Designing a Highlighting Interface

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Project Overview

My previous research into online note-taking found that while copy-pasting is more efficient than typing, producing equivalent learning in less time, students want the ability to type [1]. Highlighting, which shares a similar selection-based interaction to copy-pasting, may produce similar efficiency results while reducing the desire to type. The work summarized here involves the user-centered design of a highlighting interface, and its experimental comparison with a copy-paste note-taking interface.

Design Procedure

Highlighting is currently supported online in a variety of different fashions. I did a competitive analysis of over 20 interfaces in order to determine the dimensions across which these applications differ. **Timing** is one example of an interface dimension: some applications require users to press a button before selecting text, while others require users to press a button after making a selection. Another dimension is **duration**. For some interfaces, after the user clicked the highlight button every subsequent selection is highlighted. For others only the following selection is highlighted. In total, I described 5 dimensions across which the interfaces differed (for more information, see my thesis [3]).

Once the dimensions were defined, I developed representative interfaces to assess user responses to the different dimensions. Students were then exposed to enough interfaces in **think-aloud user tests** to give them experience with different levels of each dimension. **Questionnaires** involving Likert-scale items assessing responses to interface dimensions and specific interfaces were then given, and averaged ratings were associated with observations from the user tests. Finally, **semi-structured interviews** asked users questions regarding general note-taking strategy and allowed the opportunity for participatory design. An earlier iteration of this design process is described in my JCDL paper [2].

Sample Findings from User Tests

Design decisions are fairly easy to make along some dimensions. For example, users strongly prefer to click a button after making a selection, and user tests showed a variety of errors for interfaces that required button clicks beforehand.

Duration was an example of a more controversial dimension. While some had a strong preference for the permanent tool that turned highlighting on and off, other users strongly preferred an interface that only lasted for a single selection. Several of these users were observed to select text to help them read (a behavior I previously reported [2]), and did not want these selections to be highlighted.

The **visibility** dimension was also controversial. While some stated strong preference for a visible button that served as a reminder of functionality, others strongly preferred an invisible interaction, such as pressing a button or clicking on a selection. In the second major phase of the user tests, I evaluated interfaces that combined visible buttons with selection-clicks and key presses, and found that this combination satisfied all users.

The only tool rated positively by all users was a contextual tool that placed a highlighting button near the mouse once the user selected text. The exact

Research Question: Do highlighting and copy-pasting, both of which rely on selection-based interactions, share similar behavioral, learning, and attitudinal outcomes?

Design Problem: Highlighting online text is supported in a variety of ways by a variety of applications. Which way is most appropriate?

Goal of User Tests: Associate qualitative data with ratings of interface dimensions in order to provide anecdotal and quantitative evidence for design decisions.

Highlighting Digital Text
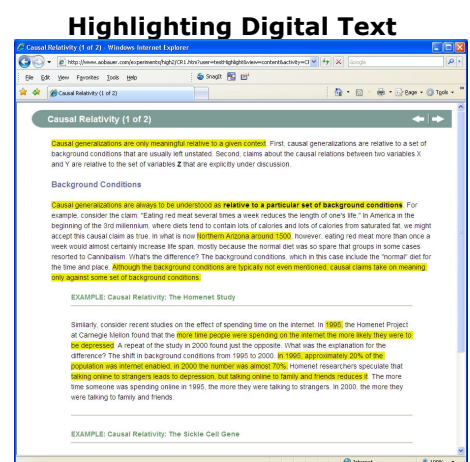
How should highlighting be supported in an online interface?

placement of this button was the product of much iteration. While users wanted it located near the mouse, this often impeded them from reading the subsequent line, especially when they were selecting text simply to help them read. This was solved by placing the button near the mouse but above the selection and outside the standard reading path.

Experimental Evaluation

The **button-follows-mouse** highlighting interface described above was compared with copy-paste based note-taking in a between-subjects experimental study evaluating behavior, learning and outcomes. An additional **highpad** interface was included to evaluate the impact of the presence of a notepad. This interface behaved like the highlighting interface, but every time the student highlighted material, it was placed in a notepad at the bottom of the screen.

Key Experimental Outcomes

The survey indicated a significant preference for the highlighting interface with regards to user satisfaction. As only students using the copy-paste interface expressed a desire for typing functionality, highlighting appears to discourage typing. This may make highlighting a more efficient interface in classroom settings. However, students using the highpad interface wanted the ability to organize and markup the notepad, which costs time without affecting learning.

Copy-pasting and highlighting only appear beneficial for review, as neither performed better on learning outcomes unless given the opportunity to review their notes. Students only benefit from reviewing highlighted material if while they are studying they are given access to the notepad.

Students using a highlighting interface record far more ideas than students who take notes using a text-editor. If given a notepad that allows them to view highlighted material from previous pages, they finish the learning material more quickly. Text-editing appears to be slower due to time students spend manipulating their notes.

Students also differentiated note-taking (not just copy-pasting) and highlighting with regards to goals. Students use the process of note-taking primarily to help them learn, while they use highlighting primarily to facilitate rapid review. However, they report recording the same material. This suggests integrating the two may be worthwhile, especially considering the efficiency results observed for the highpad interface.

References/Further Information

This recently completed work has not been published yet. Detailed descriptions are available in my thesis, which also describes the design process [3]. All the papers below are available on my website (www.aobauer.com), along with videos demonstrating the interfaces developed for this study.

1. Bauer, A., Koedinger, K.R. (2007) Selection-Based Note-Taking Applications. In Proceedings of *ACM Conference on Human Factors in Computing Systems (CHI '07).* pp. 981-990 ACM Press (Honorable Mention Best Paper)
2. Bauer, A. and Koedinger, K. R. (2008) Note-taking, selecting, and choice: designing interfaces that encourage smaller selections. In Proceedings of the *8th ACM/IEEE Joint Conference on Digital Libraries (JCDL '08).* pp. 397-406. ACM Press
3. Bauer, A., (2008) *Designing Note-Taking Interfaces for Learning.* Carnegie Mellon University, Human-Computer Interaction Institute, Doctoral Dissertation - CMU-HCII-08-103.

Highlighting Interaction

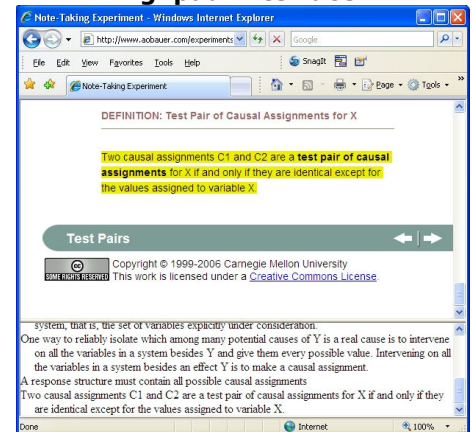*After making a selection, the user can highlight the text by a) clicking on the button located above the selection near the mouse, b) double-clicking on the selection, c) pressing the "h" key*

Highpad Interface

The frame in the bottom third of the browser contains highlighted material from previous and subsequent pages, allowing the student to revisit the definition of "causal assignments."

Sample User Quotes*

"It doesn't make sense to do it [press highlight button] before [making a selection]. What if you don't like the text you select yet? – *User 3 expressing a preference for taking the highlight action under after making a selection.*

"I liked having the toolbar visible as a reminder of the toolbar being there."– *User 1, stating dislike for buttons only available when selections are made.*

* Unfortunately, due to human subjects considerations, I cannot make these videos available online. Video demonstrating the interfaces described here is available on my website, at www.aobauer.com.