

Curriculum Vitae

Research interests:

Interactive design tools that enable digital fabrication of complex shapes and structures

In my work, I propose **unifying material and device** and develop what I call metamaterial devices. While metamaterials, which are materials with properties defined by their engineered microstructure, were so far understood as materials—I think of them as devices. My research focuses on new types of machines, the functionality of which are solely defined by the material's microstructure. The typically intricate cell-structures are hard to design, because only if all cells move in concert, they can perform their macroscopic device function. I develop interactive systems and computational design tools that assist users in modeling and generating the material geometry.

My research and expertise lie at the intersection of **human-computer interaction**, **digital fabrication**, **mechanical engineering**, and **material science**. My work has been published in and awarded by premier venues, including ACM UIST and CHI.

Educational background

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|---------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mar 2019 – present | Postdoctoral researcher at ETH Zürich Advisor: Prof. Olga Sorkine-Hornung, Interactive Geometry Lab |
| Sep 2018 – Jan 2019 | Research stay at ETH Zürich Advisor: Prof. Olga Sorkine-Hornung, Interactive Geometry Lab |
| Jul 2013 – Apr 2019 <i>Dr. rer. nat.</i> | PhD student at Hasso Plattner Institute, University of Potsdam Advisor: Prof. Patrick Baudisch, Human-Computer Interaction Thesis: Metamaterial Devices Committee: Prof. Scott Hudson, Prof. Sriram Subramanian, Prof. Marc Alexa |
| Oct 2010 - Nov 2012 <i>MSc</i> | University of Applied Sciences Upper Austria, Hagenberg Thesis advisor: Prof. Michael Haller Thesis: Uncovering moving off-view objects on large interactive displays. |
| May 2012 - Oct 2012 | Research stay at University of Waterloo, ON, Canada. Advisors: Prof. Mark Hancock, Prof. Stacey Scott |
| Oct 2006 - Jul 2009 <i>BSc</i> | University of Applied Sciences Upper Austria, Hagenberg |

Publications

PEER-REVIEWED PAPERS

ACM CHI and UIST are premiere venues for HCI, 20-26% acceptance rate

[10] Understanding Metamaterial Mechanisms.

Alexandra Ion, David Lindlbauer, Philipp Herholz, Marc Alexa, and Patrick Baudisch.

In *Proceedings of CHI '19. Glasgow, UK, May 4 – 9, 2019.*

[9] TrussFormer: 3D Printing Large Kinetic Structures.

 Robert Kovacs, **Alexandra Ion**, Pedro Lopes, Tim Oesterreich, Johannes Filter, Philipp Otto, Tobias Arndt, Nico Ring, Melvin Witte, Anton Synytsia, and Patrick Baudisch.

In *Proceedings of UIST'18. Berlin, Germany, October 14 – 17, 2018.*

CHI'19 Video Showcase **Best Visual Communication Award.**

[8] Metamaterial Textures.

Alexandra Ion, Robert Kovacs, Oliver Schneider, Pedro Lopes and Patrick Baudisch.

In *Proceedings of CHI '18. Montreal, Canada, April 21 – 26, 2018.*

[7] Adding Force Feedback to Mixed Reality Experiences and Games using Electrical Muscle Stimulation.

Pedro Lopes, Sijing You, **Alexandra Ion**, and Patrick Baudisch.


In *Proceedings of CHI '18. Montreal, Canada, April 21 – 26, 2018.*

[6] Digital Mechanical Metamaterials.

Alexandra Ion, Ludwig Wall, Robert Kovacs, and Patrick Baudisch.

In *Proceedings of CHI '17. Denver, CO, May 6 – 11, 2017.*

[5] Metamaterial Mechanisms.

 **Alexandra Ion**, Johannes Frohnhofer, Ludwig Wall, Robert Kovacs, Mirela Alistar, Jack Lindsay, Pedro Lopes, Hsiang-Ting Chen, and Patrick Baudisch.

In *Proceedings of UIST'16. Tokyo, Japan, October 16 – 19, 2016. pp. 529-539.*

BEST PAPER HONORABLE MENTION (top 2% of submissions).

[4] Skin drag displays: dragging a physical factor across the user's skin produces a stronger tactile stimulus than vibrotactile.

Alexandra Ion, Edward Wang, and Patrick Baudisch.

In *Proceedings of CHI'15. Seoul, Korea, April 18 – 23, 2015.*

Short paper.

[3] Proprioceptive Interaction.

Pedro Lopes, **Alexandra Ion**, Willi Mueller, Daniel Hoffmann, Patrik Jonell, Patrick Baudisch.



In *Proceedings of CHI'15. Seoul, Korea, April 18 – 23, 2015*

[2] Impacto: Simulating Physical Impact by Combining Tactile Stimulation with Electrical Muscle Stimulation.

Pedro Lopes, **Alexandra Ion**, Patrick Baudisch.

In *Proceedings of UIST'15. Charlotte, NC, November 8 – 11, 2015.*

[1] Canyon: Providing location awareness of multiple moving objects in a detail view on large displays.

 **Alexandra Ion**, Yu-Ling Chang, Michael Haller, Mark Hancock, Stacey Scott.
 In *Proceedings of CHI'13. Paris, France, April 27 – May 2, 2013. 3149-3158.*
BEST PAPER HONORABLE MENTION (top 5% of submissions).

NON-PEER-REVIEWED PUBLICATIONS

[4] Metamaterial Devices.

Alexandra Ion and Patrick Baudisch.
In ACM SIGGRAPH 2018 Studio.

[3] Using Your Own Muscles: Realistic physical experiences in VR.

Pedro Lopes, **Alexandra Ion**, Robert Kovacs.
Magazine article, XRDS, Fall 2015, Vol. 22.

[2] Understanding mid-air hand gestures: A study of human preferences in usage of gesture types for HCI.

Roland Aigner, Daniel Wigdor, Hrvoje Benko, Michael Haller, David Lindlbauer, **Alexandra Ion**, Shengdong Zhao, and Jeffrey Tzu Kwan Valino Koh.
Technical Report MSR-TR-2012-111. 2012.

[1] Hot Topics in Personal Fabrication Research. Tutorial.

Stefanie Mueller, **Alexandra Ion**, and Patrick Baudisch.
In *Proceedings of ACM ITS 2014, 499-502.*

DEMONSTRATIONS

...of physical prototypes and software during hands-on sessions

[5] Metamaterial Devices.

ACM SIGGRAPH 2018 Studio Installation. August 2018.

[4] Metamaterial Devices.

ACM CHI 2018 Interactivity. May 2018.

[3] Metamaterial Mechanisms & Digital Mechanical Metamaterials.

ACM CHI 2017 Interactivity. May 2017.

[2] Metamaterial Mechanisms.

ACM UIST 2016 Demonstration. October 2016.

[1] Impacto: Simulating Physical Impact by Combining Tactile Stimulation with EMS.

ACM UIST 2015 Demonstration. November 2015.

Awards & honors

ACADEMIC

- [7] Selected for Rising Stars in EECS 2019.
- [6] Best visual communication award for TrussFormer. ACM CHI 2019 Video Showcase.
- [5] Scholarship for academic exchange (2018 DAAD FIT program, ~9 000 EUR)
- [4] My CHI 2015 talk is the example for a good presentation on the CHI conference website, 2016 – present
- [3] **Best paper honorable mention** award. ACM UIST 2016.
- [2] **Best paper honorable mention** award. ACM CHI 2013.
- [1] Nomination for national best master's thesis award. 2012.

INDUSTRY/ART/DESIGN

- [5] Fast Company's Innovation by Design Award (Honorable Mention) 2018, for Adding Force Feedback to MR.
- [4] VIDA. Incentive Award 2016, for Ad Infinitum.
- [3] Bronze Cyber Lion, Cannes Lions 2010, for "Last call" (interactive movie)
- [2] Bronze Media Lion, Cannes Lions 2010, for "Last call" (interactive movie)
- [1] Bronze "Digital Media Craft", ADC Germany 2010, Art directors club, for "Last call" (interactive movie)

Invited talks

- [22] University of Chicago, hosted by Pedro Lopes. November 1, 2019.
- [21] University of Stuttgart, hosted by Achim Menges. September 16, 2019.
- [20] Google (Mountain View), hosted by Alex Olwal. August 9, 2019.
- [19] UC Berkeley, hosted by Björn Hartmann. August 8, 2019.
- [18] Stanford, hosted by Sean Follmer. August 7, 2019.
- [17] UCLA, hosted by Ankur Mehta. August 2, 2019.
- [16] MIT Media Lab, hosted by Hiroshi Ishii. June 19, 2019.
- [15] MIT CSAIL, hosted by Stefanie Mueller. June 19, 2019.
- [14] ETH Zurich, PhD Seminar. October 26, 2018.
- [13] University of Sussex, hosted by Diego Martínez & Sriram Subramanian. May 21, 2018.
- [12] Université de Montréal, hosted by Bernhard Thomaszewski. April 27, 2018.
- [11] IST Austria, hosted by Bernd Bickel. March 2, 2018.
- [10] ETH Zürich, hosted by Olga Sorkine-Hornung. December 14, 2017.
- [9] SAP Walldorf, hosted by Andreas Polze & Bernd Welz. December 11, 2017.
- [8] TU Delft, hosted by Jouke Verlinden. December 4, 2017.
- [7] Aarhus University, hosted by Roman Rädle. October 5, 2017.
- [6] Technomania, hosted by The Danish Society of Engineers IDA. October 4, 2017
- [5] Driving 3D, hosted by The Danish Society of Engineers, IDA. September 29, 2017.
- [4] TEDx Poznan. April 8, 2017.
- [3] Singularity University Copenhagen, hosted by Märtha Rehnberg. December 14, 2016.

[2] TU Berlin, hosted by Marc Alexa. 2016.

[1] TU Berlin, hosted by Marc Alexa. 2015.

Outreach

Diversity. I am currently a **co-lead of the network of women in computer science (CSNOW)** at ETH Zurich. We focus on increasing the number of women in CS by providing mentors and role models, informing and motivating girls to consider CS. For example, we organize twice a year a week-long programming workshop for girls in their final high-school year such that they can make an informed decision on their study program and feel welcomed.

Service & volunteering

Program committee: ACM UIST 2020
ACM CHI 2020
ACM CHI 2019
ACM SIGGRAPH Asia 2019 – Technical briefs and posters

Organizing committee: ACM UIST 2020 – demonstrations co-chair
ACM UIST 2019 – sustainability co-chair
ACM UIST 2018 – local arrangements co-chair, accessibility chair
ACM UIST 2017 – student volunteer co-chair
ACM UIST 2016 – documentation chair

Session chair: at ACM CHI 2019, session “Designing with Materials”
at ACM CHI 2018, session “Craft, Fabrication, Making”
at ACM CHI 2017, session “Haptics on Skin”

Reviewing:
(conferences) ACM CHI 2019 – 2014
ACM UIST 2019 – 2016
ACM SIGGRAPH Asia 2018
ACM TEI 2019, 2017
ACM DIS 2017, 2016
ACM Augmented Human 2016, 2015
IEEE World Haptics 2015, 2017
IEEE Haptics Symposium 2018
ACM ICMI 2017, ACM SUI 2016

(journals) ACM IMWUT 2019
Elsevier Computers & Graphics 2018
Nature Scientific Reports 2018
Interacting with Computers 2014

Student volunteer: ACM CHI 2016, ACM UIST 2015, ACM ITS 2014

Teaching

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| Research projects <i>(semester course, approx. 1 day/week)</i> | <p>Michael Janke, graduate. 2017/18. Pascal Crenzin, graduate. 2017/18. Benjamin Feldmann, graduate. 2016/17. Martin Schlegel, graduate. 2016/17. Johannes Frohnhofen, graduate. 2016. Johannes Filter, graduate. 2016. John Geiger, undergraduate. 2016. Noel Danz, undergraduate. 2016. Friedrich Horschig, graduate. 2015/16. Noel Danz, undergraduate. 2015/16. Sijing You, graduate. 2014. Friedrich Horschig, graduate. 2014. Martin Fritzsche, graduate. 2014. Max Schneider, graduate. 2014. Martin Fischer, undergraduate. 2013/14. Johannes Frohnhofen, undergraduate. 2013. Julian Risch, undergraduate. 2013. Florian Meinel, undergraduate. 2013.</p> |
| Bachelor's thesis <i>(6 months, ~2 days/week)</i> | <p>Nuno Dantas Pereira. 2019/2020. Space Filling Splines for Shape Representation.</p> |
| Master's thesis <i>(6 months full time)</i> | <p>Ludwig Wilhelm Wall. 2016. Design and Synthesis of Digital Mechanical Metamaterials. published at ACM CHI 2017.</p> |
| Lectures | <p>"3D printed mechanics" 60-minute lecture as part of the "Building Interactive Devices" undergraduate course.</p> <p>"Inspecting and analyzing data using SPSS" 150-minute lecture as part of "Future Interactive Technologies" graduate course.</p> |
| Workshop | <p>Designing metamaterial mechanisms, ~35 participants Invited workshop at TU Delft. December 4, 2017.</p> |
| Teaching assistance | <p>"Designing interactive systems" (HCI1). 2015/16. Hasso Plattner Institute. "Designing interactive systems" (HCI1). 2014/15. Hasso Plattner Institute. "Applied software techniques" (C++ programming). 2010/11. Hagenberg. "Online Multimedia" (Flex development). 2011. Hagenberg. "Digital Imaging". 2011/12. Hagenberg. "Computer Graphics" (OpenGL). 2012. Hagenberg.</p> |

Invited exhibitions

METAMATERIAL DEVICES

Ars Electronica Center, Linz, Austria. 2019 – 2020.

BMBF (german federal ministry for education and research) InnoTruck (travelling exhibition). 2017 – 2020.

UNIVERSUM Mexico City, “3D, printing the world”. September 2019 – February 2020.

Espacio Fundación Telefónica Chile, Santiago, “3D, printing the world”. March 2019 – July 2019.

Espacio Fundación Telefónica Argentina, Buenos Aires, “3D, printing the world”. July 2018 – October 2018.

Espacio Fundación Telefónica Peru, Lima, “3D, printing the world”. December 2017 – April 2018.

Espacio Fundación Telefónica Spain, Madrid, “3D, printing the world”. June – September 2017.

CeBit 2017. Futurium booth (Berlin-based museum for ideas of the future). March 20 – 24, 2017.

AD INFINITUM (<http://a-parasite.org/>)

Przemiany Festival, Copernicus Science Center Warsaw. September 13-16, 2018.

World Economic Forum, San Francisco. December 2017 – May 2018.

Ars Electronica Festival, Linz, Austria. 7-11 September 2017.

Science Gallery Dublin, Ireland, “Humans need not apply”. February – May 2017.

Natural History Museum Bern, Switzerland. September 9, 2016.

Selected press

IEEE Spectrum. Mechanical Metamaterials and other 3D Printing Tech from CHI 2017. 2017.

3ders.org. Researchers use 3D printing to make 'digital mechanical metamaterials' that function like machines. 2017.

think3D. 'Digital Mechanical Metamaterials' made by the Researchers. 2017.

digital trends. This 3D printed door latch can be unlocked with a PIN code, yet doesn't require electricity. 2017.

fast company. These Metamaterials Act Like Machines. 2016.

gizmodo. This Simple 3D-Printed Door Handle Works Without Any Moving Parts. 2016.

creative applications. Metamaterial Mechanisms – 3D Grids with Mechanical Properties. 2016.

Make:. “Metamaterials” Allow You to 3D Print Simple Machines. 2016.

dezeen. Metamaterials Make it Possible to Create Mechanisms from a Single Piece of Plastic. 2016.

digital trends. 3D-printed Metamaterial 'Machines' are Greater than the Sum of their Parts. 2016.

Previous professional experience

- Mar 2013 - Jul 2013 Software Developer & Usability Engineer (Full time employee, Professional/Experienced)
Bernecker+Rainer Industrie Elektronik Ges.m.b.H., <http://www.br-automation.com/>
- Sep 2010 - Feb 2012 Software Developer (Part time employee, Professional/Experienced)
Interactive Pioneers GmbH, <http://interactive-pioneers.com/> (former Powerflasher GmbH)
- Oct 2009 - Aug 2010 Software Developer (Full time employee, Entry Level)
Interactive Pioneers GmbH, <http://interactive-pioneers.com/> (former Powerflasher GmbH)
Developer for WPF, Silverlight, Java Backend, Actionscript 3.0, Flex
- Mar 2009 - Aug 2009 WPF/Silverlight Developer (Student/Intern)
Interactive Pioneers GmbH, <http://interactive-pioneers.com/> (former Powerflasher GmbH)
- Aug 2008 - Sep 2008 Screen/Web Designer, Web Developer (Student/Intern)
Lomographic Society International, <http://www.lomography.com/>

References

Prof. Patrick Baudisch (PhD advisor)

Hasso Plattner Institute, University of Potsdam
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Prof. Olga Sorkine-Hornung (post-doc advisor)

ETH Zurich
sorkine@inf.ethz.ch

Prof. Hiroshi Ishii

MIT Media Lab
tmqadmin@media.mit.edu

Prof. Scott Hudson

Carnegie Mellon University
scott.hudson@cs.cmu.edu

Prof. Sriram Subramanian

University of Sussex
sriram@sussex.ac.uk