The Next Generation *in Human-Computer Interaction*

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Today, the dominant framework for interface development is User-Centered Design (UCD). As first crystallized in 1986, in the seminal book *User Centered System Design*, by Don Norman and Steven Draper, the needs and capabilities of users ought to be the driving force of software design; ease of programming must give way to ease of end use. Moreover, simply providing the user with functionality is not enough; a UCD interface must reduce the user's cognitive load, be easy to learn, reduce time-on-task, and so forth.

As indicated in Figure 1, however, for over 30 years, interface design was constrained by the technology. In those early days, there was barely enough computer horsepower (measured, for instance, in MIPS, millions of instructions per second) to handle the task at hand, and thus there was precious little zorch left over to support the user in accessing the functionality.

The rise of UCD was afforded by a rise in computational zorch. While the actual MIPS increase is almost imperceptible in Figure 1, it was still enough to spawn a new era in interface design. Now, as we rocket into an era of plentiful zorch, the special section on Learner-Centered Design (LCD) in this issue of *Communications* outlines an agenda for taking advantage of those newly minted computrons.

The Need: Beyond Ease of Use To Support for Learning

Ease of use, valuable as it certainly is, is too limited a vision. We need to raise our expectations for what computationally based technologies can support. We need to address the real issue

of our times: nurturing the intellectual growth of children and adults, supporting them as they grapple with ideas, unleashing and training their imaginations, and developing all manner of expertise.

Besides constructing interfaces that support "doing tasks," we need interfaces that support "learning while doing tasks." For example, a new generation of spreadsheets are needed to support learners developing an understanding of the concepts and procedures of forecasting, say, as learners actually are doing forecasting. Pedagogically, this makes perfect sense. Students learn best when they engage in authentic, motivating tasks, and where the tasks, activities and tools are "appropriately scaffolded." While scaffolding has typically been provided by a teacher, a mentor, a parent, and/or the curriculum, interfaces, too, should scaffold the learner—enable the learner to start doing the task with his or her current understanding, but then challenge and channel the learner to develop the next level of understanding and performance.

In transitioning from UCD to LCD, we need to deeply appreciate the fact that learners have unique needs beyond those of professional users:

- *Growth.* By definition, learners change. Not our current crop of software, however. The interface to our spreadsheet is by and large the same on day 100 as it is on day 1. To support growth, interfaces must adapt and be adaptable.
- *Diversity.* By definition, individuals in a profession share a significant degree of homogeneity. Software for a professional leverages quite directly off this homogeneity. In contrast, heterogeneity is the hallmark of learners. For example, in a representative public school classroom, there are invariably enormous differences in cognitive and social development, cultural background, and learning style.
- *Engagement.* By definition, professionals can be counted on to attend and persevere. From batch processing to clunky teletypes, from screens upon screens of forms to arcane and arbitrary command sequences, professionals have repeatedly demonstrated that they will adjust to whatever it takes to get the job done. Children, on the other hand, are not so accommodating; while we are not advocating gratuitously sweet interfaces, designers must realize that helping to focus and engage learners is part of their responsibility.

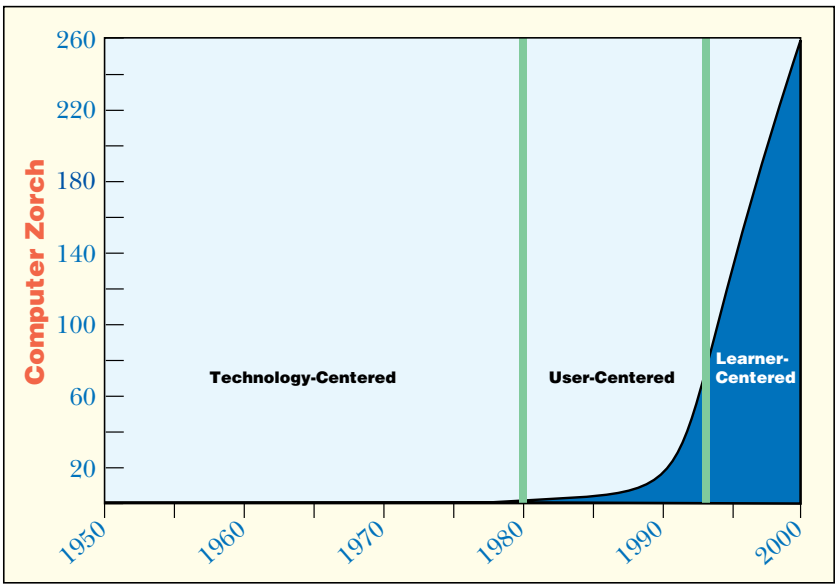

Figure 1. Interface design history

And by the way, learners are not just children; business visionaries, such as Peters Drucker and Senge, have persuasively argued that the "learning organization" must support professionals as they routinely and continually grow. Thus, while the particular manner may differ in which their needs are addressed, professionals when acting as learners have much in common with the shorter and younger set.

The Challenge: Scaffolding Learners and Learning

While bountiful zorch makes LCD possible, that's only the tip of the iceberg. Doing something intelligent with those MIPS is the challenge:

- How should a word processor's interface support a visual-style learner in writing a report on ancient medicine? On the history of the flute? On the demographics of poverty?
- How should a project planner's interface support a group of students developing cooperation and collaboration skills?
- How should a Web browser fade its scaffolding when a student has demonstrated his or her ability to effectively search on the Web?
- When will we have code libraries that permit designers and programmers to just drop in particular scaffolding strategies?
- When will software development environments support the construction of only good learner-centered interfaces?

There are no obvious answers to such questions. But, just as UCD engendered the growth of

an entire industry and new academic pursuits, the practice of LCD also fosters the growth of new disciplines, methodologies, and professionals.

Technologies for Learning: Crying Wolf No Longer

"I believe that the motion picture is destined to revolutionize our educational system and that in a few years it will supplant largely, if not entirely, the use of textbooks."

—Thomas Edison, 1922

Similar quotes on the potential educational impact of TV and computers abound. However, it is safe to say that electronic technologies have 1) not revolutionized education, and in fact, have 2) had little—if any—impact on education. However, this time it will be different; this time digital technologies will go beyond *telling* stories and presenting information to support individuals and groups in *doing* activities.

Computers are increasingly mediating our moment-by-moment actions. The computer is an integral component in our work; we do our work through the computer. Thus, learning opportunities are omnipresent; instructional support can be interwoven naturally and beneficially into our daily activities. Similarly, as computational appliances become more commonplace in the classroom and help mediate student and teacher activities, integrating instructional supports into the fabric of moment-by-moment classroom activities will become the norm.

In doing so, the vision in Edison's quote will finally be realized.

LCD Special Section

We genuinely hope you enjoy the fresh and provocative ideas represented in the articles in this special section. It is just a small sampling of the exciting and diverse efforts under way. The intent of all these efforts is clear: While digital technologies can and have made users' lives better, it is time to move to the next quantum level and exploit the amazing potential of these technologies to nurture and nourish the learner in each and every one of us.

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