

Ken Nakagaki | Curriculum Vitae

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Research Interests

My Human-Computer Interaction research focuses on developing and designing **Actuated Tangible User Interfaces (TUIs)** that embody dynamic digital information through robotic and interactive hardware technologies. Under the vision of seamlessly combining digital information into physical materials and environments, I invent and speculate novel physical embodied experiences through a range of engineering techniques.

Research Fields

Human Computer Interaction, Tangible User Interfaces, Shape Changing Interfaces, Haptic Interfaces, Interactive Material / Hand Tools, Human Robot Interaction and Entertainment Media.

Education

MIT Media Lab – Ph.D candidate in Media Arts and Sciences Jun 2016 - Aug 2021

Tangible Media Group - Advisor: Prof. Hiroshi Ishii

Dissertation: ‘Mechanical Shells for Actuated TUIs: Hybrid Architecture of Active and Passive Machines for Tangible Interaction’

MIT Media Lab –M.S. in Media Arts and Sciences Sep 2014 - Jun 2016

Tangible Media Group - Advisor: Prof. Hiroshi Ishii

Thesis: ‘LineFORM: Designing Interactions with Actuated Curve Interfaces’

Keio University – Master of Media and Governance [M.M.G] (Interaction Design Major) Apr 2013 - Sep 2014

Advisor: Prof. Yasuaki Kakehi

Thesis: ‘Design of Interactive Media with Sense of Agency by Referring to Hand-Tools’

Keio University – B.A. in Policy Management (Interaction Design Major) Ap 2009 - Mar 2013

Advisor: Prof. Yasuaki Kakehi

Thesis: ‘Needle User Interface: A Sewing Interface using Layered Conductive Fabrics’

Professional Experience

Assistant Professor – The University of Chicago, Computer Science Department
- Expected to join the rapidly growing computer science department with a focus in the field of Human Computer Interaction, to teach classes (undergraduate and graduate) and conduct research.
- Expected to establish and direct my own research group, tentatively named ‘Actuated Experience Lab’, whose mission is to invent and design novel user experience using actuated and shape changing user interface technologies.

Jan 2022
(expected) –

Research Assistant– MIT Media Lab
- Conduct research on novel robotic and shape-changing interfaces and interaction techniques based on interaction design and engineering techniques.
- Present research at top HCI Conferences (ACM CHI, UIST, TEI) based on publications, generating significant media exposure in print and video.
- Mentor students from different backgrounds for successful research outcome.
- Manage research projects to support the funding of the lab including industrial company funded collaborations.

Sep 2014 –
Aug 2021

Research Associate (Internship)– Disney Research
- Conducted research on pneumatically actuated jacket for full-body haptic experiences and published in ACM CHI.

May 2017 –
Aug 2017

Academic Service

Organizer

- Cambridge CHI¹

Program Committee

- ACM TEI 2022
- Augmented Humans 2021

Reviewer

- ACM CHI 2016-2021
- ACM UIST 2016-2021
- ACM TEI 2017-2021
- ACM DIS 2017-2021

¹ Virtual Alternative event of ACM CHI2020 in the area of Cambridge, MA - URL: <http://shorturl.at/flu55>

- Augmented Humans 2016-2017
- SIGGRAPH Asia 2016, 2018, 2019
- EUROHAPTICS 2016
- IROS 2017
- DESFORM 2017
- WHC 2019
- IEEE Pervasive Computing Journal 2017
- IEEE Transactions on Cognitive and Developmental Systems 2021

Publications

(*431 citations and 10 h-index according to Google Scholar - <https://scholar.google.com/citations?&user=-lfXPUEAAAAJ>)

Journal Article

- 1) **Ken Nakagaki**, Artem Dementyev, Sean Follmer, Joseph A. Paradiso, and Hiroshi Ishii: “Designing Line-Based Shape-Changing Interfaces,” IEEE Pervasive Computing, 16(4), 36-46, (2017.10).

Peer Reviewed Conference Papers

- 1) Takatoshi Yoshida, Junichi Ogawa, Kyung Yun Choi, Sanad Bushnaq, **Ken Nakagaki**, and Hiroshi Ishii. “inDepth: Force-based Interaction with Objects beyond A Physical Barrier,” In ACM TEI’21, Work-in-Progress (2021.2).
- 2) **Ken Nakagaki**, Joanne Leong, Jordan L Tappa, Joao Wilbert, and Hiroshi Ishii. “HERMITS: Dynamically Reconfiguring the Interactivity of Self-propelled TUIs with Mechanical Shell Add-ons,” In ACM UIST’20 (2020.10).
- 3) Hila Mor, Tianyu Yu, **Ken Nakagaki**, Benjamin Harvery Miller, Yichen Jia, and Hiroshi Ishii: “Venous Materials: Towards Interactive Fluidic Mechanisms,” In ACM CHI’20 (2020.4).
- 4) **Ken Nakagaki**, Yingda (Roger) Liu, Chloe Nelson-Arzuaga, and Hiroshi Ishii. “TRANS-DOCK: Expanding the Interactivity of Pin-based Shape Displays by Docking Mechanical Transducers,” In ACM TEI’20 (2020.2).
- 5) Takatoshi Yoshida, Xiaoyan Shen, Tal Achituv, Koichi Yoshino, **Ken Nakagaki**, and Hiroshi Ishii. “SCALE: Enhancing Force-based Interaction by Processing Load Data from Load Sensitive Modules.” In ACM UIST’19 (2019.10).
- 6) **Ken Nakagaki**, Daniel Fitzgerald, Zhiyao (John) Ma, Luke Vink, Daniel Levine and Hiroshi Ishii: “inFORCE: Bi-directional `Force` Shape Display For Haptic Interaction,” In ACM TEI’19 (2019.3). [*Honorable Mention Award*]

- 7) Alexandra Delazio, **Ken Nakagaki**, Roberta L. Klatzky, Scott E. Hudson, Jill Fain Lehman and Alanson P. Sample: "Force Jacket: Pneumatically-Actuated Jacket for Embodied Haptic Experiences," In ACM CHI'18 (2018.4)
- 8) **Ken Nakagaki**, Udayan Umapathi, Daniel Leithinger, and Hiroshi Ishii. "AnimaStage: Hands-on Animated Craft on Pin-based Shape Displays," In ACM DIS'17 (2017.6).
- 9) **Ken Nakagaki**, Artem Dementyev, Sean Follmer, Joseph A. Paradiso, and Hiroshi Ishii. "ChainFORM: A Linear Integrated Modular Hardware System for Shape Changing Interfaces." In ACM UIST'16, 2016.
- 10) **Ken Nakagaki***, Luke Vink*, Jared Counts, Daniel Windham, Daniel Leithinger, Sean Follmer, and Hiroshi Ishii. "Materiable: Rendering Dynamic Material Properties in Response to Direct Physical Touch with Shape Changing Interfaces." In ACM CHI'16, 2016. (*Contributed Equally)
[Best Paper Honorable Mention Award]
- 11) **Ken Nakagaki**, Sean Follmer, and Hiroshi Ishii. "LineFORM: Actuated Curve Interfaces for Display, Interaction, and Constraint." In ACM UIST'15, 2015.
- 12) **Ken Nakagaki**, Keina Konno, Shuntaro Tashiro, Ayaka Ikezawa, Yusaku Kimura, Masaru Jingi, and Yasuaki Kakehi. "Petanko Roller: A VR System with a Rolling-Pin Haptic Interface for Entertainment." In *Advances in Computer Entertainment*, Springer International Publishing, 2013.

Peer-Reviewed Demos, Posters, Workshops, and etc.

- 1) **Ken Nakagaki**, "Mechanical Shells: Physical Add-ons for Extending and Reconfiguring the Interactivities of Actuated TUIs," In ACM UIST '20 Adjunct, Doctoral Consortium (2020.10).
- 2) Koichi Yoshino, Takatoshi Yoshida, Yo Sasaki, Xiaoyan Shen, **Ken Nakagaki**, Hiroshi Ishii. "KI/OSK: Practice Study of Load Sensitive Board for Farmers Market," In ACM CHI2020, Case Studies (2020.4).
- 3) Hila Mor, **Ken Nakagaki**, Yu Tianyu, Benjamin Harvey Miller, Yichen Jia, and Hiroshi Ishii. "Prototyping Interactive Fluidic Mechanisms," In ACM TEI2020, Studio (2020.2).
- 4) Joanne Leong, Jose Martinez, Florian Perteneder, **Ken Nakagaki**, and Hiroshi Ishii. "WraPr: Spool-Based Fabrication for Object Creation and Modification," In ACM TEI2020, Work-in-Progress (2020.2).
- 5) Udayan Umapathi, Patrik Shin, **Ken Nakagaki**, Daniel Leithinger, and Hiroshi Ishii. "Programmable Droplets for Interaction," In ACM CHI2018 EA, Video Showcase (2018.4).
[Golden Mouse Award (Best Video Showcase)]
- 6) **Ken Nakagaki**, Pasquale Totaro, Jim Peraino, Thariq Shhipar, Chantime Akiyama, Yin Shuang and Hiroshi Ishii. "HydroMorph: Shape Changing Water Membrane for Display and Interaction," In ACM TEI2016, Work-in-Progress (2016.2).

- 7) Luke Vink, Viirj Kan, **Ken Nakagaki**, Daniel Leithinger, Sean Follmer, Philipp Schoessler, Amit Zoran and Hiroshi Ishii. “TRANSFORM as Adaptive and Dynamic Furniture,” In ACM CHI2015 EA, Video Showcase (2015.4). *[Golden Mouse Award (Best Video Showcase)]*
- 8) **Ken Nakagaki**, Chikara Inamura, Pasquale Totaro, Thariq Shhipar, Chantime Akikyama, Yin Shuang and Hiroshi Ishii: “Linked-Stick: Conveying a Physical Experience using a Shape-Shifting Stick,” In ACM CHI2015 EA, Posters (2015.4).
- 9) Momoko Okazaki, **Ken Nakagaki** and Yasuaki Kakehi. “metamoCrochet: Augmenting Crocheting with Bi-stable Color Changing Inks,” ACM SIGGRAPH2014, Posters (2014.8).
- 10) **Ken Nakagaki**, and Yasuaki Kakehi. “COMP*PASS: A Compass-based Drawing Interface,” ACM CHI2014 EA, Interactivity (2014.4).
- 11) **Ken Nakagaki** and Yasuaki Kakehi. “Needle User Interface: A Sewing Interface Using Layered Conductive Fabrics,” ACM UIST2012, Demo Session (2012.10).
- 12) **Ken Nakagaki**, Keina Konno, Shuntaro Tashiro, Ayaka Ikezawa, Yusaku Kimura, Masaru Jingi, and Yasuaki Kakehi. “Petanko Roller: Rolling-pin-based Interface for Representing Sensations of Rolling Out Virtual Objects,” Laval Virtual2012, ReVolution, Dem.2 (2012.3-4).
- 13) **Ken Nakagaki** and Yasuaki Kakehi. “SonalShooter: A Spatial Augmented Reality System Using Handheld Directional Speaker with Camera,” In ACM SIGGRAPH2011, Posters (2011.8).

Selected Awards and Honors

- 1) Core 77 Design Awards 2021, **Student Notable in Interaction Award** (HERMITS, 2021)
- 2) A’ Design Awards 2021, **Platinum [top 1%] in Interface and Interaction Design Category, Silver [top 5%] in Design Quality and Innovation Category, Silver [top 5%] in Idea Design Category** (Venous Materials, 2021)
- 3) **Innovators Under 35 Japan**, MIT Technology Review (2021)
- 4) Innovation by Design Awards 2020, **Finalist in Experimental, Honorable Mention in General Excellence Category, and Finalist in Students Category** (Venous Materials, 2020)
- 5) ACM TEI2019, **Honorable Mention Award** (inFORCE, 2019)
- 6) Innovation by Design Awards 2018, **Honorable Mention in Experimental** (Programmable Droplets, 2018)
- 7) ACM CHI2018, **Golden Mouse Award [Best Video Showcase]** (Programmable Droplets, 2018)
- 8) YouFab Global Creative Award 2017, **Finalist** (ChainFORM, 2018)
- 9) 20th Japan Media Arts Festival, Entertainment Division - **Jury Selections** (LineFORM, 2017)
- 10) Innovation by Design Awards 2016, **Honorable Mention Award in Students Category** (LineFORM, 2016)

- 11) **Golden A' Design Award [top 3%]** in Interaction Design Category (LineFORM, 2016)
- 12) **ACM CHI2016, Best Paper Honorable Mention Award** (Materiable, 2016)
- 13) **ACM CHI2015, Golden Mouse Award [Best Video Showcase]** (TRANSFORM, 2015)
- 14) **James Dyson Award - Third Place of National Stage and Top 20 of International Stage** (COMP*PASS, 2014)
- 15) **IPJS Yamashita SIG Research Award** (COMP*PASS, 2014)
- 16) **16th Japan Media Arts Festival, Entertainment Division - Jury Selections** (Petanko Roller, 2012)
- 17) **The 19th International collegiate Virtual Reality Contest(IVRC2011) - Grand Prix, DCEXpo/ConTEX Award, Laval Virtual Award, and Popular Vote Award** (Petanko Roller, 2011)

Selected Exhibitions

- 1) **Ars Electronica, "Radical Atoms"** (LineFORM, 2016.9.8-2018).
- 2) **Cooper Hewitt Museum, "Tools: Extending Our Reach."** (inFORM, 2014.12.12-2015.5.25).
- 3) **ICC OPEN SPACE 2014, "HABILITATE"** (COMP*PASS, 2014.6.21-9.21).
- 4) **Arita Contemporary Art Garden Place** (Petanko Roller, 2013.9.14-15).
- 5) **3D & Virtual Reality EXPO** (Petanko Roller, 2012.6.20-22).
- 6) **Laval Virtual 2012** (Petanko Roller, 2012.3)
- 7) **DIGITAL CONTENT EXPO (DCEXpo)** (Petanko Roller, 2011.10.20-22).

Selected Press Coverage

Mar 2021 - IEEE Spectrum, 'MIT's HERMIT Crab Robots Can Do Anything You Shell Them To'

Oct 2020 - Core77, '*Inspired by Hermit Crabs, Desktop Mini Robots Inhabit Different "Shells" for Different Functions*'

Oct 2020 - hackster.io, '*MIT's Crab-Inspired Robot HERMITS Can Dock with "Mechanical Shells" for a Variety of Tasks*'

Mar 2019 - hackster.io, '*MIT's inForce Brings Haptic Feedback with Force Controlled Shape Display*'

Apr 2018 - engadget, '*MIT researchers turn water into 'calm' computer interfaces*'

May 2018 - CNET, '*Disney's VR 'force jacket' sends snakes wriggling over your body*'

Oct 2017 - Mashable, '*MIT is making furniture that comes to life*'

Feb 2016 - Wired, '*You Know How Spoons Splash Under Faucets? MIT Made It an Art*'

Feb 2016 - IEEE Spectrum, '*MIT Turns Splashing Water into an Interactive Display*'

Dec 2016 - IEEE Spectrum, '*MIT's Modular Robotic Chain Is Whatever You Want It to Be*'

Dec 2016 - Popular Mechanics, *'This Caterpillar of Robots Could Become Whatever You Need'*

May 2016 - Wired, *'MIT's New Shapeshifting Interface Can Mimic The Behavior of Water'*

May 2016 - engadget, *'Shape-shifting interface lets you touch computer simulations'*

Nov 2015 - FastCompany, *'MIT's Weird Snake Bot Could Be The Future Of UI'*

Nov 2015 - Core77, *'MIT Media Lab's Wearable, Interactive Snakebot Experiments'*

Nov 2015 - Gizmodo AU, *'A Robotic Worm Is Your Only Device In This Incredibly Strange Vision Of The Future'*

Nov 2015 - The Verge, *'MIT's friendly snake robot concept can transform into many things'*

Nov 2014 - dezeen, *'Ken Nakagaki's Comppass draws simple shapes from digital files'*