

Sarah Kushner

Physical Computing Engineer & Creative Technologist

Specialist in Physical Storytelling, HCI, and Geometry for Fabrication

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Senior Interactive Play Designer candidate with a PhD in Computer Science specializing in Computational Fabrication, Human Computer Interaction (HCI) and Animatronics. Over 8 years of experience bridging physical and digital worlds through creative technology, including novel 3D zoetropes, papertronic puppetry, and physical storytelling frameworks. Proven track record of conducting user experience studies to optimize engagement, mentoring interdisciplinary student groups, and translating complex engineering systems into intuitive, joyful play experiences.

PROFESSIONAL EXPERIENCE

Postdoctoral Researcher — Geometric Intelligence Lab

University of California, Santa Barbara

2025 – Present

Santa Barbara, CA, USA

- Conducting geometric shape analysis frameworks for complex 3D datasets and building a digital twin model for the maternal brain.
- Mentorship:** Directing data science projects and mentoring researchers on statistics for pregnancy brain data.

PhD Researcher & Computational Designer

University of Toronto (Advised by Daniel Wigdor & Paul H. Dietz)

2017 – 2024

Toronto, ON, Canada

- Defended Doctoral Thesis: “**Techniques for Physical Storytelling**”, prototyping novel physical-digital hybrid play and educational tools.
- Zoetropes:** Engineered and built an innovative **Interactive 3D Zoetrope system** using strobe-flashlight synchronization with audio components within a large-scale mechanical contraption to achieve more complex and deeper storytelling abilities.
- Animatronics:** Realized an affordable yet intuitive **Educational Animatronics Kit** enabling users of all ages to design and build articulated papercraft characters and control the characters with voice activated motion through custom electronic circuit boards.
- User Experience & Play Studies:** Designed and executed formal user studies and creative construction workshops to measure interaction engagement, cognitive load, and play satisfaction among students and teachers alike, evaluating its realistic use in school classrooms.

Visiting PhD Student

University of California, Santa Barbara (Advised by Nina Miolane)

Oct 2022 – Mar 2023

Santa Barbara, CA, USA

- Developed mathematical interpolation techniques for 3D rigged character animations using geometric statistics, allowing compression of animations and stylizing motions with user-selected parameters.

Research Intern (Computational Animation)

Inria Grenoble Rhône-Alpes

Feb 2017 – Jun 2017

Montbonnot-Saint-Martin, France

- Developed sketch-based animation interaction techniques to control multi-character physical poses in sequences of dancing couples.

EDUCATION

PhD in Computer Science (Geometry, Animation & Fabrication)

University of Toronto — Focus on Physical Storytelling, Kinematics, and HCI

2017 – 2024

Toronto, ON, Canada

MS in Informatics (Graphics, Vision & Robotics Specialization)

Institut polytechnique de Grenoble (Grenoble INP) — avec la mention Bien

2016 – 2017

Grenoble, France

BS in Computer Science (Minor in Digital Media)

Drexel University — Magna Cum Laude, Pennoni Honors College

2012 – 2016

Philadelphia, PA, USA

SELECTED PLAY-CENTRIC PUBLICATIONS & DEMOS

- **Paper Animatronics Workshop** — *SIGGRAPH Labs 2025* (Hands-on paper animatronics demo where we lead researchers and teachers through making their own animatronic puppets and shows).
- **Papertronic Puppets: Teaching STEM and Storytelling Through Creative Construction** — *IEEE Frontiers in Education 2024* (Empirical user study evaluating physical story crafting).
- **Interactive 3D Zoetrope with a Strobing Flashlight (Demo)** — *ACM UIST 2022* (A novel physical prototype blending 3D printed animation loops with interactive stroboscopic vision hardware).
- **Levitating Rigid Objects with Hidden Rods and Wires** — *Eurographics 2021* (Computational optimization for structural physical support engineering).

INTERACTIVE MENTORSHIP & PLAY LEADERSHIP

- **Capstone Physical Computing for K-12 Education Mentor:** Guided student teams on crafting the educational experiences they designed including a show featuring projection mapping, an escape room, and a capacitive sensing puzzle.
- **Capstone Research Mentor (Zoetrope Audio Integration)** Advised undergraduate engineering student developing dynamic multi-sensory interactive soundscapes for physical kinetic zoetropes.
- **Capstone Research Mentor (Educational Lego Zoetrope Kit):** Mentored computer science student on translating advanced computational zoetrope design principles into repeatable, low-cost physical **zoetrope kits for classroom and consumer-play environments**.
- **Large-Scale Toy Engineering Mentor:** Supervised a mechanical student on structural and mechanical engineering optimization of large-scale physical zoetropes.
- **Mentorship Director (HER CODE CAMP):** Directed creative programming, technical marketing, and interactive workshops introducing programming concepts to underrepresented high school students.

TECHNICAL & CREATIVE SKILLS

Hardware:	Actuators/Servos, Stepper Motors, DC Motors, PICKit, M5Stack, Arduino, Raspberry Pi, PIC microcontrollers, Custom Circuit Design (EasyEDA), Embedded Firmware (MPLAB X), LEDs, IMUs, IR Sensors, Photo Interrupters, Inductive Proximity Sensors, Triggerable Cameras, Soldering, Jigsaw, Drill Press, Aluminum Extrusion Design & Assembly.
Fabrication:	3D Printing Slicers, 3D Printers (Bambu, Prusa, Stratasys, Ultimaker), Laser Cutting (Trotec, Versalaser), CNC Milling, Motion Capture (Vicon, Noraxon), Rapid Prototyping.
3D & 2D Software:	3D: Blender, Autodesk Maya, Fusion 360. 2D: Adobe Creative Suite (Photoshop, Illustrator, AfterEffects), iMovie, ProCreate for iPad, Apple Keynote, Microsoft Office Suite.
Programming & IDEs:	Languages: Python, C++, Matlab, HTML, CSS, Bash, LaTeX, JavaScript, OpenGL, GLSL. IDEs: Visual Studio, Visual Studio Code, Arduino IDE, Jupyter Notebooks.
Creative, Art & UX:	User Studies & Testing, Workshop Design, Physical Storytelling, Web Design, Graphic Design, iPad Drawing. Fine Art: Watercolor, Acrylic, Oil Painting, Silkscreen, Graphite, Pen, Charcoal, Chalk Pastel.