

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 - present
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) Apr 2009 - Mar 2013
Advisor: Prof. Yasuaki Kakehi
Thesis: ‘Needle User Interface: A Sewing Interface using Layered Conductive Fabrics’

Professional Experience

Research Assistant— MIT Media Lab

Sep 2014 — Present

- 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.

Research Associate (Internship)— Disney Research

May 2017 — Aug 2017

- Conducted research on pneumatically actuated jacket for full-body haptic experiences and published in ACM CHI.

Academic Service

Organizer

- Cambridge CHI¹

Program Committee

- Augmented Humans 2021

Reviewer

- ACM CHI 2016-2021
- ACM UIST 2016-2020
- ACM TEI 2017-2021
- ACM DIS 2017-2020
- 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

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

Publications

(*354 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).

Pear Reviewed Conference Papers

- 1) **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).
- 2) 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).
- 3) **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).
- 4) 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).
- 5) **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*]
- 6) 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)
- 7) **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).
- 8) **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.
- 9) **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*]

- 10) **Ken Nakagaki**, Sean Follmer, and Hiroshi Ishii. "LineFORM: Actuated Curve Interfaces for Display, Interaction, and Constraint." In *ACM UIST'15*, 2015.
- 11) **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 WIP (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) **Innovators Under 35 Japan**, MIT Technology Review (2021)
- 2) Innovation by Design Awards 2020, **Finalist in Experimental, Honorable Mention in General Excellence Category, and Finalist in Students Category** (Venous Materials, 2020)
- 3) ACM TEI2019, **Honorable Mention Award** (inFORCE, 2019)
- 4) Innovation by Design Awards 2018, **Honorable Mention in Experimental** (Programmable Droplets, 2018)
- 5) ACM CHI2018, **Golden Mouse Award [Best Video Showcase]** (Programmable Droplets, 2018)
- 6) YouFab Global Creative Award 2017, **Finalist** (ChainFORM, 2018)
- 7) 20th Japan Media Arts Festival, Entertainment Division - **Jury Selections** (LineFORM, 2017)
- 8) Innovation by Design Awards 2016, **Honorable Mention Award in Students Category** (LineFORM, 2016)
- 9) **Golden A’ Design Award** in Interaction Design Category (LineFORM, 2016)
- 10) ACM CHI2016, **Best Paper Honorable Mention Award** (Materiable, 2016)
- 11) ACM CHI2015, **Golden Mouse Award [Best Video Showcase]** (TRANSFORM, 2015)
- 12) James Dyson Award - **Third Place of National Stage and Top 20 of International Stage** (COMP*PASS, 2014)
- 13) IPSJ Yamashita SIG Research Award (COMP*PASS, 2014)
- 14) 16th Japan Media Arts Festival, Entertainment Division - **Jury Selections** (Petanko Roller, 2012)
- 15) 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

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'*