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HCI is a multidisciplinary field focused on human aspects of the development of computer technology. As computer-based technology becomes increasingly pervasive—not just in developed countries, but worldwide—the need to take a human-centered approach in the design and development of this technology becomes ever more important. For roughly 30 years now, researchers and practitioners in computational and behavioral sciences have worked to identify theory and practice that influences the direction of these technologies, and this diverse work makes up the field of human-computer interaction. Broadly speaking it includes the study of what technology might be able to do for people and how people might interact with the technology. The HCI series publishes books that advance the science and technology of developing systems which are both effective and satisfying for people in a wide variety of contexts. Titles focus on theoretical perspectives (such as formal approaches drawn from a variety of behavioral sciences), practical approaches (such as the techniques for effectively integrating user needs in system development), and social issues (such as the determinants of utility, usability and acceptability).

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Editors

Revolutionizing Education with Digital Ink

The Impact of Pen and Touch Technology on Education

Springer

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Foreword

The 2015 Workshop on the Impact of Pen and Touch Technology on Education was the ninth annual iteration of this conference. Researchers and practicing K-16 educators converged to the mutual benefit of each group. The conference content was a rich amalgam of keynote speakers, research papers, presentations by practicing teachers of classroom techniques that they found worthwhile, and hands-on You-Try-It sessions. People had ample opportunity to connect with one another to explore ideas and practices, yielding a stimulating cross-pollination in a diverse community.

Our tagline for the conference was "The Perfect Storm," carefully chosen to emphasize the converging conditions that provide opportunity as well as risks.

Many of us watched the initial excitement but subsequent malaise around the Microsoft Tablet PC, and felt that the tremendous impact that tablets could and should have on education—often testified to by WIPTTE researchers—wasn't being broadly realized. Some wondered when, or even if, it ever would be. But now—it may seem sudden but in reality developed over a couple of years—things are moving rapidly forward.

A perfect storm is the concurrency of multiple events that combine to create an extremely powerful weather phenomenon. We are seeing this same concurrence now around digital ink, much of it spurred by this year's host, Microsoft but also evident in a flurry of new tablets emphasizing the advantages of digital ink, including (after the conference) the Apple iPad Pro and Pencil.

Microsoft's rededication to software exploiting digital ink and touch in education was evident in sponsor's talks by the Office team that recently released OneNote Class Notebooks for O365—an application inspired by WIPTTE 2013 presentations followed by a lunch brainstorming meeting!—and the originators of education-oriented applications Sway and Mix. Wacom also described its innovations in a sponsor keynote address.

On the hardware side, the release of the Surface Pro 3 has captured the eye of the media as no ink-based tablet computer ever has. Other hardware vendors are following suit, exploring innovative, varied and very functional designs for systems

supporting ink on devices that are increasingly affordable. Samsung is an alternative hardware platform with pen support. Wacom and the Surface Pro team gave sponsor talks on hardware design with education in mind.

Another development of potentially profound import is recent research showing the advantages in learning and problem-solving for students using digital pens in contrast to typing or even using traditional writing and sketching tools. The first two WIPTTE 2015 keynote speakers, Pam Mueller and Sharon Oviatt, presented their landmark research on this subject.

Abetting these developments is the shift toward new "twenty-first century" forms of pedagogy that rely on digital technology, and the building out of school infrastructure capable of supporting it. We at WIPTTE are contributing to all of these, and by showcasing best practices also support crucial professional development activity. Though much remains to be done, it is indeed a perfect storm, and one which bodes well for those in this community and in education at large who focus new developments.

The conference organizers are grateful to the many sponsors who have so generously funded us this year and without whom this whole affair would have been impossible. As Platinum level sponsors, we have Microsoft (Windows, OneNote, Surface Pro, Surface Hub, and Research), in addition to their support as host. Wacom is a Gold level sponsor. Fujitsu is a Silver level sponsor. Bronze sponsors are DyKnow, PDF Annotator, and the Sketch Recognition Lab of Texas A&M University. All were vital to the success of this conference.

We want to acknowledge here the hard work put in by all of the members of the organizing committee. Special praise goes to Tracy Hammond and her amazing students from Texas A&M. The conference would not have happened without them.

And last, thank you to all who attended. Every presentation, whether a keynote or a poster, represents many hours of work on the part of the presenter. Every attendee had to juggle other priorities to realize the opportunity to learn from and contribute to this community. Together, we will continue to push the capabilities of digital ink and touch technologies as powerful tools for education.

St. Louis, MO, USA
Redmond, WA, USA
January 2016

Mark Payton
Dr. Jonathan Grudin
WIPTTE 2015 Co-chairs

Mark Payton is the Director of Technology and Library Services for Whitfield School, an independent 6–12 school in St. Louis, MO. He is in his 17th year as an IT Director in independent schools, having been at schools in Vermont and Madaba, Jordan previously. He started his IT career working in the ski industry at Killington and as IT Director for Burton Snowboards. Between the industry and academic stints, he was a software developer. Self-taught as a programmer and IT person, his training is in early childhood education with a BA from the University of Kansas. He has taught subjects as varied as Introductory Programming and Christian Theology, and to students of every grade between Pre-K and the undergraduate university level. He has been interested in pen-based computing since the days of the GRiDpad and Windows for Pen Computing and has been a member of the WIPTTE steering committee since the conference's inception.

Jonathan Grudin is a Principal Researcher at Microsoft Research in the fields of human–computer interaction (HCI) and computer-supported cooperative work (CSCW). Grudin is a pioneer of the field of CSCW and one of its most prolific contributors, and was awarded the inaugural CSCW Lasting Impact Award in 2014 on the basis of his work. Grudin is currently also an Affiliate Professor at the Information School in the University of Washington. Previously, he was a Professor of Information and Computer Science at University of California Irvine. Grudin received his Ph.D. under Don Norman in Cognitive Psychology from the University of California San Diego.

Acknowledgements

We also thank the contributing authors and presenters, reviewers, students, and staff at the Microsoft Campus for the truly outstanding work that was done to produce, publish, present, and demonstrate at the conference, and in providing the behind-the-scenes work necessary to make it all possible. Thanks also to Anna Stephanova (Texas A&M University) and Jung In Koh (Texas A&M University).

The generous sponsorship of several corporations and organizations has been crucial to enabling WIPTTE to provide a high quality program at a very low cost to attendees. We would particularly like to thank our sponsors who have provided invaluable resources, both financial and in-kind. The 2015 Platinum and host sponsor was Microsoft. The 2015 Gold Sponsor was Wacom, with special thanks going to Sierra Modro and David Fleck. The 2015 Silver Sponsor was Fujitsu, with special thanks going to Mitsi Miller. The 2015 Bronze Sponsors included DyKnow, with special thanks to Anastasia Way and Michael Vasey; PDF Annotator, with special thanks to Oliver Grahl; and the Texas A&M University Sketch Recognition Lab, with special thanks to Dr. Tracy Hammond and Stephanie Valentine. Student volunteers included Laura Barretto (Sketch Recognition Lab, Vassar College), Seth Polsley (Sketch Recognition Lab, Texas A&M University), Raniero Lara-Garduno (Sketch Recognition Lab, Texas A&M University), and Paul Taele (Sketch Recognition Lab, Texas A&M University).

Organizing Committees

The chairs of WIPTTE 2015 were Dr. Jonathan Grudin (Microsoft) and Mark Payton (Whitfield School).

The paper chairs was Dr. Aaron Adler (BBN).

The poster chair was Dr. Jane Dong (California State University).

The high school chairs were Stephanie Valentine (Texas A&M University) and Cassandra Oduola (Texas A&M University).

The webmasters were Paul Taele (Texas A&M University) and David Turner (Texas A&M University).

Ex Officio members of the committee included Dr. Eric Hamilton (Pepperdine University), Dr. Tracy Hammond (Texas A&M University), and Dr. Joseph Tront (Virginia Tech).

Contents

Part I Introductions and Welcome

1 Introduction 3
Tracy Hammond, Aaron Adler, and Stephanie Valentine

Part II Why We Pen and Touch

2 Computer Interfaces Can Stimulate or Undermine Students' Ability to Think 19
Sharon Oviatt

3 Inking Outside the Box: How Context Sensing Affords More Natural Pen (and Touch) Computing 27
Ken Hinckley and Bill Buxton

Part III Novel Tutoring Systems and Intelligent Ink

4 Design Studies for Stylus and Finger-Based Interaction in Writing Instruction on Tablets 51
Robert Thompson, Steven Tanimoto, Virginia Berninger, and William Nagy

5 Tablet-Based Technology to Support Students' Understanding of Division 71
Kimberle Koile and Andee Rubin

6 A Tablet-Based Math Tutor for Beginning Algebra 91
Guan Wang, Nathaniel Bowditch, Robert Zeleznik, Musik Kwon, and Joseph J. LaViola Jr.

7 Leveraging Trends in Student Interaction to Enhance the Effectiveness of Sketch-Based Educational Software 103
Seth Polsley, Jaideep Ray, Trevor Nelligan, Michael Helms, Julie Linsey, and Tracy Hammond

8 PerSketchTivity: An Intelligent Pen-Based Educational Application for Design Sketching Instruction 115
Blake Williford, Paul Taele, Trevor Nelligan, Wayne Li, Julie Linsey, and Tracy Hammond

9 An Intelligent Sketch-Based Educational Interface for Learning Complex Written East Asian Phonetic Symbols 129
Paul Taele and Tracy Hammond

10 A Stylus-Driven Intelligent Tutoring System for Music Education Instruction 141
Laura Barreto, Paul Taele, and Tracy Hammond

11 SmartStrokes: Digitizing Paper-Based Neuropsychological Tests 163
Raniero Lara-Garduno, Nancy Leslie, and Tracy Hammond

Part IV The Empowering Effects of Active Media-Making

12 The Digital Sash: A Sketch-Based Badge System in a Social Network for Children 179
Stephanie Valentine, Angelica Leyva-McMurtry, Katya Borgos-Rodriguez, and Tracy Hammond

13 A Cyberensemble of Inversion, Immersion, Shared Knowledge Areas, Query, and Digital Media-Making in STEM Classrooms 191
Eric Hamilton, George Foe-Aman, Lynette Foe-Aman, and Israel Ramirez-Gamez

14 A System Dynamics Approach to Process Evaluation of Pen-Based Digital Media-Making Projects 209
Moses Okumu, Hiroo Kato, and Nishesh Chalise

15 A Model and Research Agenda for Teacher and Student Collaboration Using Pen-Based Tablets in Digital Media Making in Sub-Saharan Africa 223
Eric Hamilton, Loide Kapenda, Zachary Mbasu, Helena Miranda, Elizabeth Ngololo, Joseph Carilus Ogwel, Sandra Sarmonpal, and David Stern

16 Student Producers: OneNote, Camtasia Studio, and the Authentic Project 231
Audrey Lampe Ploesser

17 An Aqua Squiggle and Giggles: Pre-Teens as Researchers Influencing Little Lives Through Inking and Touch Devices 241
Michelle Zimmerman

Part V Research in the Wild: Classroom Perspectives

18 Personalizing Student Learning Using the MyEduDecks Application Through Teacher Supervision and Peer-to-Peer Networks 275
Radhir Kothuri, Samuel Cohen, Nicholas Wilke, and Aileen Owens

19 Inking Pedagogy 287
Dale Pokorski, David Okoth, Vaishali Nandy, Julaine Fowlin, Catherine Amelink, and Glenda Scales

20 Impact of Undergraduate Tablet PC Use on Retention in STEM Majors 301
Carla A. Romney

21 Analysis of Student Perspectives on Using Tablet PCs in Junior and Senior Level Chemical Engineering Courses 307
Enrique Palou, Zaira Ramírez-Apud, Nelly Ramírez-Corona, and Aurelio López-Malo

22 Student Demonstrations of Learning: Making Thinking Visible Using Pen and Touch 321
Richard Kassissieh and Jeff Tillinghast

23 The Integration of Inking, Touch and Flipping Within the Mathematics Middle School Classroom 329
Leslie Williams

24 DYKNOW as a Tool for Differentiation: Exploring Alternative Ways to Assess in the Middle School Social Studies Classroom 335
Sara Mata

Part VI Voices of the Future: Student Perspectives

25 WIPTTE 2015 High School Contest 345
Stephanie Valentine, Hannah Conrad, Cassandra Oduola, and Tracy Hammond

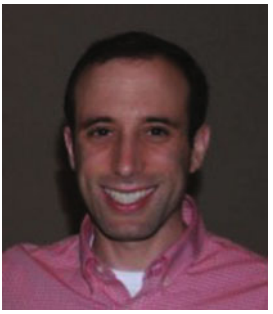
26 Youth Re-envisioning the Future of Education 365
Kayla Gonzalvo, Tiffany Dinh, Scott Nguyen, Jasmine Fernandez, and Michelle Zimmerman

Editors and Contributors

About the Editors

Tracy Hammond Director of the Sketch Recognition Lab and Associate Professor in the Department of Computer Science and Engineering at Texas A&M University, Dr. Hammond is an international leader in sketch recognition and human–computer interaction research. Dr. Hammond's publications on the subjects are widely cited and have well over 1500 citations, with Dr. Hammond having an h-index of 19, an h10-index of 29, and four papers with over 100 citations each. Her sketch recognition research has been funded by NSF, DARPA, Google, Microsoft, and many others, totaling over 3.6 million dollars in peer reviewed funding. She holds a Ph.D. in Computer Science and FTO (Finance Technology Option) from M.I.T., and four degrees from Columbia University: an M.S. in Anthropology, an M.S. in Computer Science, a B.A. in Mathematics, and a B.S. in Applied Mathematics. Prior to joining the TAMU CSE faculty, Dr. Hammond taught for 5 years at Columbia University and was a telecom analyst for 4 years at Goldman Sachs. Dr. Hammond is the 2011–2012 recipient of the Charles H. Barclay, Jr. '45 Faculty Fellow Award. The Barclay Award is given to professors and associate professors who have been nominated for their overall contributions to the engineering program through classroom instruction, scholarly activities, and professional service.

Stephanie Valentine is a Ph.D. student in the Department of Computer Science and Engineering at Texas A&M University. A Nebraska native, Valentine graduated Salutatorian of her class with a B.A. in Computer Science with a minor in Electronic Publishing from Saint Mary's University of Minnesota. Valentine is an NSF Graduate Fellow, winner of the Susan M. Arseven '75 Make-A-Difference Award, and Vice President of the CSE Departmental graduate student association. Valentine's research focuses around understanding how children communicate in online social networks and empowering children to have safe, healthy, and expressive digital friendships. Valentine is also the founding president of Wired Youth, Inc., a 501(c)3 nonprofit organization that works to educate the community about safe social networking for children as an active prevention strategy for cyberbullying, online predation, and other cyberthreats.



Aaron Adler is a Scientist at Raytheon BBN Technologies in Columbia, Maryland and Cambridge, Massachusetts. Dr. Adler has worked on variety of projects for DARPA and AFRL involving security, machine learning, robotics, artificial intelligence, and synthetic biology. Dr. Adler has a particular interest in creating intelligent user interfaces by automatically handling complexities to enable intuitive interfaces for users. He received his Ph.D. in Computer Science from M.I.T. where he also received his M.Eng. in Computer Science and Engineering and S.B. in Computer Science. His Ph.D. thesis centered on constructing multimodal interactive dialogues: combining speech recognition and sketch recognition for user input and generating speech and sketching for multimodal computer output. The system helps the user describe simple mechanical (Rube-Goldberg-like) devices by asking probing questions.

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