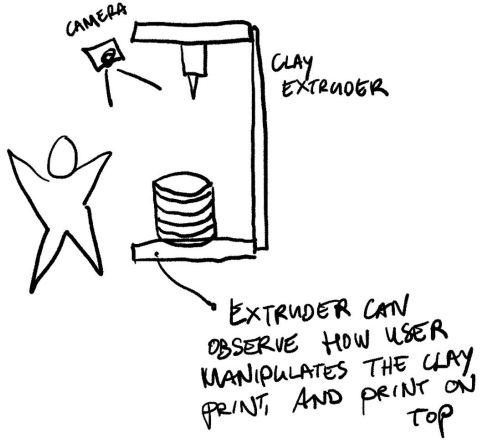
Portfolio

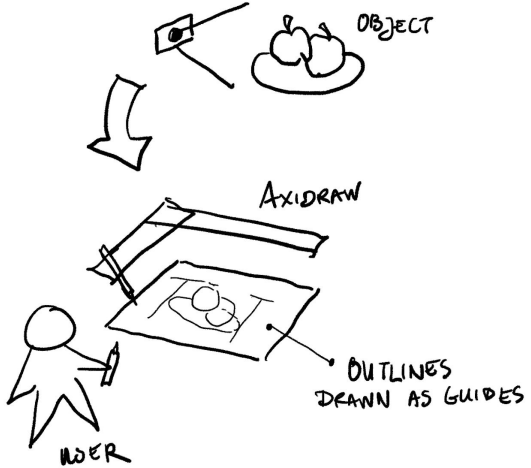
Alexandra Bremers

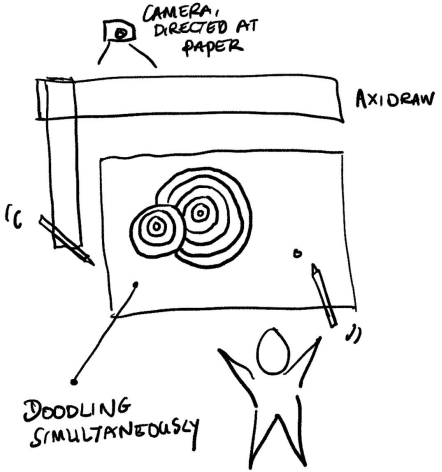
March 2025

PhD Dissertation Work

Collaborative Machines (2020-2024)



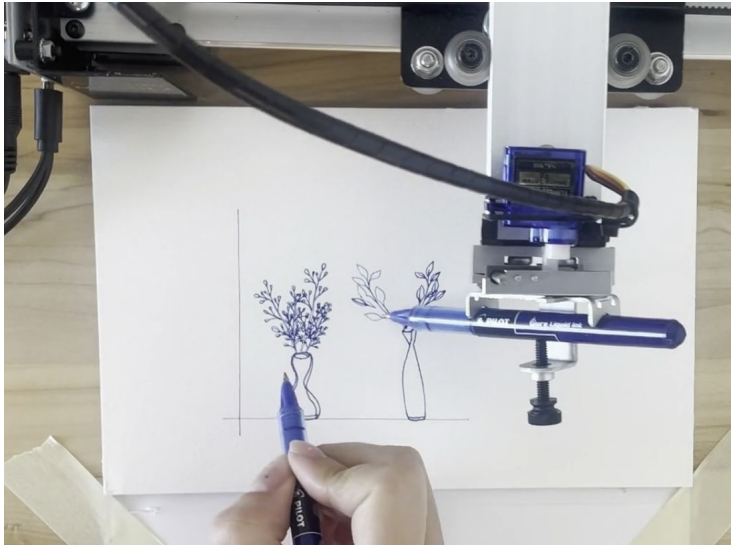




For my PhD thesis, I envision, enact, and prototype new ways of collaborating with creative machines, starting from sketches. First, I explored how people could collaborate with machines in various ways, and the values at play there.

Alexandra Bremers, Wendy Ju. “Designing Interactions for Mixed-Initiative Machines: Balancing Automation and Craftsmanship”. In: *1st International Workshop on Worker-Robot Relations at the 19th Annual ACM/IEEE International Conference on Human-Robot Interaction*. 2024. d o i: http://dx.doi.org/10.13140/RG.2.2.22111.06562.

Plotter Art (2020-2024)



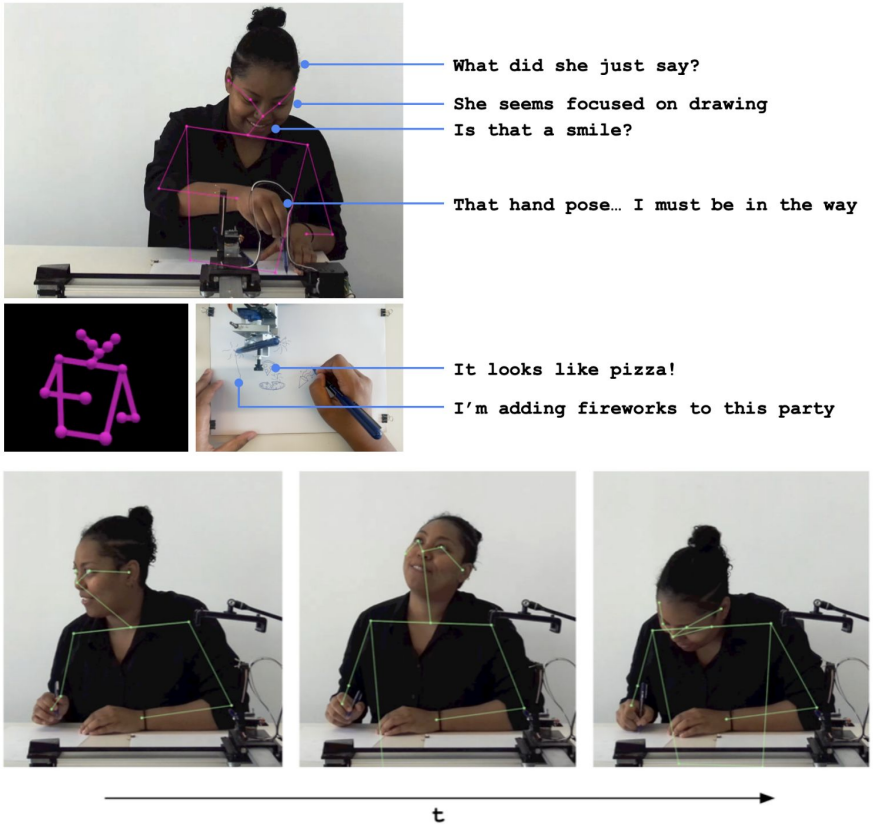
Simultaneously, I experiment with artistic workflows and ways to use the AxiDraw pen plotter. This has led to explorations with watercolor (left), 3D modeled drawings (middle), and co-drawing (right).

Can Machines Tell What People Want? (2024)

How should a collaborative machine behave?

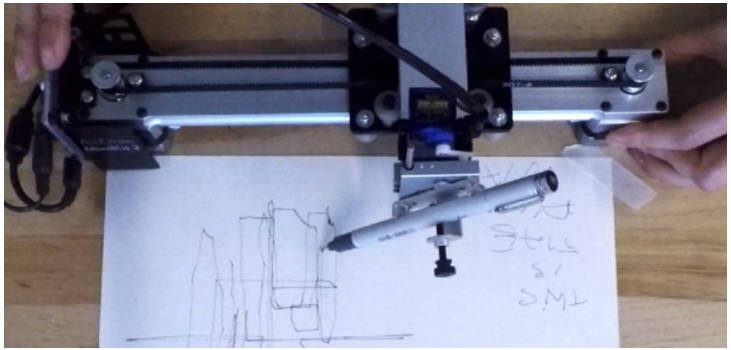
Assisting in creative tasks without getting in the way of the artist's workflow can be challenging. Since there is no "correct" answer in creative works for the machine to steer towards, the machine must gauge the "goodness" or "badness" of its actions by watching the user's response.

My system, 'Hero', can be used for eliciting and developing interactions around creative machines, particularly drawing machines. I am using this system in user studies and interviews with artists.

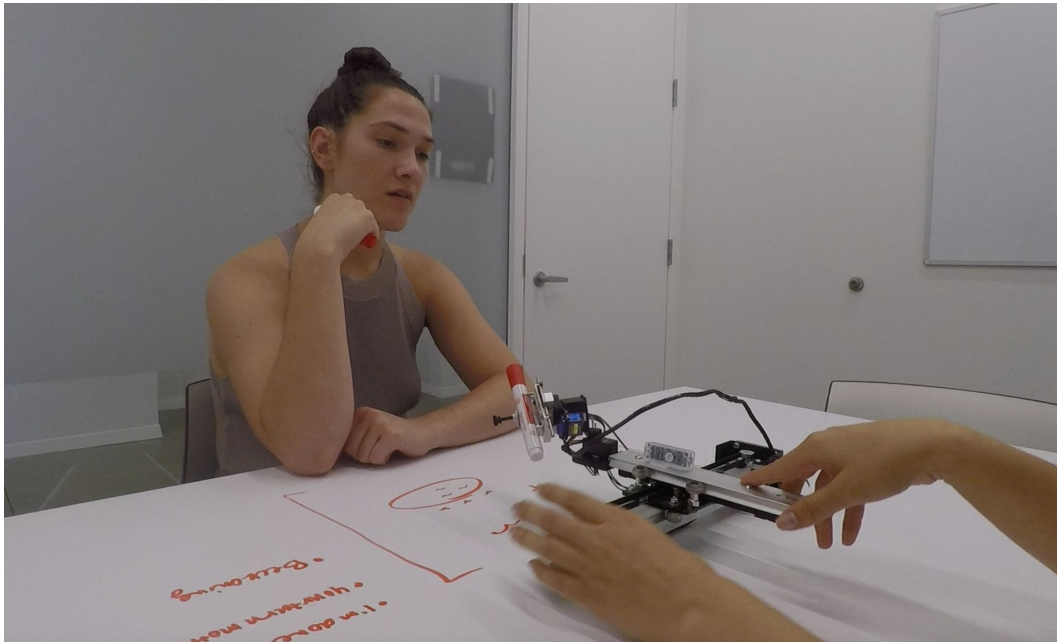


Alexandra Bremers, Wendy Ju. "Can Machines Tell What People Want? Bringing Situated Intelligence to Generative AI". In: *HTTF 2024: Proceedings of the Halfway to the Future Symposium*. 2024. d o i: https://doi.org/10.1145/3686169.3686172.

Machine Movement (2020-2024)

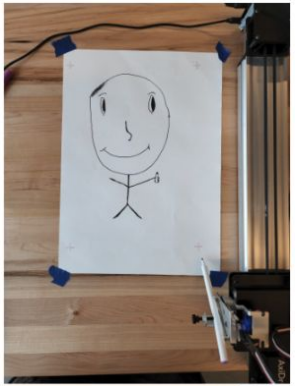


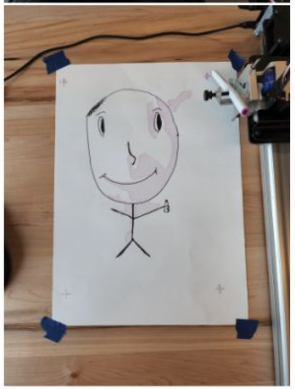
I also study the communicative properties of machines and how they facilitate communication. This work involves collaborations with comedians, dancers, and mechanical engineers, and has led to the development of a drawing robot with additional degrees of freedom, allowing it to wave and gesture at people.

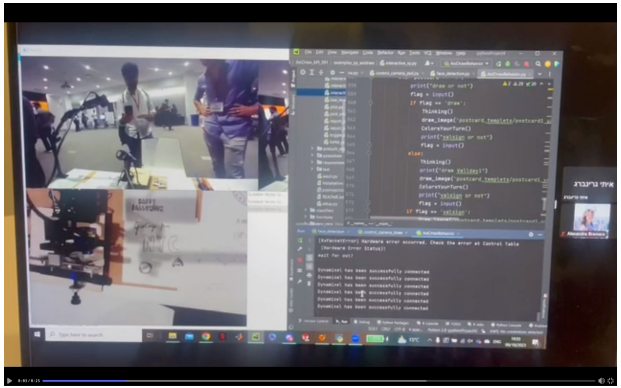


Itay Grinberg, Alexandra Bremers, Louisa Pancoast, Wendy Ju. “Implicit collaboration with a drawing machine through dance movements”. In: *ACM Symposium on Computational Fabrication*. 2023. d o i: https://doi.org/10.1145/3623263.3629150.

Wizarding Machines (2020-2024)

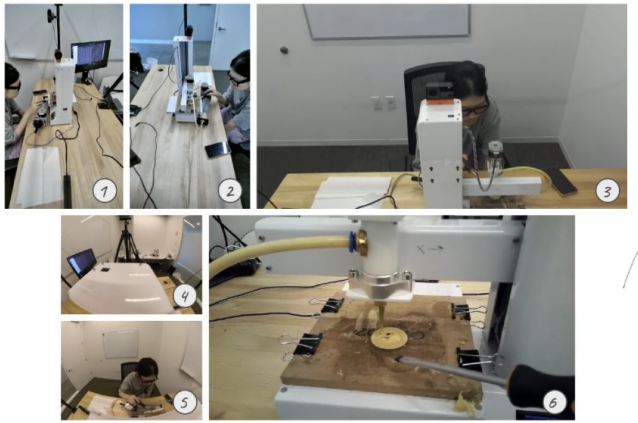


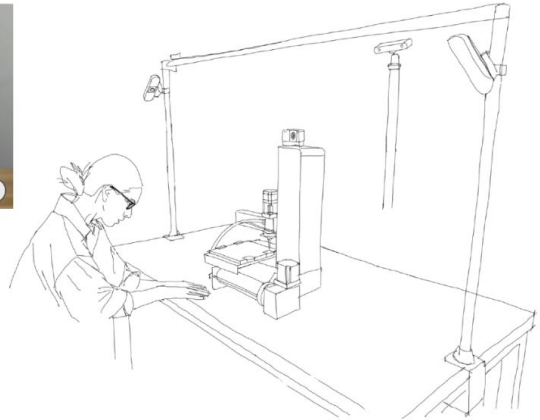


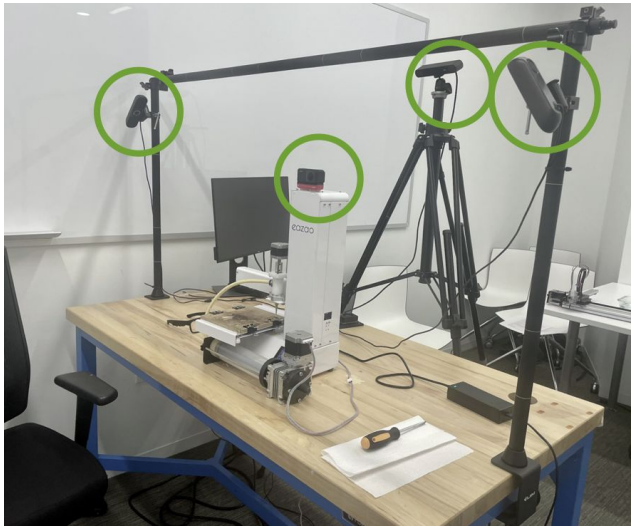


I built these interactions into Wizard-of-Oz systems with various degrees of autonomy, to test interactions with people.

Towards Designing Collaborative Creative Machines (2025)

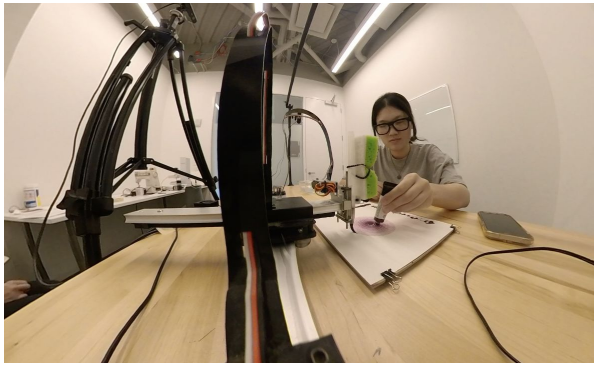






The machine needs to capture what is going on. But how should the machine be instrumented for creative human-machine collaboration?

This ongoing project explores this through three sub-questions: (1) What types of signals and situations need to be captured for interaction designers to understand human-machine interactions? (2) How well does multi-camera instrumentation enable designers to observe these signals and situations? (3) Which signals could future machines leverage to improve collaboration?



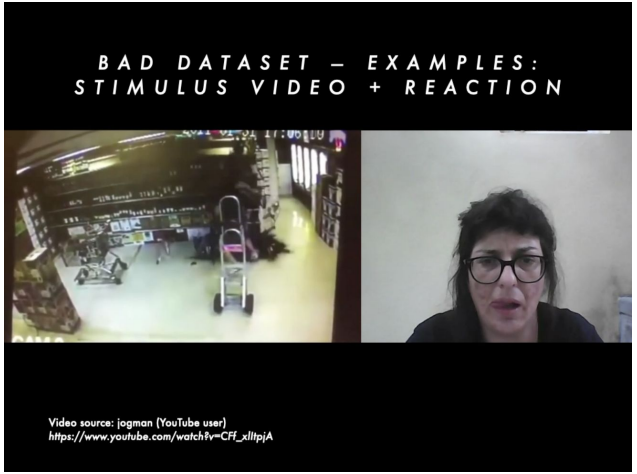
Human-Robot Interaction Research

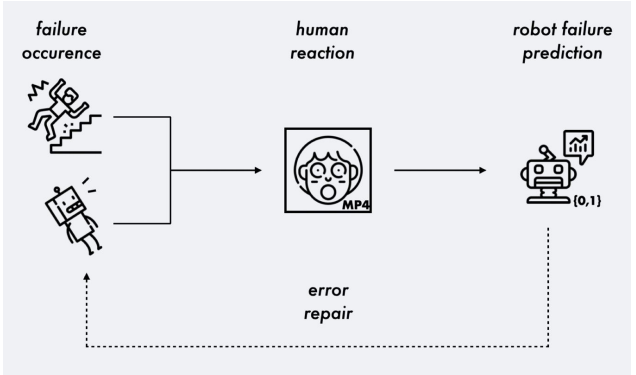
BAD Robots (2023)

The Bad Robots project investigated the potential of error recognition for robotic systems by looking at human facial expressions. The project consisted of 1) development of a framework, published on arXiv; 2) development of the Bystander Affect Detection dataset of human reactions to failures, and 3) the development of BADNet, a model trained to detect failures based on facial reactions.

The BAD Dataset was collected through Qualtrics using Prolific as a recruitment method, and the dataset is available through the Qualitative Data Repository (QDR).

The project led to a publication in IROS as well as a project website at https://irl.tech.cornell.edu/bad-dataset/





Alexandra Bremers, Maria Teresa Parreira, Xy Fang, Natalie Friedman, Adolfo Ramirez-Aristizabal, Alexandria Pabst, Mirjana Spasojevic, Mike Kuniavsky, Wendy Ju. “The Bystander Affect Detection (BAD) dataset for failure detection in HRI”. In: *2023 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. 2023. doi: https://doi.org/10.1109/IROS55552.2023.10342442.

Alexandra Bremers, Alexandria Pabst, Maria Teresa Parreira, Wendy Ju. “Using Social Cues to Recognize Task Failures for HRI: Overview, State-of-the-Art, and Future Directions”. 2023. d o i: https://doi.org/10.48550/arXiv.2301.11972.

BAD Robots (2023)

	PID	QID	Description	Task	Context
1	1001	Q160	Truck untied crashes into a car in the parking lot.	Agree	Disagree
2	1001	Q190	Man tries to climb over a railing with a motorcycle an…	Agree	Disagree
3	1001	Q214	Guy proposing to his girlfriend in a waterfall drops th…	Disagree	Somewhat agree
4	1001	Q220	Bus driver goes into a bush and in the end breaks a fi…	Disagree	Somewhat disagree
5	1001	Q238	Truck putting the boat in the water ends up falling wi…	Strongly disagree	Somewhat disagree
6	1001	Q256	Guy riding a motorcycle close to a pool makes it fall i…	Agree	Disagree
7	1001	Q268	Guy riding is motorcycle and breaking it.	Disagree	Disagree
8	1001	Q286	Guy doing football tricks with his cellphone close to t…	Agree	Somewhat disagree
9	1001	Q304	Guy using the drone to light up the fire fail and make…	Somewhat disagree	Neither agree or disagree
10	1001	Q322	Guy trying the motorcycle makes it run into the public.	Somewhat disagree	Disagree
11	1001	Q382	Truck full of shopping carts forgets to close it making…	Disagree	Disagree
12	1001	Q394	Worker doing the restock makes all the wine bottle fal…	Agree	Disagree
13	1001	Q418	Robot feeding a fake person starts bumping really har…	Disagree	Somewhat disagree
14	1001	Q436	Girl doing pole vault ends up bad.	Strongly disagree	Somewhat disagree
15	1001	Q466	Girl playing an umbrella.	Neither agree or disagree	Neither agree or disagree
16	1001	Q616	Kid inside a gift falls.	Disagree	Somewhat agree

Table 2. BADNet model performance summary

Grand performance summary of all BADNet models per each labeling strategy of the dataset. We report $M \pm SD$ across the 4 validation folds.

Models	Recall%	Precision%	F1%	Kappa%
Manual	95.26(±1.60)	95.74(±1.34)	95.31(±1.57)	89.92(±3.36)
FvC	95.02(±1.77)	95.12(±1.67)	95.00(±1.78)	89.95(±3.57)
FailT	89.88(±0.486)	90.03(±0.468)	89.88(±0.481)	79.77(±0.95)

The BAD Dataset for Failure Detection in HRI

Bremers, A., Parreira, M.T., Fang, X., Friedman, N., Ramirez-Aristizabal, A., Pabst, A., Spasojevic, M., Kuniavsky, M. and Ju, W., 2023. The Bystander Affect Detection (BAD) Dataset for Failure Detection in HRI. arXiv preprint arXiv:2303.04835.

Read our paper

Download a preview of the BAD Dataset

Request access to the full BAD Dataset

Hosted on GitHub Pages — Theme by orderedlist

A dataset of bystander facial reactions to human and robot failures.

We introduce the Bystander Affect Detection dataset – a dataset of videos of bystander reactions to videos of failures. This dataset includes 2452 human reactions to failure, collected in contexts that approximate "in-the-wild" data collection – including natural variances in webcam quality, lighting, and background.

Our video dataset may be requested for use in related research projects. As the dataset contains facial video data of our participants, access can be requested along with the presentation of a research protocol or data use agreement that protects participants.

This project is part of a collaborative research effort between Cornell Tech (PI: Associate Professor Wendy Ju) and Accenture Labs.

Read our paper here: link.

Request access to the BAD dataset here: link.

Automotive Interface Research

Discomfort in Cars (2021)

Unpleasant social interactions on the road can negatively affect driving safety.

We recorded nine families going on drives and performed interaction analysis on this data. We define three strategies to address social discomfort: contextual mediation, social mediation, and social support.

We discuss considerations for engineering and design, and explore the limitations of current large language models in addressing social discomfort on the road.

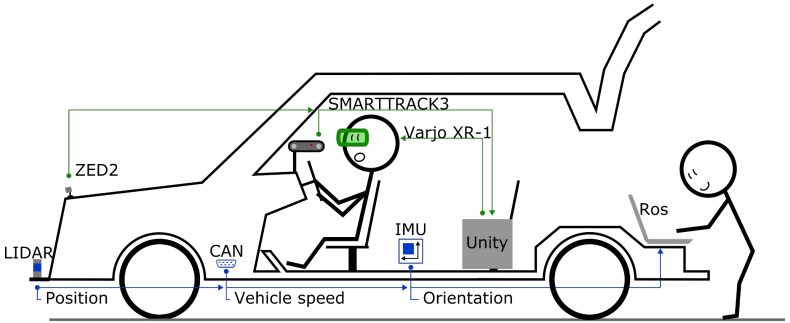
Alexandra Bremers, Natalie Friedman, Sam Lee, Tong Wu, Eric Laurier, Malte Jung, Jorge Ortiz, Wendy Ju. "(Social) Trouble on the Road: Understanding and Addressing Social Discomfort in Shared Car Trips". In: *CUI '24: Proceedings of the 6th International Conference on Conversational User Interfaces*. 2024. u r l: https://dl.acm.org/doi/10.1145/3640794.3665580.

XR-OOM: Mixed Reality On-Road (2021)

High-fidelity driving simulators can act as testbeds for designing in-vehicle interfaces or validating the safety of novel driver assistance features.

In this system paper, we develop and validate the safety of a mixed reality driving simulator system that enables us to superimpose virtual objects and events into the view of participants engaging in real-world driving in unmodified vehicles.

To this end, we have validated the mixed reality system for basic driver cockpit and low-speed driving tasks, comparing the use of the system with non-headset and with the headset driving conditions, to ensure that participants behave and perform similarly using this system as they would otherwise.



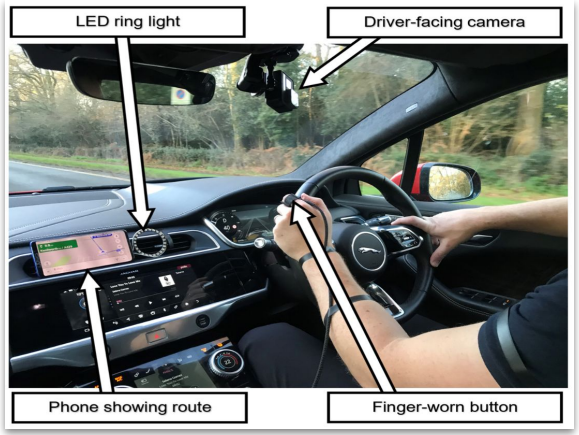
David Goedicke, Alexandra Bremers, Sam Lee, Fanjun Bu, Hiroshi Yasuda, Wendy Ju. "XR-OOM: MiXed Reality Driving Simulation With Real Cars". In: *Proceedings of the ACM International Conference on Human Computer Interaction (CHI)*. 2022. d o i: https://doi.org/10.1145/3491102.3517704.

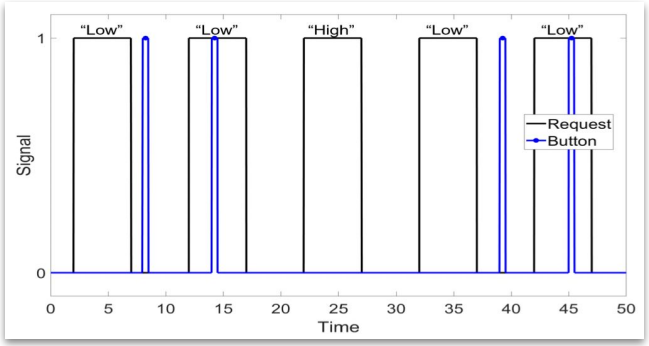
Workload (2019-2020)

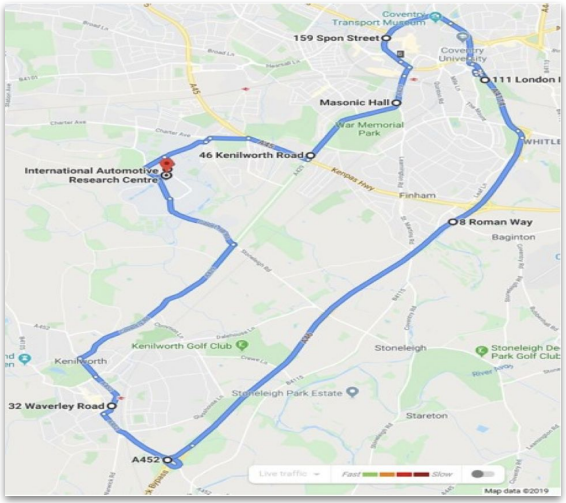
During my time at Jaguar Land Rover, I was tasked to design an experiment to determine the right time to interrupt drivers with non-critical audio information on the road.

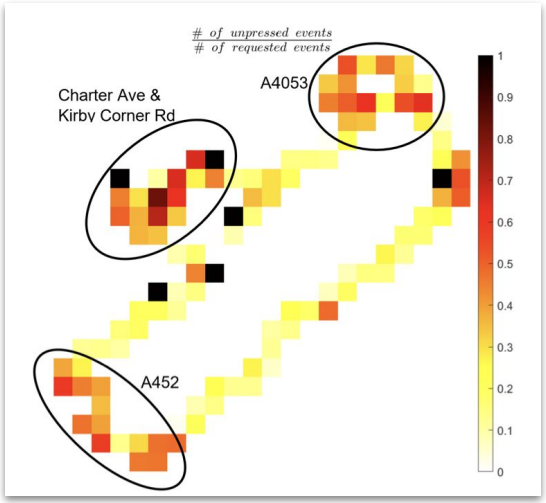
I used a modified peripheral detection task to gather a fine-grained dataset of moments of subjective high or low cognitive workload.

Together with University of Cambridge, a model was developed to predict these moments of low workload based on vehicular signals such as driving speed and steering wheel data. The results were published.



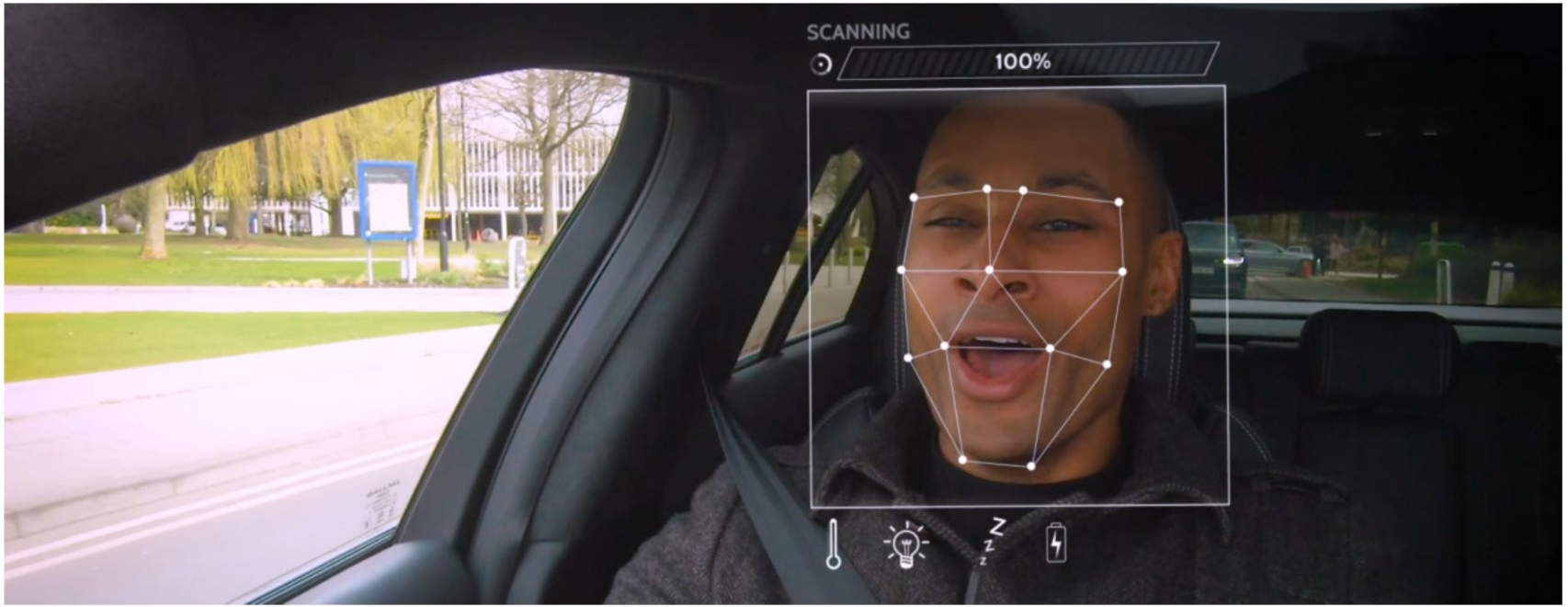






Nermin Caber, Jiaming Liang, Bashar I. Ahmad, Simon Godsill, Alexandra Bremers, Philip Thomas, David Oxtoby, Lee Skrypchuk. "Driver Profiling and Bayesian Workload Estimation for Adaptive In-Vehicle HMI". In: *IEEE Transactions on Intelligent Vehicles*. 2023. d o i: https://doi.org/10.1109/TIV.2023.3313419.

The Car That Responds to Your Mood (2020)



“Jaguar Land Rover is researching new artificial intelligence (AI) technology to understand our state of mind while driving – and adjust cabin settings to improve driver wellbeing.”

Source: https://www.jaguarlandrover.com/news/2019/07/car-responds-your-mood-new-jaguar-land-rover-tech-helps-reduce-stress

3D AR HUD Displays (2018)

I conducted two perception experiments to understand depth perception around the perspective cue, in a Head-Up Display, to inform engineering and design.

This work was part of my master's thesis. The project was done in collaboration with Jaguar Land Rover and the University of Cambridge.

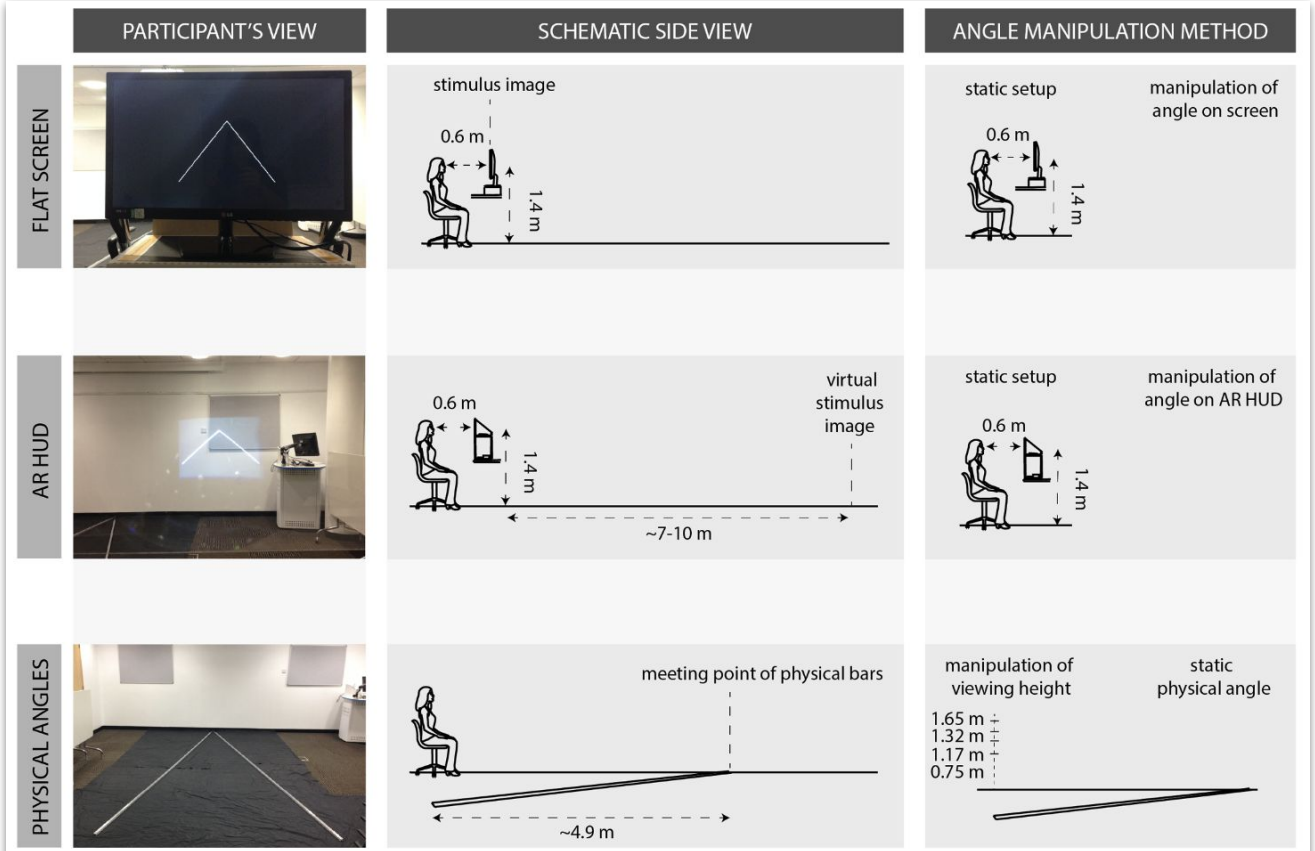


Fig. 1. Overview of the experimental setups: image of the angle (left), schematic side view (middle) and angle manipulation method (right). Slight deformations in the photographs were caused by camera characteristics.

Alexandra W.D. Bremers, Ali Özgür Yöntem, Kun Li, Daping Chu, Valerian Meijering, Christian P. Janssen. "Perception of Perspective in Augmented Reality Head-Up Displays". In: *International Journal of Human-Computer Studies* (2021), p. 102693. i s s n: 1071-5819. d o i: https://doi.org/10.1016/j.ijhcs.2021.102693.

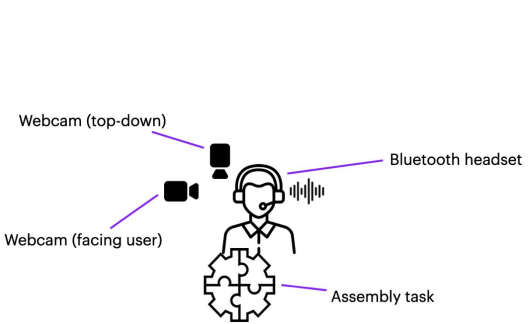
Human-Computer Interaction Research

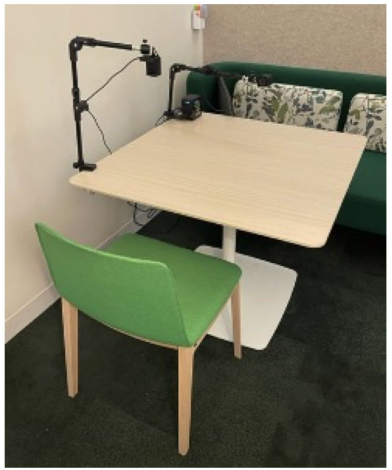
Audio Task Guidance (2023)

Conversational user interfaces have a potential in helping people with guidance during physical tasks.

To investigate the potential for various forms of feedback, I worked with Accenture Labs to conduct a Wizard-of-Oz system that investigated different audio cues as feedback for performing various assembly tasks.

The results were published at CUI 2024 and fed into further research at Accenture Labs.





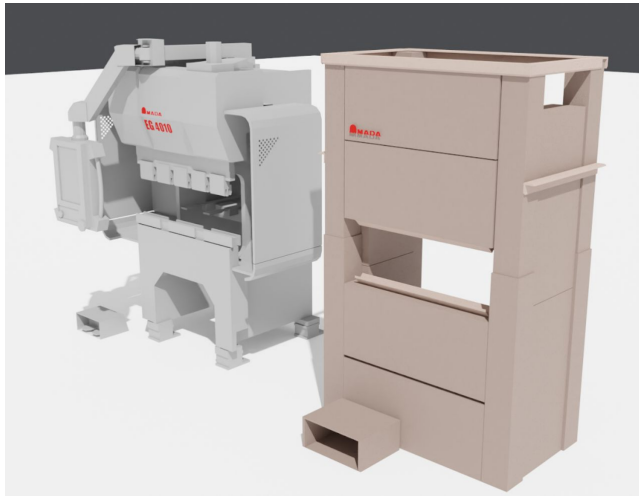
Bremers, A. W., Saha, M., & Ramirez-Aristizabal, A. G. (2024, July). Situated Conversational Agents for Task Guidance: A Preliminary User Study. In *Proceedings of the 6th ACM Conference on Conversational User Interfaces* (pp. 1-7).

Designing for Industrial Machines (2021)

Large industrial manufacturing machines can be challenging to study and prototype. For instance, some machines, like sheet metal press brakes, are large and require reinforced floors to support the weight of the machine.

In order to understand the interactions with these machines and design for them, I collaborated with another PhD student to build a cardboard version of a sheet metal press brake and use it in user studies to observe task confusion during metal bending tasks.

As such, we were able to study complex interactions using low-cost and quick prototyping methods.



Street Fashion (2021)

Developments in autonomous driving and other technologies have led to the increased availability of large scale street-level image datasets. These datasets, in turn, have been used in social science studies to understand human behavior at scale.

In this project, I explored the potential of these datasets to give designers an idea of how trends move over spaces and time. As part of this work, I developed a KNN clustering-based method to detect the most prominent colors in clothing worn by people on the street.

At the moment, my collaborators and I are refining the color detection method and implementing privacy-protection measures.

The examples of the right feature imagery from the Mapillary Vistas dataset. This work was made possible in part by Toyota Research Institute.

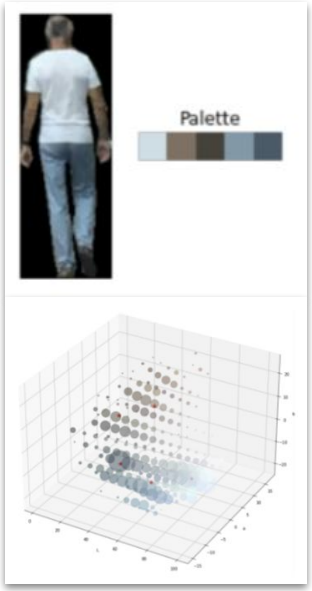
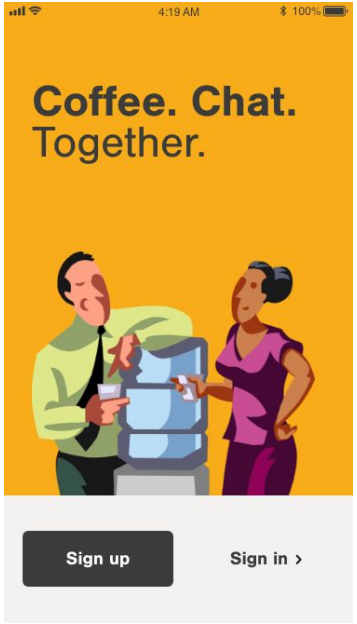


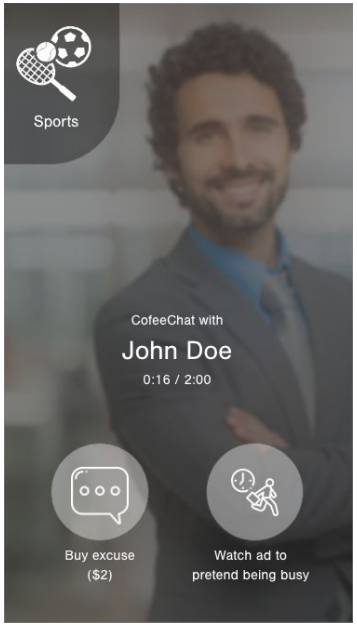
Fig. 1. Image segments of people in the global Mapillary Vistas Dataset, along with the palette colors derived from applying k-means.

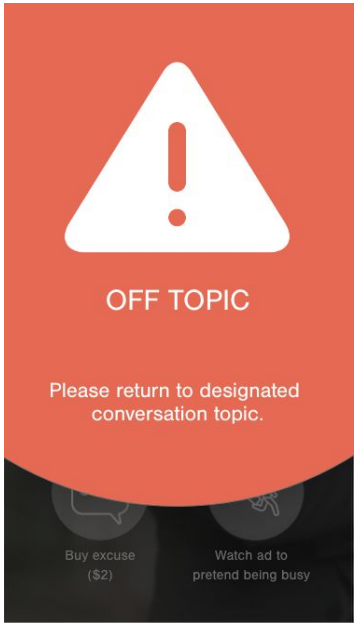
Manuscript is currently being revised.

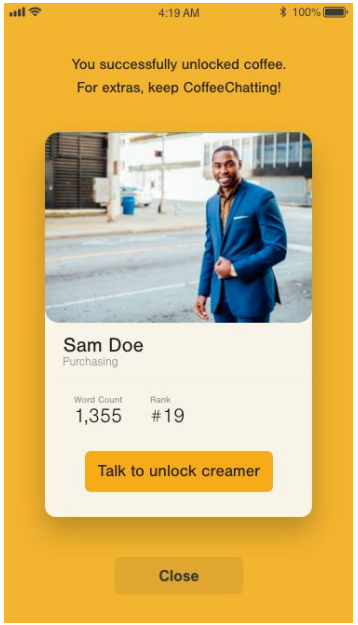
Digital User Interface Design

CoffeeChat (2020)









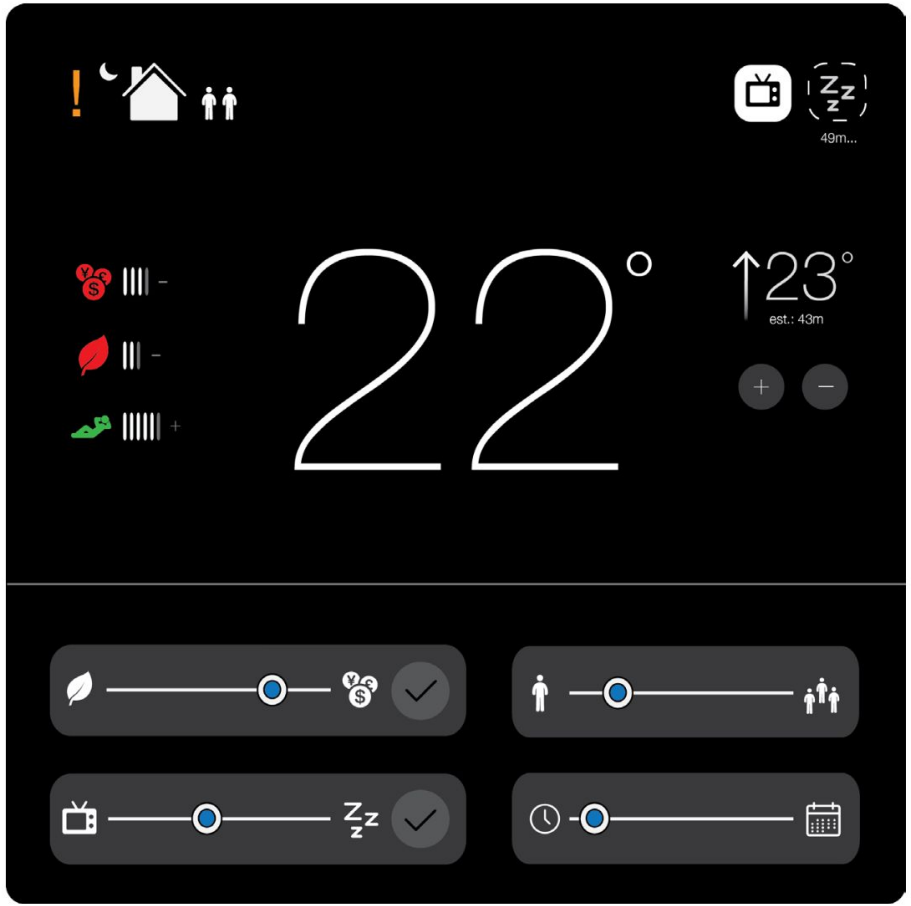
Design can also be used as food for thought.

CoffeeChat is a design for a fictional app that brings the office watercooler talk to your home setup. You cannot get coffee without discussing sports with John. The design questions the role of computer-mediated communication and the proliferation of apps that claim to bring people together.

(Super) Smart Home UI (2017)

A graphical user interface was designed to include additional preference controls and information regarding system status of a complex smart home system. The design process gave insights to the technical side of the system, and the design served as a design probe during semi-structured qualitative interviews, which were used to inform engineering decisions.

This project was done during an internship at the NTU IoX Center in Taipei, summer 2017.



Physical Product/Experience Design

Embroidered Radio Receivers (2016)

I developed AM crystal radio receivers based on machine-embroidered coils. When a person covers the receiving coil with one hand and the antenna (also being an embroidered coil) of a transmitter with the other, they could listen to music.

The coils were created based on a Processing program that generated a .pdf file based on a specified number of windings and diameter of the coil, which was then converted into .dst and embroidered with a digital embroidery machine and multi-kernel isolated copper thread.

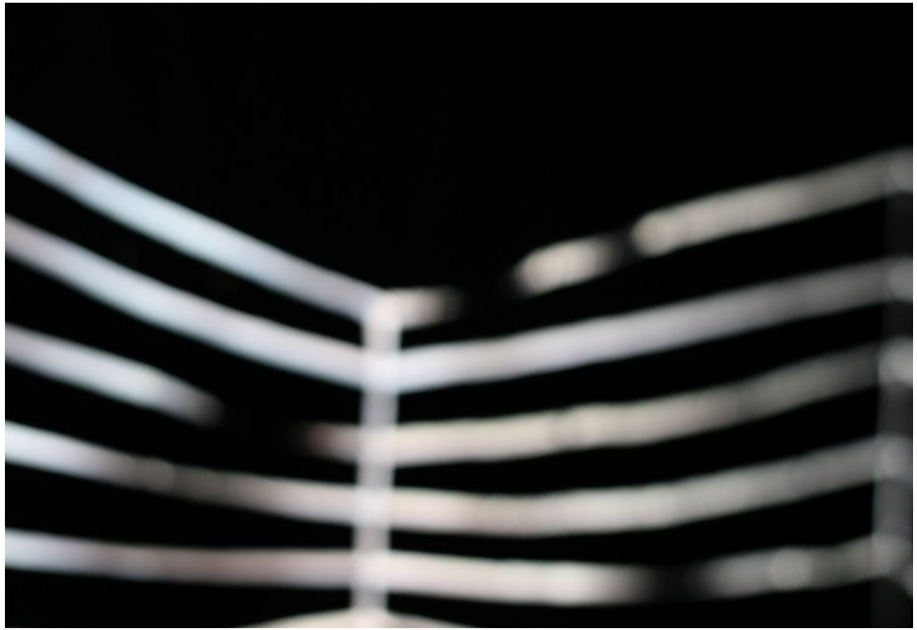
This was my B.Sc. graduation project at Industrial Design TU/e, Wearable Senses lab.

Chiaroscuro (2015)

During my Industrial Design degree, I spent time investigating unique experiences that are possible with light.

This light installation, based on retro-reflectivity, consisted of a dark room that would be experienced in groups. One person would wear LED-implemented eyeglasses, which would enable them to see the art covering the walls.

As such, light becomes a private experience in a shared space.



Speculative Design: Meat the Future (2015)

I spent 5 months as an intern at Next Nature Network in the fall semester of 2015.

I was responsible for the finalization of the Bistro In Vitro Ice Cart project, exhibited at the Dutch Design Week. This project served to promote the Meat The Future project, which featured a fictional cookbook with recipes that questioned the possibilities of cooking with lab-grown meat.

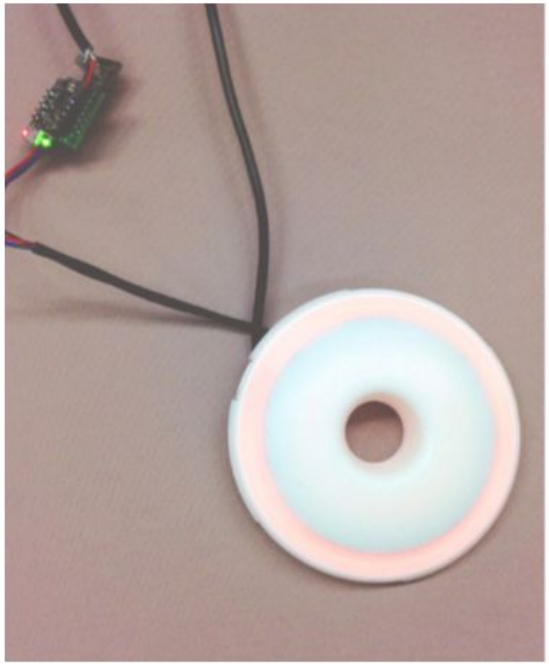
For this project I developed graphical artefacts, such as booklets, an interactive presentation, and flyers. In addition, I was responsible for operating and running the Bistro in Vitro Ice Cart during Dutch Design Week 2015.

Speculative Design: Energy Belt (2015)

The second project I delivered for Next Nature Network was a prototype for the Nano Supermarket exhibition. The prototype embodied the story of a hypothetical belt which could be used to charge your phone on belly fat.

I developed the concept for a color-changing LED ring that could be remote-controlled for demonstration purposes. The program was developed in C++, and the central part was an Adafruit Neopixel ring.

The prototype that we delivered was battery-powered. I designed this together with another intern, who focused on the 3D model and fabric belt.



Fast, Intense, and Repulsive (2015)

This project was part of a course on the expression of aesthetic qualities through visuals and materials. At first, we made a collage around the words ‘fast’, ‘intense’ and ‘repulsive’, based on magazine images and Photoshop.

Starting from the collage, the assignment was to develop a set of objects in which the aesthetic qualities from the collage where expressed. The final objects were made from clay that was polished with a spray painted finish (top right), wood (middle right) and carved potato with alpaca wool (bottom right).

The project was done with a partner during the second year of my B.Sc. in Industrial Design, TU/e.

Making & Prototyping

TA: Interactive Device Design (2021-2025)

During my time at Cornell Tech I have been a teaching assistant for three classes on interactive device design.

These classes (with Wendy Ju and Joey Castillo) involved teaching 50-90 students how to use Raspberry Pi, rapid prototyping, design sketching, video, and prototyping electronics, to design and build their own interactive devices.

The figure on the right illustrates some of the contents of this class: sketching interactions and prototyping interactions using simple electronics.

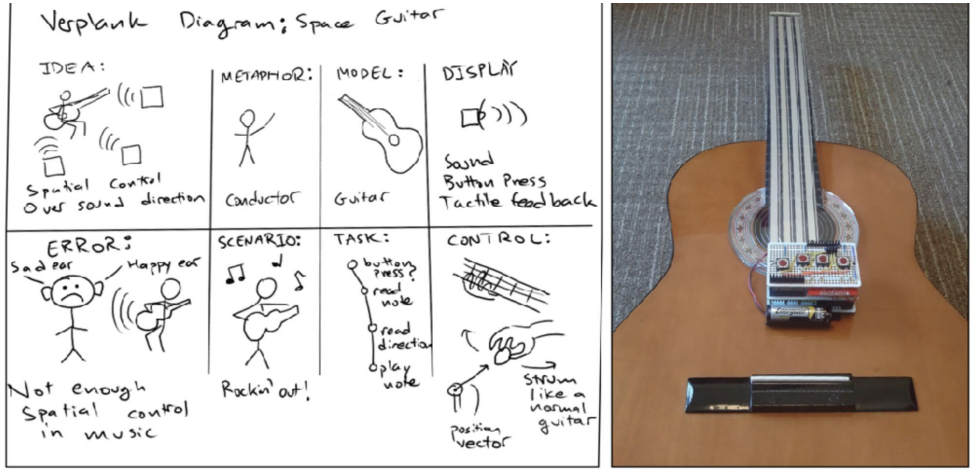


Figure 4: On the left is a Verplank Interaction Diagram, a framework for assessing different key aspects of a design.[13] On the right is the final project, a digital guitar with linear soft membrane potentiometers, to address the spatial sound control issues that the student had identified.

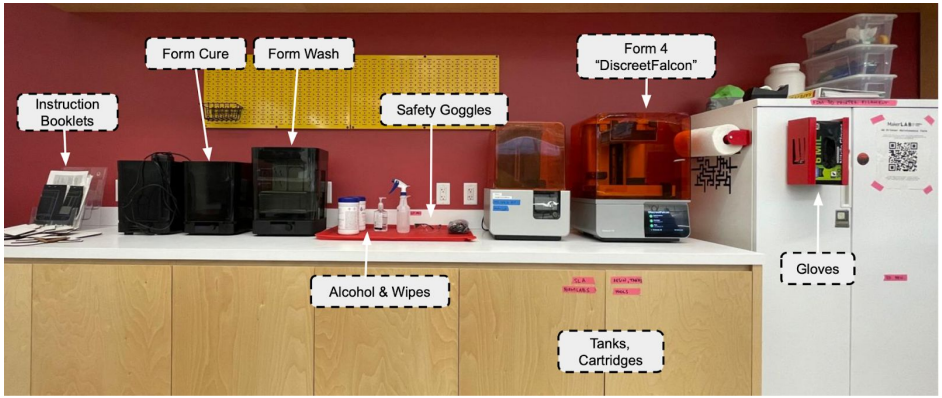
David Sirkin, Wendy Ju. Press Play: A Course in Interactive Device Design. Proceedings of 2014 American Society for Engineering Education Annual Conference. Indianapolis, IN. June 15-18, 2014.

MakerLab @ Cornell Tech (2025)

I am also spending time each week as a Supermaker at the Cornell Tech MakerLab, where I volunteer to operate the lab, as well as help students with projects that they want to make.

At the moment, I am working on a project to document the process from beginning to end, of using a Form 4 resin printer to design and print highly detailed prototypes of custom jewelry.

On the right, I included an image from the documentation I have been developing, as well as test print images of a ring based on an existing model.



Media Computation

Computation for Content Creation (2025)

As part of my PhD minor in Computer Science (advised by Steve Marschner), I am learning more about computer graphics and computer vision.

Right now, I am taking Cornell CS6682 Computation for Content Creation with Abe Davis, which has been a great way to learn more about the technical methods behind manipulating audiovisual media using computation.

On the right you see an example of an introductory assignment where I dynamically mapped images of flowers to a video of my face using MediaPipe face tracking and an affine image transformation using Python.

The assignment was inspired by Giuseppe Arcimboldo's art!

Smaller Design Explorations

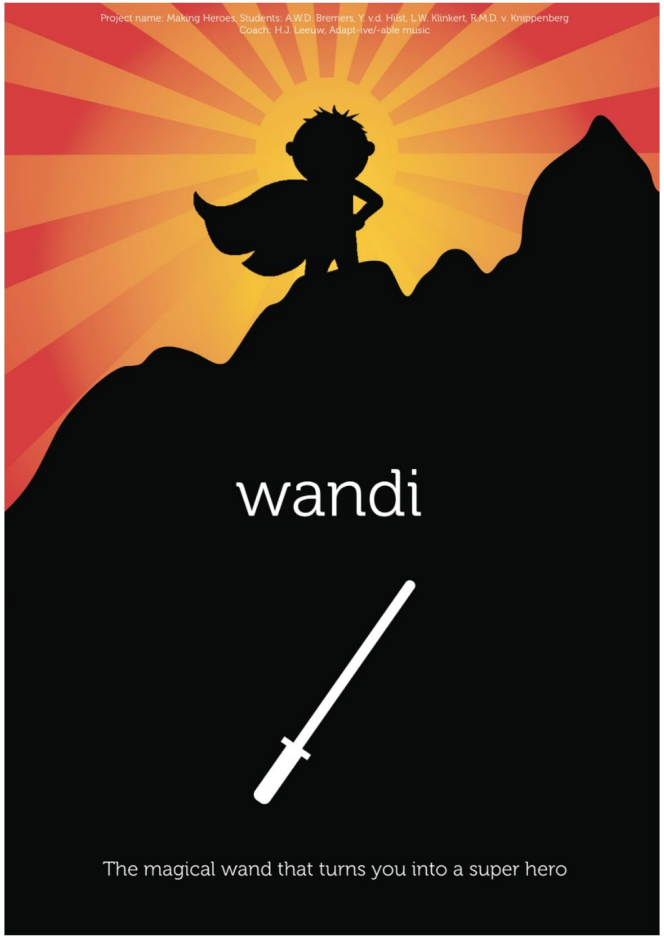
Wandi & Kepi (2014)

The aim of this project was to design a musical object for children with disabilities.

From user studies with a patient with Smith-Magenis Syndrome, we learned that among other symptoms, a lot of times these patients suffer from low self-esteem since they realize that they can do less than their peers. Also, these patients seemed to prefer playing with toys that had sound effects.

We developed the concepts of Kepi and Wandi, a superhero cape and a wand that would accompany movements made by the patient with superhero sound-effects. A technical prototype was made using Teensy, XBees, gyro/acc. sensors and MaxMSP.

This was a team project in my first year of my B.Sc. in Industrial Design, TU/e.



A Post-Modern Entrance (2013)

As a part of a course on design history, during my B.Sc. in Industrial Design at TU/e, we were assigned to design a new (concept) entrance for the Groninger Museum, based on the ideas of postmodernism.

I started with the idea to use cacti, not only because it would evoke strangeness when placed in front of a museum in Groningen. A cactus is a sturdy plant that survives in difficult climates, that looks dangerous but is crucial since it reveals to man where water is. I found this an interesting metaphor for the role of art in society.

Two cacti could easily serve as pillars for a temple entrance. I added a triangle to resemble the Greek tympanon, as well as two contrasting circle halves to create a more balanced whole.

The result looks comical and ironic, but given that the assignment was on postmodernism, that was more or less the goal.

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