

Robert Xiao

CURRICULUM VITAE

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EDUCATION

PhD in Human-Computer Interaction

2011 – Present

Carnegie Mellon University, Pittsburgh, PA

Thesis Proposed: March 29, 2017

Estimated Graduation April 2018

Bachelor of Mathematics

2007 – 2011

University of Waterloo, Waterloo, ON

Double Honours in Computer Science and Combinatorics & Optimization

HONOURS AND AWARDS

SCHOLARSHIPS & FELLOWSHIPS

NSERC Postgraduate Scholarship

2013 – 2015

\$63,000 award for three years, awarded to top Canadian graduates in their third year of a graduate program of study

Qualcomm Innovation Fellowship

2012

\$100,000 award for one year for a team of two students

NSERC Julie Payette Postgraduate Scholarship

2011

\$25,000 award for one year awarded to top Canadian students in their first year of a graduate program of study

NSERC Undergraduate Student Research Award

2008 – 2010

Canadian federal fellowships to support academic research as an undergraduate student

Rene Descartes Scholarship

2007 – 2011

Awarded to students with strong performance on Canadian national mathematics competitions

SELECTED HONOURS AND AWARDS

Fast Company Innovation By Design Student Award	2016
Awarded for EM-Sense, recognizing an outstanding work of innovation. A total of 15 awards were given out from a pool of 1700 nominations	
Allen Newell Award for Research Excellence	2015
Awarded w/ Scott Hudson to recognize outstanding body of work within the School of Computer Science at Carnegie Mellon University	
Governor General's Silver Medal	2011
Awarded to the individual with the highest academic average over all graduating students	
Rising Stars of Research Honourable Mention	2010
Awarded to outstanding posters in the national Rising Stars of Research Poster Competition	
NSERC USRA Poster Competition First Prize	2009, 2010
Awarded to the top poster presented at the University of Saskatchewan USRA Poster Fair	
Putnam Mathematics Competition	2008
110 th place in North America (4 th in U of Waterloo)	
President's Scholarship of Distinction	2007
Awarded to students with a 95% entrance average or higher	

PUBLICATIONS

25. **Xiao, R.**, Hudson, S.E. and Harrison, C. (2017). Supporting Responsive Cohabitation Between Virtual Interfaces and Physical Objects on Everyday Surfaces. In *Proceedings of the 9th ACM SIGCHI Symposium on Engineering Interactive Computing Systems, 2017* (EICS '17). ACM, New York, NY, USA. Article 11. 12 pages.
24. **Xiao, R.**, Laput, G., Zhang, Y. and Harrison, C. (2017). Deus EM Machina: On-Touch Contextual Functionality for Smart IoT Appliances. In *Proceedings of the ACM Special Interest Group on Computer-Human Interaction, 2017* (CHI '17). ACM, New York, NY, USA, 4000-4008.
23. **Xiao, R.**, Hudson, S.E. and Harrison, C. (2016). CapCam: Enabling Quick, Ad-Hoc, Position-Tracked Interactions Between Devices. In *Proceedings of the 2016 International Conference on Interactive Surfaces & Spaces (ISS '16)*. ACM, New York, NY, USA, 169-178.

22. **Xiao, R.**, Hudson, S.E. and Harrison, C. (2016). DIRECT: Making Touch Tracking on Ordinary Surfaces Practical with Hybrid Depth-Infrared Sensing. In *Proceedings of the 2016 International Conference on Interactive Surfaces & Spaces (ISS '16)*. ACM, New York, NY, USA, 85-94.
21. Laput, G., **Xiao, R.** and Harrison, C. (2016). ViBand: High-Fidelity Bio-Acoustic Sensing Using Commodity Smartwatch Accelerometers. In *Proceedings of the 29th Annual ACM Symposium on User Interface Software & Technology (UIST '16)*. ACM, New York, NY, USA, 321-333. Best Paper Award!
20. Zhang, Y., **Xiao, R.** and Harrison, C. (2016). Advancing Hand Gesture Recognition with High Resolution Electrical Impedance Tomography. In *Proceedings of the 29th Annual ACM Symposium on User Interface Software & Technology (UIST '16)*. ACM, New York, NY, USA, 843-850.
19. **Xiao, R.**, Benko, H. Augmenting the Field-of-View of Head-Mounted Displays with Sparse Peripheral Displays. In *Proceedings of the ACM Special Interest Group on Computer-Human Interaction, 2016 (CHI '16)*. ACM, New York, NY, USA, 1221-1232. Honorable Mention Award!
18. **Xiao, R.**, Schwarz, J. and Harrison, C. (2015). Estimating 3D Finger Angle on Commodity Touchscreens. In *Proceedings of the 2015 International Conference on Interactive Tabletops & Surfaces (ITS '15)*. ACM, New York, NY, USA, 47-50.
17. Guo, A., **Xiao, R.** and Harrison, C. (2015). CapAuth: Identifying and Differentiating User Handprints on Commodity Capacitive Touchscreens. In *Proceedings of the 2015 International Conference on Interactive Tabletops & Surfaces (ITS '15)*. ACM, New York, NY, USA, 59-62.
16. Chatterjee, I., **Xiao, R.** and Harrison, C. (2015). Gaze+Gesture: Expressive, Precise and Targeted Free-Space Interactions. In *Proceedings of the 2015 ACM on International Conference on Multimodal Interaction (ICMI '15)*. ACM, New York, NY, USA, 131-138. Best Paper Award!
15. Laput, G., Yang, C., **Xiao, R.**, Sample, A. and Harrison, C. (2015). EM-Sense: Touch Recognition of Uninstrumented, Electrical and Electromechanical Objects. In *Proceedings of the 28th Annual ACM Symposium on User Interface Software & Technology (UIST '15)*. ACM, New York, NY, USA, 157-166. Best Talk Award!
14. Laput, G., Lasecki, W.S., Wiese, J., **Xiao, R.**, Bigham, J.P. and Harrison, C. (2015). Sensors: Adaptive, Rapidly Deployable, Human-Intelligent Sensor Feeds. In *Proceedings of the ACM Special Interest Group on Computer-Human Interaction, 2015 (CHI '15)*. ACM, New York, NY, USA. 1935-1944.
13. Laput, G., **Xiao, R.**, Chen, X., Hudson, S.E., Harrison, C. (2014). Skin Buttons: Cheap,

- Small, Low-Powered and Clickable Fixed-Icon Laser Projectors. In *Proceedings of the ACM Symposium on User Interface Software and Technology, 2014* (UIST '14). ACM, New York, NY, USA. 389-394.
12. **Xiao, R.**, Lew, G., Marsanico, J., Hariharan, D., Hudson, S.E., Harrison, C. (2014). Toffee: Enabling Ad Hoc, Around-Device Interaction with Acoustic Time-of-Arrival Correlation. In *Proceedings of the 16th International Conference on Human-Computer Interaction with Mobile Devices and Services* (MobileHCI '14). ACM, New York, NY, USA. 67-76.
 11. **Xiao, R.**, Laput, G., Harrison, C. (2014). Expanding the Input Expressivity of Smartwatches with Physical Pan, Twist, Tilt and Click. In *Proceedings of the ACM Special Interest Group on Computer-Human Interaction, 2014* (CHI '14). ACM, New York, NY, USA. 193-196.
 10. Schwarz, J., **Xiao, R.**, Mankoff, J., Hudson, S.E., Harrison, C. (2014). Probabilistic Palm Rejection Using Spatiotemporal Touch Features and Iterative Classification. In *Proceedings of the ACM Special Interest Group on Computer-Human Interaction, 2014* (CHI '14). ACM, New York, NY, USA. 2009-2012.
 9. Harrison, C., **Xiao, R.**, Schwarz, J., Hudson, S.E. (2014). TouchTools: Leveraging Familiarity and Skill with Physical Tools to Augment Touch Interaction. In *Proceedings of the ACM Special Interest Group on Computer-Human Interaction, 2014* (CHI '14). ACM, New York, NY, USA. 2913-2916.
 8. **Xiao, R.**, Harrison, C., Hudson, S.E. (2013). Lumitrack: High Speed, High Precision, Low-Cost Tracking with Projected m-Sequences. In *Proceedings of the ACM Symposium on User Interface Software and Technology, 2013* (UIST '13). ACM, New York, NY, USA. 3-12.
 7. **Xiao, R.**, Harrison, C., Hudson, S.E. (2013). WorldKit: Rapid and Easy Creation of Ad-hoc Interactive Applications on Everyday Surfaces. In *Proceedings of the ACM Special Interest Group on Computer-Human Interaction, 2013* (CHI '13). ACM, New York, NY, USA. 879-888.
 6. Tang, J., **Xiao, R.**, Hoff, A., Venolia, G., Therien, P., Roseway, A. (2013). HomeProxy: Exploring a Physical Proxy for Video Communication in the Home. In *Proceedings of the ACM Special Interest Group on Computer-Human Interaction, 2013* (CHI '13). ACM, New York, NY, USA. 1339-1342.
 5. Bateman, S., Mandryk, R.L., Gutwin, C., **Xiao, R.** (2013). Analysis and Comparison of Target Assistance Techniques for Relative Ray-Cast Pointing. In *International Journal of Human-Computer Studies* (IJHCS), 71(5), 511-532.
 4. Harrison, C., **Xiao, R.**, Hudson, S.E. (2012). Acoustic Barcodes: Passive, Durable and

Inexpensive Notched Identification Tags. In *Proceedings of the 25th Annual ACM Symposium on User Interface Software and Technology (UIST '12)*. ACM, New York, NY, USA, 563-568.

3. **Xiao, R.**, Nacenta, M., Mandryk, R.L., Cockburn, A., Gutwin, C. (2011). Ubiquitous Cursor: A Comparison of Direct and Indirect Pointing Feedback in Multi-Display Environments. In *Proceedings of Graphics Interface 2011 (GI '11)*. Canadian Human-Computer Communications Society, Waterloo, Ontario, Canada, 135-142. **Best Student Paper!**
2. Bateman, S., Doucette, A., **Xiao, R.**, Gutwin, C., Mandryk, R.L., Cockburn, A. (2011). Effects of view, input device, and track width on video game driving. In *Proceedings of Graphics Interface 2011 (GI '11)*. Canadian Human-Computer Communications Society, Waterloo, Ontario, Canada, 207-214.
1. Gutwin, C., Schneider, O., and **Xiao, R.** (2011). Chalk Sounds: Using Synthesized Audio to Improve Workspace Awareness in Distributed Groupware. In *Proceedings of the ACM 2011 conference on Computer supported cooperative work (CSCW '11)*. ACM, New York, NY, USA, 85-94.

POSTERS

3. **Xiao, R.**, Bateman, S., Mandryk, R., Gutwin, C. (2009). Enhancing the Effectiveness of Remote Pointing. Presented at the University of Saskatchewan USRA Poster Fair, August 2009.
2. **Xiao, R.**, Nacenta, M., Cockburn, A., Mandryk, R., Gutwin, C. (2010). Ubiquitous Cursor: Filling in the Space Between Displays. Presented at the University of Saskatchewan USRA Poster Fair, August 2010.
1. **Xiao, R.**, Harrison, C. (2012). Synthetic Sensors and Displays. Presented at the Qualcomm Innovation Winner's Day, September 2012.

INVITED PRESENTATIONS

2. Invited to demonstrate research projects at the Engadget Live event held in New York City, USA, Oct 29, 2015.
1. Invited speaker to the "WE: Way to Evolve" 2013 summit held in Shenzhen, China, Nov 10, 2013 and hosted by Tencent, Inc. Presented my engineering work on mobile interaction enhancements with Qeexo, and my research on on-world interfaces (WorldKit). http://we.tencent.com/index_en.php

SELECTED PRESS COVERAGE

Desktopography, 2017

<http://www.dailymail.co.uk/sciencetech/article-4650346/Fancy-turning-DESK-touchscreen.html>
<http://www.popularmechanics.com/technology/gadgets/a27124/desk-touchscreen-projector/>

Deus EM Machina, 2017

<https://www.engadget.com/2017/05/09/deus-em-machina-electromagnetic-emissions-sensing/>
<https://techcrunch.com/2017/05/09/how-a-tap-could-tame-the-smart-home/>

ViBand, 2016

<https://techcrunch.com/2016/11/21/overclocked-smartwatch-sensor-uses-vibrations-to-sense-gestures-objects-and-locations/>
<https://www.theverge.com/circuitbreaker/2016/11/2/13463312/carnegie-mellon-lg-smartwatch-hack-gesture-accelerometer-viband-project>

SparseLight, 2016

<https://www.theverge.com/2016/4/26/11512820/sparselight-ar-vr-led-hack-microsoft-hololens>
<https://arstechnica.com/gaming/2016/05/how-side-mounted-leds-can-help-fix-vrs-tunnel-vision-and-nausea-problems/>

EM-Sense, 2015

<http://www.wired.com/2015/11/em-sense-enabled-smartwatch-can-detect-when-you-touch-a-door-knob/>
<http://www.nbcnews.com/tech/innovation/disney-smartwatch-knows-what-youre-touching-tells-you-what-do-n461741>
<https://www.fastcodesign.com/product/em-sense>

Sensors, 2015

<http://www.pcworld.com/article/2914552/sensors-app-lets-you-crowdsource-live.html>
<http://gizmodo.com/one-old-android-phone-could-make-all-your-dumb-things-s-1699362305>

3D Finger Angle, 2015

<http://gizmodo.com/a-touchscreen-that-knows-the-angle-of-your-finger-is-wa-1742667522>
<http://www.digitaltrends.com/mobile/qeexo-fingerangle-news/>

Skin Buttons, 2014

<http://phys.org/news/2014-10-skin-icons-smartwatch.html>
<http://www.fastcodesign.com/3036985/this-smartwatch-projects-laser-buttons-onto-your-skin>

TouchTools, 2014

<http://gizmodo.com/what-life-would-be-like-if-skeuomorphism-ruled-our-ipad-1570806039>
<http://www.engadget.com/2014/05/01/touchtools-user-interface-manipulating-objects/>

6DOF Physical Smartwatch, 2014

<http://www.newscientist.com/article/dn25482-tilting-smartwatch>
<http://www.engadget.com/2014/04/30/concept-smartwatch-joystick/>

WorldKit, 2013

Work featured as segment on “Stephen Hawking’s Science of the Future”, Episode 4.

<http://www.reuters.com/video/2013/06/12/researcher-gives-new-meaning?videoid=243310701>

<http://www.foxnews.com/tech/2013/07/08/projector-turns-everything-into-touchscreen/>

TEACHING EXPERIENCE

Lab Instructor

2014

Lab Instructor for the Programming Usable Interfaces Prototype Lab, in the Human-Computer Interaction Institute at Carnegie Mellon University, during the September-December 2014 academic term.

Teaching Assistant

2014

Teaching Assistant for an introductory course on Applied Gadgets, Sensors and Activity Recognition, taught by Scott E. Hudson, in the Human-Computer Interaction Institute at Carnegie Mellon University, during the January-April 2014 academic term.

Tutoring and TAing

2008-2010

Various tutoring and TA positions with the Tutorial Center and Tutoring in Residence programs (four semester-long appointments total), Faculty of Mathematics, University of Waterloo

MATH 227 TA (Calculus 3 for Honours Physics)

2009

Received outstanding evaluation from MATH 227 professor for TA work

MATH 146 TA (Advanced Linear Algebra)

2009

Received outstanding evaluation from MATH 146 professor for TA work

CS 116 Tutor (Intro to Computer Science 2)

2009

Developed and maintained entirely new version of the automatic grading system (used by nearly 1000 students per semester). Department of Computer Science, University of Waterloo, Waterloo, ON, Canada.

POSITIONS AND APPOINTMENTS HELD

Research Consultant, Microsoft Research

2017

Mentored by Julia Schwarz and Hrvoje Benko. Work focused on advancing interactions in augmented reality.

Redmond, WA, USA

<p>Research Intern, Microsoft Research Mentored by Andy Wilson and Hrvoje Benko. Work focused on advancing interactions in augmented reality. Redmond, WA, USA</p>	2016
<p>Research Intern, Microsoft Research Mentored by Andy Wilson. Work focused on expanding the FoV of VR systems using sparse peripheral displays. Work resulted in the Sparse Peripheral Displays paper, which earned an honorable mention at CHI 2016. Redmond, WA, USA</p>	2015
<p>Software Architect, Qeexo, Co. Summer internship with CMU spinoff. Work focused on engineering rich multitouch solutions for mobile devices. Pittsburgh, PA, USA</p>	2013
<p>Research Intern, Microsoft Research Mentored by John Tang. Work focused on in-home physical proxies for video communication. HomeProxy publication resulted from this internship. Redmond, WA, USA</p>	2012
<p>Embedded Software Developer, Research in Motion Development and validation of embedded radio firmware for 3G modems. Waterloo, ON, Canada</p>	2011
<p>Summer Research Student, University of Saskatchewan Summer research with the Interaction Lab, Department of Computer Science, mentored by Carl Gutwin. Research funded by NSERC under the Undergraduate Student Research Award program. Saskatoon, SK, Canada</p>	2010
<p>Summer Research Student, University of Saskatchewan Summer research with the Interaction Lab, Department of Computer Science, mentored by Regan Mandryk and Carl Gutwin. Research funded by NSERC under the Undergraduate Student Research Award program. Saskatoon, SK, Canada</p>	2009
<p>Summer Research Student, University of Saskatchewan Summer research with the Imaging, Multimedia and Graphics Lab, Department of Computer Science, mentored by Mark Eramian. Research funded by NSERC under the Undergraduate Student Research Award program. Saskatoon, SK, Canada</p>	2008

Database Analyst, University of Saskatchewan **2007**
Database analyst with the Centre for Continuing and Distance Education at the University of Saskatchewan. Minimum qualifications required 3rd year Computer Science undergraduates; I took the job while in high school. Saskatoon, SK, Canada

COMMUNITY SERVICE

Contributing Writer, Crash Course Computer Science **2017**
Invited contributing writer for 18 episodes of the PBS Digital “Crash Course Computer Science” educational video series.

Program Committee Member, IUI 2018 **2017**
Invited program committee member for the 22nd ACM International Conference on Intelligent User Interfaces (IUI 2018) conference held in Tokyo, Japan.

Program Committee Student Volunteer, UIST 2017 **2017**
Student volunteer at the program committee meeting for the 30th Annual ACM Symposium on User Interface Software & Technology (UIST 2017).

Regular Conference Paper Reviewer
Reviewer for over 50 submitted papers across several conferences, including CHI, UIST, UbiComp, DIS, CSCW, ITS/ISS and MobileHCI. Annual reviewer for CHI and UIST since 2013.
3 “*Excellent Reviewer*” distinctions received at CHI (2016, 2017, 2017).

Journal Paper Reviewer
Reviewer for over 10 journal articles, including articles submitted to IJHCS, IEEE Computer and IEEE Photonics.

ADDITIONAL HONORS AND AWARDS

First place, DEFCON CTF **July 2017**
Competed with the CMU PPP team at the 22nd annual DEFCON CTF in Las Vegas.

First place individual, Cambridge 2 Cambridge Challenge **July 2017**
In-person computer security competition held in Cambridge, UK, among over 100 prequalified contestants. £3000 prize for first place individual.

First place team, Cambridge 2 Cambridge Challenge **July 2017**
In-person computer security competition held in Cambridge, UK, among 22

teams of 5 prequalified people each. £9000 prize for first place team.

First place, DEFCON Quals CTF

May 2017

Online team computer security competition; qualified to final competition in Las Vegas, NV

First place, NSA Codebreaker Challenge 2016

December 2016

Individual cryptography/reverse engineering competition held online

First place, DEFCON CTF

August 2016

Competed with the CMU PPP team at the 21st annual DEFCON CTF in Las Vegas

First place, Codegate CTF

May 2016

Four-person team, computer security competition held in Seoul, S. Korea. 50,000,000 KRW (\$45000 USD) prize.

Second place, OCTF Finals

April 2016

Four-person team, attack-defense style computer security competition held in Shanghai, China. 20000 RMB (\$3000 USD) prize

Fifth place, Microsoft College Puzzle Challenge

April 2016

Four-person team, ranked fifth nationally and first at CMU

First place, Microsoft Build the Shield Competition

March 2016

Four-person team computer security competition held in Seattle, Washington with over 40 participating teams.

First place, Codegate Quals CTF

March 2016

Online team computer security competition; qualified to final round in Seoul, S. Korea

First place, Tsinghua University BCTF

March 2016

Online team computer security and cryptography competition, over 500 participating teams

Fourth place, OCTF Qualification Round

March 2016

Online team computer security competition with over 800 participating teams; qualified to final round in Shanghai, China

Third place, Boston Key Party CTF

March 2016

Online team computer security and cryptography competition, over 750 participating teams

Top 25, NSA Codebreaker Challenge 2015

December 2015

Individual cryptography/reverse engineering competition held online

Fifth place, HITCON 2015 Final CTF Four-person team computer security competition held in Taipei, Taiwan	December 2015
First place, HITCON 2015 Quals CTF Online team computer security competition, qualification for final round	October 2015
Second place, DEFCON 2015 CTF Participated in this team computer security competition in Las Vegas	August 2015
First place, Microsoft Code Hunt Individual programming competition held on the Microsoft campus and open to all employees	August 2015
Third place, SECCON 2014 Final CTF Four-person team computer security competition held in Tokyo, Japan	February 2015
First place, CMU-Citadel Programming Challenge	January 2015
Third place, Microsoft College Puzzle Challenge Four-person team, ranked third in national standings	April 2014
Invited participant of the USA Mathematics Olympiad	2007
Pythagoras Contest Canadian Champion	2001

REFERENCES

DR. CHRIS HARRISON
 Human-Computer Interaction Institute
 School of Computer Science
 Carnegie Mellon University
 5000 Forbes Ave
 Pittsburgh, PA 15213-3891
 Email: chris.harrison@cs.cmu.edu

DR. HRVOJE BENKO
 Microsoft Research
 Bldg. 99
 One Microsoft Way
 Redmond, WA 98052-6399
 Email: benko@microsoft.com

DR. SCOTT HUDSON
 Human-Computer Interaction Institute
 School of Computer Science

Carnegie Mellon University
5000 Forbes Ave
Pittsburgh, PA 15213-3891
Email: scott.hudson@cs.cmu.edu

DR. CARL GUTWIN
176 Thorvaldson Building
110 Science Place Drive
The University of Saskatchewan
Saskatoon, SK S7N 5C9
Tel: 306-966-8646
Fax: 306-966-4884
Email: gutwin@cs.usask.ca