

CURRICULUM VITAE
XIAO, Robert
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PERSONAL

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EDUCATION

Carnegie Mellon University, Pittsburgh, PA Sept 2011 – Present (est. Apr 2018)
PhD in Human-Computer Interaction
Thesis Proposed: March 29, 2017

University of Waterloo, Waterloo, ON Sept 2007 – Apr 2011
Bachelor of Mathematics Double Honours in Computer Science and Combinatorics & Optimization

University of Saskatchewan, Saskatoon, SK Sept 2006 – Apr 2007
Enrolled in Open Studies; attended two classes, Mathematics 110 and Computer Science 115

Walter Murray Collegiate Institute, Saskatoon, SK Sept 2003 – June 2007
High School Diploma

HONOURS AND AWARDS

Financial Support

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, 2009, 2010

President's Scholarship of Distinction 2007
Awarded to students with a 95% entrance average or higher

Rene Descartes Scholarship 2007-2011
Awarded to students with strong performance on the national Euclid math competition

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 to recognize an outstanding body of work within the School of Computer Science

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
110th place in North America (4th in U of Waterloo) 2008

PUBLICATIONS

Conference Papers

24. **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. 12 pages.
23. **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.
22. **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.
21. **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.
20. 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!**
19. 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.
18. **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!**
17. **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.
16. 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.
15. 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!**
14. 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!**
13. Laput, G., Lasecki, W.S., Wiese, J., **Xiao, R.**, Bigham, J.P. and Harrison, C. (2015). Zensors:

- 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.
12. 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.
 11. **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.
 10. **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.
 9. 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.
 8. 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.
 7. **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.
 6. **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.
 5. Tang, J., **Xiao, R.**, Hoff, A., Venolia, G., Therien, P., Roseway, A. 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.
 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. (USRA 2010 work, Bachelor's).

Patents

7. Harrison, C., Schwarz, J., **Xiao, R.B.** (2015). Determining pitch and yaw for touchscreen interactions. WIPO Patent Application 2015123081 A1, filed February 5, 2015. Patent pending.
6. Harrison, C., Schwarz, J., **Xiao, R.** (2015). Method and apparatus for classifying finger touch events on a touchscreen. US Patent Application 20160026320, filed February 2, 2015. Patent pending.
5. **Xiao, R.B.**, Lew, G., Schwarz, J., Harrison, C. (2014). Using Capacitive Images for Touch Type Classification. US Patent Application 20150242009, filed February 26, 2014. Patent pending.
4. Harrison, C., Schwarz, J., **Xiao, R.B.** (2013). Capture of Vibro-Acoustic Data Used to Determine Touch Types. US Patent Application 20150035759, filed August 2, 2013. Patent pending.
3. Harrison, C., Schwarz, J., **Xiao, R.B.** (2013). Using Finger Touch Types to Interact with Electronic Devices. US Patent Application 20140327626, filed May 6, 2013. Patent pending.
2. Harrison, C., Schwarz, J., **Xiao, R.B.**, Hudson, S.E. (2013). Virtual Tools for Use with Touch-Sensitive Surfaces. US Patent Application 20140310631, filed April 15, 2013. Patent pending.
1. Harrison, C., Schwarz, J., **Xiao, R.B.** (2013). Method and system for activating different interactive functions using different types of finger contacts. US Patent 9013452, filed March 25, 2013 and granted April 21, 2015.

Journal Articles

1. 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, doi:10.1016/j.ijhcs.2012.12.006.

Technical Reports

1. Bateman, S., Mandryk, R.L., Gutwin, C., **Xiao, R.** (2009). Investigation of Targeting-Assistance Techniques for Distant Pointing with Relative Ray Casting. In *Technical Report 2-2009, University of Saskatchewan*. 8 pages. Published December 14, 2009.

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.

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

Community Service

1. Session Chair for the "Hands and Fingers" papers session at the ACM Symposium on User Interface Software and Technology, 2015 (UIST 2015).

SELECTED PRESS COVERAGE

General Coverage

Work featured as a significant segment on the documentary “Stephen Hawking’s Science of the Future”, part 4 of 6 – Perfect City

WorldKit, 2013

<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/>

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/>

Mechanical Smartwatch, 2014

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

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>

Zensors, 2015

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

EM-Sense, 2015

[http://www.wired.com/2015/11/em-sense-enabled-smartwatch-can-detect-when-you-touch-a-door knob/](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> (Fast Company Innovation By Design Student Award, 2016)

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/>

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/>

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>

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/>

TEACHING EXPERIENCE

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 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 TA Positions, Faculty of Mathematics, University of Waterloo, Waterloo, ON, Canada.

Tutoring in Residence, Sept 2008 – Dec 2008

MATH 146 Marking (Advanced Linear Algebra), Jan 2009 – Apr 2009

Received outstanding evaluation from MATH 146 professor for TA work

Tutorial Centre Tutoring and MATH 227 Marking (Calculus 3 for Honours Physics), Sept 2009 – Dec 2009

Received outstanding evaluation from MATH 227 professor for TA work

Tutorial Centre Tutoring, Jan 2010 – Apr 2010

Tutoring in Residence, Sept 2010 – Dec 2010

Computer Science Tutoring (CS 116 – Introduction to Computer Science 2), Department of Computer Science, University of Waterloo, Waterloo, ON, Canada, Jan 2009 – Apr 2009.

POSITIONS AND APPOINTMENTS HELD

Research Consultant, Microsoft Research, Redmond, WA, USA. Jan-Feb 2017, mentored by Julia Schwarz and Hrvoje Benko. Work focused on advancing interactions in augmented reality.

Research Intern, Microsoft Research, Redmond, WA, USA. May-Aug 2016, mentored by Andy Wilson and Hrvoje Benko. Work focused on advancing interactions in augmented reality.

Research Intern, Microsoft Research, Redmond, WA, USA. May-Aug 2015, 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.

Software Architect, Qeexo, Co. Pittsburgh, PA, USA. May-Aug 2013, summer internship with CMU spinoff. Work focused on engineering rich multitouch solutions for mobile devices.

Research Intern, Microsoft Research, Redmond, WA, USA. May-Aug 2012, mentored by John Tang. Work focused on in-home physical proxies for video communication. HomeProxy publication resulted from this internship.

Embedded Software Developer, Research in Motion, Waterloo, ON, Canada. Feb-Aug 2011.

Summer Research Student, Interaction Lab, Department of Computer Science, University of Saskatchewan, Saskatoon, SK, Canada. May-Dec 2010.

Research funded by NSERC under the Undergraduate Student Research Award program.

Summer Research Student, Interaction Lab, Department of Computer Science, University of Saskatchewan, Saskatoon, SK, Canada. May-Sept 2009.

Research funded by NSERC under the Undergraduate Student Research Award program.

Summer Research Student, Imaging, Multimedia and Graphics Lab, Department of Computer Science, University of Saskatchewan, Saskatoon, SK, Canada. May-Aug 2008.

Research funded by NSERC under the Undergraduate Student Research Award program.
 Database Report Writer, Centre for Continuing and Distance Education, University of
 Saskatchewan, Saskatoon, Canada. May-Aug 2007. Minimum qualifications required 3rd year
 Computer Science undergraduates; I took the job while in high school.

Additional Honors and Awards

First place, DEFCON CTF	August 2016
Competed with the CMU PPP team at the 21 st 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 Carnegie Mellon University	
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	December 2015
Four-person team computer security competition held in Taipei, Taiwan	
First place, HITCON 2015 Quals CTF	October 2015
Online team computer security competition, qualification for final round	
Second place, DEFCON 2015 CTF	August 2015
Participated in this team computer security competition in Las Vegas	
First place, Microsoft Code Hunt programming contest	August 2015
Third place, SECCON 2014 Final CTF	February 2015
Four-person team computer security competition held in Tokyo, Japan	
First place, CMU-Citadel Programming Challenge	January 2015
Third place, Microsoft College Puzzle Challenge	April 2014
Four-person team, ranked third in national standings	
First place, U of Saskatchewan Programming Contest	2007
Invited participant of the USA Mathematics Olympiad	2007
Pythagoras Contest Canadian Champion	2001
Canadian National Mathematics League Championship Competitions	
Second Place National in Grade Six	2001
First Place National in Grades Seven and Eight	2002, 2003
Canadian Mathematics Competition Pascal Contest	

National Champion (Grade Nine)	2004
Saskatchewan Math Counts Provincial Competition	
First Place Individual for Grade Nine and Overall	2004
Canadian Open Mathematics Challenge	
Two-time Saskatchewan Champion	2005, 2006
Canadian National Euclid Mathematics Contests	
Three-time Saskatchewan Champion	2005, 2006, 2007
E.C. Leslie Saskatchewan Debate Tournament	
Provincial Champion, Division IV Novice	2005
Provincial Champion, Division IV Open	2006
ISM Canada Award, Magna Cum Laude, Canada Wide Virtual Science Fair	2002, 2003, 2004
American Mathematics Competitions	
Fifty-Seventh Overall and Provincial Champion	2006

REFERENCES

Dr. Chris Harrison

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School of Computer Science
Carnegie Mellon University
5000 Forbes Ave
Pittsburgh, PA 15213-3891
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Dr. Hrvoje Benko

Microsoft Research
Bldg. 99
One Microsoft Way
Redmond, WA 98052-6399
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Dr. Scott Hudson

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School of Computer Science
Carnegie Mellon University
5000 Forbes Ave
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Email: scott.hudson@cs.cmu.edu

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110 Science Place Drive
The University of Saskatchewan
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Tel: 306-966-8646
Fax: 306-966-4884
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