

# Heather Jinhee Kim

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## EDUCATION

**Cornell University**, New York, United States

PhD, Human Behavior and Design

September. 2020 – August. 2024 (Expected)

Minor in Electrical & Computer Engineering

Thesis committee: Dr. Cindy Hsin-Liu Kao (chair), Dr. Kirstin Petersen, Dr. Robert Shepherd

**Royal College of Art**, London, United Kingdom

MA, Product Design

Sep. 2016 – Jun. 2018

Thesis advisor: Dr. Robert Phillips

**Ewha Woman's University**, Seoul, South Korea

BA, Industrial Design

Mar. 2012 – Aug. 2016

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## PUBLICATIONS

### Robotic Barrier Construction through Weaved, Inflatable Tubes, IROS '23

J. H. (Heather) Kim\*, H. Abdel-Raziq\*, X. Liu, A. Siskovic, S. Patil, K. Petersen, and C. H.-L. Kao. (\* = equal contribution)

- Developed a novel steering mechanism for a tip-everting vine robot.
- Characterized the load distribution of the robot and its resilience against map errors.
- Demonstrated autonomous construction of a two-layer barrier by steering the robots around three vertical obstacles.

### KnitDema: Robotic Textile as Personalized Edema Mobilization Device, CHI '23

J. H. (Heather) Kim, Stilling, J., O'Dell, M., & Kao, H. C. 2023. KnitDema: Robotic Textile as Personalized Edema Mobilization Device. Conference on Human Factors in Computing Systems.

- Developed portable, customized fabric-based devices for hand edema. Designed PCBs and portable press-fit enclosures.
- Developed a simulated lymphatic system using elastomers to mimic fluid displacement under pressure. Characterized pressure parameters.
- Wrote and conducted IRB-approved studies on edema patients. Utilized mixed methods approach and performed statistical and qualitative analyses.

### KnitSkin: Machine-Knitted Scaled Skin for Locomotion, CHI '22

J. H. (Heather) Kim, S. D. Patil, S. Matson, M. Conroy, and C. H.-L. Kao, "KnitSkin: Machine-Knitted Scaled Skin for Locomotion," in Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems, New York, NY, USA, Apr. 2022, pp. 1–15.

- Developed a soft robot that performs stick-slip locomotion on the body leveraging anisotropic friction.
- Assessed locomotion performance on various terrains. Analyzed the surface topography of the terrains using a laser scanning profilometer.

### KnitDermis: Fabricating Tactile On-Body Interfaces Through Machine Knitting, DIS '21, Best Paper Honorable Mention (Top 5%)

J. H. (Heather) Kim, K. Huang, S. White, M. Conroy, and C. H.-L. Kao, "KnitDermis: Fabricating Tactile On-Body Interfaces Through Machine Knitting," in Designing Interactive Systems Conference 2021, New York, NY, USA, Jun. 2021, pp. 1183–1200.

- Developed compliant textile-based haptic devices using bucking knit structures integrated with nitinol micro springs. Elicited four tactile sensations without a rigid end effector.
- Conducted mixed methods user studies, analyzed tactile perception variability using a linear mixed effects model.

### Intelligent Product Design, HRI '15

H. N. Lee, Y. Namkoug, J. Kim, S. Lee, D. Jeong, H. Seo, S. Park, K. Lee, S. Yang, J. Choi, Y. Kim, J. J. Choi, and S. S. Kwak., "Intelligent Product Design," in Proceedings of the Tenth Annual ACM/IEEE International Conference on Human-Robot Interaction Extended Abstracts, New York, NY, USA, Mar. 2015, p. 301.

- Developed smart home devices based on anthropometric design and evaluated them using Product Ecology theory.

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## MANUSCRIPTS IN PREPARATION

**MediKnit: Soft Medical Making for Personalized and Clinician-Designed Wearable Devices for Hand Edema** (Accepted for revision for IMWUT '24)

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**StiffFiber: Variable Stiffness Fiber Fabricated via Accessible and Modular Extruders** (under review for UIST '24)

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**Controlling Collision-Induced Aggregations with Reactive Morphology** (under review for DARS '24)

Anon. et al.

**Melt-Spun Variable Stiffness Fibers for Impact-Resistant Garments** (in preparation for Advanced Materials Technologies)

Heather Jin Hee Kim et al.

## PATENTS

Title Wearable Device for Fluid Mobilization  
Inventors Hsin-Liu Kao, **Heather Jin Hee Kim**, Joan Stilling, Michael O'Dell  
Status Filed on April 10, 2023  
Application No. (US) 63/495,276

Title Wearable Interface Devices With Tactile Functionality  
Inventors Hsin-Liu Kao, **Heather Kim**, Kungpeng Huang, Ruoja Sun, Jeyeon Jo  
Status Filed on September 5, 2022  
Application No. PCT/US2022/028340

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## RESEARCH PROJECTS

**PiRehab**, advised by Joe Skovira

- A home-based edema management tool for patients and therapists, employing Raspberry Pi 4.
- Employed PiCamera to capture hand images to estimate hand volume and configured a server to store patient data.
- Utilized MediaPipe to measure hand range of motion and enabled server access through RFID tags.

**Pneumatically-Driven Multimodal Textile Actuation**, in collaboration with Accenture Labs

- Manufactured millimeter-scale fiber-reinforced soft pneumatic actuators capable of multimodal actuation in textiles. Built a relay circuit to control air pressure.
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## MEDIA COVERAGE

<b>Daily Mail</b> "How a hi-tech knitted glove could treat swollen hands"	May 29, 2023
<b>New Atlas</b> "KnitDema glove puts the electronic squeeze on swollen fingers"	April 26, 2023
<b>Cornell Chronicle</b> "Knitted robotic textile promising for hand edema patients"	April 26, 2023
<b>Trend Hunter</b> "The 'KnitDema' Glove Alleviates Extremity Swelling"	April 27, 2023
<b>The Engineer</b> "KnitDema wearable tech could improve hand edema treatment"	April 28, 2023
<b>MHealth Intelligence</b> "Weill Cornell Medicine Wearable Aims to Treat Hand Edema Patients"	May 5, 2023
<b>Cornell CIS News</b> "From Cornell's Hybrid Body Lab, KnitSkin, a stretchable knitted textile robot that can locomote"	May 5, 2022
<b>Hackster.io</b> "KnitDermis Wearables Provide "Intimate" Tactile Feedback"	May 5, 2021
<b>Mirage News</b> "Weaving inclusivity, style into wearable tech"	Sep 10, 2021

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## GRANTS & HONORS

- Virginia F. Cutler, Jean Failing, Home Economics Extension, Orrilla Wright Butts Memorial, Grace C. Dimelow, and Human Ecology Alumni Association Fellowships 2024
  - EECS Rising Stars 2023
  - IEEE IROS Travel Grant 2023
  - Dissertation Research Grant, Cornell University 2022
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## AWARDS & SCHOLARSHIPS

- Design Challenge Grand Prize Coway Co., Ltd, 2015
  - Ewha Art and Design Award Ewha Womans Univ., 2014
  - Vision Ewha Scholarship Dean of College of Art and Design, Ewha Womans Univ., 2014
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## ACADEMIC SERVICES

- AC of DIS '24
  - Reviewer of IEEE Sensors Journal, ACM CHI, UIST, IMWUT, DIS, TEI, ISWC, TOCHI, IASDR, and Frontiers in Materials.
  - Lead teaching assistant for DEA 6560 Research Design (Fall 2023), DEA 6040 Future Body Craft (Fall 2021, Fall 2022), and DEA 1110 Making a Difference by Design (Fall 2022).
  - Student Representative of Design Thinking Executive Masterclass 2017 at the Royal College of Art. Facilitated discussions on co-design methodologies and critical thinking.
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## SKILLS & OTHERS

**Material Analysis:** thermal analysis (DSC), scanning electron microscopy (SEM), laser-scanning profilometer (Keyence)  
**Fabrication:** PCB design, Eagle, rapid prototyping, fiber spinning & drawing, polymer extrusion, soft matter & soft pneumatic actuators fabrication  
**Programming & Software:** Arduino, Raspberry Pi (configuring Linux kernel), Python, R, Atlas.Ti, Qualtrics, Adobe Bundle  
**CAD & Simulation:** Autodesk Alias, Grasshopper, Rhino, Autodesk Maya, Keyshot, Abaqus (incompressible materials simulation), LTspice  
**Machine Knitting:** KnitPaint on Shima Seiki Apex 3, SRY123 operation, Knitout  
**Research:** writing and running IRB protocols, mixed methods study, surveys, interviews, statistics