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# *Special Issue in Honor of Ben Shneiderman's 60th Birthday: Reflections on Human–Computer Interaction*

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Round numbers call for reflection and celebration. In 2007, SIGCHI celebrated its 25th anniversary, and Ben Shneiderman celebrated his 60th birthday (August 21). To follow the agreeable tradition of celebrating anniversaries in our field, the editors of *International Journal of Human–Computer Interaction* (*IJHCI*) have asked us to assemble a special issue—a *Festschrift*—to honor Dr. Ben Shneiderman's accomplishments, while looking forward to the next phases for human–computer interaction (HCI) and for him.

By bringing scientific methods to the study of human use of computers, Ben Shneiderman has played a key role in developing a new academic discipline that promotes more usable information and computing technologies—generally called HCI. His early influential work helped foster graphical user interfaces, the World Wide Web, information visualization, and touch screen designs for portable devices. His projects for the U.S. Library of Congress, National Library of Medicine, NASA, Census Bureau, and so on, and consultations for corporations have

Each paper was read by four to six reviewers, some reading multiple times. We thank all the anonymous reviewers but also the many others who helped us during the preparation of this special issue: Robert Ball, Ed Chi, Mark Chignell, Steven Drucker, Allison Druin, Susan Dumais, Stephen Eick, Kenneth Fleischmann, Edward Fox, Georges Grinstein, Frank van Ham, Marti Hearst, Julie Jacko, Eser Kandogan, Amy Karlson, Anita Komlodi, Allan Kuchinsky, Henry Lieberman, Adam Perer, Jenny Preece, George Robertson, Gavriel Salvendy, Andrew Sears, and John Stasko. We also thank the authors of the articles, who produced wonderful articles working through multiple review cycles under considerable time pressure. Finally, we thank Ben Shneiderman for being our mentor, colleague, and friend, and for many more years to come.

Catherine Plaisant is a research scientist at the University of Maryland and Associate Director of Research in the Human–Computer Interaction Lab. She has worked with Ben Shneiderman for 20 years, and they have co-authored more than 50 refereed papers together. Chris North is Associate Professor of Computer Science at Virginia Tech. He graduated from the University of Maryland in 2000 as a Ph.D. student of Ben Shneiderman.

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brought novel technologies to widespread beneficial use. Ben has shaped technology evolution through his more than 300 technical publications as well as inspirational keynotes, leading textbook, informative tutorials, satellite TV broadcasts, and research seminars.

For more than 30 years, Ben Shneiderman has promoted HCI through his prolific writing and lecturing and his direction of the Human–Computer Interaction Lab (HCIL; 1983–2000) at the University of Maryland, where he is Professor of Computer Science. He is one of the most frequently referenced researchers in computer science (http://www.cs.ucla.edu/~palsberg/h-number.html ) and a passionate educator.

We are proud to introduce this special issue prepared in his honor. It comprises five articles, combining both new work and reflections on important topics influenced by Shneiderman's career. We requested proposals for articles from Ben's past students and close collaborators who could best write on those topics. Then, through rigorous external review of drafts, we narrowed the final selection to five articles with contributions of most interest to the *IJHCI* readership.

We first introduce each article and present background information and stories about Shneiderman's specific impact on each article's topic (including text contributed by the authors themselves), then summarize Shneiderman's other accomplishments in the field of HCI. A Web page lists resources and provides access to full-size color versions of the figures: http://www.cs.umd.edu/hcil/ben60.



## 1. INTRODUCING THE ARTICLES AND BEN SHNEIDERMAN'S IMPACT ON THEIR DOMAINS

The five articles in this special issue cover four domains in which Ben has had a major influence during his career, spanning his earliest to most recent work. Hence, these articles well represent the longevity of Ben's impact on many researchers.

### 1.1. Pioneering Hypertext and Digital Libraries

The first article is "Find What You Need, Understand What You Find" by Gary Marchionini (a former HCIL faculty member and longtime collaborator of Ben's) and Ryen W. White. This article uses an information-seeking framework to examine current progress toward the goal of effective and usable search systems, highlighting several important recent results.

In his early work, Ben Shneiderman served not only as an example for others aiming to understand how people search for and use digital resources but also as a hands-on pioneer in developing novel user interfaces that support the information-seeking process. Shneiderman's landmark book *Software Psychology* published in 1980 was instrumental in the evolution toward usability in computing and the collaboration between computer science and psychology. In his seminal paper in 1983, Shneiderman coined the term "direct manipulation" and posited principles for designing interactive interfaces accordingly. This work laid the foundation for many of the later HCIL designs

for hypertext systems, search systems, and the general rubric of dynamic query systems.

One of the earliest implemented hypertext systems was HyperTies from HCIL. HyperTies "embedded menus" (Koved & Shneiderman, 1986) evolved from dozens of user studies and foreshadowed the inline hyperlinks of today's Web pages. In September 1988, Addison-Wesley published the world's first commercial electronic book titled *Hypertext Hands-On!,* written by Ben Shneiderman and Greg Kearsley, which included a HyperTies version of the book on a disk in the jacket. Tim Berners-Lee referenced "Hypertext on Hypertext," a *Communications of the ACM* special issue implemented in HyperTies, in his original 1989 proposal for constructing the web.

Shneiderman and his colleagues in psychology undertook a series of studies of library catalogs, which eventually led to installing and testing the first 51 public access touch panel workstations at the Library of Congress in 1991. In the 1990s, Shneiderman and his team developed the concept of dynamic query interfaces (Shneiderman, 1994), in which direct manipulation is applied to metadata and dynamically filters search results in real time. Dynamic queries anticipated the recent highly interactive techniques of today's search systems. Marchionini and White examine the current state of continuing efforts in these areas.



### *1.2. Visualizing the Path to Discovery*

Two articles present information visualization techniques that support discovery. The first article is titled "Twenty Years of Four HCI Conferences: A Visual Exploration," by Nathalie Henry, Howard Goodell, Niklas Elmqvist, and Jean-Daniel Fekete (a regular HCIL visitor and collaborator). It presents a wide-angle view of the HCI literature using information visualization tools. In contrast, the second article, "Exploratory Data Analysis With Categorical Variables: An Improved Rank-by-Feature Framework and a Case Study" by Jinwook Seo (Ph.D. alumnus of Ben) and Heather Gordish-Dressman, presents a detailed description of a new visualization technique and its use in biological research.

Ben Shneiderman began to champion interactive visualization interfaces when he built his polynomial viewer as a graduate student in 1972. During the 1990s, Shneiderman created information visualization methods to give users visual overviews of large databases, including the starfield (scattergram with zooming, filtering, and color-coded items) and Treemaps (two-dimensional space-filling representation of trees with thousands of nodes). He promoted user-controlled filtering of visualized data by dynamic queries, using double-boxed range sliders for numeric values, alphasliders for nominal lists, and buttons for categorical variables. After early prototypes of the HomeFinder and FilmFinder, Shneiderman's two-time summer visitor Christopher Ahlberg created the internationally successful company Spotfire, now with more than 200 employees, that applied these visualization techniques to tabular data. The Spotfire software suite is now widely used for drug discovery and microarray DNA analyses in the pharmaceutical industry. In 1996, Shneiderman formulated the Visual Information Seeking Mantra: "Overview first,

zoom and filter, then details on demand," which has been widely cited, extended, countered, and parodied.

Shneiderman's Treemaps, which visually present large quantities of hierarchical information in a single screen (Shneiderman, 1992), continue to be applied to new domains. The essential idea is to recursively subdivide a rectangular display into subrectangles where each subrectangle is proportional in size and color to data attributes. First popularized by SmartMoney's MarketMap Web site, which gave an overview of the stock market, Treemaps have been used for applications as diverse as file system exploration, coffee selection, and counterterrorism analysis. It has been shown on TV news and commercialized by a range of companies, perhaps most notably by the Hive Group, which is applying their Treemap-based "honeycomb" technology to e-commerce applications.

More recently, Shneiderman and Seo developed the Hierarchical Clustering Explorer (HCE) to help bioinformatics researchers analyze large multidimensional microarray data. HCE initially built on Shneiderman's previously developed techniques by tight coupling a dendrogram cluster display, starfield displays, and dynamic query filters. Then, to deal with the huge number of possible 2D scatterplots for a large multidimensional dataset, they developed a new strategy of ranking scatterplots by meaningful statistical criteria in a compact graphical overview called the rank-by-feature framework. These techniques enabled their bioinformatics collaborators to discover unexpected features revealed in low dimensional spaces. This led them to a new set of principles for exploratory data analysis, called GRID (Graphics, Ranking, and Insights for Discovery), which suggests examining lower dimensional projections to find features, using ranking to guide insight, and then applying statistics to confirm (Seo & Shneiderman, 2006).

Shneiderman's techniques and principles provide a firm foundation for the two articles presented here and are clearly visible as landmarks in the analysis of the field presented by Henry et al.

### *1.3. Documenting Our Lives and Communities With Photographs*

The fourth article is "Capture, Annotate, Browse, Find, Share: Novel Interfaces for Personal Photo Management" by Hyunmo Kang (Ph.D. alumnus of Ben), Benjamin B. Bederson (HCIL faculty member), and Bongwon Suh (HCIL Ph.D. student). This article summarizes a broad vision for photo management.

A trademark of Shneiderman's research is the development of working tools that help people by solving meaningful problems. He accomplishes this by closely collaborating with user groups, identifying driving problems, implementing complete solutions, and carefully evaluating results. He evaluates tools in both laboratory studies and real-world application.

Shneiderman's involvement in creating new tools for managing and sharing digital photographs derives from his own passion for photography. Many have seen Ben photographically document our community at work as he stealthily approaches the podium during a speaker's presentation and waits to capture the speaker's most lively oratory gesture. His devotion to photographing professional events

and carefully annotating the photos since 1982 has resulted in the 3,300 photos at the ACM SIGCHI PhotoHistory (http://www.sigchi.org/photohistory) and the University of Maryland Department of Computer Science PhotoHistory (http://www.cs.umd.edu/projects/photohistory). The March/April 2007 issue of *ACM Interactions* ran an eight-page portfolio of more than 100 of his photos from the 25-year history of ACM CHI conferences. Ben Shneiderman's devotion to photography is inspired by his uncle David Seymour (1911–1956), a world-famous photojournalist. Ben helped design Web sites to document Seymour's biography at the International Center of Photography (http://www.icp.org/chim) and elsewhere (http://www.davidseymour.com).

Shneiderman's interest led to the development of several tools such as PhotoFinder, including the patented drag-and-drop annotation method to place labels directly on photos. PhotoFinder directly motivated Ben Bederson to build PhotoMesa, which incorporated the functionality of PhotoFinder and was sold commercially for several years. Kang, Bederson, and Suh expand on these ideas in this article.



### *1.4. Making the World a Better Place*

The last article is "HCI and Social Issues: A Framework for Engagement" by Harry Hochheiser (Ph.D. alumnus of Ben) and Jonathan Lazar (close collaborator with Ben). This article examines the fundamental social concerns that arise in HCI and the roles that HCI professionals can play in addressing them. This forward-looking framework addresses a broad array of HCI social issues that Shneiderman has championed.

Ben Shneiderman's work in HCI is rooted in a deep passion for using computers to improve the quality of our lives. His focus on computers as tools for improving the quality of work, leisure, and relationships is summed up in the epigram of his 2002 book *Leonardo's Laptop:* "The old computing was about what computers can do. The new computing is about what people can do" (p. 2). *Leonardo's Laptop* won the 2004 IEEE Award for Distinguished Literary Contribution.

His focus on people can be seen in engagement with many aspects of the HCI community and outside of the HCI community. His research does not occur in a vacuum. Rather, this engagement can be seen in a history of efforts aimed at applying novel research to build systems for museums (Shneiderman, Brethauer, Plaisant, & Potter, 1989) or government agencies (Marchionini, Haas, Plaisant, Shneiderman, & Hert, 2005), and his recent calls for the development of citizen-based emergency response systems (Shneiderman & Preece, 2007). He has worked in many socially conscious domains, including personal medical records (Plaisant et al., 1996), Web usability guidelines in the early years of the Web (Shneiderman, 1997), and interfaces for users with disabilities (Christian, Kules, Shneiderman, & Youssef, 2000). His push to explore how computer-based tools can be used to support human creativity led him to organize a National Science Foundation–funded workshop on this topic in 2005 (http://www.cs.umd.edu/hcil/CST ) and to be the general chair of the Creativity & Cognition Conference in 2007.

Shneiderman has repeatedly moved beyond working on novel applications of HCI results toward active advocacy of forceful ethics positions. His 1990 "Declaration of Responsibility" challenged colleagues to address the problems of illiteracy, pollution, and world peace. His proposed "social impact statements" (Shneiderman & Rose, 1996) asks software developers to examine and disclose the ramifications of their work.

His concerns about exclusivity of computer technology led him to propose universal usability—the need for usability to span wide ranges of technological devices, user backgrounds, and user knowledge (Shneiderman, 2000). This initial call helped spawn universal usability statements (Hochheiser & Shneiderman, 2001), the ACM Conference on Universal Usability (2000 and 2003), and an active community of universal usability researchers. For example, his Ph.D. student Haixia Zhao (coadvised by Catherine Plaisant) developed "iSonic," an interactive sonification tool for blind users to explore census data.

Shneiderman complements his academic work with an active involvement with policymakers. He has served on committees of the National Academy of Science and spoken to the President's Council of Advisors on Science and Technology, Networking and Information Technology Technical Advisory Group; represented the Association for Computing Machinery in testimony before Congress on National ID issues (*National Identification Cards*, 2001); and co-chaired ACM's Policy '98 conference, which brought policymakers together with computing professionals. He also serves on USACM, the policy committee of ACM. In 2001, Ben was awarded the Making a Difference award by the ACM's Special Interest Group on Computers and Society. He also initiated (and provided the funding for) the SIGCHI Social Impact Award, first awarded in 2005.



## 2. OTHER CONTRIBUTIONS AND ACCOMPLISHMENTS OF BEN SHNEIDERMAN

As the time of this printing, Ben Shneiderman has authored 13 books, 19 book chapters, 132 journal articles, and 118 refereed conference papers. He has edited 5 books, been a member of 15 journal editorial boards, and acquired 96 funded grants. He has been giving approximately 40 invited presentations each year and has presented more than 100 conference keynotes. Some of his early papers and archives are available as "The Ben Shneiderman Papers" housed at the Archive and Manuscripts Department of the University of Maryland Libraries at College Park. His textbook *Designing the User Interface: Strategies for Effective Human-Computer Interaction* (1st ed., 1987; 2nd ed., 1992; 3rd ed., 1998) came out in its fourth edition in April 2004 (coauthored with Catherine Plaisant) and remains one of the leading texts in HCI, translated and broadly adopted around the world.

Ben Shneiderman played a key role in the creation of SIGCHI. In 1976, Shneiderman initiated the Software Psychology Society, which held monthly meetings from 1976 to 1996 in Washington, DC. Aided by Jim Foley, Bill Curtis, and many others, this informal group launched the March 1982 Gaithersburg, MD Conference on Human Factors in Computer Systems. The remarkable turnout of 906 participants confirmed the strong interest in research on programmers, users,

and their interfaces. This success, added to other efforts, quickly led to the formation of the ACM Special Interest Group on Computer Human Interaction (SIGCHI), whose first conference was held in 1983 in Boston. In April 2001, Shneiderman received the ACM SIGCHI Lifetime Achievement Award (the second awarded by SIGCHI).

Promoting HCI required a broad community effort, spanning several disciplines. Shneiderman seeks out partnerships to formulate and bolster their collective vision. His frequent collaboration with other HCI researchers is illustrated by his topping the list of central researchers as measured by number of coauthor relationships (Horn, Finholt, Birnholtz, Motwani, & Jayaraman, 2004, p. 586).

In 1983, Shneiderman created the interdisciplinary HCIL at the University of Maryland, College Park. This laboratory was the first of its kind and has had broad influence evidenced by similar labs now functioning at Carnegie Mellon, Georgia Tech, and MIT. Under his guidance, the laboratory showcases its research in an annual full-day symposium that regularly attracts an audience of more than 200 visitors from the region and beyond. In the edited book *Sparks of Innovation* (Shneiderman, 1993), Shneiderman wrote an introduction entitled "Supporting the Process of Innovation: The Maryland Way" (www.cs.umd.edu/hcil/pubs/books/maryland-way.shtml ) in which he outlines his strategy to sustaining this successful research community.

He states,

> We begin by choosing excellent and pleasant people. Then the Maryland Way is to foster innovation through seven sparks:
>
> 1. Choose a good driving problem
> 2. Become immersed in related work
> 3. Clarify short-term and long-term goals
> 4. Balance individual and group interests
> 5. Work hard
> 6. Communicate with internal and external stakeholders
> 7. Get past failures. Celebrate success!

Every member of the HCIL can attest that they do celebrate, with lots of chocolate, parties, walking, ice skating, skiing, laughter, and annual group retreats.

Shneiderman has trained 13 computer science Ph.D. graduates and 19 M.S. graduates. His influence extends through his Ph.D. alumni, who are now engaged in diverse careers in academia (both research and instructional), industry (research laboratory, production, and entrepreneurial), and government agencies. Among his students, Ben is known for his personal approach, continuous encouragement, timely challenges that develop skills, pride in his students' achievements, and generous time investment in each student despite his busy schedule. Each readily recognizes Ben as one the most influential sources of positive change in their lives.

In the classroom, Shneiderman's innovative approaches to educational technology and pedagogical methods for using the Internet has influenced many educators beyond his own field, including primary school teachers. From the

beginning, he pushed students in his classes to work on solving real problems for clients and producing educational resources that others could use and learn from, a strategy he called relate-create-donate (Shneiderman, 1998). One example is OLIVE, the On-line Library of Information Visualization Environments (http://www.otal.umd.edu/olive ) developed entirely by students in his 1997 graduate Information Visualization course, which for many years was the first hit returned by search engines when given the keywords *information visualization*. Jenny Preece (Dean of the College of Information Studies, University of Maryland) comments on Ben Shneiderman as an educator (Preece, June 2007, Personal Communication):

> I have watched Ben give talks to computer scientists, radiologists, economists, sociologists, educators, humanities scholars, children, and photographers. Whether testifying before Congress or talking to students, Ben informs, challenges and charms listeners. His talks and lectures end with a call for action to make the world a better place because he genuinely believes in doing scientifically exciting work that positively impacts society. His desire for excellence is relentless; he polishes arguments, finds the right phrase, and makes compelling images. Couple this with the curiosity of a child and more energy than many people of half his age, and you can see why Ben is an inspiring educator, a founder of our field, and a friend to so many people across the world.
>
> *Designing the User Interface: Strategies for Human-Computer Interaction* has shaped our field and provided the foundation for many books, papers and research topics that we now take for granted. Each of the four editions carefully documents the intellectual developments in HCI at that time. Ben insists on including many references to ensure that he gives credit to colleagues, includes work that he particularly likes, and recognizes contributions from young academics and students. Each edition not only maps out the field, each charts an intricate set of personal and intellectual relationships. Each is fed by a passion for ideas, respect for creative colleagues and desire to foster community.

What will Shneiderman do in his next 60 years? We can only guess, but we are certain that Ben will not retire anytime soon. He is busy having fun working with students on new research ideas and traveling to meet with all of you. Despite his own accomplishments, he affirms that it took many other vocal champions and hard-working researchers to shape the field of HCI and that we need many new leaders to take on the future challenges. We look forward to seeing in what new ways Ben will strengthen our community, spark innovation, build bridges to others, and make the world a better place.

We conclude with this personal quote from Ben Bederson (HCIL Director, 2000–2006):

> While Ben Shneiderman's career stands on its own, his personal commitment to the people he works with, his honesty and openness, his deep desire to make the world a better place, his humble understanding of his limitations, and his persistence in doing what he can—makes him a true inspiration. In the eight years that I have worked with him on a daily basis, I have not once seen him get angry, take another human being for granted, or act condescendingly to those without as much knowledge and experience as him. I find myself extraordinarily lucky to have him as my

mentor, and I am a better person because of it. I truly can not think of a more deserving person of our professional admiration than Ben Shneiderman (Benderson, June 2007, Personal Communication).

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