*Leonardo's Laptop: Human Needs and the New Computing Technologies*. By Ben Shneiderman. Cambridge, MA: The MIT Press, 2002. Pp. xi + 269. $24.95. ISBN: 0-262-19476-7.

To begin exploring the shift from old to new computing that Shneiderman advocates in *Leonardo's Laptop*, it is helpful to re-examine the parallel shift from systems-centered to user-centered thinking Don Norman proposed in *The Invisible Computer* (Cambridge, MA: The MIT Press, 1998). Norman argued that "information appliances," invisible, interconnected communication devices that meet specific user needs, are the future of computing. He wrote that the personal computer is currently limited by designers who think only in terms of available technologies, instead of how people use those technologies. He argued that developers must start thinking about computers as consumer appliances, each designed to meet specific human needs. Shneiderman echoes this argument, stating, "The old computing was about what computers could do; the new computing is about what users can do" (p.2).

Shneiderman draws his inspiration for the new computing from Leonardo da Vinci, the openly acknowledged tenth muse behind this book. Shneiderman argues that Leonardo, were he alive today, would "put people at the center and try to apply technology for their benefit" (p. 13). Reflecting on Leonardo's genius throughout the book, Shneiderman takes the reader on a grand tour of renaissance ideals as applied to the modern world, explaining the problems with the old, or system-centered, computing and demonstrating why the new, or user-centered, computing will result in technologies more in tune with human activities and better able to meet human needs. Each chapter is illustrated with vignettes from Leonardo's life and reflections on how Leonardo would have reacted to some new technological development. Each chapter also concludes with a skeptic's corner where the difficulties and potential negative consequences of Shneiderman's ideas are discussed.

Readers already familiar with the concepts of usability, human-computer interaction, and user-centered design will find little that is new in *Leonardo's Laptop*. Such readers, however, are likely not the book's target audience. This book excels in its ability to introduce students or the general public to the concepts of user-centered design for the first time. Shneiderman explains how the new computing will empower future computer users and does an admirable job of raising expectations and encouraging readers to set higher standards for acceptable computing technologies today.

Shneiderman begins this book by explaining what is wrong with the old computing approach. He explains why computer systems are so hard to use and calls for a world where computers are usable by anyone, no matter their age, expertise, or abilities. Shneiderman refers to this goal as universal usability, and he discusses the benefits (notably, bridging the digital divide) that would accrue to society if this ideal were achieved. Shneiderman explores the challenges that must be overcome if universal usability is to become a reality: the need to support a variety of technologies, the need to accommodate diverse users, and the need to help users overcome gaps in their own knowledge. The biggest challenge, however, comes from technology developers and designers who see no value in the user-centered approach to computing. Despite overwhelming evidence that a solid understanding of human-computer interaction results in more usable software, defenders of the old computing approach continue to resist involving actual users in the design process. Overcoming this resistance will require new guidelines for design and new goals

for designers. To solve this problem, Shneiderman turns to Leonardo for a better understanding of human activities and relationships.

Drawing inspiration from Leonardo's integration of art and science, Shneiderman develops an "activities and relationships table (ART)" (p.87) that he hopes will help users understand the role of technology in their lives and help developers build systems that meet human needs. The table is a four-by-four matrix of activities (collect, relate, create, and donate) and relationships (self, family & friends, colleagues & neighbors, and citizens & markets). Shneiderman argues that designers and users can better understand information and communication technologies by mapping them into this matrix. Using the ART to examine technologies such as digital photo databases and ubiquitous computing devices, Shneiderman is not only able to discuss the role of these technologies in our lives, he is able to make predictions about how future technological advances could make our lives more productive.

Shneiderman uses the ART to explore four areas of human-computer interaction: e-learning, e-business, e-healthcare, and e-government. For each area, Shneiderman asks provocative questions intended to encourage users to demand more from computing technologies. Why can't distance learning transform the educational experience so that the educational process meets every student's individual needs and every student earns an A? Why can't new technologies personalize our commercial interactions so that every individual, whether seller or buyer, gets the deal he or she wants? Why can't electronic medical records be used to develop a personalized approach to healthcare where one's medical history is always available when needed, on demand, and where the role of physicians is to prevent people from ever being sick? Why can't new technologies revolutionize the political system, making governments ever more responsive to the needs of the people, reducing waste, encouraging open access, and giving every citizen the government he or she wants?

Shneiderman concludes by discussing the need for the new computing approach to support creativity, and by exploring hypothetical arguments about how computing in the twenty-first century will change our lives. He asks us to look for the next Leonardo, the innovative visionary who will lead us to the new world of human-centered computing in the future. He argues that the new computing technologies will not replace human activities, but augment them, resulting in empowered individuals who use technology to add value for the benefit of all humanity. In the end, Shneiderman argues, the new computing approach could "increase life expectancy, control population growth, reduce homelessness, reduce illiteracy worldwide, reduce automobile accident deaths, increase air quality in major cities, [and] reduce the threat of war" (p.239).

*Leonardo's Laptop* is a well-written and well-argued book. The theories and issues discussed in this book should be read by all individuals, designers or users, interested in improving the quality of computing technologies. Shneiderman's approach, however, may not be appropriate for all audiences, and there are three potentially troublesome aspects of *Leonardo's Laptop* that should be mentioned.

First, in exhorting users to demand more usable technologies and greater accountability from system designers, Shneiderman seems to let the system designers off too easily. He provides them with a ready-made excuse: if users do not step forward with their demands for the new

computing, designers are under no pressure to change. One would have expected Shneiderman to argue a little more clearly, as does Thomas Landauer in *The Trouble with Computers* (Cambridge, MA: The MIT Press, 1995), that the problems of the old computing lie as much with the designers as with the users.

Second, *Leonardo's Laptop* relies heavily on the Leonardo gimmick. From theories such as the ART to examples such as LEON (Shneiderman's hypothetical online learning system), the book is steeped in Leonardo allusions. When reading the book, one never knows when Leonardo is going to show up next, and when he does, he invariably does so in a glowing story portraying Leonardo as a visionary living hundreds of years before his time. While the ultimate success of this gimmick should be left up to each individual reader, by the end of the book one seriously begins to wonder if there was anything Leonardo could not do? It would have been refreshing if, just once, Shneiderman had suggested that Leonardo, faced with the reality of a modern-day laptop computer, might have run screaming in the opposite direction.

Finally, Shneiderman's rhetoric sometimes gets in the way of his argument. His points are so important for the future of computing technologies, one would hate to see a potential advocate turned off by Shneiderman's grand vision of the potential benefits of the new computing. Given the importance of this book for explaining the significance of user-centered design to the uninitiated, it would be a shame if Shneiderman's rhetoric caused some readers not to take this book as seriously as they should.

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