

Seongkook Heo

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I am interested in the design and development of interactive technologies and systems that enrich the human-computer and human-computer-human interactions.

Keywords: interaction techniques, sensing techniques, haptics, computer-mediated communication.

Appointments

- 2019 – **University of Virginia**, Virginia, USA
Alfred Weaver Assistant Professor, Department of Computer Science
- 2017 – 2019 **University of Toronto**, Ontario, Canada
Postdoctoral Researcher, Department of Computer Science

Education

- Feb 2017 **Korea Advanced Institute of Science and Technology**, Daejeon, South Korea
Ph.D. Computer Science
Advisor: Dr. Geehyuk Lee
- Aug 2009 **Korea Advanced Institute of Science and Technology**, Daejeon, South Korea
M.S. Digital Media
Advisor: Dr. Minsoo Hahn
- Feb 2007 **Sungkyunkwan University**, Suwon, South Korea
B. S. Electric and Electronic Engineering
B. S. Computer Engineering (Double Major)

Professional Experience

- Jan – Apr 2016 **Autodesk Research**, Toronto, Canada
Research Intern supervised by Dr. Tovi Grossman
Developing interaction techniques for wearable devices
- May – Aug 2015 **Microsoft Research**, Redmond, USA
Research Intern supervised by Dr. Ken Hinckley
Developing interaction techniques for mobile devices
- Jun – Aug 2008 **Samsung Advanced Institution of Technology (SAIT)**, Suwon, South Korea
Research Intern at Multi-modal Interaction Lab
- 2005-2006 **AhnLab**, Seoul, South Korea
Software Engineering Intern

Selected Honors and Awards

- 2021 **Facebook Research Award**
- 2021 **University of Virginia Engineering Research Innovation Award**
- 2016 **Naver Ph.D. Fellowship**

Peer-Reviewed Publications

- 2022 E. Hu, M. A. R. Azim, and S. Heo, “Fluidmeet: Enabling frictionless transitions between in-group, between-group, and private conversations during virtual breakout meetings,” in *Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems*, 2022 (**Cond. Accepted**)
- 2021 E. Pakdamanian, S. Sheng, S. Bae, S. Heo, S. Kraus, and L. Feng, “Deeptake: Prediction of driver takeover behavior using multimodal data,” in *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*, 2021, pp. 1–14
- 2021 H. Kim, S. Hong, J. Kim, T. Jang, W. Woo, S. Heo, and B. Lee, “Realitybrush: An ar authoring system that captures and utilizes kinetic properties of everyday objects,” *Multimedia Tools and Applications*, vol. 80, no. 20, pp. 31 135–31 158, 2021
- 2020 K. Park, D. Kim, S. Heo, and G. Lee, “Magtouch: Robust finger identification for a smartwatch using a magnet ring and a built-in magnetometer,” in *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*, 2020, pp. 1–13
- 2019 S. Heo, J. Lee, and D. Wigdor, “Pseudobend: Producing haptic illusions of stretching, bending, and twisting using grain vibrations,” in *Proceedings of the 32nd Annual ACM Symposium on User Interface Software and Technology*, 2019, pp. 803–813
- 2019 D. Hayatpur, S. Heo, H. Xia, W. Stuerzlinger, and D. Wigdor, “Plane, ray, and point: Enabling precise spatial manipulations with shape constraints,” in *Proceedings of the 32nd annual ACM symposium on user interface software and technology*, 2019, pp. 1185–1195
- 2018 S. Hong, E. Jeong, S. Heo, and B. Lee, “Fdsense: Estimating young’s modulus and stiffness of end effectors to facilitate kinetic interaction on touch surfaces,” in *Proceedings of the 31st Annual ACM Symposium on User Interface Software and Technology*, 2018, pp. 809–823
- 2018 Z. Lu, S. Heo, and D. J. Wigdor, “Streamwiki: Enabling viewers of knowledge sharing live streams to collaboratively generate archival documentation for effective in-stream and post hoc learning,” *Proceedings of the ACM on Human-Computer Interaction*, vol. 2, no. CSCW, pp. 1–26, 2018
- 2018 S. Heo, C. Chung, G. Lee, and D. Wigdor, “Thor’s hammer: An ungrounded force feedback device utilizing propeller-induced propulsive force,” in *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*, 2018, pp. 1–11
- 2018 Z. Lu, H. Xia, S. Heo, and D. Wigdor, “You watch, you give, and you engage: A study of live streaming practices in china,” in *Proceedings of the 2018 CHI conference on human factors in computing systems*, 2018, pp. 1–13
- 2017 S. Ahn, S. Heo, and G. Lee, “Typing on a smartwatch for smart glasses,” in *Proceedings of the 2017 ACM International Conference on Interactive Surfaces and Spaces*, 2017, pp. 201–209
- 2017 S. Heo, M. Annett, B. Lafreniere, T. Grossman, and G. Fitzmaurice, “No need to stop what you’re doing: Exploring no-handed smartwatch interaction,” in *Graphics Interface*, 2017
- 2016 S. Heo and G. Lee, “Vibrotactile compliance feedback for tangential force interaction,” *IEEE transactions on haptics*, vol. 10, no. 3, pp. 444–455, 2016
- 2016 S. Heo, J. Jung, and G. Lee, “Melodictap: Fingering hotkey for touch tablets,” in *Proceedings of the 28th Australian Conference on Computer-Human Interaction*, 2016, pp. 396–400
- 2016 K. Hinckley, S. Heo, M. Pahud, C. Holz, H. Benko, A. Sellen, R. Banks, K. O’Hara, G. Smyth, and B. Buxton, “Pre-touch sensing for mobile interaction,” in *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems*, 2016, pp. 69–2881
- 2016 J. Hong, S. Heo, P. Isokoski, and G. Lee, “Comparison of three qwerty keyboards for a smart-watch,” *Interacting with Computers*, vol. 28, no. 6, pp. 811–825, 2016
- 2016 C.-M. Kim, S. Heo, K. A. Jeong, and Y.-K. Lim, “Formula one: Mobile device supported rapid in-the-wild design and evaluation of interactive prototypes,” in *Proceedings of HCI Korea*, 2016,

- pp. 333–338 (**Best paper award**)
- 2015 J. Hong, S. Heo, P. Isokoski, and G. Lee, “Splitboard: A simple split soft keyboard for wristwatch-sized touch screens,” in *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*, 2015, pp. 1233–1236
 - 2014 S. Heo, J. Gu, and G. Lee, “Expanding touch input vocabulary by using consecutive distant taps,” in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 2014, pp. 2597–2606
 - 2014 J. Han, S. Heo, H.-E. Lee, and G. Lee, “The irpen: A 6-dof pen for interaction with tablet computers,” *IEEE Computer Graphics and Applications*, vol. 34, no. 3, pp. 22–29, 2014
 - 2013 S. Heo, J. Han, and G. Lee, “Designing rich touch interaction through proximity and 2.5 d force sensing touchpad,” in *Proceedings of the 25th Australian Computer-Human Interaction Conference: Augmentation, Application, Innovation, Collaboration*, 2013, pp. 401–404
 - 2013 S. Heo and G. Lee, “Indirect shear force estimation for multi-point shear force operations,” in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 2013, pp. 281–284
 - 2013 J. Gu, S. Heo, J. Han, S. Kim, and G. Lee, “Longpad: A touchpad using the entire area below the keyboard of a laptop computer,” in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 2013, pp. 1421–1430
 - 2013 J. Choi, S. Heo, J. Han, G. Lee, and J. Song, “Mining social relationship types in an organization using communication patterns,” in *Proceedings of the 2013 conference on Computer supported cooperative work*, 2013, pp. 295–302
 - 2012 J. Han, S. Choi, S. Heo, and G. Lee, “Optical touch sensing based on internal scattering in touch surface,” *Electronics letters*, vol. 48, no. 22, pp. 1420–1422, 2012
 - 2012 S. Heo and G. Lee, “Forcedrag: Using pressure as a touch input modifier,” in *OzCHI '12 Proceedings of the 24th Australian Computer-Human Interaction Conference*, ACM, 2012, pp. 204–207
 - 2011 S. Heo, J. Han, S. Choi, S. Lee, G. Lee, H.-E. Lee, S. Kim, W.-C. Bang, D. Kim, and C. Kim, “Ircube tracker: An optical 6-dof tracker based on led directivity,” in *Proceedings of the 24th annual ACM symposium on User interface software and technology*, 2011, pp. 577–586
 - 2011 S. Heo and G. Lee, “Force gestures: Augmenting touch screen gestures with normal and tangential forces,” in *Proceedings of the 24th annual ACM symposium on User interface software and technology*, 2011, pp. 621–626
 - 2011 S. Heo and G. Lee, “Forcetap: Extending the input vocabulary of mobile touch screens by adding tap gestures,” in *Proceedings of the 13th International Conference on Human Computer Interaction with Mobile Devices and Services*, ACM, 2011, pp. 113–122
 - 2011 J. Han, S. Heo, G. Lee, W.-C. Bang, D. Kim, and C. Kim, “6-dof tracker using led directivity,” *Electronics letters*, vol. 47, no. 3, pp. 177–178, 2011

Book Chapters

- 2013 S. Heo, J. Han, and G. Lee, “Designing for hover-and force-enriched touch interaction,” in *Australian Computer-Human Interaction Conference*, Springer, Cham, 2013, pp. 68–87

Posters and Demonstrations

- 2020 A. Lalamentik and S. Heo, “Tactile glance: Encoding notifications using illusive movement constraints for eyes- and ears-free interaction,” in *IEEE Haptics Symposium 2020 Works-in-progress*, 2020

- 2018 S. Heo, C. Chung, G. Lee, and D. Wigdor, “Thor’s hammer: An ungrounded force feedback device utilizing propeller-induced propulsive force,” in *ACM CHI 2018 Demo*, 2018
- 2017 S. Heo and G. Lee, “Creating haptic illusion of compliance for tangential force input using vibrotactile actuator,” in *ACM UIST ’17 Demo*, 2017
- 2014 J. Han, S. Heo, J. Gu, and G. Lee, “Trampoline: A double-sided elastic touch device for repoussé and chasing techniques,” in *ACM CHI’14 Works-in-progress*, 2014
- 2013 S. Heo and G. Lee, “Ta-tap: Consecutive distant tap operations for one-handed touch screen use,” in *ACM UIST ’13 Poster*, 2013
- 2012 S. Heo, Y.-K. Lee, J. Yeom, and G. Lee, “Design of a shape dependent snapping algorithm,” in *ACM CHI’12 Works-in-progress*, 2012
- 2011 S. Choi, J. Han, S. Kim, S. Heo, and G. Lee, “Thickpad: A hover-tracking touchpad for a laptop,” in *UIST ’11 Demo*, 2011
- 2011 S. Heo and G. Lee, “Force gestures: Augmented touch screen gestures using normal and tangential force,” in *CHI’11 Works-in-progress*, 2011, pp. 1909–1914
- 2008 S. Heo, D. Lee, and M. Hahn, “Floatingpad: A touchpad based 3d input device,” in *ICAT ’08 Poster*, 2008
- 2008 S. Lee, S. Heo, Y. Kim, Y. Kim, S. Lee, and M. Hahn, “An interactive knocking floor,” *on ubiquitous Computing*, p. 20, 2008
- 2007 S. Park, S. Lee, S. Heo, K. S. Park, and M. Hahn, “Escape!: An indoor location-based horror game using indirect ambient cues,” 2007

Patents

- 2017 No-handed smartwatch interaction techniques, US Patent Pending, Application #US20180024642A1, 7/14/2017
- 2017 Pre-interaction context associated with gestures and touch interactions, US Patent Pending, Application #US20180239509A1, 2/20/2017
- 2016 Pre-touch sensing for mobile interaction, US Patent Pending, Application #US20180004386A1, 6/30/2016
- 2015 Touch screen controlling method in mobile device, and mobile device thereof, KR Patent #1496017, 2/16/2015
- 2015 User interface method and apparatus using successive touches, US Patent Pending, Application #US20150026619, 1/22/2015
- 2014 Optical touchpad apparatus with proximity and force sensing capabilities and method of sensing touch in apparatus, KR Patent #1449833, 10/2/2014
- 2014 Method and apparatus of playing haptic feedback for shear movement, KR Patent Pending, Application #2014-0026719, 3/6/2014
- 2014 Device and method of video playback control using force and contact position information, KR Patent #1393261, 4/30/2014
- 2014 Apparatus and method for multi-touch sensing using total internal reflection, KR Patent #1356835, 1/22/2014
- 2013 Method and apparatus for one-handed application of multi-touch gesture using continuous touch, KR Patent Pending, Application #2013-0083986, 7/17/2013
- 2013 Method and system for body tracking for spatial gesture recognition, KR Patent #1256046, 4/12/2013
- 2012 Device and method for identifying multi-touch points using internal scattering, PCT/KR2012/006624, 8/21/2012

- 2012 Method and system for body tracking for spatial gesture recognition, PCT/KR2012/006372, 8/10/2012
- 2012 Method for controlling touch screen in portable device, and portable device of the same, KR Patent #1177650, 8/21/2012
- 2011 System and method for estimating position and direction, EU Patent #EP2385390, 21/8/2013, China Patent #CN102279380, 21/10/2015 US Patent Pending, Application #US20110261270, 4/18/2011
- 2011 Apparatus and method for sensing a moving object and a virtual golf simulation device using the same capable of accurately implementing the center point coordinate about an extracted object, KR Patent #1019801, 2/25/2011
- 2011 Apparatus and method for sensing a moving object and a virtual golf simulation device using the same capable of obtaining a multiple exposure image about a moving object, KR Patent #1019823, 2/25/2011
- 2011 Apparatus and method for sensing a moving object and a virtual golf simulation device using the same capable of accurately extracting an image of an object, KR Patent #1019798, 2/25/2011
- 2011 Apparatus and method for sensing a moving object and a virtual golf simulation device using the same capable of exactly extracting the center point coordinate of a moving object using a low speed camera, KR Patent #1019824, 2/25/2011
- 2011 Apparatus and method for sensing a moving ball and a virtual golf simulation device using the same capable of obtaining the center point coordinate about an image of a ball, KR Patent #1019829, 2/25/2011
- 2011 Sensing processing device for a moving object and a method thereof, and a virtual golf simulation device using the same capable of accurately extracting center point coordinate of an overlapped object, KR Patent #1019782, 2/25/2011
- 2011 Apparatus and method for sensing a moving ball and a virtual golf simulation device using the same capable of obtaining an image of a moving ball, KR Patent #1019847, 2/25/2011
- 2011 Device and method for sensing processing of a moving object, and a virtual golf simulation device using the same capable of achieving accuracy of sensing, KR Patent #1019902, 2/25/2011
- 2011 Method for controlling touch screen on portable device using built-in accelerometer, and portable device of the same, KR Patent #1173400, 8/6/2011
- 2011 Apparatus for sensing if a driver drives a car safely, KR Patent #1054062, 7/28/2011

Teaching

- Spring 2020 - 22 **CS4501/6501: Engineering Interactive Technologies**, *University of Virginia*
Instructor
- Fall 2019 - 21 **CS6501: Human-Computer Interaction**, *University of Virginia*
Instructor
- Fall 2018 **CSC318: Design of Interactive Computational Media**, *University of Toronto*
Guest Lecturer
- Winter 2018 **CSC2514: Human-Computer Interaction**, *University of Toronto*
Guest Lecturer
- Spring 2012 **CS420: Compiler Design**, *KAIST*
Teaching Assistant
- Spring 2011 **CS684: Human-Computer Interaction**, *KAIST*
Teaching Assistant
- Spring 2010, 11 **CS472: Human-Computer Interaction**, *KAIST*
Teaching Assistant

Invited Talks

- Nov 2021 Physicalizing Virtual and Augmented Reality
Virginia Tech
- Nov 2021 Physicalizing Virtual and Augmented Reality
George Mason University
- Sep 2021 Physicalizing Virtual and Augmented Reality
Yonsei University
- May 2020 High-bandwidth Human-Computer Interaction: Possibilities and Challenges
Korean-American Scientists and Engineers Association (KSEA) Central VA Chapter
- Apr 2019 Towards Man-Computer Symbiosis
Pohang University of Science and Technology (POSTECH)
- Apr 2019 Towards Man-Computer Symbiosis
University of Virginia
- Nov 2018 Expanding Touch Interaction Bandwidth by Making Computers to Feel Our Touch and to be Felt
TUX: Toronto User Experience Speaker Series
- Aug 2018 As We May Touch—toward richer and more natural touch interaction
Oculus Research
- Jul 2018 As We May Touch—toward richer and more natural touch interaction
EPIC Group, Microsoft Research
- Feb 2018 Let it move—Creating force and movement feedback on the surface and in the air
Future Reality Lab, New York University
- Feb 2018 Let it move—Creating force and movement feedback on the surface and in the air
HCI Group, Saarland University
- Dec 2017 As We May Touch—toward richer and more natural touch interaction
HCI Group, KAIST
- Jan 2016 Enriching Touch – with force, hover, and manual dexterity
DGP Lab, University of Toronto
- Jan 2016 Enriching Touch – with force, hover, and manual dexterity
Autodesk Research
- Oct 2014 Enriching Touch
Hideep Co.
- Mar 2014 Enriching interaction on and over the surface
Korea Electronics Technology Institute
- Feb 2014 Completing Touch
TEDxKAIST Salon: Beyond Now

Academic Service

Organizing Committee, ACM ISS 2019 Demos Co-Chair

Program Committee, CHI 2019, 2020, 2022, UIST 2020, MobileHCI 2015, VRST 2021, TEI 2022

Reviewer, CHI, UIST, DIS, TEI, MobileHCI, SIGGRAPH ASIA, ICMI, IEEE VR, IMWUT,
IEEE Trans. Haptics, ACM TOCHI, IJHCS

Student Volunteer, World Haptics Conference 2015, UIST 2016