BEN SHNEIDERMAN
University of Maryland | ben@cs.umd.edu
Professor, Department of Computer Science and founding director of Human-Computer Interaction Laboratory, University of Maryland, College Park.

Claiming Success, Charting the Future: Micro-HCI and Macro-HCI

The remarkable growth of HCI over the past 30 years has transformed this once nascent interdisciplinary field into an intellectually rich, worldwide phenomenon. We've grown from a small, rebellious group of researchers who struggled to gain recognition as we broke disciplinary boundaries to a large, influential community with potent impact on the daily lives of people everywhere.

The aspirations of early HCI researchers and practitioners were to make better menus tied to predictive models, design graphical user interfaces based on direct manipulation, improve input devices in accordance with design space theories, design effective control panels that supported task action models, and present information in comprehensible formats guided by cognitive theories. HCI software developers contributed innovative tools that enabled programmers and non-programmers to create interfaces for widely varying applications and diverse users. HCI professionals developed design principles, guidelines, and sometimes standards dealing with consistency, informative feedback, error prevention, shortcuts for experts, and user control. Success was measured by individual performance metrics, such as learning time, speed, and error rates, while user satisfaction was assessed with detailed questionnaires filled with numbered scales.

In the early days, HCI researchers and professionals fought to gain recognition, and often still must justify HCI's value to academic colleagues or corporate managers. However, the larger world embraced our contributions and now has high expectations for what we can deliver. Few fields can claim such rapid expansion and broad impact as the one responsible for the desktop, Web, and mobile interfaces now being used by billions of people around the world. HCI designs now influence commercial success, reform education, change family life, and affect the political stability of nations.

As HCI progresses, it's gaining greater acceptance in the academic environment, where it is now part of computer science, iSchool, business, engineering, and other departments and has advocates in fields including medicine, the social sciences, journalism, and the humanities. While the term "human-computer interaction" has achieved widespread recognition, many insiders feel it is no longer accurate. They complain that it suggests one human interacting with one computer to complete narrow tasks. Instead, these critics believe that the discipline should reflect user-oriented technologies that are ubiquitous, pervasive, social, embedded, tangible, invisible, multimodal, immersive, augmented, or ambient. Some want to break free from the focus on computer use and emphasize areas such as user experience, emotional impact, aesthetics, and social engagement.

New terms have been proposed, such as *human-centered computing, social computing, human-information interaction, human-social interaction, human-centered informatics,* and just *human interaction*. Novel, but already thriving, application areas include computational biology, computational social science, e-commerce (and m-commerce), information visualization, open government, and sustainability. While these broader visions are important, many researchers are still working on innovative display designs, input devices, and predictive models of user performance.

New names and applications are promising signs of the field's success, but finding the balance between sticking with an established term like HCI and welcoming innovative directions is difficult. Maybe an old aphorism helps: "Make new friends and keep the old, one is silver and the other gold." One way we might retain the brand-name recognition of HCI while embracing new directions is by thinking in terms of *micro-HCI* and *macro-HCI*.

Micro-HCI researchers and developers design and build innovative interfaces and deliver validated guidelines for use across the range of desktop, Web, mobile, and ubiquitous devices. The challenges for micro-HCI are to deal with rapidly changing technologies while accommodating the wide range of users: novice/expert, young/old, literate/illiterate, and abled/disabled. These distinctions are tied to differences in users' skills, but there are further differences in gender, personality,

culture, ethnicity, and motivation that interface designs must now address. Micro-HCI researchers can take comfort in dealing with well-stated requirements, clear benchmark tasks, established measures of human performance, and effective predictive models, such as Fitts' Law.

Macro-HCI researchers and developers design and build interfaces in expanding areas, such as affective experience, aesthetics, motivation, social participation, trust, empathy, responsibility, and privacy. The challenges for macro-HCI are to address new opportunities across the range of human experience: commerce, law, health/wellness, education, creative arts, community relationships, politics, policy negotiation, conflict resolution, international development, and peace studies. Macro-HCI researchers have to face the challenge of more open tasks, unanticipated user goals, new measures of system efficacy, and even conflicts among users in large communities.

Although micro-HCI and macro-HCI have healthy overlaps, they attract different types of researchers, practitioners, and activists, thereby further broadening the scope and impact of HCI in general. Since commercial, social, legal, and ethical considerations play an increasing role in all areas of HCI, educational curricula and professional practices need to be updated regularly; midcareer continuing education for HCI professionals will help keep them current.

An important goal will be to develop new metrics and evaluation methods for micro-HCI and macro-HCI. Moore's Law has been useful in charting the growth of computing, enabling everyone to admire and benefit from the increase in gigahertz, terabytes, and petaflops. These are still useful, but we need newer metrics to understand the impact of HCI designs that have enabled the spread of billions of mobile devices and the emergence of YouTube, Facebook, Twitter, and others. Understanding this transformation would be facilitated by measures of "giga-hellos," "tera-contribs," and "peta-thankyous," and by newer metrics such as trust, empathy, responsibility, and privacy. These metrics capture the volume of usage, but another measure—maybe the regional cellphone density or community email adoption rates—should report the breadth of usage.

Traditional evaluation approaches such as controlled experiments and usability testing are being continuously refined to fit the needs of micro-HCI, while the newer methods of qualitative, ethnographic, and case-study methods are being explored to match the needs of macro-HCI. Both groups will benefit from the remarkable increased opportunities to log usage on a massive scale through increasingly connected communications, data, and sensor networks. Traditional surveys of small samples of users who offer biased perceptions or reports of attitudes are giving way to actual usage measurements that reveal the learning ability, efficacy, and satisfaction of users. Even more exciting is the potential to capture manifestations of trust, empathy, responsibility, privacy, security, and motivation. Researchers are also beginning to measure brand loyalty, parental engagement, political leaning, potential for violence, community commitment, and much more. The dangers of inappropriate intrusion, misguided applications, scamming/spamming, deception, and bullying are now part of macro-HCI. Even greater concerns come from criminals, terrorists, and oppressive governments, who can use these technologies to threaten individuals, intimidate communities, or destroy the environment.

The power of these widely used social technologies means that we will face ethical challenges similar to what the nuclear physicists dealt with during the 1940s and beyond. We cannot and should not avoid these responsibilities. Rather, we should embrace them and show leadership in shaping technology to produce positive outcomes. This is never easy, but every worthy project that improves the health, environment, or education of children or builds capacity for constructive communities should be recognized, disseminated, scaled up, and continuously improved. Even more ambitious should be our efforts to promote open government, independent oversight, deliberative systems, and citizen participation. The research agenda for HCI should include the UN Millennium Development Goals, such as eradicating extreme hunger and poverty, ensuring universal childhood education, promoting maternal health, and ensuring environmental sustainability. If HCI professionals also courageously address conflict resolution, international development, and peace studies, we can inspire others and help build a better world.

We should be proud of what HCI has accomplished, but there is much work to be done. Let's get on with it!

Acknowledgements

Thanks to Ron Baecker, Jack Carroll, Susan Dray, Gerhard Fischer, Julie Jacko, Rob Jacob, Clare-Marie Karat, Clayton Lewis, Brad Myers, Jennifer Preece, and Gavriel Salvendy for comments on earlier drafts.

NOTE: This essay is a revised version of the foreword for the forthcoming *Handbook of HCI: 3rd Edition* (J. Jacko, editor, to be published by Taylor & Francis, 2012).

DOI: 10.1145/2008176.2008180