TOM SCHERLIS | PORTFOLIO

Engineering, Art & Speculative Design, Photo

Portfolio > Background

I am a student at Carnegie Mellon University, majoring in **Electrical and Computer Engineering** with interests in **Robotics** and **Art.**

My projects combine **art and technology** with a focus on **motion**, **interaction**, **nature**, and **sociology**. My engineering work focuses on **robotic systems software** and **planning/controls**. I have a passion for bringing objects to life through motion design and robotics.

In my free time I enjoy **photography**, **music**, **surfing/skiing**, and **creating weird things**.

Portfolio > Info

Education

Carnegie Mellon University
B.S. Electrical and Computer Engineering
Graduating **May 2022**

Links

Personal	www.tomscherlis.com
Instagram	@tomscherlis
Github	toms42
Linkedin	Tom Scherlis
Email	tomscherlis@gmail.com

Portfolio > Skills

Programming	Python, C, C++, React-js, matlab
Concepts	Control Systems (PID, LQR, MPC), Trajectory Planning, Embedded Systems, Networks, Simulation, Mechatronics, UI Design,
Tools	ROS, Qt, FreeRTOS, Altium, Solidworks, Linux/Unix, Git, SVN, Agile, Docker, React, Adobe Suite, Figma
Hardware	PCB Design/Layout, 32-bit microcontrollers (TI, Atmel), FPGA, ODrive, Px4, Jetson, Raspi

PROJECTS

Projects > Spotlight

Spotlight is an installation that explores the relationship between humans and their environment by means of a robot observer. The project explores personification of robotics through animated behavior.

The centerpiece is a mechanical **Lamp**, which observes a set of robotic **Creatures** in its **garden**. Visitors may walk calmly through the scene, but being too aggressive disturbs the Lamp causing it to shine oppressively on the intruder.

Spotlight explores the **intrusive role** we often play in our environments, as well as the **powerlessness** of that environment to respond. The Lamp shines a light on its disturbers, but it is ultimately up to them to decide how to respond.

Technical: I was **behavior lead** on Spotlight, and implemented the electronics and software for **tracking**, **actuation and motion control**, and **behaviors** of the robot. Spotlight was created with mechanical engineering by Ben Stern, industrial design by Samantha Ho, and garden work by Avi Rudich, Abel Tesfaye, and Elton Spektor.

Spotlight was controlled using **ROS**, and uses a **motion capture system** installed in the room to track visitors and determine orientation feedback.

Portfolio: http://tomscherlis.com/otw-portfolio/spotlight/
Video: https://youtu.be/nVBmhCVrOWo

Projects > are you ok?

are you ok? is a satirical implementation of a mental health support kiosk. The inspiration for this project came from the feelings of frustration and alienation that come from dismissive, canned responses to serious mental health issues.

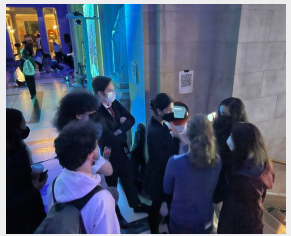
The kiosk idly displays **“are you ok?”** - answering **yes** will terminate the session, but answering **no** will kick off a series of increasingly more patronizing prompts.

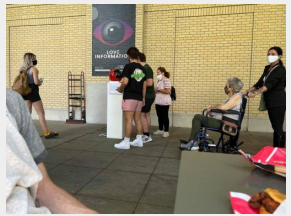
The kiosk was installed around the Carnegie Mellon campus in Fall 2021 with a satirical description attached.

Technical: This was a solo project and made use of a vintage **CRT television**, RF **modulator** electronics, and a **raspberry pi** running Processing and text-to-speech. Software could be deployed over wifi to the kiosk to update the prompts remotely.

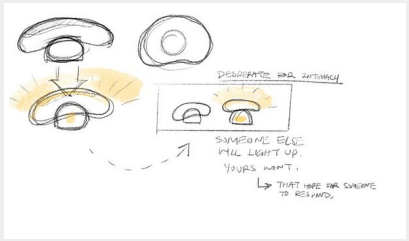
Portfolio: http://tomscherlis.com/otw-portfolio/are-you-okay/
Video: https://youtu.be/UzucSPzP1Rs

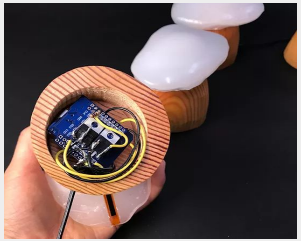
The kiosk on campus





Projects > Nexum Lights





Nexum Lights are anonymous and non-performative remote intimacy devices. When you press your nexum, another glows.

In a world where we constantly seeking interaction and validation, we are ironically less intimate with more people we try to connect with. **Our actions become less meaningful and more performative.** With Nexum, you are compelled to see intimacy with a new lens. Send a pulse into the network, know that the pulse will reach someone else, and shared a warm moment. This removes the performative agenda of connection and simplifies the way that we identify as members of a larger group.

Nexum Lights are styled in the form of mushrooms, and are inspired by the electrical pulses that travel through vast **mycelial networks**. They can be part of a **global** network, or a **local** group with friends.

Technical: This project was done in 2 weeks with Patricia Yu, Sam Zeloof, and Juhi Danesha. I took on **woodworking**, **network software**, and **behavior** implementation for the mushrooms and server.

Portfolio: http://tomscherlis.com/otw-portfolio/nexum-light/

Projects > Pipe Dreams / Wormholes

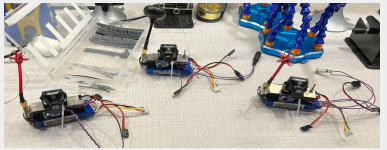
Pipe Dreams uses audio/video transmitters embedded into organic ductwork forms to provide glimpses of spatially disconnected locations in the Carnegie Mellon College of Fine Arts building.

Pipe Dreams was shown as part of a larger exhibition of sculpture, projection, and musical performances. These wormholes introduce a sense of curiosity and exploration into the building and create a place of refuge to view other performances from the show in a quiet, intimate environment.

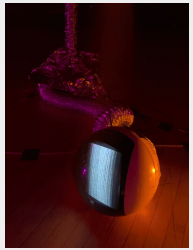
Technical: This project was done in 3 weeks with Kirman Hansen. We used video transmitters designed for FPV Drone Racing along with wired microphones and speakers. FPV goggle displays and a CRT television were used as video displays.

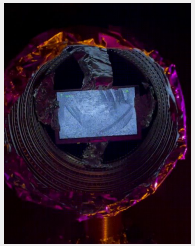
Portfolio: https://tomscherlis.com/otw-portfolio/pipe-dreams-wormholes/
Video: https://youtu.be/P-Xa6cjA9zg

Probe and Video Capture

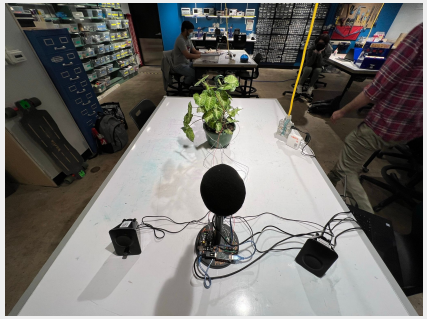


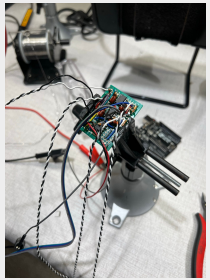
Video Displays





Projects > Thoughts of a Plant



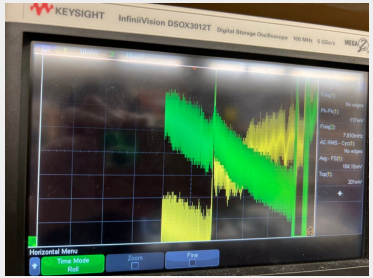


Thoughts of a Plant explores the **slowness** and **passivity** of plant life by transducing **plant biosignals** into an evolving **ethereal soundscape**. A microphone wired into the plant allows visitors to speak into the system, transducing their own thoughts through the plant.

When left alone, the soundscape evolves slowly over time as the plant biosignals drift over the course of minutes and hours. When the visitor engages with the plant, the sounds wildly change with the detected speech.

Technical: This was a solo project. I created a custom amplifier board to read the plant biosignals and used Max4Live with Ableton for sound synthesis.

Portfolio: https://tomscherlis.com/otw-portfolio/thoughts-of-a-plant/



Projects > Hagrid’s Wild Ride

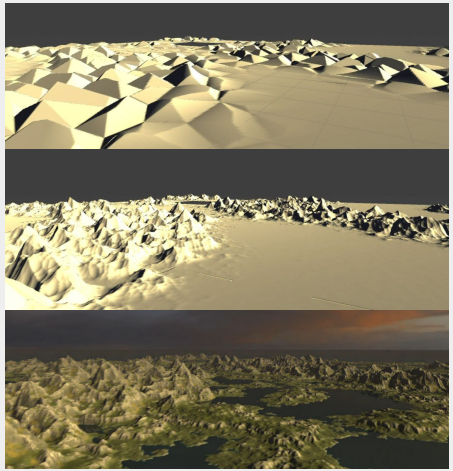
Hagrid’s Wild Ride was a haptic Virtual Reality flight simulator with a Harry Potter Quidditch theme. We designed a novel spring-based haptic rig that does not rely on expensive actuators to create a realistic and immersive flight experience.

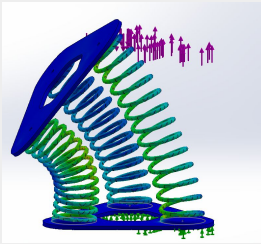
Hagrid’s Wild Ride uses a tilt sensor embedded in the spring platform to feed the user’s tilt inputs into Unity. The flight simulator maps the user’s tilt to angular rates, creating an intuitive control scheme.

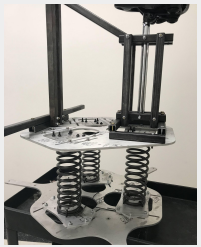
Technical: This was a one-week hackathon project. Advaith Sethuraman created the embedded tilt sensor, and Alvin Shek did character rigging and animation.

My responsibilities included:
- Mechanical design and fabrication
- Procedural Terrain Generation using MapMagic
- Game Creation in Unity, including flight simulator mechanics and basic enemy AIs.

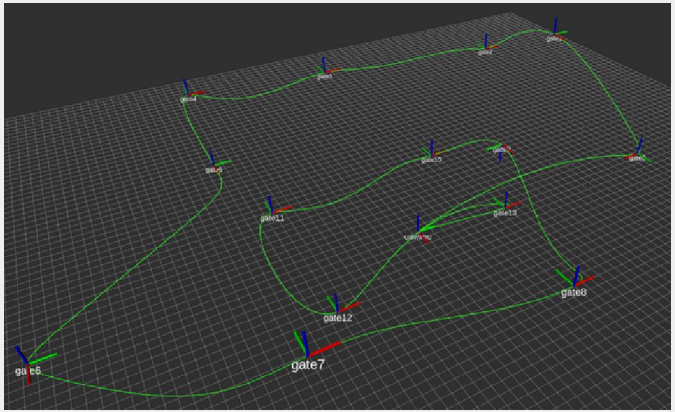
Portfolio: https://tomscherlis.com/otw-portfolio/quidditch/

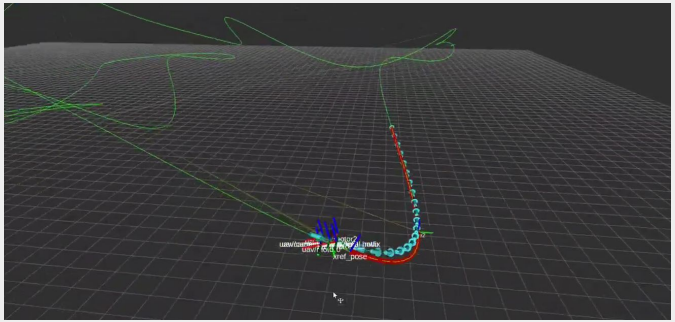






Projects > Autonomous Drone Racing





MPC Drone Racing was a research project for CMU's Adaptive Controls and Reinforcement Learning (16-899C) course. I worked with Alvin Shek to implement a model predictive controller (MPC) and trajectory planner for simulated drone racing.

We ran the system at up to 50Hz using a warm-started Quadratic Program (QP) solver and a custom linear MPC solver. 50Hz PID control and a 1kHz PD angular rates controller were used for orientation control.

Trajectory planning was done using minimum-snap spline optimization with a null-space constraint for gate orientation constraints.

Details: My responsibilities included developing the MPC controller and trajectory planner. Alvin Shek implemented a Linear Quadratic Regulator (LQR) controller and the PID attitude controls.

Portfolio: https://tomscherlis.com/otw-portfolio/mpcdrone/
Video: https://www.youtube.com/watch?v=uN9TzCkSSKk
Paper: http://tomscherlis.com/wp-content/uploads/2020/05/drone_control_16899_final_report.pdf

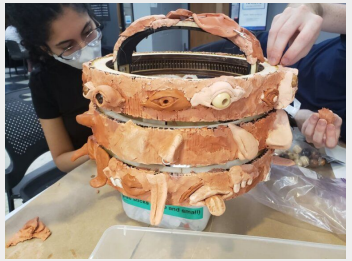
Projects > How to Create a Human: De-Abstracting the Flesh

How to Create a Human is a speculative headpiece exploring the abstract nature of the human face. When we look at each other, we make immediate judgements of emotions, familiarity, intent, beauty, and even personality based purely on how we **see** and **interpret** faces. These **first impressions** lead to significant **social consequences** informed only by facial structure.

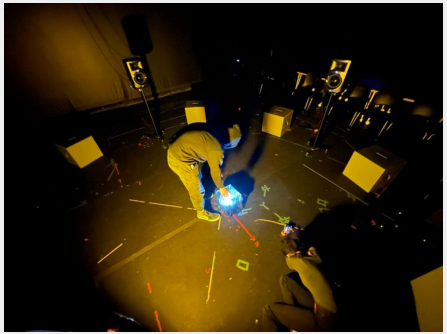
The headpiece lets us see the face as an object, so that we bypass these perceptions and understand the flesh as a **medium for self-expression**. The wearer of the headpiece can turn three wheels of body parts - eyes, noses, mouths - to **transform** their physical appearance and adopt various **personas**, taking ownership of the first impressions they create.

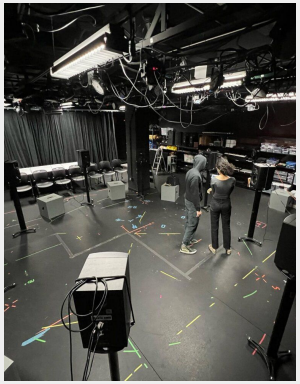
Details: This 2-week project was done with Patricia Yu, Juhi Dhanesha, and Sam Zeloof. I researched the psychology of first impressions, designed and built the laser-cut plywood frame, and participated in sculpting.

Portfolio: https://tomscherlis.com/otw-portfolio/how-to-create-human/



Projects > You are Invited to Listen





You are Invited to Listen is an experimental sound installation combining spatial audio with motion capture. The installation promotes **focused listening** through the use of a spatial soundscape played from 8 loudspeakers arranged in a circle.

The experience takes around 5 minutes, and involves an evolving soundscape played over the 8 speakers. As you approach a speaker, the sound will “come into focus” and the other speakers will become silent. We call this combination of spatial audio with user tracking “hyperspatial audio.”

Technical: This was a 2 week project with Sam Zeloof, Patricia Yu, Eli Wirth-Apley, and Juhi Dhanesha. I created the spatial audio mixing patch using Max MSP and created a python script to stream motion capture data into Max.

Portfolio: https://tomscherlis.com/otw-portfolio/you-are-invited-to-listen/

Experience

Experience > Zipline

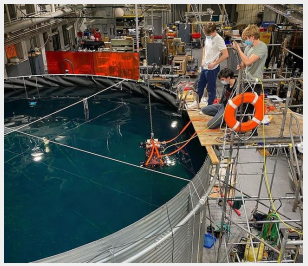
Zipline International Robotics Systems Engineering Intern

August 2020 - August 2021 >> https://flyzipline.com <<

Zipline is the world's largest operational drone delivery network, delivering blood transfusions, Covid-19 vaccines, and other medical products around the world.

- I **led software engineering** on the **prototyping R&D** team for a novel multi-vehicle delivery system (not shown). The prototype was successfully used as a proof of concept and as a testbench for actuator configurations, control algorithms, and aerodynamic properties.
- Created software using ROS/Python/C++/px4 for multi-vehicle communications, guidance/control, mission management, health monitoring, time synchronization, operator dashboard (React-js), and RTK GPS.
- Implemented **multi-vehicle motion control** and guidance software for synchronized, dynamically coupled drone flight.
- Helped run a **hiring** pipeline and **onboarded** 2 employees on prototype software.

Experience > Carnegie Mellon Submarine Team

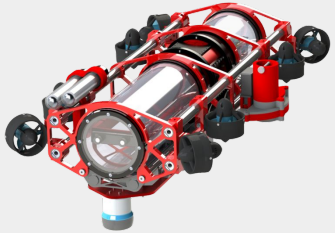


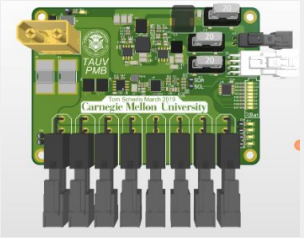
CMU Submarine Team Co-Founder & President, Mentor

October 2018 - Present >> *https://tartanauv.com* <<

Tartan AUV is Carnegie Mellon University's autonomous submarine team. We build an Autonomous Underwater Vehicle (AUV) to compete annually in the international RoboSub competition.

- Led and maintained software stack developed with ROS and Gazebo for python and C++, including guidance, navigation, controls, and perception.
- Implemented model predictive control, submarine dynamics models, networked communications software, and drivers.
- Led design of electronics and sensor system, including an NVIDIA Xavier, Doppler Velocity Log, inertial measurement unit, cameras, and sonar.
- Raised and manage $40k team budget for 2020 - placed fifth overall.

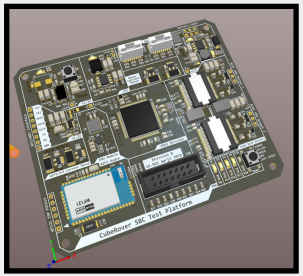


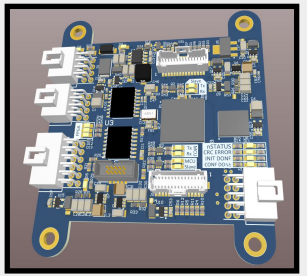


Experience > Carnegie Mellon CubeRover

CMU Lunar Rover Firmware, Electronics, Operator Interface

Spring/Summer 2018 >> https://irislunarrover.space <<





CubeRover is Carnegie Mellon's low-mass, low-cost research lunar rover. I did a mix of real-time firmware, electronics, and interface design for a prototype rover designed to test electronics and mobility. Currently, the newest iteration of the rover "Iris" is planned to launch in 2022.

- Developed a safe, event-driven embedded flight-software system for a NASA-funded lunar rover using C and FreeRTOS.
- Led development of a custom operator interface GUI using C++ and Qt for remote command and telemetry.
- Designed two printed circuit boards. One 8-layer board with an Intel FPGA and camera interfaces, and one 4-layer board with an MCU, motor drivers, and wifi.
- The rover is an ultra-small, low-cost platform designed with automotive electronics for commercial lunar missions.

Photography

Photography > Wildlife

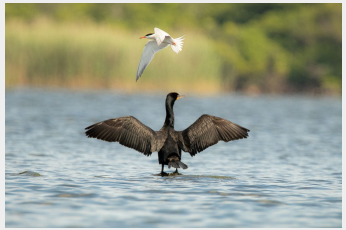




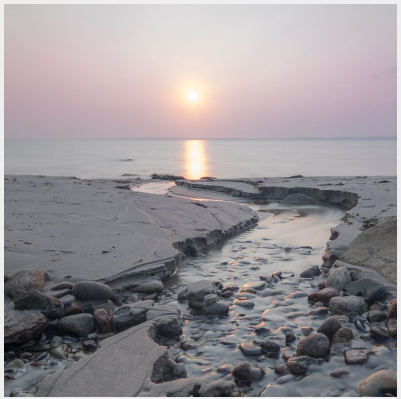







Photography > Landscape



Photography > Astro