Seongkook Heo

Assistant Professor, University of Virginia

85 Engineer's Way
Charlottesville, VA
USA, 22903

seongkook@virginia.edu
https://seongkookheo.com

I am interested in the design and development of interactive technologies and systems that enrich the human-computer and human-computer-human interactions.
Keywords: VR/AR, immersive computing, interaction techniques, sensing techniques, haptics, computer-supported communication.

Appointments

Aug 2019 –   **University of Virginia**, Virginia, USA
Alfred Weaver Assistant Professor, Department of Computer Science

May 2017 –   **University of Toronto**, Ontario, Canada
Aug 2019   Postdoctoral Researcher, Department of Computer Science
Advisor: Dr. Daniel Wigdor

Education

Feb 2017   **Korea Advanced Institute of Science and Technology**, Daejeon, South Korea
Ph.D. Computer Science
Advisor: Dr. Geehyuk Lee

Jun 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 2016 –   **Autodesk Research**, Toronto, Canada
Apr 2016   Research Intern supervised by Dr. Tovi Grossman
Developing interaction techniques for wearable devices

May 2015 –   **Microsoft Research**, Redmond, USA
Aug 2015   Research Intern supervised by Dr. Ken Hinckley
Developing interaction techniques for mobile devices

Selected Honors and Awards

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

Peer-Reviewed Publications

2023   C. Hildebrandt, W. Ying, S. Heo, and S. Elbaum, "Mimicking real forces on a drone through a haptic suit to enable cost-effective validation," in *Proceedings of the 2023 IEEE International Conference on Robotics and Automation (ICRA)*, 2023 (Accepted)

2023   A. Rahman, M. A. R. Azim, and S. Heo, "Take my hand: Automated hand-based spatial guidance for the visually impaired," in *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems*, 2023 (Cond. Accepted)

2023   E. Hu, J. E. S. Grønbæk, W. Ying, R. Du, and S. Heo, "Thingshare: Ad-hoc digital copies of physical objects for sharing things in video meetings," in *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems*, 2023 (Cond. Accepted)

2023   E. Hu, J. E. S. Grønbæk, A. K. Houck, and S. Heo, "Openmic: Utilizing proxemic metaphors for conversational floor transitions in multiparty video meetings," in *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems*, 2023 (Cond. Accepted)

2023   S. Hong, S. Heo, and B. Lee, "Materialsense: Estimating and utilizing material properties of contact objects in multi-touch interaction," *International Journal of Human-Computer Studies*, 2023 (To appear)

2022   E. Pakdamanian, E. Hu, S. Sheng, S. Kraus, S. Heo, and L. Feng, "Enjoy the ride consciously with cawa: Context-aware advisory warnings for automated driving," in *Proceedings of the ACM AutomotiveUI '22*, 2022

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

2021   E. Pakdamanian, S. Sheng, S. Baee, 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 (UIST)*, 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 (UIST)*, 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 (UIST)*, 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

2017   S. Heo and G. Lee, "Vibrotactile compliance feedback for tangential force interaction," *IEEE Transactions on Haptics*, vol. 10, no. 3, pp. 444–455, 2017

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 smartwatch," *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 (UIST)*, 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 Tech-

nology (UIST), 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

Workshop papers, Posters, Demonstrations

2023   W. Ying and S. Heo, "VRScroll: A Shape-Changing Device for Precise Sketching in Virtual Reality," in *IEEE VR '23 Poster*, 2023 (Accepted)

2022   P. Zhang, W. Ying, and S. Heo, "Fringer: A Finger-Worn Passive Device Enabling Computer Vision Based Force Sensing Using Moiré Fringes," in *UIST '22 Poster*, 2022

2022   M. A. R. Azim, A. Rahman, and S. Heo, "Over-The-Shoulder Training Between Redundant Wearable Sensors for Unified Gesture Interactions," in *UIST '22 Poster*, 2022

2022   A. Narayanan, E. Hu, and S. Heo, "Enabling remote hand guidance in video calls using directional force illusion," in *CSCW '22 Poster*, 2022

2022   Z. Su, F. H. Shezan, Y. Tian, D. Evans, and S. Heo, "Perception Hacking for 2D Cursorjacking in Virtual Reality," in *ACM CHI'22*, *Workshop on Novel Challenges of Safety, Security and Privacy in Extended Reality*, 2022

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," in *UbiComp '08 Poster*, 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 - 22 **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

May 2022 As we may chat: virtualizing proxemic cues for fluid transitions in virtual meetings
UNIST

Dec 2021 Why I Chose Academia
KAIST

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
University of Copenhagen

Oct 2019 User Interface for Future Computers
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: Beyong Now

Academic Service

Organizing Committee, ACM ISS 2019 Demos Co-Chair, IEEE SIEDS 2021 Workshop Organizer
Program Committee, CHI 2019, 2020, 2022, UIST 2020, MobileHCI 2015, VRST 2021, 2022, TEI 2022
Reviewer, CHI, UIST, DIS, TEI, MobileHCI, SIGGRAPH ASIA, ICMI, IEEE VR, IMWUT,
        IEEE Trans. Haptics, ACM TOCHI, IJHCS, Frontiers in Virtual Reality
Volunteering, Workshop Instructor for Girls Who Code@UVA,
        Student Volunteer at World Haptics Conference 2015 and UIST 2016