

Shared Freeform Input for Note Taking across Devices

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ABSTRACT

Shared freeform input is a technique for facilitating note taking across devices during a meeting. Laptop users enter text with a keyboard, whereas PDA and Tablet PC users input freeform ink with their stylus. Users can quickly reuse text and freeform ink already entered by others. We show how a new technique, freeform pasting, allowed us to deal with a variety of design issues such as quick and informal ink sharing, screen real estate, privacy and mixing ink-based and textual material.

Keywords

Shared input, freeform pasting, note taking, pen computing

INTRODUCTION

In a previous work, we have presented Shared Text Input, a system for letting PDA users share textual notes in real-time during a meeting [1]. This system proved to be useful to quickly reuse words already entered by fellow note takers. However, instead of having to input text with a soft-keyboard, PDA and Tablet PC users felt that freeform ink input was more natural to use on their device.

Based on this feedback, we designed freeform pasting, a new technique that allows PDA and Tablet PC users to quickly share and reuse freeform ink in real time. First, a user selects ink strokes (Figure 1a) with a single gesture (Figure 1b). The system selects all the strokes intersecting the selection stroke and allows the user to select more strokes within a second. The selection stroke is then approximated with the segment [AB] (Figure 1b). The user can quickly paste or share the selected strokes by drawing a new stroke (Figure 1c). Again, the system approximates this stroke with a segment [CD] (Figure 1c). Using [AB], [CD] and the set of selected strokes, the system is able to **reposition**, **rescale**, and **reorient** the strokes before they are pasted or shared (Figure 1d).

Because the system remembers the association between a set of selected strokes and a given segment [AB], users can quickly reuse a set of strokes with a single tap and paste them somewhere else with a new pasting stroke (defining a new segment [CD]).

The note-taking server also uses the grouping to automatically present ink material horizontally and correctly rescaled (Figure 2 bottom), as in a traditional chat system. This traditional layout allows us to include both ink and text content in the shared area, enabling both laptop and PDA users to quickly reuse textual and ink material.

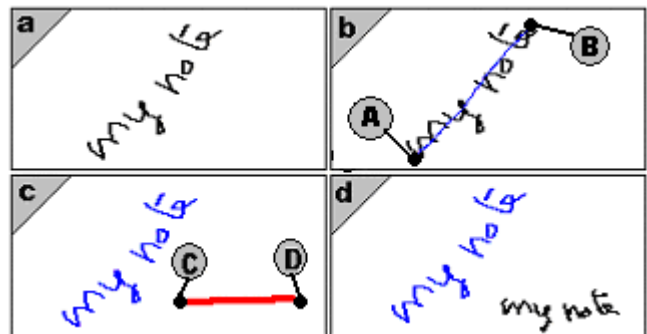


Figure 1. Freeform pasting technique: a) freeform ink; b) user draws a selection stroke, giving segment [AB]; c) user draws a pasting stroke, giving segment [CD]; d) the algorithm positions, rotates and scale the selected strokes to fit along [CD].

DESIGN ISSUES

When designing the system, we had to address several issues: provide a quick and informal way to share freeform ink, address privacy concerns, account for the small PDA screens and mix ink-based and textual content. We explain how freeform pasting addresses these issues.

First, we observed that users typically write at different angles and different sizes. Simply copying ink from a user into the shared area would be impractical: the shared area would quickly become cluttered, with strokes from all users being layered on top of each other. Also, reusing ink strokes would be challenging: which strokes should be selected when a lasso or a selection stroke is drawn? With freeform pasting, users specify the grouping of their strokes with a single selection stroke. This stroke is used to determine the set of selected strokes, the length of the selection and its orientation.

Privacy is also an issue. In our previous system [1], text filtering was used to deal with screen real estate and privacy. With ink, we ask users to explicitly select the ink they want to share.

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Users selections are recorded by the system to link a set of strokes with its associated selection segment [AB]. This knowledge is useful to address the issue of small screen real estate: the note-taking server is able to correctly rotate and rescale the strokes before they are shared. This simple ink processing also permits a seamless integration of textual and ink-based material into the shared area (Figure 2 bottom).



Figure 2. Shared ink is automatically rescaled and rotated before it is displayed in the shared area. Shared content appears without overlap, allowing users to quickly reuse it with a single tap and then drawing a new pasting line into the private area.

FREEFORM PASTING IMPLEMENTATION

In figure 1b, the user draws a selection stroke across the words “my note”. The system approximates this selection stroke with a segment [AB] and groups all strokes intersected by [AB]. Japanese Kanji characters and print style (as opposed to cursive) forced us to extend this algorithm by automatically adding the strokes intersecting any stroke already grouped, and so recursively.

Still, some strokes may not have been properly selected as expected by the user. Within one second, the user is still able to add more strokes. The original segment [AB] remains untouched.

Using the set of selected strokes and its associated segment [AB], the system is then able to reposition, rescale and reorient these strokes. The user simply inputs a new stroke (called “pasting stroke”), from which a new segment [CD] is approximated. Each point of a selected stroke is projected perpendicularly to the segment [AB], and projected back from segment [CD]. The scaling factor is simply the length of [CD] divided by the length of [AB].

PROTOTYPE TESTING

As part of our iterative design process, we built a prototype and tested it. We reused the previous note-taking server written as a Java servlet and modified the client applets running in Pocket Internet Explorer on wireless iPAQs. The prototype has not yet been used in real settings, but we give

preliminary comments from the authors based on its use during several informal tests.

First, the ability to enter freeform ink proved to be valuable. It’s fast, informal and fun. Also, freeform pasting was useful to cut and paste our own notes. We would write big, select the words and then paste them smaller somewhere in our own notes.

Reusing freeform ink was useful and efficient to insert ink from another user into our own private area at a size and orientation that fitted our own writing style.

Finally, not relying on a soft-keyboard removed the frustration we experienced with our early system.

DESIGN IMPROVEMENTS

Although arguably good for privacy issues, asking users to select ink that they want to share could severely limit the amount of shared material, ultimately lessening the interest of the system. We are investigating ways of automatically fitting a segment [AB] onto a set of strokes without user intervention.

At the moment, freeform pasting does not allow users to insert ink: strokes are simply overlaid on top of the canvas. If we know the supporting segments [AB] of existing strokes or apply ink-grouping algorithms [see 3], we can easily use the segment [AB] of the new strokes to automatically move existing strokes, and reposition, reorient and rescale the strokes to paste.

As in our previous system, we also noticed that some users would enter and share the same word, adding unnecessary information to the shared area. Several ideas could be implemented. We could allow users to manually remove specific material from the shared area. On the server side, we could also recognize similar ink [2] or even run an ink recognition engine.

CONCLUSION

We presented the shared freeform input system and freeform pasting, a technique allowing stylus users to share and reuse freeform ink in a quick and informal way. Freeform pasting could benefit other applications. We are especially interested in applying the technique to share ink across a range of devices like PDAs, Tablet PCs and big interactive public displays.

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