D. Pillis Portfolio 2013-2020

Ivan Sutherland's Trojan Cockroach

The exhibit, **Ivan Sutherland's Trojan Cockroach**, a multimedia spatial narrative, tells the interwoven story of the development of virtual reality, the origins of computer graphics, and the genesis of walking robots. The primary protagonist of the exhibit, Ivan Sutherland, is considered the "father" of the field of computer graphics, for developing the world's first computer drawing program, *Sketchpad,* as well as an early XR simulation.

Hosted in a rare books archive, the exhibit featured eight vitrines of rare texts coupled with robotic artifacts, including a first edition of Mary Shelley's "Frankenstein" (1818) as well as "R.U.R.", the 1920 play that coined the term "robot". Staged in the archive were displays of the original core components of the "Trojan Cockroach" robot, hoisted on wooden crates.

The exhibit featured a custom virtual reality simulation on the Oculus DK2- recreating Sutherland's original research for a new generation of VR enthusiasts.

Ivan Sutherland's Trojan Cockroach, 2016

Installation view of parts of the robot, the "Trojan Cockroach", showcased in The Posner Center, Carnegie Mellon's rare books archive.
Each vitrine featured parts from the "Trojan Cockroach" throughout the exhibit. Each vitrine featured a combination of rare books, walking machine artifacts, robots, and ephemera from related research. The exhibit also included rare books underlying the origins of the field, such as Aloysii Galvani's *Effects of Electricity on Muscular Motion* (1791), Bernouilli's *Hydronamica* (1738), *The Human Figure in Motion* (1830-1904) by Eadweard Muybridge, Sutherland's influential MIT thesis, *Sketchpad: A Man-machine Graphical Communication System* (1963) & Sutherland's essay, *Technology and Courage,* a first printing of *R.U. R* (1920), by Karel Capek, and a first edition of *Frankenstein* (1818), by Mary Shelley.

Ivan Sutherland's Trojan Cockroach

Roles:

Curator
Virtual Reality Developer

Themes:

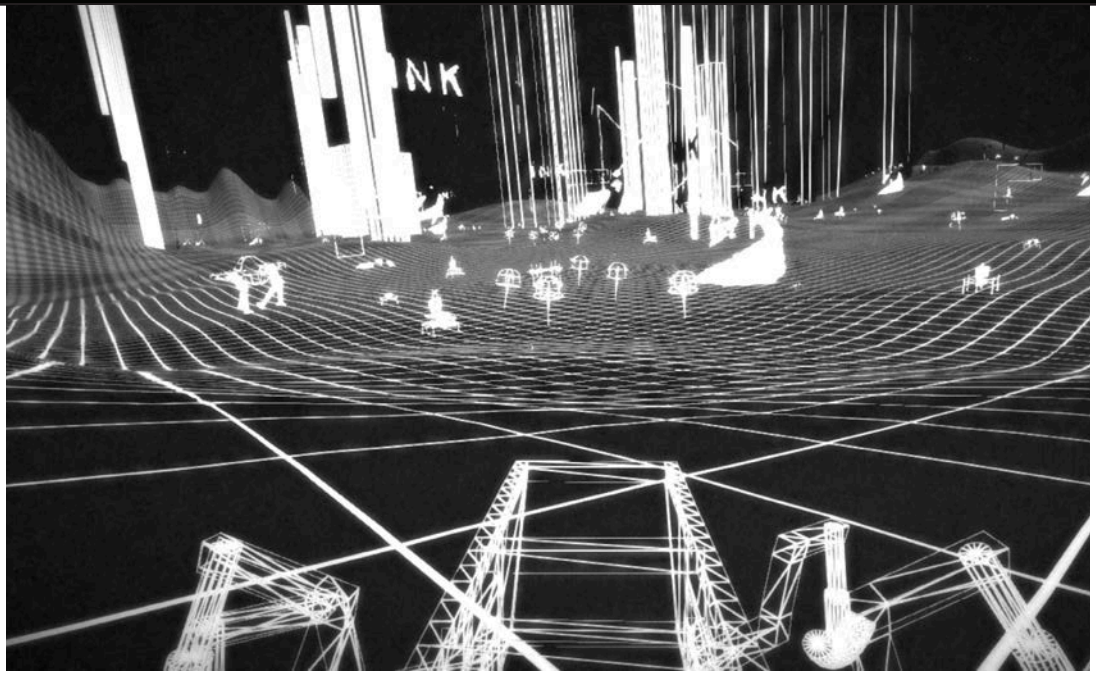
An experimental curatorial project
Interactive History Exhibit
Oculus DK2 VR Experience

VR Simulation:

Inspired by the aesthetic of Ivan Sutherland's groundbreaking AR/VR experiment from 1968, I developed an interactive virtual reality experience as an homage to his work, developed in Unity for the Oculus Development Kit.

Visitors could ride the "Trojan Cockroach" through a virtual reality simulation based on Ivan's early graphics work. This interactive virtual reality landscape was filled with computer-generated animated artifacts and crude early iterations of walking machines, derived from early research in VR & robotics. Sutherland's original drawings from the first computer graphics program, Sketchpad, were converted into animations that filled the skyline of this virtual world.

For many, this was their first experience of virtual reality (when the Oculus DK2 was still new). exploring a wireframe world populated by other significant robots-walking machine schematics brought to life by primitive AI algorithms.



A virtual reality experience developed on the Oculus DK2, using joystick, original Sutherland Sketchpad drawings, animated walking robots, developed in Unity.

Marcia Sutherland viewing the Trojan Cockroach Simulation

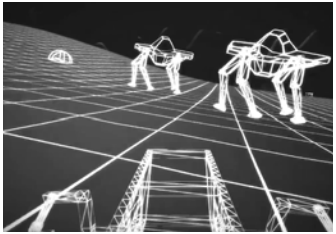


Photo Documentation of VR Experience

Opening night VR Simulation Documentation

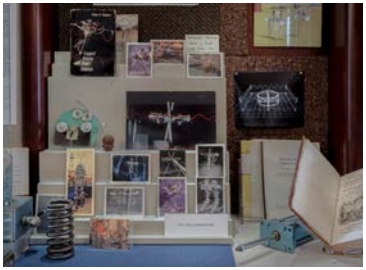
Rare Books & Robots

Each vitrine featured images & objects from Sutherland's groundbreaking research in computer graphics, virtual reality, and robotics; as well as subsequent research and influential work that came after.

Backdrops and stands for each display were Boston Dynamic's "terrain simulations" used to train a robotic dog, the "Little Dog" version of "Big Dog".

The Leg Laboratory

The exhibit connected the work on the Trojan Cockroach with the influence it had on the future of "machines that walk", such as the "Leg Laboratory", a group of researchers at M.I.T. whose work led to the development of robotic animals; such as "Little Dog", featured alongside a first printing of "Frankenstein".



Events + Experiences

The exhibit's opening featured a unique audience of students from both engineering and the arts, creating a context for disciplines to converge.

In collaboration with The Robotics Institute, we hosted a joint lecture featuring Ivan Sutherland with his longtime friend and protege, Marc Raibert, founder of the influential robotics company, Boston Dynamics.

The Blue Plate: (The Machine Stops)

The immersive exhibit **The Blue Plate (The Machine Stops)** is a spatial narrative, connecting three otherwise disparate landmark moments in the history of modern computing media.

An adaptation of a short story from 1909, *The Machine Stops* by E.M. Forster, the story is considered prescient for its prediction of telecommunications and digital technology.

The story of *The Machine Stops* was displayed spatially by using a variety of historical computing hardware, each representing a milestone in the advancement of "personal computing" into its status as a fixture in everyday life. The story's characters were animated by reconstructing and reanimating early three-dimensional models of the computer-generated human body.

The Blue Plate: (The Machine Stops), 2015-16
Interactive computer animation controlled by Leap Motion, two computer animations running on iMacs G3s, A Commodore Pet running a simulation of "Conway's Game of Life". Developed using the Unity, After Effects, Maya, & Leap Motion. Main animation contains excerpts from: Sketchpad (1963), Pantomation (1977), Xerox Mockingbird (1980), Put That There (1980), MAGI Synthavision Demo Reel (1980), Image West Demo Reel (1981), Blit Terminal (1982), Shirogumi Sample Reel (1983), Mandala (1983), The Bicycle Company (1984) Wonder Works (1984), Martian Magnolia (1984), Eurythmy Motion Studies (1985), Sogitec Showreel (1985), Intelligent Light (1985), Japan Computer Graphics Lab (1985), Deja Vu (1987), Locomotion Studies - MIT - (Karl Sims) (1987), Mental Images (1987).

The Blue Plate (The Machine Stops)

In 1909, noted queer author E.M. Forster published *The Machine Stops*, predicting a future where all humans live in quarantine from one another. This project was inspired by the name of the "wireless" device imagined in Forster's story, a sort of "portal" described as a "blue plate".

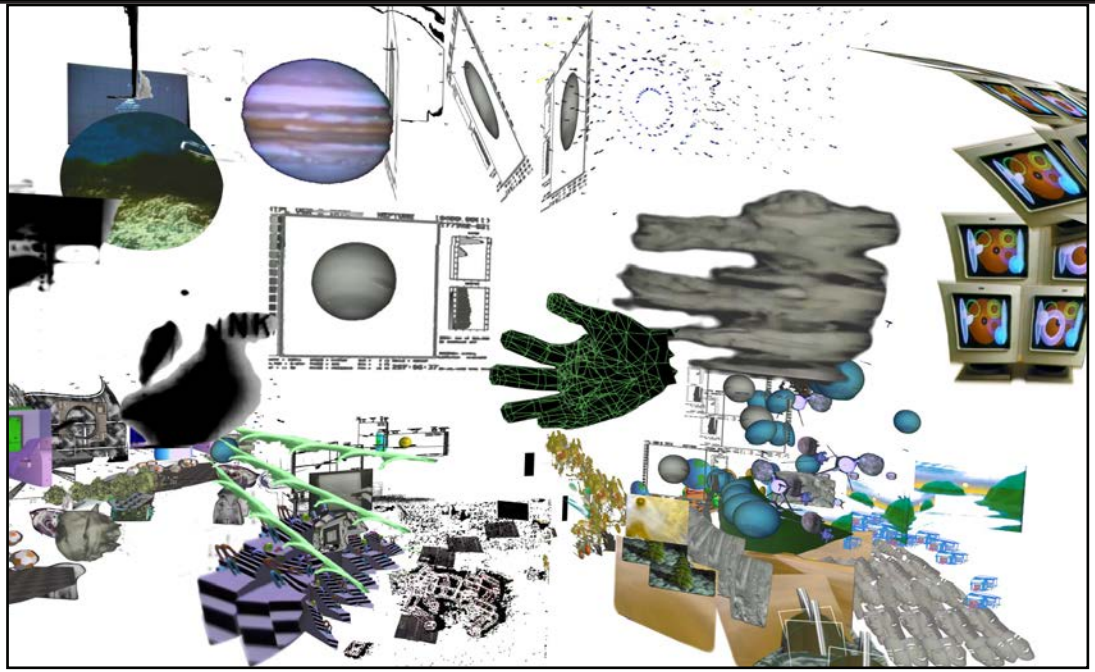
For Forster's future to be realized, a century of evolution in artificial life, computer-generated human bodies, and the advent of the personal computer would be required.

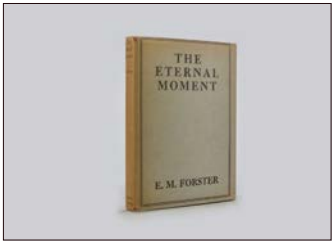
In the 1950s, the idea of "artificial life" was originally conceived of by Nils Barricelli, lost for ages in shoeboxes of punch cards.

In 1970, John Conway developed the code for the "Game of Life", considered the first example of "cellular automata", a digital simulation of evolution.

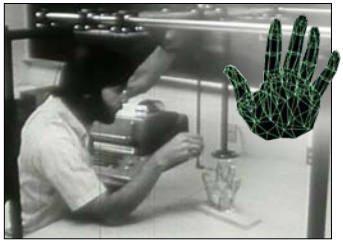
In 1972, the world's first computer-animated three-dimensional human face and human hand were rendered by Ed Catmull and Fred Parke, in a short film titled "A Computer Animated Hand".

In the late 70s, computing became mainstream, as the Commodore Pet revolutionized the idea of the "Personal Computer", soon to become mainstream by the rapid spread of the Apple Macintosh in 1984.





First printing of E.M Forster's short stories, containing "The Machine Stops"



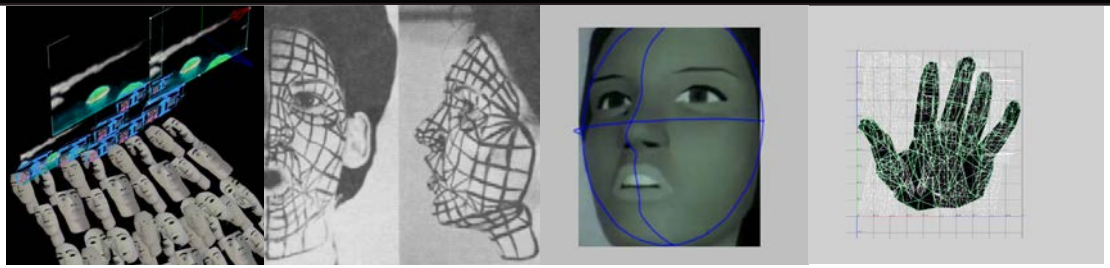
Ed Catmull mapping the 3D contours of a hand to produce a mesh

Exhibit showing "Personal Computing" chronological lineage

Storytelling through Multimedia

I collected public domain 2D animations comprising a geneology of CGI from 1963 to 1987, and used fragments of the animations to create a 3D environment for an interactive storytelling experience.

Ed Catmull's 3D hand and Fred Parke's 3D face were re-created in contemporary 3D software, and re-animated in the interactive 3D narrative environment as subjects in *The Machine Stops*.

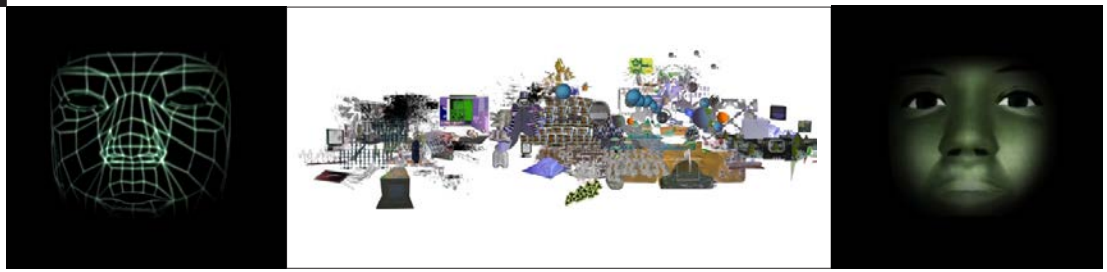


From Left to Right: 3D environment composed of 2D CGI extracts, Fred Parke's original 3D face workflow, created by drawing on his wife's face, reconstructed as 3D, along with Catmull's hand

Interacting in a 3D Timeline

Users explored a chronology of CGI history by retargeting their hand gestures via a Leap Motion Controller onto Catmulls' "hand".

The dialougue of the story was told by two bookended iMac G3 monitors, each animated by Parke's faces, re-animated with the original Apple text-to-speech engine, "MacinTalk".



From Left to Right: Re-constructed 3D mesh re-animated, entire 3D/2D environment used for interactive animation, second re-constructed character, each speaking dialogue from "The Machine Stops"

A Spatial Narrative on Hardware

Using media artifacts with contemporary technology, the story of *The Machine Stops* was told through the medium of media archeaology.

A Commodore Pet ran "Conway's Game of Life", the code of which was written in chalk on a large chalkboard, surrounded by ephemera about Barricelli's work on "digital life". A Mac Plus had the full narrative in a HyperCard application.

From Left to Right: installation at "The Mint Museum", Charlotte, North Carolina; installation at "The Powder Room", Pittsburgh, PA; exhibited at SIGGRAPH 2019, Vancouver, BC.

Virtual Newell/Simon Simulation

Virtual Newell/Simon Simulation incorporated both computer-generated and analog interactive experiences in a large-scale mixed-reality environment, to engage visitors with the history of artificial intelligence.

A type of "augmented reality archive", this environment was inspired by the architecture of the offices of notable scientists Allen Newell and Herbert Simon, often considered the "fathers of artificial intelligence".

A collage of period-specific computing environments- stretching from the 1960s to the 1980s- the space was embedded with augmented reality image triggers and gesture-controlled interactive applications.

By "embodying" the original researchers, and interacting with their immense archive of research in a technologically advanced format, this interactive research environment provided a rich and engaging way for visitors to learn about the origins of artificial intelligence.

Virtual Newell/Simon Simulation, 2016

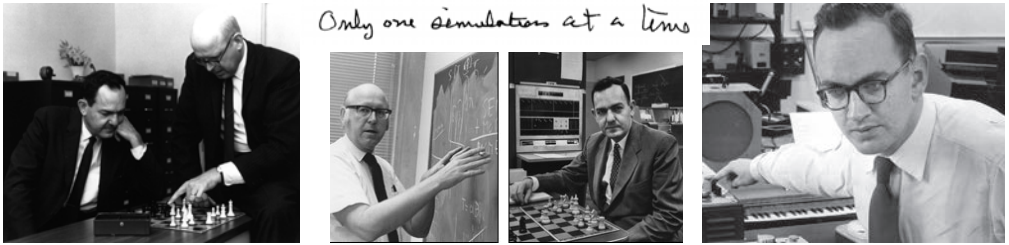
Image of a full custom room installation. Components: Herbert Simon's chairs, Allen Newell "standing desk" re-created with cement blocks, multiple embedded audio speakers, 8 empty standard-issue filing cabinets, multiple bulletin boards (with removable facsimile documents from the Newell Simon archives), a Perq workstation, a Mac Plus, a Commodore Pet, an iPad and camera system running custom augmented reality software, two Tektronix Oscilloscopes with a live feed of speech-to-text files of artificial intelligence research read by standard text-to-speech software, various period-specific accouterments, plants, vintage TV monitor with video cassette of Herbert Simon lecturing, found 1970s chalkboard with a recreation of a writing from a photograph of Newell's original chalkboard.

Virtual Newell/ Simon Simulation

In the 1950s', Allen Newell and Herbert Simon developed the first program that could "solve problems like a human"; a program named "The Logic Theorist", a program presented at a conference at Dartmouth that has since been considered "the birth of artificial intelligence".

Drawing inspiration from images and oral histories of Newell & Simon's offices, the installation featured Herbert Simon's original leather chairs, a Perq workstation- (the computer used by Allen Newell)- and a range of period specific objects. A plaster model hand, produced from a preserved cast of Herbert Simon's actual hand, had retained hairs from Simon's arm- the resulting model storing a sample of his DNA!

As a "spatial collage", the room combined elements of their offices with the architecture of a archival facility, Iron Mountain, where Newell & Simon's original corpus of AI research is stored. Iron Mountain's underground storage facility, built in a former limestone mine in Butler, PA, has the ideal climate provided by limestone for preserving paper ephemera.



Images of Herbert Simon and Allen Newell in their original offices, used as source material for the aesthetic of the abstract re-construction.

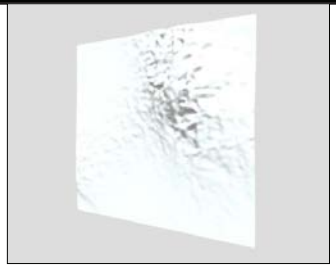
A Mac Plus, Herbert Simon's original chairs, and a Perq workstation were used as the foundational elements of the installation, enabling users to access "desks" from the point of view of the original researchers.

From Left to Right: underground facility, "Iron Mountain", where the archives of Newell & Simon are stored – a 3D dense cloud scanned computer resconstruction scan of the "re-installation"

Digitally Fabricated Environment

The limestone of Iron Mountain was re-created in the installation with a 3D printed relief as the backdrop of the space, extruded from an image of an actual office at Iron Mountain.

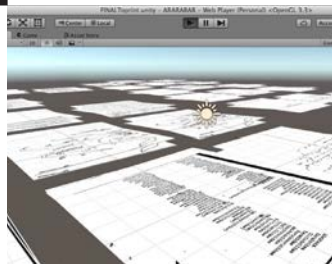
The image was used to generate a 3D digital model, which was cut with a CNC router into a large multi-paneled relief, painted silver for lining the back wall.



From Left to Right: office of facility, “Iron Mountain”, image was used to create the 3D mesh, seen to the right extruded as a backfrop to the installation.

Mixed Reality Interactions

Newell & Simon were known for having copious amounts of paper in their offices. This installation used AR to re-create the clutter by using animated paper simulations. Over 100 document facsimiles from the Newell Simon archives were printed on cardstock. Each physical document acted as a “QR” code when viewed through the custom AR application.

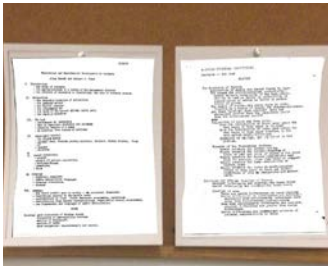


From Left to Right: Unity Application showing the AR development workflow, document tray featuring an embedded display that showed 3D simulations of each document, screen capture of AR

AI Research Comes to Life

As “image targets” when viewed through a tablet or cameras embedded in the room, each physical document triggered an augmented reality simulation of paper simulations, filling the office.

The application was coded to recognize each document and duplicate it, triggering physics based animations based on the angle and movement of the tablet in the environment.



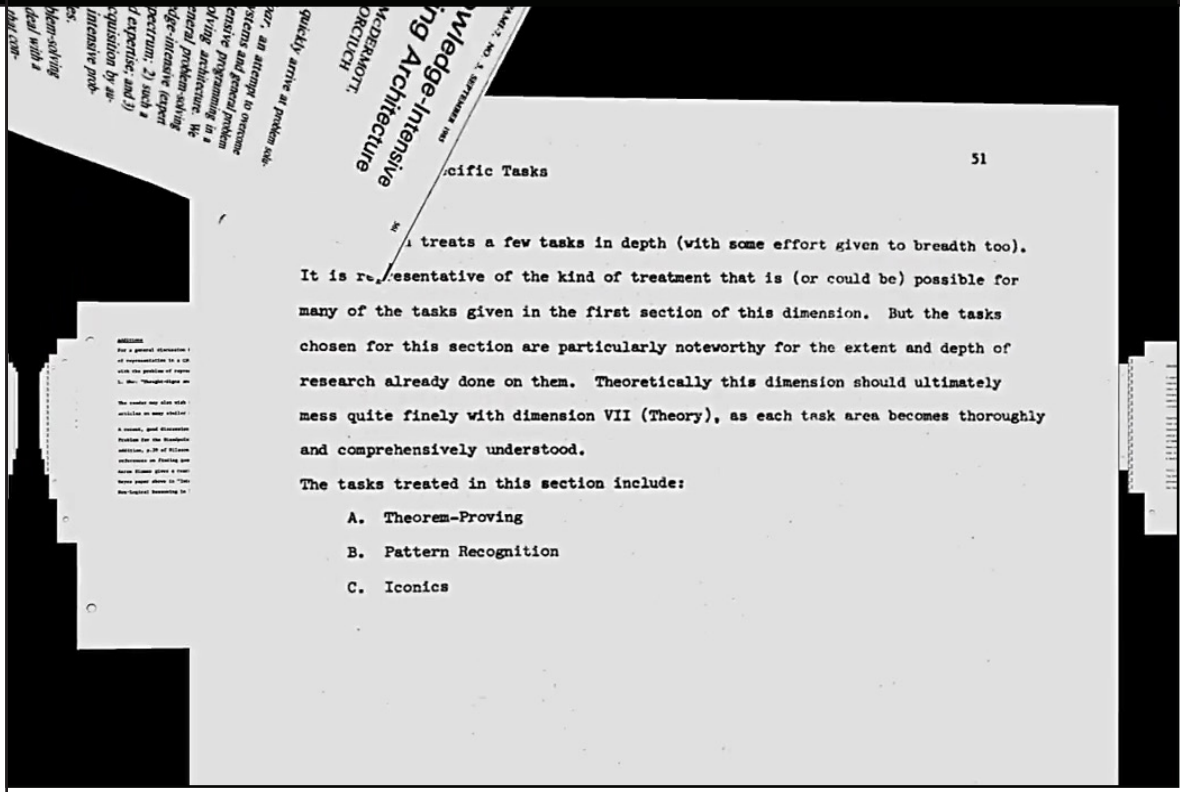
Screen Captures of Augmented Reality interface

Virtual Newell/ Simon Simulation

The “Memex”, a device designed by Vannevar Bush, considered a prototype for the modern computer, served as the inspiration for a desktop application for exploring the database of the research archives of Newell & Simon.

I developed a “Memex”-inspired application, with over 316,000 documents in a 3D space, enabling visitors to explore the entire archives of Newell & Simon.

By waving one’s hands over a Leap Motion Controller, users could navigate an infinite data-space of Artificial Intelligence Research, each document randomly populated from the original scanned documents, preserved in the Newell/Simon archive.



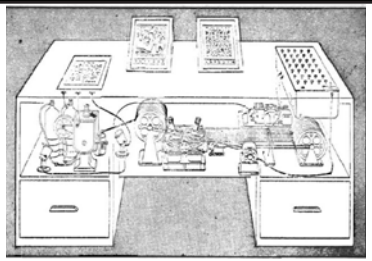
Screenshot of Interactive Memex Software:

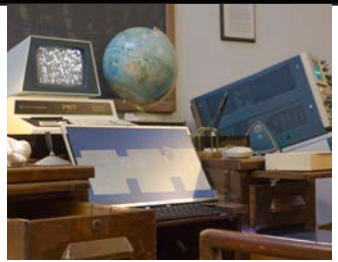
Interactive Unity software, an infinite database featuring over 316,000 documents from research archives, embedded inside a desk. Controlled by gestures through a Leap Motion Controller.

Archives courtesy of Carnegie Mellon School of Computer Science and University Library Archives.

Modern Memex Interactions

Visitors used gestures via Leap Motion controllers to interact with the archive; allowing them to read, scroll, shift and move through hundreds of thousands of documents. The interface emulated both the “micro-fische” and the “Memex”, commonly considered a prototype of the internet.





From Left to Right: Original Prototype of the “Memex”, re-creation of the “Memex in the installation, view of the interactive archive application with Conway’s Game of Life running above.

Infinite Archive

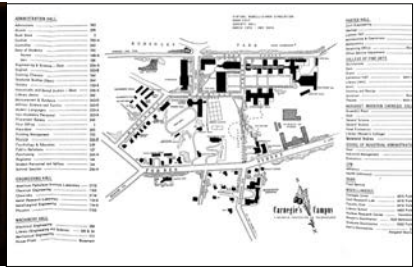
The “reading apparatus” designed and embedded inside the modernized “Memex” was novel in that it allowed for a fast and spatial experience of reading- enabling 6 degrees of freedom, both vertically, horizontally, and through a 3D space that was constantly repopulated.



Social Experiences

A video stream in a public gallery showed a live feed of the real space. Visitors to the gallery were guided by a vintage campus map to discover the installation.

The live video feed was a mixed reality program, incorporating overlaid computer graphics, responding dynamically to the physical space.


From Left to Right: Display installed in gallery showing computer simulated “documents” overlaid on a live video feed of the space. Directions to the installation and sample of gesture interactions.

Mobile Robot Museum

The idea behind the **Mobile Robot Museum** was framed as an experimental museological practice; to create pop-up, site-specific experiences where discussions around the complexity of modern robotics could happen in unconventional contexts. By engaging audiences of nonspecialists, the esoteric and idiosyncratic marvels of modern robotics were made accessible to a wider public.

For the last several years, various installations were hosted as pop-up archives and experiences- including installations in Pittsburgh, PA, Brooklyn, NYC, Virginia, Princeton, NJ, and even Ahmedabad, India.

Featuring a range of robots, ephemera, texts and tools- from the 1940s to the present- these exhibits were hosted by a humanoid robot, who recounted oral histories of robotics, on-demand!

Mobile Robot Museum, 2016-ongoing

Image of a miniature pop-up museum of robotics relics housed in Interstate art gallery in Brooklyn, NYC, NY.

The installation contained various objects and robotic ephemera, including: First model of the “Roomba”, over fifteen “RS Media humanoid robots”, Boston Dynamics relics used for training robots, Boston Dynamics aluminum truss structure for motion capture, a “little dog robot”, HTC Vive, found footage from “The Leg Laboratory” on videotape, models of Honda Asimov, steel Planetary robotics cases, motion capture truss.

Mobile Robot Museum

Virtual Experience

A virtual duplicate of the Brooklyn edition of the museum allowed users to explore interactive robotics simulations in the space that directly matched the physical environment they were in. Users could reliably navigate the physical space while totally immersed in VR, since each object was present in both the VR and real environment.

Social Media

Broadcasting daily live Facebook video series of performances and robot demonstrations, this project garnered an engaged social media following, where the sharing resources of robotics history continues to this day. Here, the conversation of contemporary robotics and robotics history was engaged and cataloged by a broad audience of individuals, from a variety of disciplines and backgrounds.

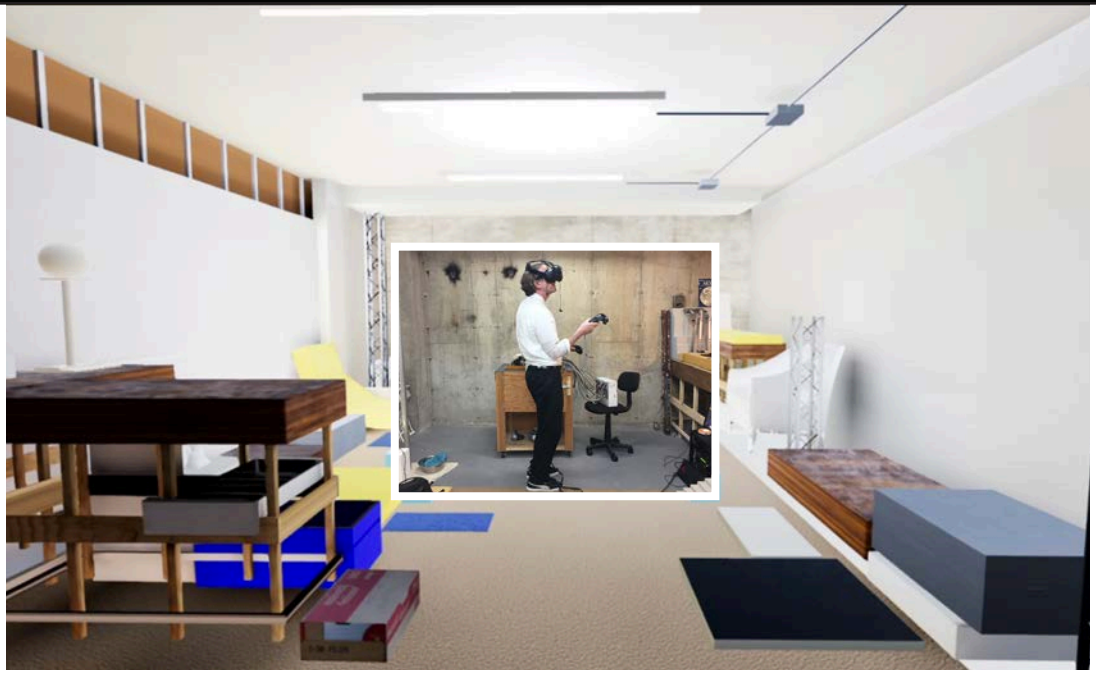
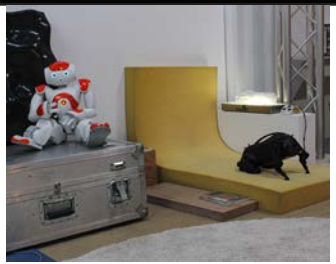


Photo Documentation of Virtual Environment inside HTC Vive, with image of user in real installation environment, which were identical and allowed for full integration.

Human-Robot Interaction

Thinking about the museum as a “robot”, various components featured embedded sensors, microprocessors, and actuated elements.

Visitors were guided through multimedia displays; incorporating VR, human-robot interactions, archival explorations of photographs and original VHS research documentation.



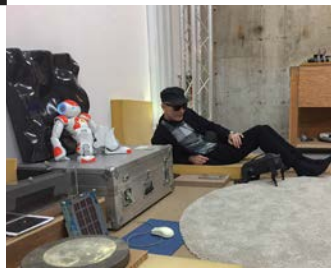
Point-Cloud Capture

A virtual version of the project constantly accrues elements from each temporary installation.

By incorporating 3D scans of the installation environments, as well as 3D models of various robotic artifacts, the virtual version acts as both an archive and interactive educational tool.

Events + Experiences

A combination of physical environments, virtual experiences and innovative methods for archiving robotics research, this project has resulted in Carnegie Mellon’s University Library developing new initiatives for archiving robot artifacts.

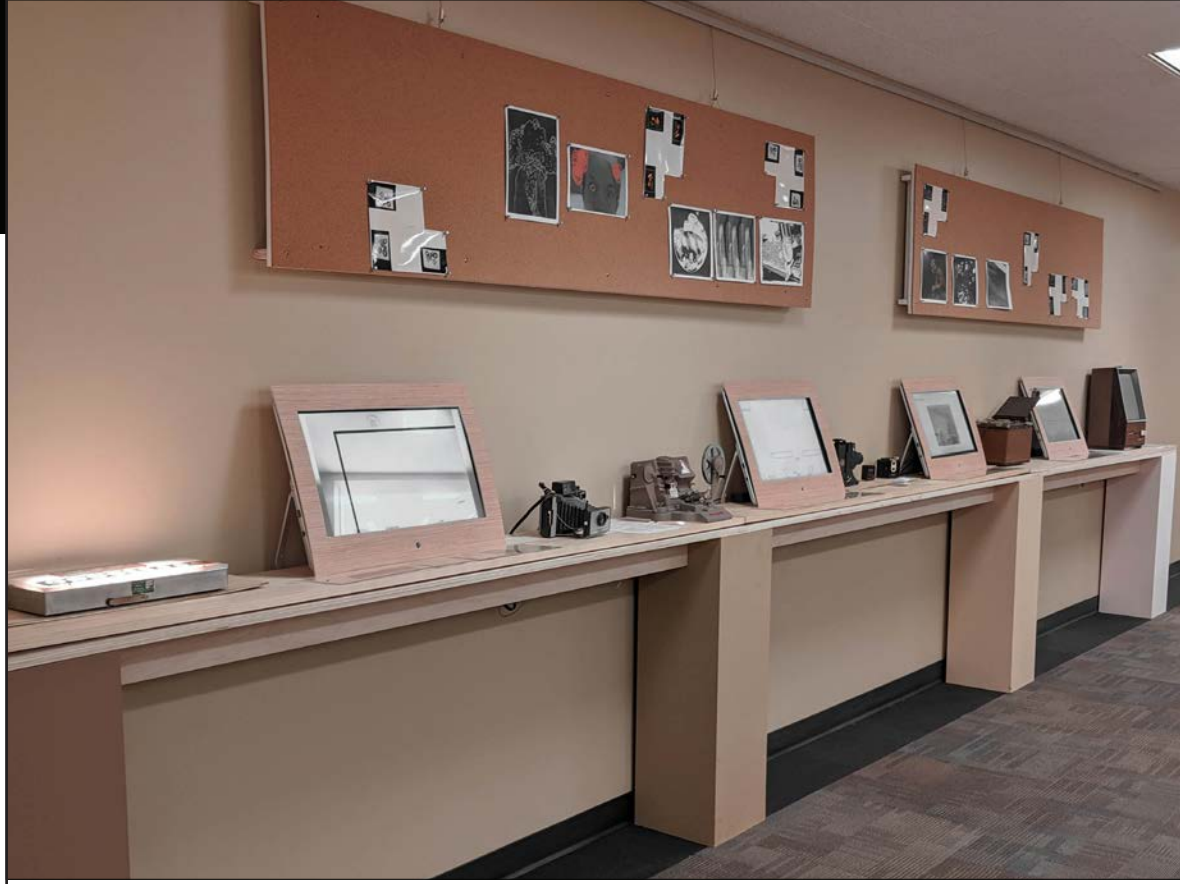


Computer Vision Museum

Exploring the media archeology of the digital camera as it relates to advances in the field of computer vision, I developed a miniature “computer vision museum” in conjunction with a series of workshops incorporating computer vision with a fine arts photography course.

As a collaboration with Virginia Tech photography faculty Michael Borowski, a series of workshops offered Fine Arts students a user-friendly introduction to the complexities of computer science; resulting in an exhibit exploring the intersection of computer vision technology and the fine art of photography.

The exhibit focused on a series of historic computer vision algorithms, each running in real-time & capturing the attention of passerby’s in the library. Each tablet-display encouraged interaction, demonstrating a video feed in real-time overlaid with a range of signficant computer vision algorithms.



Computer Vision Museum, 2020, (Installation View)

Four historically fundamental computer vision algorithms (*Realtime Face Recognition, YOLO Object Recogniton, Simple Blob Tracking and Polygon Filter*), displayed in realtime on interactive touchscreen tablets, accompanied by various historical ephemera related to the field of human vision and photography. Featuring: Four touchscreen tablets mounted in wooden frames, four embedded Logitech web cameras, an image viewer with interactive components, several historic analog cameras (in various stages of deconstruction), a light box, assorted photography ephemera, a Mansfield Model 950 8mm editor (augmented with modern physical computing hardware), mounted on a 10’ long, 5’ high table with four wooden columns for supports. A corkboard above features work produced from students during the workshops.

Computer Vision Museum

Through objects, media, and ephemera, this exhibit told the story of the history of the transition from the analog to the digital camera; now, a ubiquitous and embedded fixture of everyday modern life.

Focusing on the transmutation of the "image" from it's origins in analog processes through iterations of digital image making technologies, the exhibit served to provide a context for how integral computer vision is in modern technology as a result of the conversion of the analog image to the digital.

Between images and relics of analog photography, interactive touchscreen displays each featured a computer vision algorithm from the OpenCV library, including *Real Time Face Recognition*, *YOLO Object Recognition*, Simple Blob Tracking and *Polygon Filter*.

Collaborators

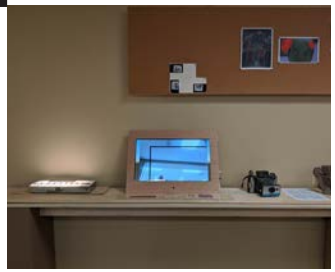
For two weeks, Fine Art students were introduced to the foundations of OpenCV through a series of workshops.

Students learned how to track faces, track objects, and 3D scan themselves, resulting in student projects derived from experiments in computer vision, using OpenCV in the Unity Game Engine.

A History of Image Making

A timeline of image capture techniques, the exhibit contextualized the function of the digital camera with its ancestry in the history of image capture technology.

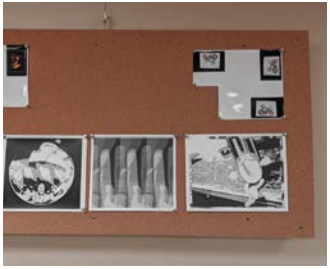
Showcasing historical visual media devices adjacent to each computer vision algorithm, the exhibit included vintage stereoscopes, camera obscuras, and various camera-related ephemera.



Events + Experiences

Our workshops resulted in an installation of modified interactive computer vision algorithms, paired with student work.

The exhibit included work by School of Visual Arts graduate and undergraduate students; featuring work by Amy Borg, Michelle Chen, Bobbie Daniels, Maddi Grainger, Paddy Huynh, George Jung, Zac Kim, Drew Nagle, Jessie Robinson, Jasmine Shah, & Ross Walter.



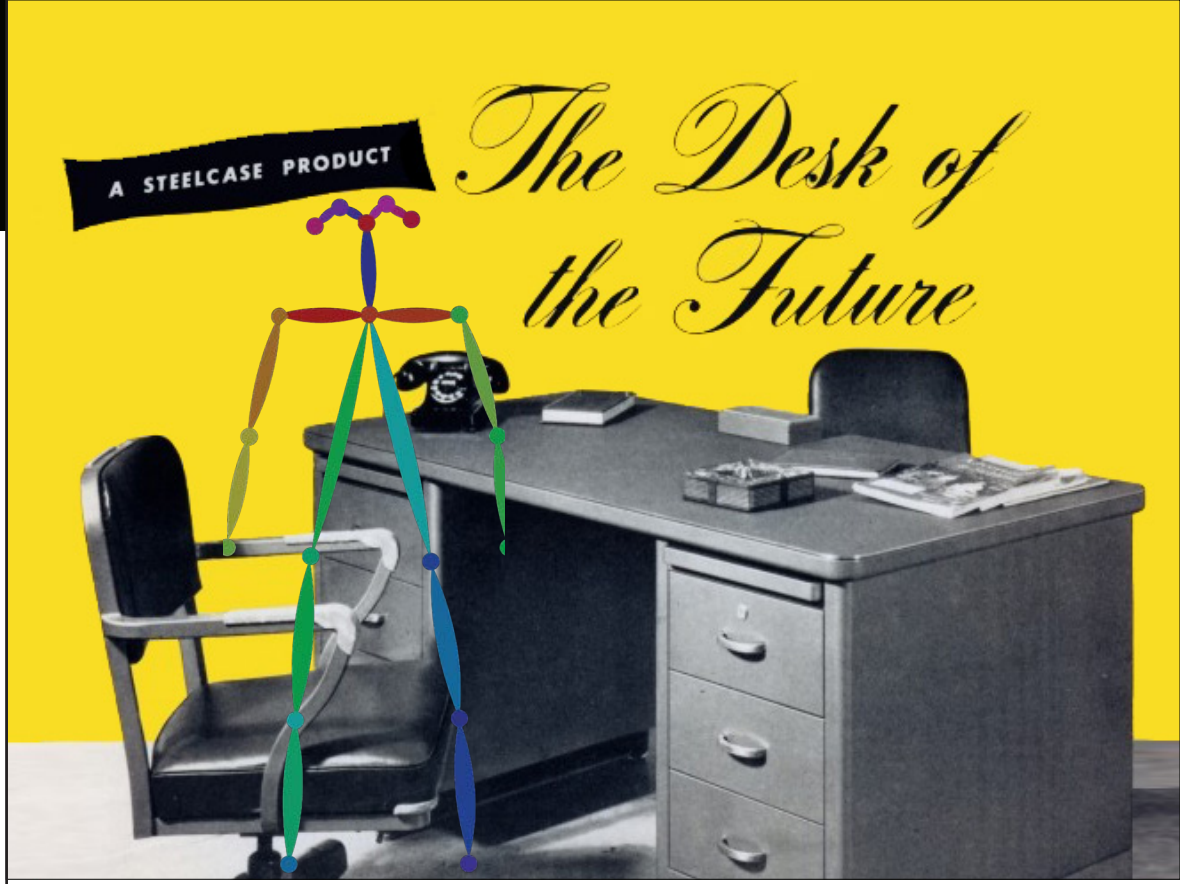
Steelcase Study

As interest in reverse classroom dynamics and collaborative learning environments continue to grow in education, learning spaces must adapt to support collaboration, creativity, and human wellbeing.

In collaboration with the BUILD research team, a group of faculty-sponsored by the education division of the furniture company, Steelcase, I collaborated on a two year research project to create a dataset about human/environment interactions.

Our team developed an experiment by converting and updating the technology of an otherwise standard classroom into a cutting-edge, active learning laboratory, designed to research the pedagogical function of active learning, from an architectural and design perspective.

By using computer vision algorithms for pose estimation to gather information to analyze how students engaged with different types of spaces, we were interested in measuring the effectiveness of different environments on learning and social interactions.



Steelcase Study, 2018-2020

A project utilizing two classroom environments with 24 embedded web cameras, networked infrastructure for data-capture, processed through "Open-pose", open-source algorithm for pose estimation, to study active learning and create a dataset of human/environment interactions.

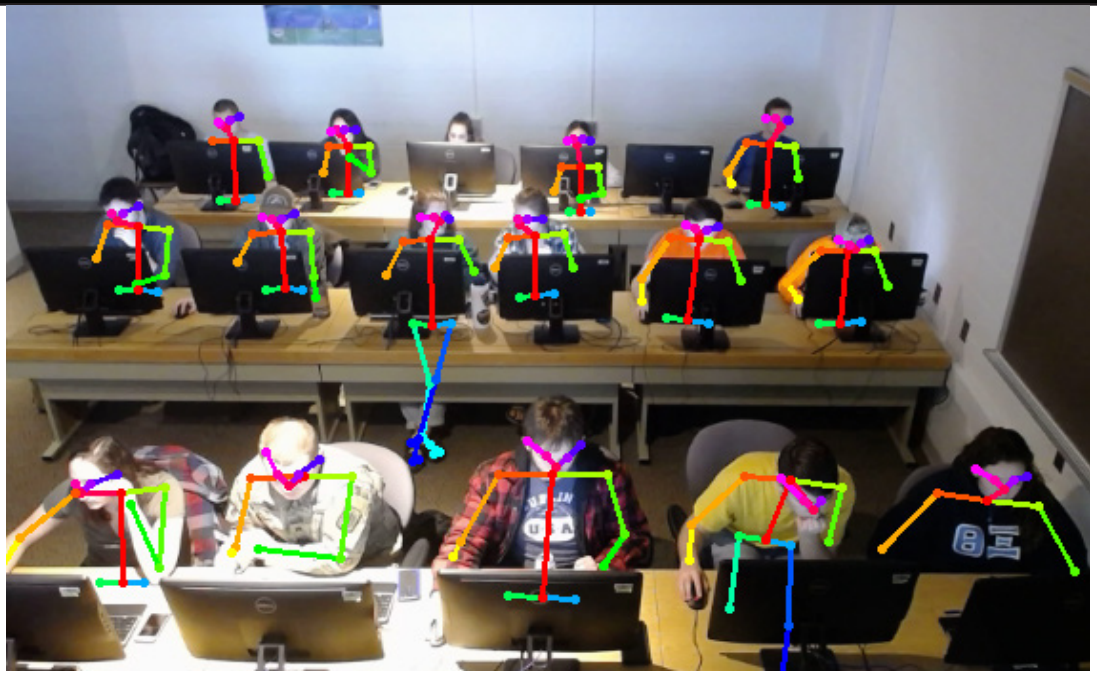
Steelcase Study

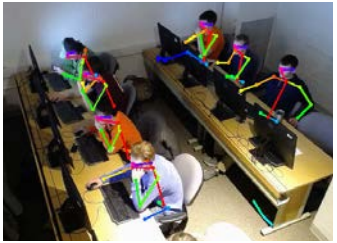
Our team found that computer vision techniques were a useful means for evaluating the dynamics of learning, and that sensor-based environments could offer valuable insights into the nature of human/computer interactions.

Our modern active learning environment incorporated a multi-camera capture computer vision system; resulting in 3D re-creations of skeletal data representing human behavior as 3D animations.

I designed a custom 3D printed multi-camera capture mechanism to facilitate the capture. We embedded a system of multiple cameras networked into the ceiling of the classrooms, enabling us to capture multiple angles of interactions.

We were then able to triangulate the data using ARUCO markers to create a ground truth correspondence between each camera, resulting in “skeletal data” of human/environment interactions, reconstructed as spatially explorable 3D animations.



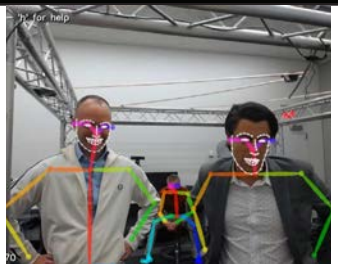


Computer Vision for Spatial Interactions

Our team designed and ran a series of studies in two conditions. In our control condition, a conventional learning environment was used.

A second condition had an active learning design.

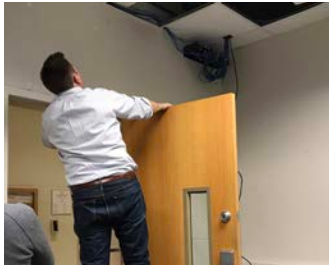
Both environments were outfitted with a multi-camera capture system.



Multi-Camera Capture

We processed the data with an algorithm called OpenPose, a computer vision algorithm able to detect body, foot, hand, and facial keypoints from single camera images.

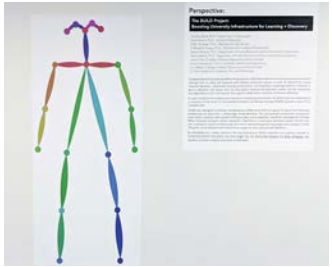
Our dataset was derived from 32 classroom sessions, captured and processed to reconstruct 3D skeletal data simulations from each session.

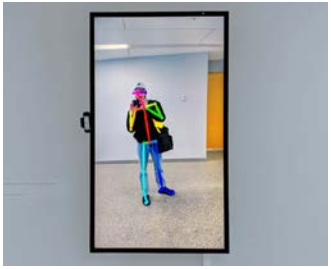


Human/Environment Datasets

Our primary interest was how architecture (i.e., active learning vs conventional) is associated with student learning outcomes.

The project resulted in a rich dataset of human/environment behaviors, a useful resource for researchers interested in group dynamics and the effects of architectural design on experiential learning.





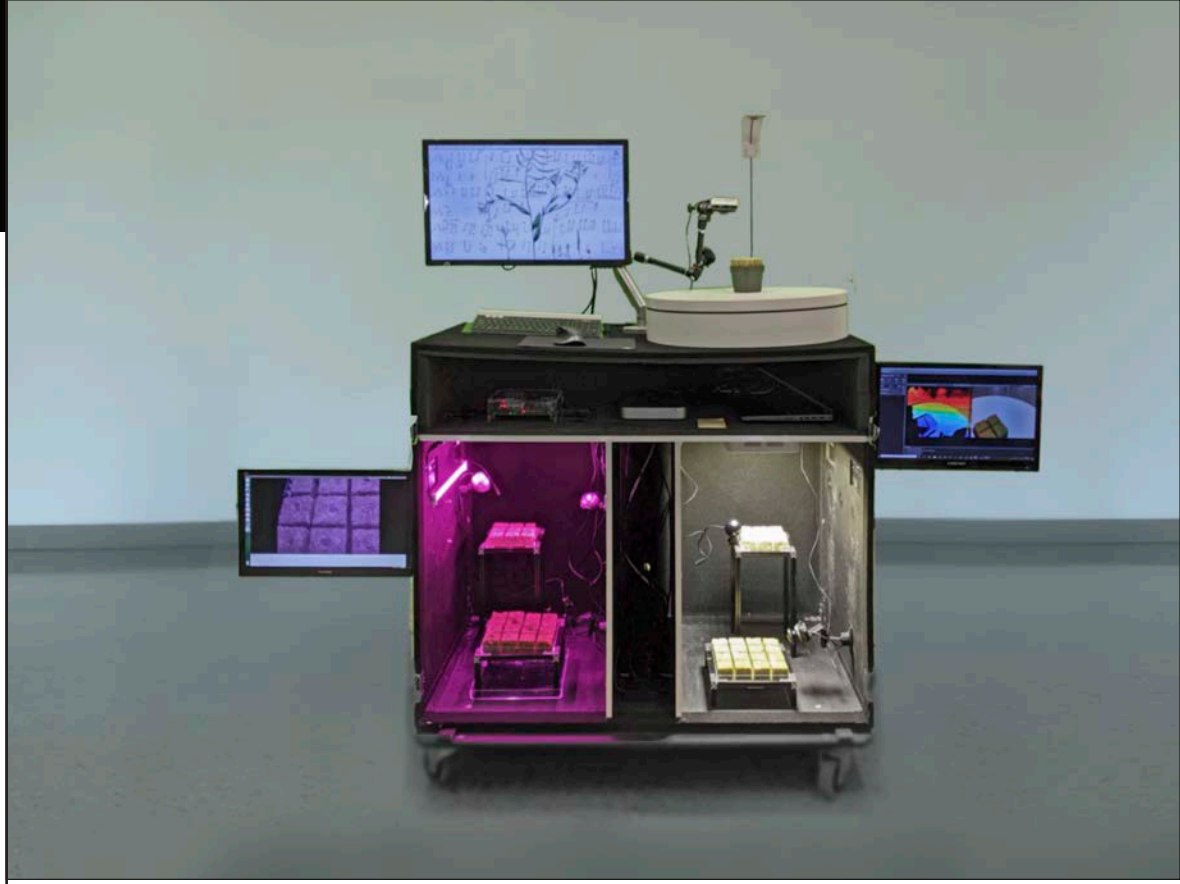
Dancing Plants

As lead creative technologist for a creative research project, **Dancing Plants**, I collaborated with colleagues across Plant Science, Computer Science and the Performing Arts to study plant movement- the “dance of plants”.

I designed a system for capturing stop-motion media of the growth of pepper plants, afterwards, analyzing the data with computer vision- in order to generate data sonifications resulting in “plant science symphonies”.

Using a variety of sophisticated imaging techniques, I outfitted a “mobile plant capture sculptural platform”, utilizing 16 webcameras, 4 Realsense Depth Cameras, and a FLIR thermal camera.

Through this collaboration of specialists from multiple disciplines, we captured a complex dataset describing each plant’s movement in relationship to varying controlled conditions, with the goal of aligning creative outputs with real scientific research.



Dancing Plants, 2019-20

A sculptural platform/display for computer vision analysis of pepper plant growth. Four chambers with embedded growth lights, automated watering system, pepper plants in hydroponic planting pods, depth cameras, web cameras, and embedded microcontrollers. The container opens and closes and captures plants in total darkness for long-term plant growth monitoring. Animations produced from time-lapse capture are then processed with machine vision algorithms and sonified into symphonic outputs.

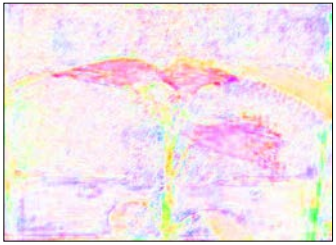
Dancing Plants

Our platform used two different kinds of lighting conditions, which enabled us to capture differences in growth patterns- one, with a full spectrum LED light, the other, with mixed blue/red LED lights.

The platform I developed enabled us to capture multiple modalities of visualization of pepper plant growth, in response to various stress stimuli based on how we controlled the lighting.

I developed software that interfaced with the multi-camera capture system, enabling us to remotely monitor each plant's response to their environment.

The resulting dataset of stop-motion animations captured the slow and subtle movements of pepper plant growth, as they moved in relation to light and hydration.

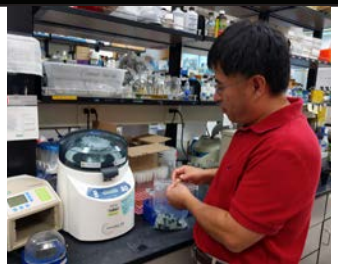


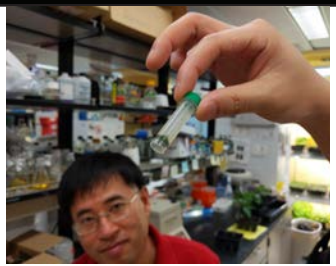
Left to Right: Pepper Plant in controlled condition, photo frame from still-frame documentation of growth, computer vision algorithm applied to capture

Plant Science Research

Through evolution, plants developed mechanisms to move their roots, leaves, and stems to capture nutrients or sunlight.

These micro-movements are a response to microbial pathogen and stress. Our goal was to capture these micro-movements, and analyse them from an artistic and structural perspective.

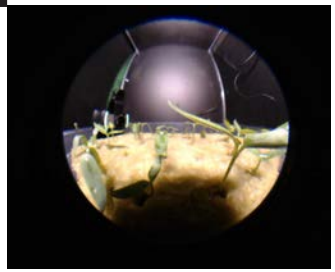


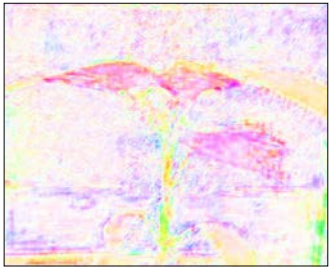


Computer Vision Sonifications

Collaborator Jia-Bin Huang, a computer vision specialist, extracted a wealth of data about plant movement, by applying computer vision algorithms to the stop-motion images.

Afterwards, Huang produced sonifications of the data into sounds, later, arranged into scores.

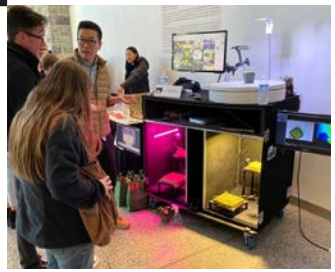




Events + Experiences

The resulting multi-camera time-lapse content, in combination with the audio sonification, produced an artful animation and score, which we displayed and exhibited at numerous public events.

This “symphony of pepper plant growth” was an experimental study into the multiple modalities of media, ever-present in the natural patterns of biological systems.



Grandmother's House

From September 2013 to August 2014, I lived and "performed" my life inside a re-installation of my grandmother's original New Jersey home.

My grandmother had begun to develop signs of Alzheimer's, and was forced to live in a nursing home, abandoning all of her belongings.

As a result, I developed a project- a year-long experiment in life, architecture and technology, at the intersection of set-design, immersive theatre and the advent of new mediums for reality capture.

After multiple trips with fully packed U-haul trucks, I transformed a vacant, 6 room, three story house in an appropriately working-class neighborhood of Pittsburgh- into a living "set".

I created a fully immersive domestic installation inspired by the conventions of film-making and theatre. For over a year, I inhabited this abstraction of my grandmother's home as an immersive performance environment.

Grandmother's House, 2013-2014

Living room of five room multi-part full house installation. Contents of my grandmother's living room transported and reinstalled, multiple carpets, afghans quilted together for lowered ceiling, two original sofas, an ottoman, a black and white television with VCR and library of tapes, lamps, photo albums, additional original components. Looping videos, embedded sound recordings, "clapping " sensors to trigger lamps.

Grandmother's House

Over the year, I held a series of performances, experiences, tours and gatherings; utilizing the entire house as a performance platform.

Each of the six rooms- the living room, dining room, kitchen, the grandmother's bedroom and the childhood bedroom, were meticulously re-constructed, with an underlying symbolic narrative commenting on the passage of time and what we lose with the media we use to capture it.

This project explored the home movie as a form of "video art", family photography as a portal to the past, and our obsession with documenting ourselves; furthermore, questioning what informs our desires for opening our inner lives up to the world.

This multi-faceted project also produced an experimental "virtual home video". The resulting animation was composed of thousands of images- anticipating and creating a parallel to the potential of full 3D image reconstruction of our lives, through the meta-artform of photogrammetry.

Photo Documentation of Installation View of Dining Room "set" reconstruction

Photo Documentation of Childhood Bedroom Reconstruction

Photo Documentation of Basement Reconstruction

Photo Documentation of Family Room Reconstruction

Media Archaeology

This project is part of an ongoing research practice in media archaeology, exploring how media capture devices differ in their depiction and reconstruction of the lived human experience.

This research environment was created to explore how future forms of capture technology may converge methods of computer simulation with live performance.

Performances & Experiences

Using the house as a platform for experimental theatre, I held miniature home movie film festivals, recruiting performers to re-enact scenes from my life.

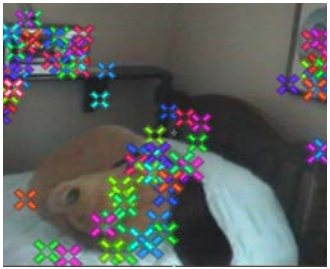
During semi-weekly performances and tours of the house, I recreated and imitated old home movies as a form of participatory theatre.

Virtual Home Videos

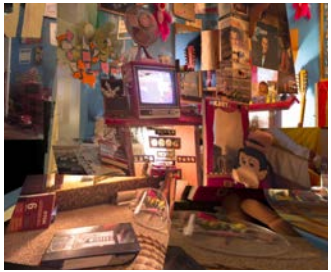
As an experiment in 3D scanning, I captured thousands of photographs to recreate the house in 3D space.

Using computer vision tracking algorithms, I extracted “motion paths” of handheld camera movements from my grandmother’s home videos. I retargeted the motion paths to a virtual camera, resulting in a “virtual home video” of the VHS camera’s trajectory through a 3D collage.

3D software aligning 2D images



Motion Tracking of original home videos



“Virtual Home Video” combining motion and 3D

Andy Warhola's Living Room

As part of a series of exhibits for emerging artists at the Andy Warhol Museum in Pittsburgh, PA, titled "Exposures", I was invited by museum curator Eric Shiner to design an exhibit for the front windows of the museum.

Notably, Warhol (whose original family name was in fact "Warhola") had begun his career as an artist by designing the front window displays of Hornes Department stores in Pittsburgh and later, New York.

I drew inspiration from Warhol's history to create Andy Warhola's Living Room, a 3D recreation of Andy Warhol's "memory" of his childhood home, digitally fabricated and spatially reformatted on the facade of his Museum.

I was invited by the Warhol archives to replicate rarely seen photographs from Warhol's childhood. I also received assistance from Donald Warhola, a consultant on the Warhol estate, one of Andy's last remaining relatives, who described his own memories of the original Warhola home.

Andy Warhola's Living Room, 2015

Installation in the front windows of the Andy Warhol Museum, Pittsburgh PA. Seven CNC routed 3D reliefs (foam, aluminum paint, steel supports, silver paint), assorted real furniture found on Craigslist from a local Pittsburgh estate sale, large yellow dyed cloth curtains, three television sets (from the 1950s, '60s and '70s), featuring a digital animation derived from Warhol's childhood home extruded as a three-dimensional landscape, assorted knick-knacks and tchotchkes.

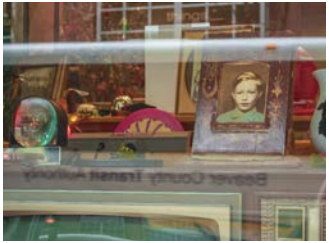
Andy Warhola's Living Room

As an undergraduate art school student, Warhol drew a "memory" of his childhood home in Pittsburgh, PA. The resulting pastel drawing, "Living Room", served as the inspiration for the installation- to re-render Warhol's 2D representation through contemporary digital fabrication.

From Warhol's translation of the physical original of his home to his interpretation in pastel representation, I converted the medium of pastel drawing into computer-generated sculpture- pulling objects from their two dimensional flattening, back into the 3D structure of reality.

Conceptually, I was inspired by Jaron Lanier's concept of a "digital object": "The definition of a digital object is based on assumptions of what aspects of it will turn out to be important. It will be a flat, mute nothing, if you ask something of it that exceeds those expectations. If you didn't specify the weight of a digital painting in the original definition, it isn't just weightless, it is less than weightless... What makes something fully real is that it is impossible to represent it to completion".
Jaron Lanier, *You Are Not a Gadget*

Andy Warhol, Living Room, 1948, © The Andy Warhol Foundation for the Visual Arts, Inc., courtesy of The Andy Warhol Museum, Pittsburgh

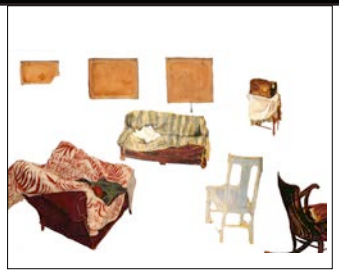


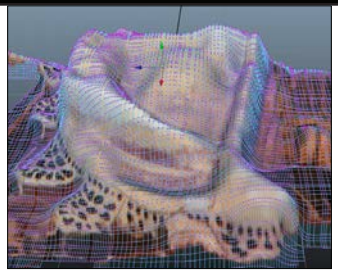
Left to Right: Facsimile photographs of young Andy Warhola, a 3D mockup architectural design from the proposal, the final center window display, featuring animation.

From 2D Image to 3D Structure

Using a high-resolution version of the painting, I applied a computer vision algorithm of “feature recognition” to isolate the furniture from the environment.

Each shape was transformed into a three-dimensional object- the 2D shape extruded with software based on a depth map generated from the light and dark values in the original image.

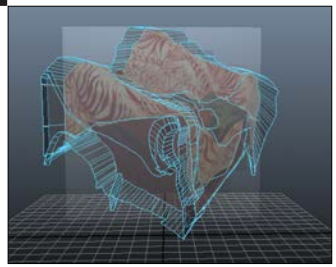


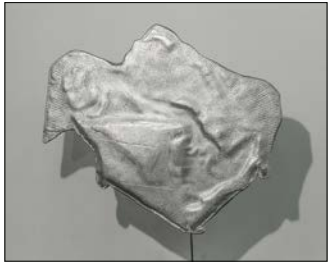


From Data to Sculpture

Using a CNC router, each part was 3D fabricated by extruding reliefs into foam, producing strangely dimensional objects, representative of the illusory perspective used in the original rendering.

Afterwards, each sculpture was painted in the iconic silver of Warhol’s notorious “Silver Factory”.



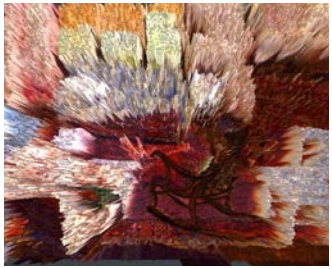


Left to Right: Maya Screen Capture of Furniture 3D conversion process, CNC routing of foam, final product, painted silver.

Installation & Context

Each sculpture was arranged in the layout of the image in the front windows of the Warhol Museum (also, with real curtains!)

The depth map from the original image was used to create an interactive animated video feed. The animation was featured on three televisions, showing a virtual tour of the 3D data extruded from the original drawing.



Left to Right: 3D prints of furniture extruded from drawing, screen capture of digital animation produced from pastel drawing, documentation of TV installation

Voyage 2 the Moon

A multipart collaboration between Performing Arts, the Department of Music and Computer Science, **Voyage 2 the Moon** was a satirical sequel cinematic reconstruction and deconstruction of Georges Méliès iconic 1902 short film, *A Trip to the Moon*; arguably the origin of science fiction in film- incorporated a variety of sophisticated computer techniques, in celebration of the film's historic and innovative technical artistry.

Through multiple mediums, I reinvented and remixed the film through the incorporation of contemporary special effects techniques.

Combining three-dimensional conversions of the original celluloid scenes as well as integrating motion capture and 3D scanning to embed new characters into a three-dimensional decomposition of the film, I produced a short re-animation and immersive projection environment, each of which was part of an award-winning musical performance.

Through this project, Méliès' masterpiece became a medium by which I furthered my exploration of the immersive potential of the cinematic spectacle.

Voyage 2 the Moon, 2015

Immersive environment using motion capture animation (2D and 3D) with live performance. Projection mapping of a re-edited and looping reconstruction of George Melies' "Voyage to the Moon". Film cycle developed in synchronization with an original score by Ash Tempke, performed by Christin Danchi on violin. Duration: 15 minutes

Collaborators: Miranda Jacoby, Christine Danci, with a score by Ash Tempke.

Voyage 2 the Moon

Though originally in black and white, an original hand-colored print was discovered in 1993. Using the colored print, restored in 2011, I converted the film into an animated immersive environment.

By isolating each individual scene and re-compositing the narrative into an equirectangular field, the narrative became suspended in a panorama, projected as the backdrop for a musical ensemble, featuring violinists Christin Danci and Dayton Kinney.

This multimedia immersive piece, titled “Time and Space”, premiered on April 29th, 2015 in Carnegie Mellon University’s Kresge Theater, as part of CMU’s Spring 2015 Rembacher Chamber Music Competition. Our project was awarded first prize in the Rembacher Competition for best collaborative ensemble.

In May of 2016, the score used for the performance, “Launch Sequence” was selected to be part of the Carnegie Mellon University Moon Arts project, a museum housed on the moon.

Photo Documentation of Christin Danci, violinist, with Dayton Kinney on Marimba (not seen)

Left to Right: Reanimated version, featuring 3D characters puppeteered using motion capture, as well as 3D scanned characters embedded into the 3D reconstruction.

Spatializing the Narrative

Due in part to what was called the "substitution splice technique", *Voyage to the Moon* has relatively few shots. This made it ideal to deconstruct.

I first re-edited the film into segments based on each scene, and extruded a static plate of each scene into a 3D shape. I then composited these 3D models of the set with the original 2D footage into a single 3D environment.

Original still from "Voyage to the Moon".

Still frame extruded into 3D shape based on depth

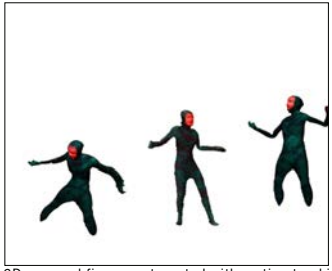
3D topology in Maya of extruded 3D result.

Motion Capture and Animation

We created 3D models of performers with full body 3D scanning hardware. Using a Qualisys motion capture system to capture performances, we then retargeted our motion onto the 3D scanned avatars.

The 3D animations were then incorporated into a 3D environment, built from the 2D & 3D footage of the original film.

Full 3D scan (Left)- Retopologized version, (Right).



3D scanned figures retargeted with motion tracking.

3D figures with motion tracking placed into reconstructed cinematic panorama.

Performance and Projections

For the performance, violinist Christin Danci performed a solo violin score entitled "Launch Sequence", immersed in the reanimated 1902 film.

The film was projected by three projectors and mapped to fit the frame of the historic Kresge theatre. The narrative unfolded, with new and original elements, in realtime to the original live score.

Full Panorama of "Voyage to the Moon" stitched together as a chronological sequence.

Experiments in the Revival of Organisms

Experiments in the Revival of Organisms was an experimental animation and theatrical performance, derived from a 1940 documentary of the same name. The original short documentary demonstrated the research of Russian scientists at the U.S.S.R. Institute of Experimental Physiology and Therapy.

My interest in the film was focused on the film's portrayal of "science" that was in fact, largely fiction. The film depicts a medical experiment using a living- and later, dead, dog; to demonstrate an experimental procedure of Frankenstein-like proportions. At the time, a Time Magazine article declared, "A thousand U.S. scientists in Manhattan last week saw dead animals brought back to life".

As is now commonplace, this "documentary" relies heavily on techniques of theatre, television production, and animation; in order to convince its audience of "scientific fact".

Experiments in the Revival of Organisms, 2012-2014

Digital animation featuring 3D and 2D composited footage extracted from a 1940 Soviet documentary regarded as a fictional form of science.

Performers: Jackie Du, Daniel Flaherty, Daniel Fig
Technology: Digital Animation, Green Screen Keying, Performance, Experimental Music, Roles: Animator

Experiments in the Revival of Organisms

Inspired by Bruno Latour's theory of "science as a form of theatre", this animation repurposed the animations and video documentary to expose the intersection of theatrical practices and scientific modes of inquiry. I extracted the animations from the film to compose a three-dimensional landscape from the animated scientific processes.

With a performance troupe of four collaborators, we developed a theatrical performance based on the animation with an original live musical score.

As part of a festival of experimental Queer Cinema at Theatre for the New City in New York, each performer interacted with objects, overlaid by the animation. A sculptural installation was produced as a byproduct of the performance as residual artifacts.

Installlation view of Performance, New York, NY

City of Lost Men

The 1950 film, **City of Lost Men** is a re-edited and shortened compilation of a twelve part serial series, originally titled "The Lost City".

Released as a serial of 12 films starting in 1935, *The Lost City* is considered to be the first science-fiction serial. The condensed version of the serial, of which this installation is based, released in the 1980s on VHS, is a chopped up and sewn together mixture of 12 original narratives, condensed into one.

The resulting 1950 version is an incoherent B-movie; exposing the colonialist, racist, and xenophobic thinking underlying the subtext of the director and era. Film critic Roy Kinnard wrote, "When a New York TV station broadcast "The Lost City" in the 1950s, the serial was considered so offensive and protests against it were so vocal that it was pulled in midrun. [Nonetheless] "Lost" is historically important as one of the earliest sound science fiction movies, and as one of the first science-fiction serials", (Kinnard, Roy, *Fifty years of Serial Thrills*).

City of Lost Men, 2015

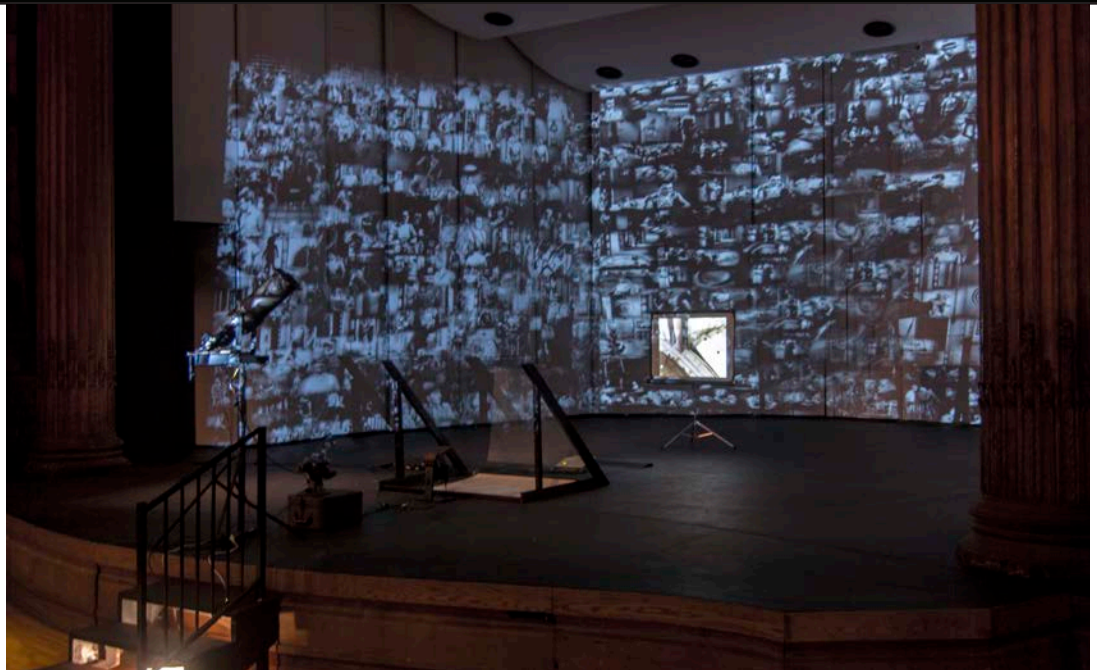
A public domain film un-edited into 820 individually looping segments, chronologically stitched into an immersive environment and projected by three projectors in an endless loop. Three DLP digital projectors running off of three networked Mac Minis, 180 immersive projection environment in the historic Krege Theatre of Carnegie Mellon, incorporating a custom Peppers Ghost (composed of glass, wood, lights), and a light canister with an embedded camera.

City of Lost Men

In this project, I argued for a critical re-reading of the **The Lost City** serial, I was interested in deconstructing the exploitative subtexts of science fiction cinema through the lens of contemporary conversations of anti-racism and queer theory.

I unedited the film, segment by segment, in order to better understand the logic of its cinematic architecture. Each scene in the film contained in a camera cut was spliced at its edit, looped, and then merged into a grid, adjacent to its subsequent scene.

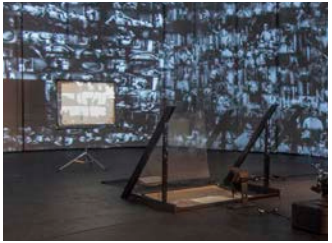
The 1950 film version, comprising 820 cuts, (originally already re-edited from 12 different serial shorts) was stitched together into an equirectangular panoramic grid. An installation in a historic theatre projected the grid as an immersive environment. There, the entire film could then be seen simultaneously, to be re-edited by visitors.



Installation view of immersive environment

Photo Documentation of Immersive Experience

Photo Documentation of Theatre Installation



Installation view of Peppers Ghost

Theory of the “Cinerama” & the “Serial”

I used a hacked Final Cut plugin to distinguish between scenes in the film. The software discerned scene changes, to precisely produce clips of each of the individual 820 edits.

Each edit, when stitched in a chronological grid, allowed for a reading of the film in a linear sequence, a mode of watching more like reading.

Deconstructing and Redirecting

Inspired by the immersive technology of the “Cinerama”, a technique developed by Fred Waller in the 1950s, the projection created full ocular immersion in the spectacle of cinema.

At the center of the stage, a modified theatre light canister contained a camera, which fed a live feed through a “Peppers Ghost”- a contraption that was an early experiment in “volumetric projection”.

2D moving image panorama of 820 edited shots, reconstructed in chronological order.

Re-Projecting and Interacting

This apparatus allowed a viewer to re-edit the film, isolating sections of the film in the viewfinder & reconstructing the narrative- depending on their operation of the light canister/camera.

By combining immersive projection and interactive narrative, this project converged the history of cinema with the potential of virtual reality, creating a spatial and theatrical analog for the ideas underlying VR storytelling.

Light Canister with embedded camera

Installation view of immersive experience

Intergalactic Immigration Station

For this collaborative performance project, **Intergalactic Immigration Station**, I directed a technology-engaged social practice intervention, based on the theme of an "intergalactic" version of the US Department of Homeland Security.

This project was selected and sponsored as part of a public arts festival, *Open Engagement*, founded by artist Jen Delos Reyes, an artist-led initiative committed to expanding the dialogue of socially engaged art. In 2014, the conference held an exhibition of public art projects throughout the city of Pittsburgh, PA.

Our collaborative team of performers and technologists invaded Schenley Park, outfitted in custom and campy green alien jumpsuits, inviting participants to enter a "futuristic volumetric capture structure".

Intergalactic Immigration Station, 2015

A 3D scanning social practice project in a public square, CNC routed architectural capture station, 3D scanning equipment, two LCD displays, green alien costumes. Location: Schenley Plaza, Pittsburgh PA

Collaborators: Zhiwan Cheung, School of Art, Leah Wulfman, School of Architecture, Zach Rispoli, School of Computer Science, Carnegie Mellon University

Intergalactic Immigration Station

Using 3D scanning technology and digitally fabricated CNC routed custom architecture, this social practice project commented on the questionable potential of new forms of facial recognition and biometric data capture.

The metaphor of the “alien” was loosely employed to comment on the controversial context and problematic policies of the US immigration experience. Participants were invited to be scanned, to create a biometric 3D scan of their face.

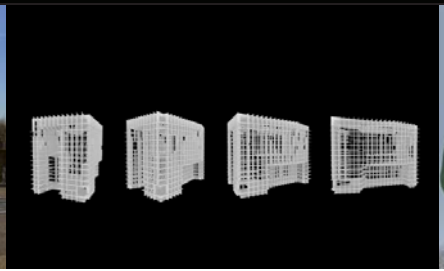
Each participant was also requested to answer standard demographic questions; as part of a critique of the invasive process of immigration.

Equal parts Artaud-inspired theatre and experiment in public volumetric capture, this piece provoked issues of how we trace and track human identity in the digital age, as the controversial potential of facial recognition technology becomes commonplace in public spaces.

Pop-up Volumetric Capture

Architect Leah Wulfman designed a modular structure for “pop-up” volumetric capture, composed of interconnecting CNC routed MDF, illuminated by silver paint.

The structure was designed to allow for multi-camera 3D scanning and capture. Once inside, individuals were able to be captured from multiple angles.



Left to Right: CNC routed spaceship parts, diagram of portable CNC routed volumetric “spaceship design”, installation documentation.

Conversations on Immigration

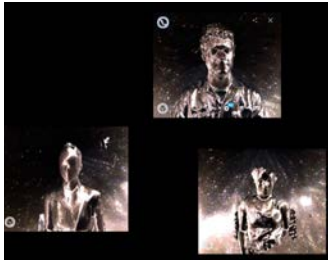
At the intake station, prior to being scanned, each participant was presented with the copious amount of paperwork required to partake in the immigration process.

The arduous paperwork process, alien to those who are already residents, illuminated the invasive complexity of immigration, creating a context where provocative conversations could occur.

3D Virtual Bio-Metric “IDs”

Collaborator Zach Rispoli developed custom software using “Open Frameworks” to rapidly modify each 3D scan.

Our dataset of 3D models intentionally removed characteristics such as race, age, or gender. Each 3D model, “alienated” from the original subject, commented on how the complexity of ethnicity and race should be carefully handled in the digital residue we create.



Holo-Booth

In the Spring of 2019, I was invited by the Science Museum of Western Virginia to develop a **Holo-Booth**, a project exploring volumetric capture in a public context, hosted during an exhibit opening held at the museum.

Using the contemporary mixed reality headset, the Microsoft Hololens, along with the volumetric capture software Depthkit, I arranged 3D stereo cameras to create a “photo-shoot”-like environment. We were enabled to rapidly capture holograms of visitors to an opening exhibit at the museum, each of whom was prompted to give short, improvisational performances.

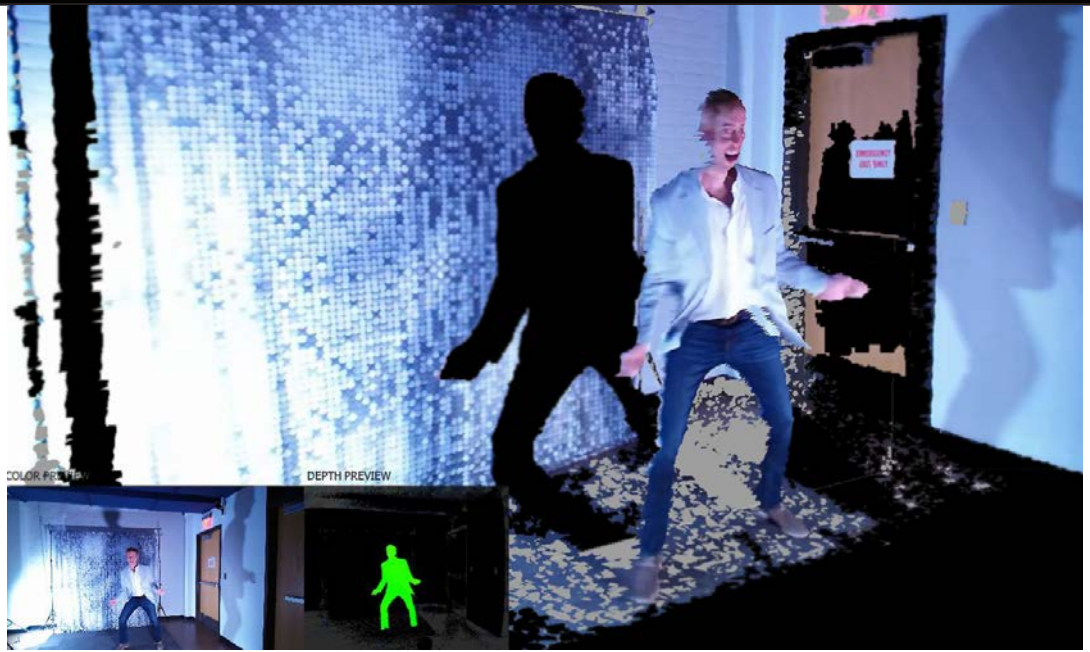
Capturing real-time depth video and viewing it wirelessly- streamed directly into mixed reality- presented a significant technical challenge. By implementing a novel workflow, which seamlessly linked captured footage into a live application from Unity onto the Hololens 1, we were able to immediately project each holographic performance into the environment of the museum.

Holobooth, 2019

Hololens, Kinect, Volumetric Capture Stage, Scatter’s Depthkit, Looking Glass, Leap Motion Controller, Lighting Equipment, various ephemera of volumetric media history.

Graduate student assistants Armighan Behzad and Huy Ngo collaborated and assisted on the development & presentation of this project.

Holo-Booth



Each 3D holographic capture, once loaded into the Hololens, was visible in the environment of the Science Museum throughout the opening.

In addition to engaging participants with the Hololens, a Looking Glass volumetric display was utilized, to demonstrate the diversity of modern holo-centric hardware.

As part of my ongoing interest in engaging audiences with the media archeology of technology, a kit was developed that contained early stereoscopic displays, vintage viewfinders, and a range of historic image making technologies.

This experimental project used a number of emerging mediums in a socially engaging way, encouraging the public to experience new technology firsthand, while broadening their awareness of where the technology is situated in the history of media and culture.

Left to Right: Case of Volumetric Media history toolkit, display of Looking Glass, screen capture of 3D video captures

Holographic Pipeline

Utilizing a combination of contemporary volumetric capture technologies, including a Kinect V2 and an Intel Realsense Depth Camera, each capture was seamlessly imported into the Unity Game Engine from Depthkit.

Each capture was then displayed in both the Hololens, as well as the Looking Glass Volumetric Display.

Mixed Reality Performance

For the event, approximately 30 participants were captured, creating short, improvisational performances.

Each 3D video was then edited and looped, capturing a holographic performance that each participant could view through the Hololens, seeing themselves in the collections of the museum.

Holo-Museum

The resulting work, a composite of each performance by all participants, became a holographic re-creation of the entire event.

When viewed through a Hololens, the museum became filled by all of the attendees, permanently on loop in a spatially-aware holographic simulation.

Left to Right: Documentation of all captures as 3D volumetric media, documentation of view through the Hololens 1, demonstrating the holograms in the museum.

Visual Language of Chromatin

To explore the **Visual Language of Chromatin**, I led the development of a multi-disciplinary team to create an immersive virtual reality exploration of the chromosomes of a fruit fly.

In this collaboration between molecular biologists, computer scientists, entomologists, and visual artists, I integrated the data visualization platform "Visual Molecular Dynamics" (VMD) a software package widely used in structural biology, with the Unity game engine. This enabled researchers to manipulate and explore DNA inside of a 360 physical and virtual environment.

As a contributor and collaborator on this $50k grant, our project utilized a large-scale motion tracking facility, the Cube, with simultaneous projections of the immersive experience surrounding the viewer.

Visual Language of Chromatin, 2018.
Immersive experience, featuring HMD's utilizing Qualysis Motion Tracking in Immersive Projection Mapped Environment.

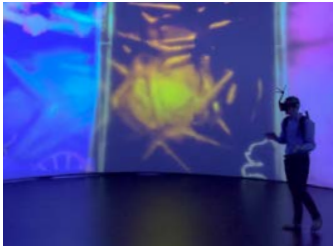
Collaborators:
Dr. Igor S Tolokh, Department of Computer Science, Eric Standley, School of Visual Art, Dr. Alexey Onufriev, Departments of Computer Science and Physics, Dr. Igor Sharakhov, Department of Entomology, Virginia Tech.

Visual Language of Chromatin

Our public exhibit was an interactive, fully immersive experience- both for participants and spectators. By combining animated projections and virtual reality, using a large scale projection environment paired with a motion capture system, the inside of the chromosome data was viewed both inside a head-mounted display as well as projected inside a 360° panorama.

Viewers could enter a simulation of the internal structure of the fruit fly chromosome, and physically navigate the spatial structure of the DNA by walking throughout the room.

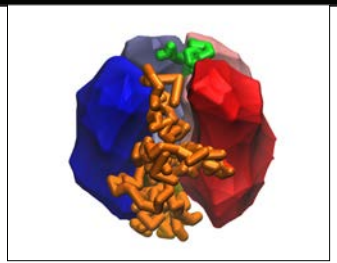
The user's view of the experience in virtual reality was projected onto two curved screens. This immersive projection environment was surrounded by Qualysis Motion Capture cameras, mapping the positions of the users and the VR headsets, tracked throughout the entire Cube environment.

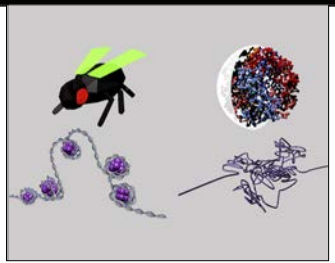


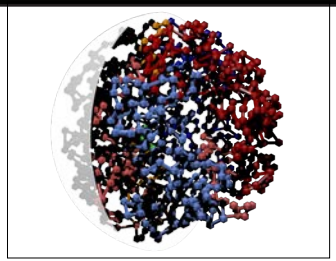
Technical Process

As a combination of a research tool and immersive artwork, this VR experience translated data from the lab of genetic scientists into the visual world of interactive art.

I assisted in the conversion of 3D models of DNA, converting the data from the lab to the studio, designing a VR environment for interacting and exploring it spatially.







Spatial Narrative Design

Placing real genetic sequences into virtual reality, I designed a lush and colorful way to explore the different layers of data.

Beginning by “entering” a fly, users were presented with a tour of the nucleus, the chromosomes, and the nucleosome, finally, exploring the blue and red helix of DNA.

Events + Experiences

Public events shared our research tool experience with visitors, to learn and explore this unique experience of DNA while interacting directly with the scientists.

Part interactive research tool and immersive experience, this project was part of my continued interest in art & science collaborations.

Virtual Princeton University Art Museum

During COVID, restrictions to the Princeton University Art Museum meant that physical access to the museum was limited.

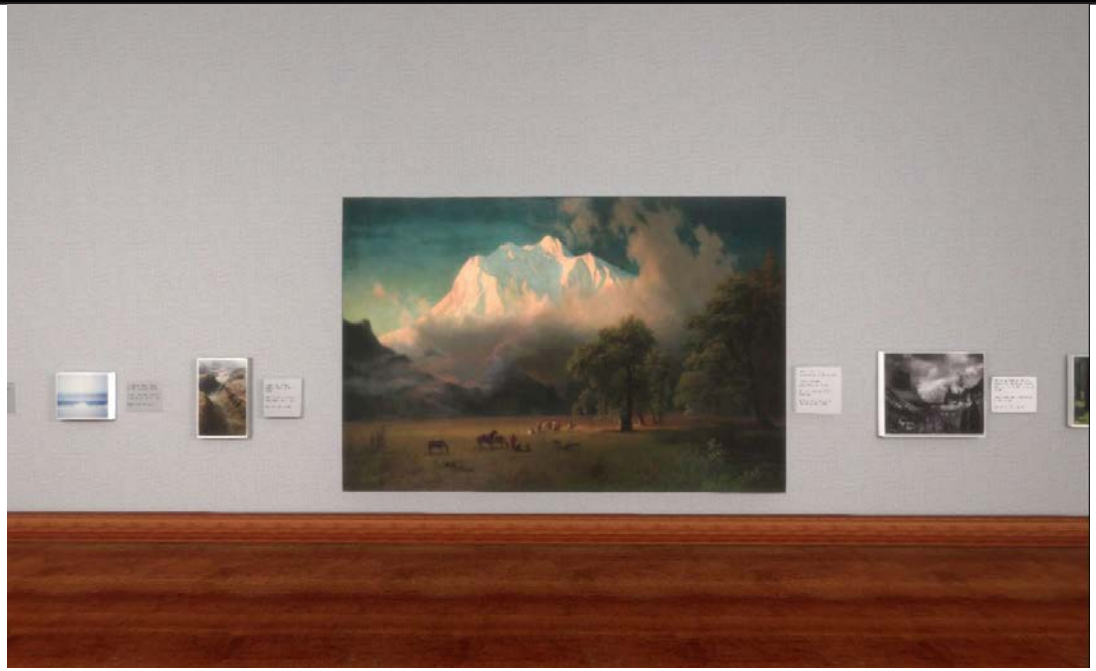
While hosted as a visiting Professional Specialist at Princeton University in the Fall of 2020, I worked with an interdisciplinary group of colleagues to develop a **Virtual Princeton University Art Museum**, to give students a novel way to experience art the pandemic.

In particular, we focused on re-creating an exhibit centering on Albert Bierstadt's 1875 oil painting of Mount Adams, Washington. Each additional work in the original exhibit was drawn from the museum's collection; focusing on images of natural and urban landscapes, each demonstrative of the effects of climate change on the natural environment.

Virtual Princeton University Art Gallery, 2020-21

Featuring the works The Rouge, Study 59 & Study 98, (1995-1996), by Michael Kenna, The Blue Lagoon & Windmills, (1958), by Virginia Beahan & Laura McPhee, Windmills, Coachella Valley, and Fire in the San Gorgonio Mountains, Amphitheater, David Gulch, Escalante basin, (1965), by Eliot Furness Porter, Sand Dunes with Truck on Pan Am Highway, (1989), and Windmill Farming, Tehachapi, (1986), by Marilyn Bridges, Denver, 1974 by Robert Adams, Barn and Smokestacks, Moss Landing, (1967–68), by Liliane DeCock-Morgan, Hoover Dam, Arizona/Nevada, from the Water in the West Project, (1987), by Robert Dawson, Manhattan Beach, California, Looking North from Marina by Robbert Flick, (1982), Palm Jumeirah, Dubai, United Arab Emirates, (2008), by Alexander Heilner, Clearing Winter Storm, Yosemite National Park, California, (1944), by Ansel Adams, Burial Ground from the series Nuclear Landscapes, (1988), by Peter Goin, Path in Woods, Great Spruce Head Island, Maine, (1981), by Eliot Furness Porter, Schoodic Point, Maine, (1968), by Minor White, Untitled, (1937), by Brett Weston, Iceberg, Ross Sea, (1976), by Eliot Furness Porter, Old Hanford City Site and the Columbia River, (1996), by Emmet Gowin, Labyrinth, Wright Valley, (1975), by Eliot Furness Porter, & Untitled #4, (2007), by Carlos Jiménez Cahua.

Virtual Princeton University Art Gallery



As a collaboration with Stephen Kim, Daniel Brennan and Cathryn Goodwin from the Princeton University Art Museum, I developed a simulated exhibit using Unity & WebGL. The resulting application enabled students to explore a lifelike simulation of a museum exhibit, while interacting live via the Zoom platform.

Students had full control of this online virtual simulation. By enabling control over navigation of the space, or, zooming in and out on particular works of their choosing, this immersive learning experience approximated the real museum environment, especially critical during a time when the pandemic prevented direct interaction

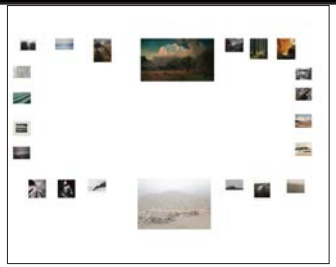
The project was regarded as successful, as it provided students the opportunity to see artworks at the appropriate relative scale, in relation to similar works, and to see a dense amount of detail; even at a proximity not possible in the real space.

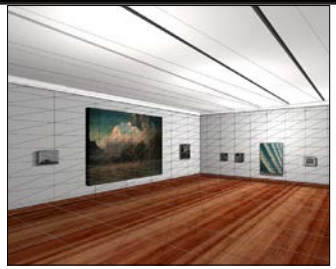
Each image featured is a screen capture of the fully interactive WebGL application.

Concept, Design & Development

An experiment in virtual curation, we started by arranging a layout in 2D, based on the work's actual size and visual similarity.

In the Unity Game Engine, I programmed each painting to link to the Museum's hard-coded high-resolution IIIF image, integrating the simulation with the museum's existing database.





Virtual Curatorial Collaboration

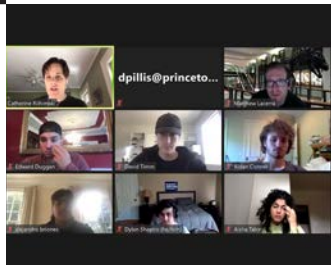
The arrangement of works spatially emulated the size and scale of an actual room in the museum.

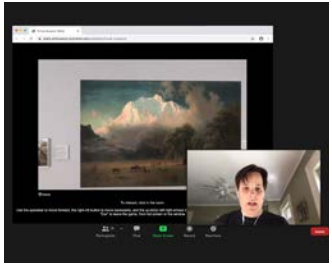
Each work was labeled with legible text descriptions, enabling students to identify works as they explored the space.

Zoom Interactive Museum

During the Zoom class, students were enabled to explore the room from the comfort of their laptop, working together in groups of Zoom breakout rooms.

This experiment in online learning was effective during the pandemic at emulating aspects of a real experience. The application can also be easily viewed through VR, when applicable.





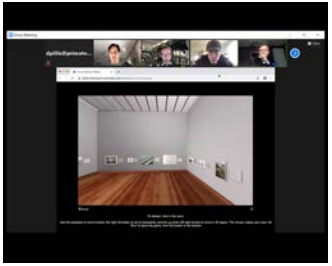


Photo Documentation of Zoom Class using Virtual Museum for interactive virtual tours.

Boo Box

Boo Box is a “virtual reality dressing room”. I developed this interactive virtual reality project in order to investigate the way we perform gender in virtual spaces, through the use of real time clothing simulations. This enabled users to try on realistic fabric simulations in VR, each of which emulated playful gender constructs.

The “virtual hands” of a user’s controllers responded to fabric realistically, depending on stretchiness, starchiness, or other properties of tactility.

The goal of the project was for a virtual avatar to “dress themselves” in virtual garments, by accurately grabbing and attaching each clothing simulation to their invisible avatar, composing a body in the process.

This project posed questions about the future effects of virtual avatars on the nature and portrayal of gender identity, enabling viewers to contemplate and experiment with their own gender representation in a virtual context.

Boo Box, 2019.

2’x2’ aluminum box, 6’ round carpet, khaki fabric, dress shirt fabric, denim, foam, LCD monitor, one pair of New Balance Sneakers, projection tray, round carpet (for VR boundary). Unity Game Engine, Looking Glass Display, Oculus Rift, encased MSI VR computer, embedded Oculus sensors, hand-held controllers.

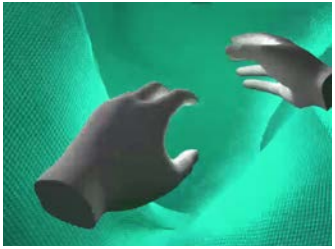
Boo Box

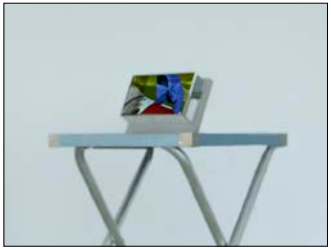
From the virtual to the physical and to the “volumetric”, multiple dimensions of interaction were explored through this project.

The contemporary volumetric display company, Looking Glass Factory Inc, began shipping the world’s first 8K light field display in 2019. Considered the first medium for interacting and viewing 3D holograms, the platform enables interactive holographic applications by interfacing with the Leap Motion Controller. I was an early adopter of this platform, and was given access to a Kickstarter developer kit. I began developing integrations between gesture controllers and live reactive 3D simulations.

I experimented with this new technology, the “Looking Glass”, to engage users with a non-VR experience for interacting with computer generated fabric simulations.

By using gestures through a Leap Motion controller, a user’s hand would trigger fabric to be stretched, moved, or bundled, depending on the interaction.

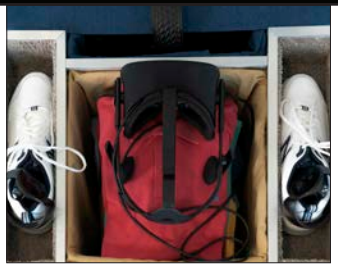




The Texture of Gender

From the virtual to the physical and the volumetric, multiple modes of interaction were explored in this project.

This technological experiment focused on a significant issue in meta-technology, the ritual of gender and the rendering of real-time clothing as they relate to the experience of virtual identity.



Three Dimensions of Experience

This hybrid physical/digital installation also enabled users to manipulate and wear other people's physical clothing, sourced from eBay, stored inside the box housing the VR apparatus.

In the physical installation environment, a large carpet set the boundaries for the VR space, with an emphasis on merging the tactile experience of real texture with the exploration of virtual texture simulations.

Exhibit and Interactions

This project was exhibited in the New Orleans Film Festival, Cinema Reset VR Exhibit, curated by Rachel Lin Weaver, New Orleans, LA as well as at the Index Art Center, Newark, NJ, in a Group Exhibit, "New & Improved", curated by Sophie Sobers.

NEW ORLEANS
FILM FESTIVAL

Snap the Drag

As part of a series of workshops in collaboration with Princeton University's LGBT center during the pandemic, I developed a project, Snap the Drag, to engage students with the complex function of drag culture in LGBTQ+ history, by using augmented reality to experiment with radical forms of self-expression.

During spring break, students were invited to work with visiting speakers and faculty across the LGBTQ+ spectrum, with the aim of providing a safe space for culturally relevant experiments in XR technology. Invited speaker Shaka McGlotten, Professor of Media Studies and Anthropology at Purchase College-SUNY, collaborated as a visiting lecturer for this workshop, in the Spring of 2021.

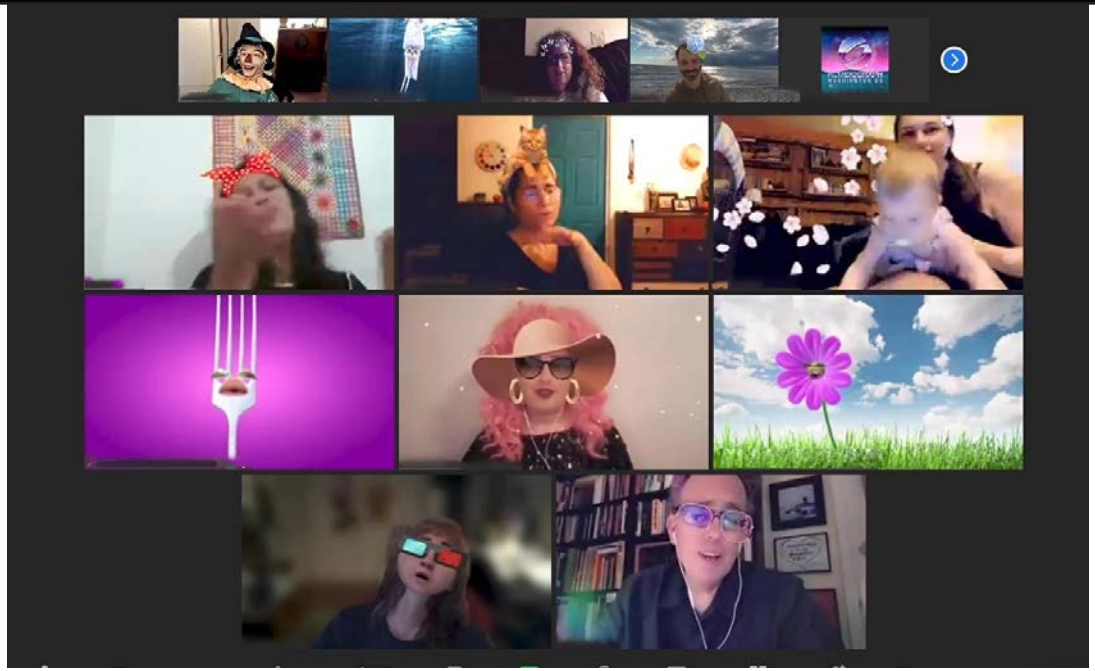
Snap the Drag both innovated with and parodied the contemporary use of augmented reality filters; questioning how AR relates to the history of drag through the mainstreaming of experimental forms of self-expression- often originating in LGBTQ+ history- and what these conversations may mean for the advancement, or further marginalization- of LGBTQ+ communities.

Snap the Drag, 2020-21

Augmented Reality Drag Cabaret series, developed using Snapchat Lens Studio, Youtube, Zoom, After Effects, Computer Vision

Collaborators: Gabriel Moore, Eric Angerlo, Daniel Benitez

Snap the Drag



Combining tutorials for computer vision to create custom augmented reality filters using accessible software with conversations on queer theory, performativity, and gender expression, this project was a provocative way to engage audiences with the intersections between these otherwise often isolated conversations.

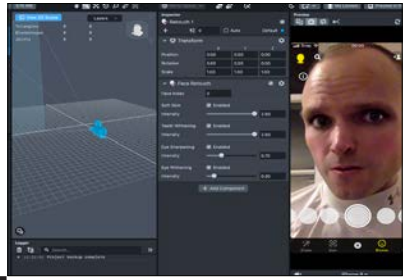
During the annual computer graphics conference, ACM's SIGGRAPH, held virtually in 2021, I collaborated with colleagues AJ Christensen, from the University of Illinois' Advanced Visualization Lab and Jeffrey D. Weekley, from the University of California Santa Cruz, to host a second edition of the event.

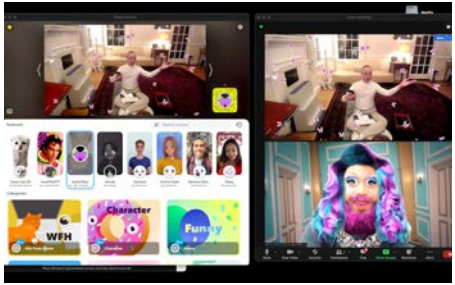
Participants were invited to create their own virtual drag-inspired personas- (either in-camera or VfX-based) through short, facilitator-led tutorials. The event was concluded with a "virtual drag cabaret", where participants debuted their digital (or IRL) avatar personas by singing karaoke- either solo or, as part of what became a full-blown Zoom sing-along via Zoom, to the likes of "Dancing Queen" by ABBA, lip-synced by fish in drag and macho cartoon cowboys.

Snap's Lens Studio

Lens Studio, a new software by Snap, the camera company behind Snapchat, is an easy to learn fully customizable Augmented Reality development environment.

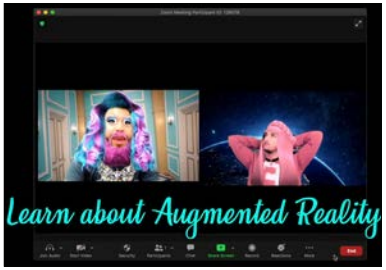
Users can either pick from templates, or create custom characters- based on Aruco Markers, face-tracking maps, or other triggers, to develop advanced and easy to use AR filters.





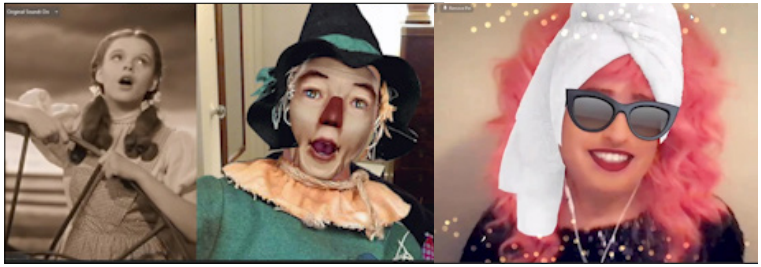
Collaboration with the LGBT Center

As part of an ongoing series of collaborations between the Princeton LGBT Center and the *Out in STEM* alliance, I was delighted to further foster LGBTQ+ oriented activities; in order to engage a wide audience by appealing to interests in contemporary technology, like Augmented Reality.



Computer Vision Drag Show!

During the SIGGRAPH event, I invited critical theorist/drag performer & University of Arizona professor Harris Kornstein to deliver a lecture on pronoun usage in digital spaces. Kornstein discussed research on the intersections of computer vision algorithms, facial recognition, and drag culture. Kornstein ignited the night with a solo performance as Lil' Hot Mess, a performative project.



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