper describes a pen computing environment 'SHOSAI' for creative document preparation. The system combines the merits of working on paper with the advantages of computing, and helps the user from the stage of thinking about contents to the stage of printing final drafts.

### 2. CHARACTERISTICS OF SHOSAI

#### 2.1. Interaction Technique with a Pen

A pen is used in almost all interactions in SHOSAI. Therefore, work can be done without changing devices. As interaction techniques, pen gestures which exploit pens' merits, floating menus, dialogs (figure 1) and the like are used

as seen suitable.

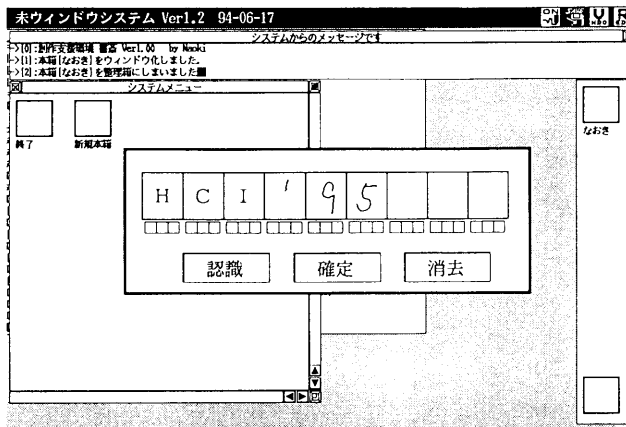


Figure 1. Labelling by handwriting.

## 2.2. Metaphor Interface

SHOSAI provides a metaphor interface that imitates the real world (figure 2). For example, SHOSAI provides paper metaphors on which one writes memos, bookcase metaphors to store them in and stationery metaphors for drawing up figures. Paper metaphors encapsulate the functions of files and applications in traditional computer environments, and users work with the paper metaphor which is most suitable for their purpose.

Metaphors can be used naturally because they are manipulated like objects in the real world, and metaphors have more merits than real objects because they include the merits of computers. However, metaphors have a problem in that they are not identical to real objects, and this gap grows wider the more you include the merits of computers. It is important to consider this point in the implementation of metaphors.

## 2.3. Lazy Recognition

Traditional pen computer systems have some problems with their recognition method and the handling of handwritten patterns. Often they try to recognize a handwritten pattern immediately as a character, symbol, or whatever else and discard the original pattern after recognition. Since recognized results sometimes include misrecognitions, the user must correct them. Correction work interrupts one's thinking, and one may not remember what one wrote. Also even if there is a mode in which handwritten patterns are kept as they are, they can not be recognized subsequently. To solve these problems a style is needed which does not recognize handwritten patterns immediately or delays the display of recognition results until needed. The 'Pen Point' operating system proposed the

style named *delayed recognition* in 1991 [1], focusing on writing down ongoing discussions or presentations where there is no time for the correction of misrecognitions. We proposed the style named *lazy recognition* in 1990 to design an interface that does not interrupt one's thinking [2]. In SHOSAI, this is employed, i.e., handwritten patterns are stored as script objects and can be recognized when the user wants to, as well as the original patterns being able to be viewed even after recognition.

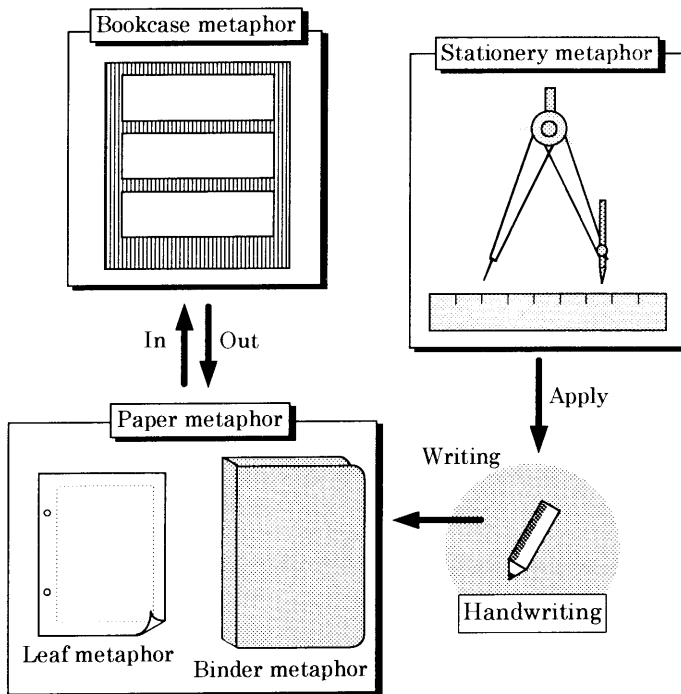


Figure 2. The metaphor interface.

### 3. HOW DOCUMENTS ARE CREATED

In the first version of SHOSAI the user can create OHP manuscripts.

#### 3.1. Phase of Creating Contents and Rough Copies

Traditional computer systems do not support the phase of creating contents and rough copies. This phase is important for creative work. SHOSAI's interface is designed to support this phase. On a *blank leaf metaphor*, which is a kind of a paper metaphor, the user can write script objects freely and directly by handwriting with a pen (figure 3). Handwriting interactions do not obstruct

one's thinking, therefore the user can write at the same time as thinking about the contents. One's thinking can even be promoted by the act of writing and then viewing the handwritten patterns.

### 3.2. Phase of Making Neat Copies

When making neat copies, the user does not have to rewrite objects. The user makes neat copies from rough copies by using various commands. In traditional pen computer systems, script objects which were not recognized when they were written could not be recognized. In SHOSAI, script objects can be recognized and converted to code objects by lazy recognition commands (figure 4). When script objects are misrecognized, the user has to correct them but in this phase there is no need for thinking. Therefore, the user's creativity is not adversely affected.

### 3.3. Phase of Revising

To complete documents, revisions are carried out repeatedly. Computer systems have the merit that documents can be edited (copied, deleted, moved, etc.) easily, but existing systems do not support our revisions like those possible on paper. We may write proof marks but we often cancel or change them while thinking. If they are executed immediately as on computers, our revision process will become inconsistent. To satisfy these needs, SHOSAI employs lazy recognition for even pen gestures. These *lazy gestures* provide a style like the proof-reading style with pen and paper in the real world. Strokes lazy gestures are kept as proof mark objects on the paper metaphor. When the proof-reading work is completed, they are specified to be executed and texts are revised with them. When a user uses the lazy gestures, one's thinking for revision is not obstructed by verifying that their recognition and revising results are correct. Also the lazy gestures provide an environment for CSCW where correction proposals by others are selectively executed by the author.

## 4. IMPLEMENTATION

SHOSAI is composed of several layers, as in figure 5. We made all the systems software experimentally by ourselves. The window system layer provides basic visual and interaction interfaces. The data management layer called the *Virtual Paper Management System* provides the functions of management, handling and visualization of objects on paper metaphors. The user interface layer is implemented by using functions of the window system and data management layer and is composed of several managers. Each layer and manager is implemented independently to ensure expandability and reliability.

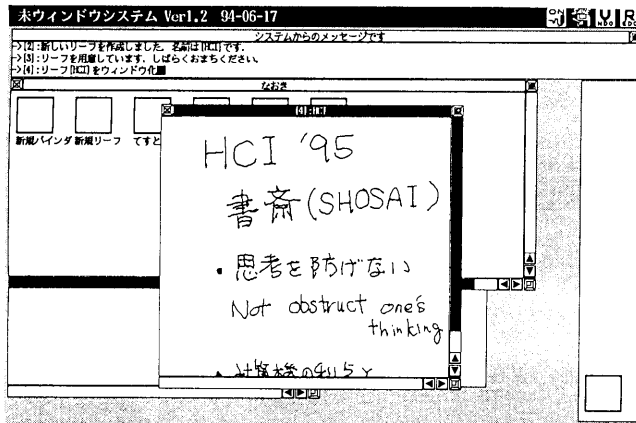


Figure 3. Free writing.

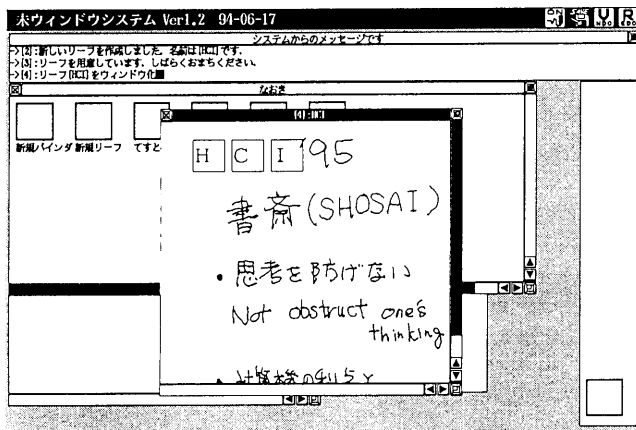


Figure 4. Character recognition.

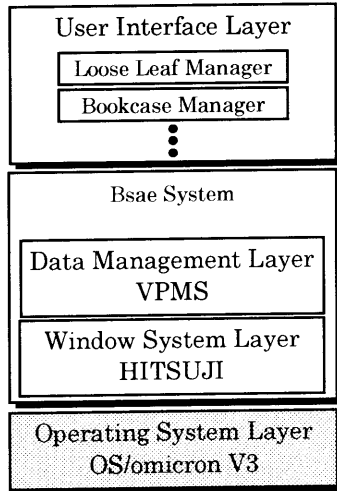


Figure 5. Structure of SHOSAI implementation.

## 5. SUMMARY

This paper have presented the system named SHOSAI for supporting creative work, using a handwriting (pen) interface. Since handwriting does not obstruct people's thinking, it is suitable for creative work. The system is designed so as not to obstruct the user's thinking and to combine the merits of paper with the advantages of computers. In order to satisfy this design concept, the system provides interaction techniques with a pen, the metaphor interface and lazy recognition. By using this system, a user can create documents effectively from the stage of thinking about contents to the stage of printing final drafts.

## REFERENCES

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