Seongkook Heo

Postdoctoral Research Fellow
University of Toronto

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My vision is to expand the interaction bandwidth between humans and computers by enabling users to manipulate virtual objects in a rich, nuanced, and bi-directional way like they do in the real world. As an HCI researcher with a background in computer science and electrical engineering, I design and build new sensing techniques and haptic feedback technologies and interaction techniques that carefully matched to human sensing capabilities and motor skills.

Education

Feb 2017 **Ph.D. in Computer Science**
KAIST, Daejeon, South Korea.
Advisor: Prof. Geehyuk Lee

Aug 2009 **M. S. in Digital Media**
KAIST, Daejeon, South Korea.
Advisor: Prof. Minsoo Hahn

Feb 2007 **B. S. in Electric and Electronic Engineering**
Sungkyunkwan University, Suwon, South Korea.

Feb 2007 **B. S. in Computer Engineering (Double major)**
Sungkyunkwan University, Suwon, South Korea.

Professional Experience

May – 2017 **University of Toronto, Toronto, Canada**
Postdoctoral Research Fellow working with Prof. Daniel Wigdor

Jan – Apr 2016 **Autodesk Research, Toronto, Canada**
Research Intern supervised by Dr. Tovi Grossman
Developing interaction techniques for wearable devices **[C.14]**

May – Aug 2015 **Microsoft Research, Redmond, USA**
Research Intern supervised by Dr. Ken Hinckley
Developing interaction techniques for mobile devices **[C.12]**

Jun – Aug 2008 **Samsung Advanced Institution of Technology (SAIT), Suwon, South Korea**
Research Intern at Multi-modal Interaction Lab
Designing multi-modal interaction techniques for consumer electronics

Aug 2005– Feb 2006 **AhnLab, Seoul, South Korea**
Software Engineering Intern

Peer-reviewed Conference and Journal Publications (index starting with C: conference paper, J: Journal paper)

C.21 **Seongkook Heo**, Jaeyeon Lee, Daniel Wigdor. (2019) PseudoBend: Producing Haptic Illusions of Stretching, Bending, and Twisting Using Grain Vibrations. ***UIST '19.*** (Accepted)

C.20 Devamardeep Hayatpur, **Seongkook Heo**, Haijun Xia, Wolfgang Stuerzlinger, Daniel Wigdor. (2019) Plane, Ray, and Point: Enabling Precise Spatial Manipulations with Shape Constraints. ***UIST '19.*** (Accepted)

C.19 Sanghwa Hong, Eunseok Jeong, **Seongkook Heo**, Byungjoo Lee. (2018) FDSense: Estimating Young's Modulus and Stiffness of End Effectors to Facilitate Kinetic Interaction on Touch Surfaces. ***UIST '18.*** (Acceptance rate: 20.6%)

C.18 Zhicong Lu, **Seongkook Heo**, Daniel Wigdor. (2018) StreamWiki: Enabling Viewers of Knowledge Sharing Live Streams to Collaboratively Generate Archival Documentation for Effective In-Stream and Post-Hoc Learning. ***CSCW'18***. (Acceptance rate: 25.6%)

C.17 **Seongkook Heo**, Christina Chung, Geehyuk Lee, Daniel Wigdor. (2018) Thor's Hammer: An Ungrounded Force Feedback Device Utilizing Propeller-Induced Propulsive Force. ***CHI '18***. (Acceptance rate: 25.7%)

C.16 Zhicong Lu, Haijun Xia, **Seongkook Heo**, Daniel Wigdor. (2018) You Watch, You Give, and You Engage: A Study of Live Streaming Practices in China. ***CHI '18***. (Acceptance rate: 25.7%)

C.15 Sunggeun Ahn, **Seongkook Heo**, Geehyuk Lee. (2017) Typing on a Smartwatch for Smart Glasses. ***ISS '17***.(Acceptance rate: 26.9%)

C.14 **Seongkook Heo**, Michelle Annett, Ben Lafreniere, Tovi Grossman, George Fitzmaurice. (2017) No Need to Stop What You're Doing: Exploring No-Handed Smartwatch Interaction. ***GI '17.***

J.5 **Seongkook Heo** and Geehyuk Lee. (2017) Vibrotactile Compliance Feedback for Tangential Force Interaction. ***IEEE Transactions on Haptics***, Vol. 10, Issue 3.

C.13 **Seongkook Heo**, Jingun Jung, and Geehyuk Lee. (2016) MelodicTap: Fingering Hotkey for Touch Tablets. ***OZCHI '16.***

C.12 Ken Hinckley, **Seongkook Heo**, Christian Holz, Hrvoje Benko, Abigail Sellen, Richard Banks, Kenton O'Hara, Gavin Smyth, and William Buxton. (2016) Pre-Touch Sensing for Mobile Interaction. ***CHI '16.*** (Acceptance Rate: 23%)

J.4 Jonggi Hong, **Seongkook Heo**, Poika Isokoski, and Geehyuk Lee. (2016) Comparison of Three QWERTY Keyboards for a Smartwatch. ***Interacting with Computers***, Vol. 28, Issue 6.

C.11 Chang-Min Kim, **Seongkook Heo**, Kyeong Ah Jeong, and Youn-Kyung Lim. (2016) Formula One: Mobile Device Supported Rapid In-the-Wild Design and Evaluation of Interactive Prototypes. ***HCI Korea '16*** *(Best paper award).*

C.10 Jonggi Hong, **Seongkook Heo**, Poika Isokoski, and Geehyuk Lee. (2015) SplitBoard: A Simple Split Soft Keyboard for Wristwatch-sized Touch Screens. ***CHI '15.*** (Acceptance Rate: 23%)

C.9 **Seongkook Heo**, Jiseong Gu, and Geehyuk Lee. (2014) Expanding Touch Input Vocabulary by Using Consecutive Distant Taps. ***CHI '14*** (Acceptance Rate: 23%)***.***

J.3 Jaehyun Han, **Seongkook Heo**, Hyong-Euk Lee, and Geehyuk Lee. (2014) IrPen: A 6-DOF Pen System to Support Over-the-surface Interactions with Tablet Computers. ***IEEE Computer Graphics and Applications***, Vol. 34, Issue 3.

C.8 **Seongkook Heo**, Jaehyun Han, and Geehyuk Lee. (2013) Designing Rich Touch Interaction through Proximity and 2.5D Force Sensing Touchpad, ***OZCHI '13.***

C.7 **Seongkook Heo** and Geehyuk Lee. (2013) Indirect Shear Force Estimation for Multi-Point Shear Force Operations. ***CHI '13.*** (Acceptance Rate: 20%)

C.6 Jiseong Gu, **Seongkook Heo**, Jaehyun Han, Sunjun Kim, and Geehyuk Lee. (2013) LongPad: A TouchPad Using the Whole Area below the Keyboard on a Laptop. ***CHI '13.*** (Acceptance Rate: 20%)

C.5 Jinhyuk Choi, **Seongkook Heo**, Jaehyun Han, Geehyuk Lee, and Junehwa Song. (2013) Mining Social Relationship Types in an Organization by using Communication Patterns, ***CSCW '13.***

J.2 Jaehyun Han, Sangwon Choi, **Seongkook Heo**, and Geehyuk Lee. (2012) Optical touch sensing based on internal scattering in a touch surface. ***Electronics Letters***, Vol. 48, Issue 22.

C.4 **Seongkook Heo** and Geehyuk Lee. (2012) ForceDrag: Using Pressure as a Touch Input Modifier, ***OZCHI '12.***

C.3 **Seongkook Heo**, Jaehyun Han, Sangwon Choi, Seunghwan Lee, Geehyuk Lee, Hyong-Euk Lee, SangHyun Kim, Won-Chul Bang, DoKyoon Kim, and ChangYeong Kim. (2011) IrCube tracker: an optical 6-DOF tracker based on LED directivity. ***UIST '11.*** (Acceptance Rate: 26%)

C.2 **Seongkook Heo** and Geehyuk Lee. (2011) Force gestures: augmenting touch screen gestures with normal and tangential forces. ***UIST '11.*** (Acceptance Rate: 26%)

C.1 **Seongkook Heo** and Geehyuk Lee. (2011) Forcetap: extending the input vocabulary of mobile touch screens by adding tap gestures. ***MobileHCI '11.*** (Acceptance Rate: 23%)

J.1 Jaehyun Han, **Seongkook Heo**, G Lee, Won-Chul Bang, DoKyoon Kim, and ChangYeong Kim. (2011) 6-DOF tracker using LED directivity. ***Electronics Letters***, Vol. 47, Issue 3.

Book Chapters

B.1 **Seongkook Heo**, Jaehyun Han, and Geehyuk Lee.
Designing for Hover-and Force-Enriched Touch Interaction. ***Computer-Human Interaction. Cognitive Effects of Spatial Interaction, Learning, and Ability***, Springer, 2015. 68-87.

Peer-reviewed Posters and Demonstrations (index starting with p: posters, d: demonstrations)

d.3 **Seongkook Heo**, Christina Chung, Geehyuk Lee, Daniel Wigdor. (2018) Thor's Hammer: An Ungrounded Force Feedback Device Utilizing Propeller-Induced Propulsive Force. ***CHI '18 Demo.***

d.2 **Seongkook Heo** and Geehyuk Lee.
Creating Haptic Illusion of Compliance for Tangential Force Input using Vibrotactile Actuator. ***UIST '17 Demo.***

p.7 Jaehyun Han, **Seongkook Heo**, and Geehyuk Lee.
Trampoline: A Double-sided Elastic Touch Device for Repousse and Chasing Techniques. ***CHI '14 Works-in-progress.***

p.6 **Seongkook Heo** and Geehyuk Lee.
Ta-tap: Consecutive Distant Tap Operations for One-handed Touch Screen Use. ***UIST '13 Poster.***

p.5 **Seongkook Heo**, Yongki-Lee, Jiho Yeom, and Geehyuk Lee.
Design of a Shape Dependent Snapping Algorithm. ***CHI '12 Works-in-progress.***

d.1 Sangwon Choi, Jaehyun Han, Sunjun Kim, **Seongkook Heo,** and Geehyuk Lee.
ThickPad: A Hover-tracking Touchpad for a Laptop, ***UIST '11 Demo.***

p.4 **Seongkook Heo** and Geehyuk Lee.
Force gestures: Augmented Touch Screen Gestures using Normal and Tangential Force, ***CHI '11 Works-in-progress.***

p.3 **Seongkook Heo**, Dongwook Lee, and Minsoo Hahn.
FloatingPad: A Touchpad based 3D Input Device, ***ICAT '08 Poster.***

p.2 Seungwoo Lee, **Seongkook Heo**, Youmin Kim, Youngjae Kim, Soojin Lee, and Minsoo Hahn.
An Interactive Knocking Floor, ***UbiComp 2008 Poster.***

p.1 Seungsoon Park, Seungwoo Lee, **Seongkook Heo**, Kyoungsin Park, and Minsoo Hahn.
Escape!: An Indoor Location-based Horror Game using Indirect Ambient Cues,
UCS 2007 Poster.

Patents

P.24 Pre-interaction context associated with gestures and touch interactions, US Patent Pending, Application #US20180239509A1, 2/20/2017

P.23 Pre-touch sensing for mobile interaction, US Patent Pending,
Application #US20180004386A1, 6/30/2016

P.22 Method and apparatus of playing haptic feedback for shear movement, KR Patent Pending, Application #2014-0026719, 3/6/2014

P.21 Touch screen controlling method in mobile device, and mobile device thereof, KR Patent #1496017, 2/16/2015

P.20 Method and apparatus for one-handed application of multi-touch gesture using continuous touch, KR Patent Pending, Application #2013-0083986, 7/17/2013

P.19 Optical touchpad apparatus with proximity and force sensing capabilities and method of sensing touch in apparatus, KR Patent #1449833, 10/2/2014

P.18 User interface method and apparatus using successive touches, US Patent Pending, Application #US20150026619, 1/22/2015

P.17 Device and method of video playback control using force and contact position information, KR Patent #1393261, 4/30/2014

P.16 Device and method for identifying multi-touch points using internal scattering, PCT/KR2012/006624, 8/21/2012

P.15 Method and system for body tracking for spatial gesture recognition, PCT/KR2012/006372, 8/10/2012

P.14 Apparatus and method for multi-touch sensing using total internal reflection, KR Patent #1356835, 1/22/2014

P.13 Method and system for body tracking for spatial gesture recognition, KR Patent #1256046, 4/12/2013

P.12 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

P.11 Method for controlling touch screen in portable device, and portable device of the same, KR Patent #1177650, 8/21/2012

P.10 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

P.9 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

P.8 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

P.7 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

P.6 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

P.5 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

P.4 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

P.3 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

P.2 Method for controlling touch screen on portable device using built-in accelerometer, and portable device of the same, KR Patent #1173400, 8/6/2011

P.1 Apparatus for sensing if a driver drives a car safely, KR Patent #1054062, 7/28/2011

Academic Service

Program Committee MobileHCI 2015, CHI 2019

Reviewer CHI, UIST, DIS, TEI, MobileHCI, SIGGRAPH ASIA, ICMI, TechSym, HCI Korea

Student Volunteer World Haptics Conference ’15, UIST ’16

Awards and Honors

Naver Co. 2016 Naver Ph.D. Fellowship Award

HCI Korea 2016 Best Paper Award

UIST 2013 Student Innovation Contest, 2nd Place in Most Creative

UIST 2012 Student Innovation Contest, 2nd Place in People’s Choice

UIST 2011 Student Innovation Contest, 2nd Place in People’s Choice

Teaching Experience

2018 Fall **The Design of Interactive Computational Media, Guest Lecturer**
Mathematical and Computational Sciences, University of Toronto

2018 Winter **Human-Computer Interaction, Guest Lecturer (1 unit)**
Computer Science, University of Toronto

2010, 2011, 2014 Spring **Human-Computer Interaction, Teaching Assistant**
School of Computing, KAIST

2012 Spring **Compiler Design, Teaching Assistant**
School of Computing, KAIST

2010 Fall **HCI – Physical Computing, Teaching Assistant**
School of Computing, KAIST

Invited Talks

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

Dec 2017 Let it move—Creating force and movement feedback on the surface and in the air
HCI Group, Saarland University

Nov 2016 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

Media and Press Coverage

- Microsoft's hover gestures for Windows phones are magnificent, *The Verge*, May 2016
- Smartphones next big thing: 'Pre-Touch', *SlashGear*, May 2016
- Apple should definitely copy Microsoft's incredible finger-sensing smartphone technology, *Business Insider*, May 2016
- Microsoft Research anticipates the future with pre-sensing touchscreen prototype, *gizmag*, May 2016
- Microsoft Research's New Touchscreen Can (Almost) Read Your Mind, *Co.Design*, May 2016
- Infrared laptop trackpad ignores accidental touches, *New Scientist*, Jan 2013
- Intelligent Keyboard-Wide Touchpad Is Smart Enough to Ignore Your Palms, *Gizmodo*, Feb 2013