PROVOCATIONS

Who Is Master; Who Slave

BY JOHN W. SENDERS & KELLY HARWOO

It is a truism in the science of the interrelationship between systems and human controllers that the designer should try to design the machine dynamics to match those of the human user. The reason is that a maladapted design requires adaptive effort on the part of the user.

In general, a human controller is an adaptive optimizing control system: it chooses a form appropriate to the form of the controlled element, and it adjusts its parameters to minimize some measure (for example, root mean square error) of overall system performance. As a simple approximation, a human controller of an integrator (a rate control system) must become a differentiator, with appropriate gain, in order to achieve a reasonably flat response with little phase shift over a reasonable bandwidth.

A user of a word processor (WP) is controlling a complex machine to move "thought" from consciousness to the visible screen. The interface of the computer system and the interface of the WP application both provide feedback to the user. Feedback is both tactual – the feel and location of the keys – and visual – the appearance and location of the text and graphics.

In addition, there are many transient information feedbacks that identify, inform, direct, and warn. If we generalize to the WP task from the rules that work for the control system task, we might well ask whether the design of the WP system should be "fitted" to the thought processes and the linguistic and literary characteristics of the human user.

The issue is whether the design of a WP system will have a palpable effect on thought and its literary manifestation. We have been told repeatedly that the computer will make it easier for children to learn to write. All well and good, but the critical question is whether they learn to write better with a WP than with a pencil. Even more critical is the question of whether, in the worst case, there will be adverse effects induced by some WPs on the quality of writing and thinking.

In an article published in the January 1990 issue of *Academic Computing*, author Marcia Peoples Halio raised in us a fearsome specter of the computer's acting as Master to the writer as Slave. The writer's ability, so it appears, may be molded and controlled by the nature of the interface.

Although Halio's observations are couched in terms of an IBM/Macintosh distinction, as will be evident in the excerpts below, the problem is broader than that: To what extent does the computer interface, both hard and soft, influence our thinking processes? Halio wrote:

> At the University of Delaware, we have had a rather unusual opportunity to compare students' writing on IBM and Macintosh computers. Since 1985, we have offered sections of freshman composition where students can use either of these machines to do their essays. Students freely choose which type of technology they wish to use by enrolling in a particular section. Because their SAT scores as well as the results of a placement essay have put them in the medium-writing-ability range, all students in the computer sections have roughly the same writing ability.
>
> In the Spring of 1987, for the first time, I taught a section of freshman composition using the Macintosh computer. Since I had been teaching composition for several semesters using IBM PCs, I was little prepared for the surprises that lay in wait [in the Macintosh sections].
>
> Never before had I seen such a sloppy bunch of papers. Words were misspelled; commas were placed haphazardly; semicolons were virtually nonexistent or placed by means of "breath" punctuation. As to style: paragraphs were brief, resulting in a lack of development of thought; sentences, too, were short, obviating the need for complex punctuation. Word choice tended to be simple, spiced with slang and colloquialisms, accentuating the simplistic and generalized nature of the thought.
>
> To test my perceptions about the childishness of the Mac writers' prose compared with the IBMers, I decided to run twenty essays randomly selected from [among the 25 sections of freshman composition]...through the *Writers' Workbench Text Analysis* programs on the VAX mainframe. The results obtained from the printout of the Style program confirmed my initial impressions: The Mac students were writing far fewer complex sentences than the IBMers (30% compared with 49.5%). They were also using many more "to be" verbs (32% compared with 23%), a sign, according to composition theorists, of weak and lifeless prose.

Readability scores (as judged by the Kincaid scale) averaged 12.1 (college level) for the IBM students, but the Mac users obtained a score of only 7.95 (slightly less than the 8th grade). Closely tied to readability scores was the measure of sentence length: an average of 16.3 words for the Mac students and 22.6 for the IBM students. And the Mac students – much more than the IBM students – used the subject of their sentences as the sentence opener (80% Mac; 66.5% IBM). Teachers know that weak writers generally rely on subject openers, while more sophisticated writers employ more varied openings. Finally, the Mac students were noticeably poorer proofreaders than the IBMers, averaging 15 misspellings per essay, compared with 4 for the IBMers.

Interested in verifying the extent to which a selection bias may have been operating, Halio conducted a survey to determine why students specifically chose one computer system over the other. Not surprisingly, more than 75% of the freshmen chose a computer section based on time of day or a class that enabled them to be with friends. Several commented that they were not even aware that they had a choice of computers before they signed up.

Halio concluded,

> I wonder: Can a technology be too easy, too playful for young, immature writers to use? Can such a technology arrest their writing at a less mature stage of development? In an age when, as Marshal McLuhan said, "The medium is the message," it is vital that teachers, computer designers, and those responsible for planning writing labs pay close attention to the effects of technology on writing – especially if one effect is a drastic change from the type of discourse that has long been valued in the academic world.

Halio's observations bear on the computer interface conflict: DOS versus Macintosh. The WP was the same in both cases. We do not know – but would do well to suspect – that the optimal "cognitive engineering" of the WP will depend on the design of the computer operating system and the characteristics of the interface.

At one extreme, we can postulate from Halio's observations that early exposure of children to particular computer interfaces may seriously affect their cognitive and linguistic skills and writing abilities. At the very least, Halio's observations strongly suggest that a computer interface can have a profound effect on performing written discourse. In either case, we had better start thinking about the mental knobs and dials.

In a recent communication (August 23, 1993), Halio noted that she has abandoned the IBM DOS/Macintosh distinction and is instead focusing on the implications of the graphical user interface for teaching strategies for writing. As she indicated in her article, "care must be taken as we include technology in writing programs to define clearly (or redefine) what we consider to be acceptable expository prose."

Quoting from Daiute (1985), who talks about a phenomenon called *graphic writing*, Halio notes that "if graphic communication becomes fast and easy to understand, it could supplement or replace writing for certain purposes." This claim urges us, as human factors practitioners, to broaden our consideration of the typical human factors issues usually addressed for computer interfaces, such as their ease of use. We must also consider how we are shaping and modifying traditional forms of discourse through word processing and computer technology.

References

Daiute, C. (1985). *Writing and computers.* Reading, MA: Addison-Wesley.

Halio, M. P. (1990, January). Student writing: Can the machine maim the message? *Academic Computing*, 16–19ff.

John W. Senders is a professor emeritus at the University of Toronto, Ontario, Canada. Kelly Harwood is a human factors engineer with Sterling Software (U.S.), Inc., Moffett Field, California.

Excerpts used with permission from "Student Writing: Can the Machine Maim the Message?" by Marcia Peoples Halio, Academic Computing, *January 1990; copyright by Marcia Peoples Halio.*