MIT Fall 2018
2.S972 Virtual Reality, Sound, and Cinema –
Implications for Storytelling and Learning
Instructor: K. Zolot with special invited guests
Teaching Assistant: Yao Wang
Class Documentation

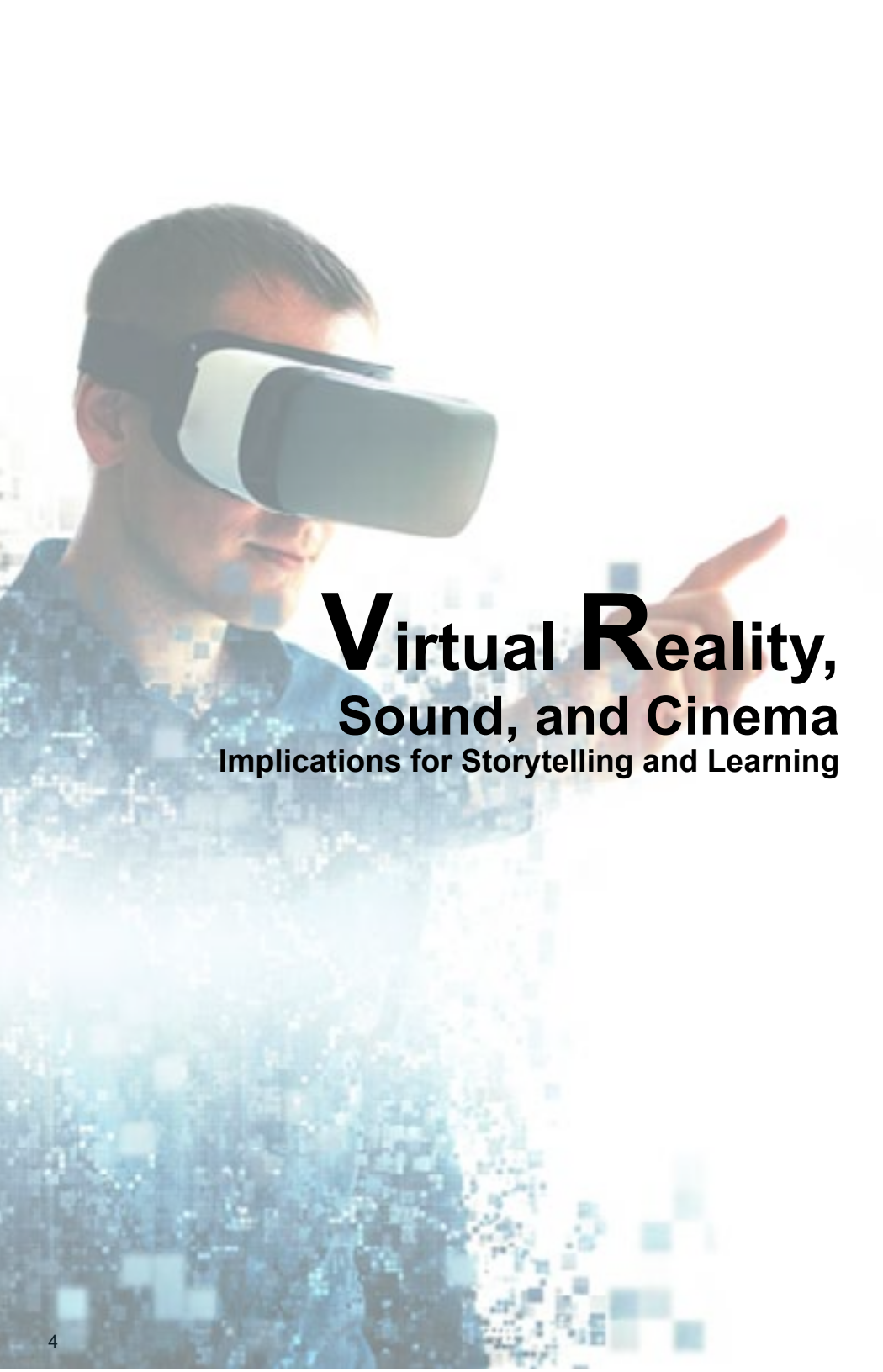
Virtual Reality, Sound, and Cinema

Implications for Storytelling and Learning

Minzi Long
Yueh-Yun (Sandy) Chen
Luis Fernando Gomes Zanforlin
Shuang Fan
Pablo Mirete Godoy
Norhan Bayomi
Nikhilesh Ghanta
Nicolas Oueijan
Yuri Goto
Zhi Zheng/George
Shirly Gurten
Wyatt Roy
Jeffery DelViscio
Daniel Dangond
Pakinam Amer
Mike Hao Jiang
Roberto Prado
Mike Skriloff
Maya van Wingerden
Alyse Brown

Massachusetts Institute of Technology

Berklee



Virtual Reality, Sound, and Cinema

Implications for Storytelling and Learning

INTRODUCTION

KEN ZOLOT

Senior Lecture, MIT Office of Digital Learning,
Professor of Creative Entrepreneurship,
The Berklee College of Music
Founder, Innovation Teams Initiative,
MIT Deshpand Center for Technological Innovation

"...We are launching a student initiative to explore VR in education and we are launching a new special seminar for Fall 2019 in which students will work with peers at Berklee College of
Music and Harvard University to explore the future of storytelling and learning through virtual and augmented reality We'll examine human perception, senses, haptics, embodiment and the ways in which we express and experience ourselves and others through many forms of media.

We'll pay special attention to 3D spatial audio and psychoacoustics. The class will develop hands-on projects in a lab setting and will learn how to tell stories interactively using spatial audio, 360º video and computer-generated environments. Students will go on field trips around Berklee, Harvard and MIT facilities and have access to state-of-the-art equipment as well as
expert visiting mentors."

TOPIC 1:
VR and Storytelling

SHEKHAR KAPUR

Is an Indian film director, actor, and producer, known for his works in Hindi cinema and international cinema. Part of the Anand family, Kapur became known in Bollywood with his recurring role in the TV series Khandan in the mid-1980s and his directorial debut in the cult Bollywood film Masoom in 1983, which won the Filmfare Critics Award for Best Movie for that year.

In this lecture, Shekhar Kapur introduced concepts of storytelling in interactive mediums, alternative practices of content creation as well as his vision to the future of narrative.

“Technology is the limit of art.”
“We don’t tell stories, we provoke stories”
“We are the stories we tell ourselves”
“Technology companies are going to be the new studios”

Shekhar Kapur
www. 5DariyaNews.com

Movie Scene of “Elizabeth” directed by Shekhar Kapur
https://www.ted.com/talks/shekhar_kapur_we_are_the_stories_we_tell_ourselves

FOX HARRELL

Professor of Digital Media & AI in both the Comparative Media Studies Program and the Computer Science and Artificial Intelligence Laboratory at MIT

Fox Harrell
http://5colldh.org/what-is-at-stake/harrell/

Professor Fox Harrell showcased his research from the “Imagination Computation and Expression Laboratory” in computing social mechanisms and understanding social dynamics in virtual worlds. In his lecture, Fox Harrell also explored the potential role of artificial intelligence in interactive storytelling experiences.

“...The ideal is for you to be able to do what you want but still have a good story.”

Student Reaction: “A great character system manager includes a feature in which a player is only able to visualize their character when they are doing well in the game. If the player is doing poorly their character display should be abstract in order to enhance avatar-character association without reinforcing negative stereotypes that relate to the character’s physicality.”

“When telling a story through a series of entries it is easier to create Artificial Intelligence generated systems in order to truly personalize a story experience to individualized players.”

AITHAN SHAPIRA

Founder at Making to Think, Lecturer at MIT Sloan.

Aithan Shapira is an artist and project manager whose subject matter spans more than a decade across three continents tackling conflicting fields of view, whether simultaneously addressing two sides of a wall or matters of migration or of false hope.

In this lecture, students participated in exercises designed to expose natural human communication systems that allow for creativity and cooperation.

“...The only two things between us and the future we are imagining are creativity and cooperation. We need to come up with better ways to be more creative and cooperative.”

Aithan Shapira
https://mitstudents.tumblr.com/post/138221575808/samtries-iap-making-to-think-leadership

TOPIC 2:
Virtual Body and True Self

DEEPAK CHOPRA

Is am Indian-born American author, public speaker, alternative medicine advocate, and a prominent figure in the New Age movement

Deepak Chopra, MD, FACP, is the founder of The Chopra Foundation and co-founder of The Chopra Center for Wellbeing and Jiyo.com. Deepak Chopra's xTalks presentation explored Immersive Realities for Learning and Creativity and the applications of virtual reality in meditation.

"...every experience you have, changes your biology… if we can create experiences of joy, of love, compassion, empathy, equanimity – what the Buddha called the Divine emotions – we'll change people's biology for the better."

MEL SLATER

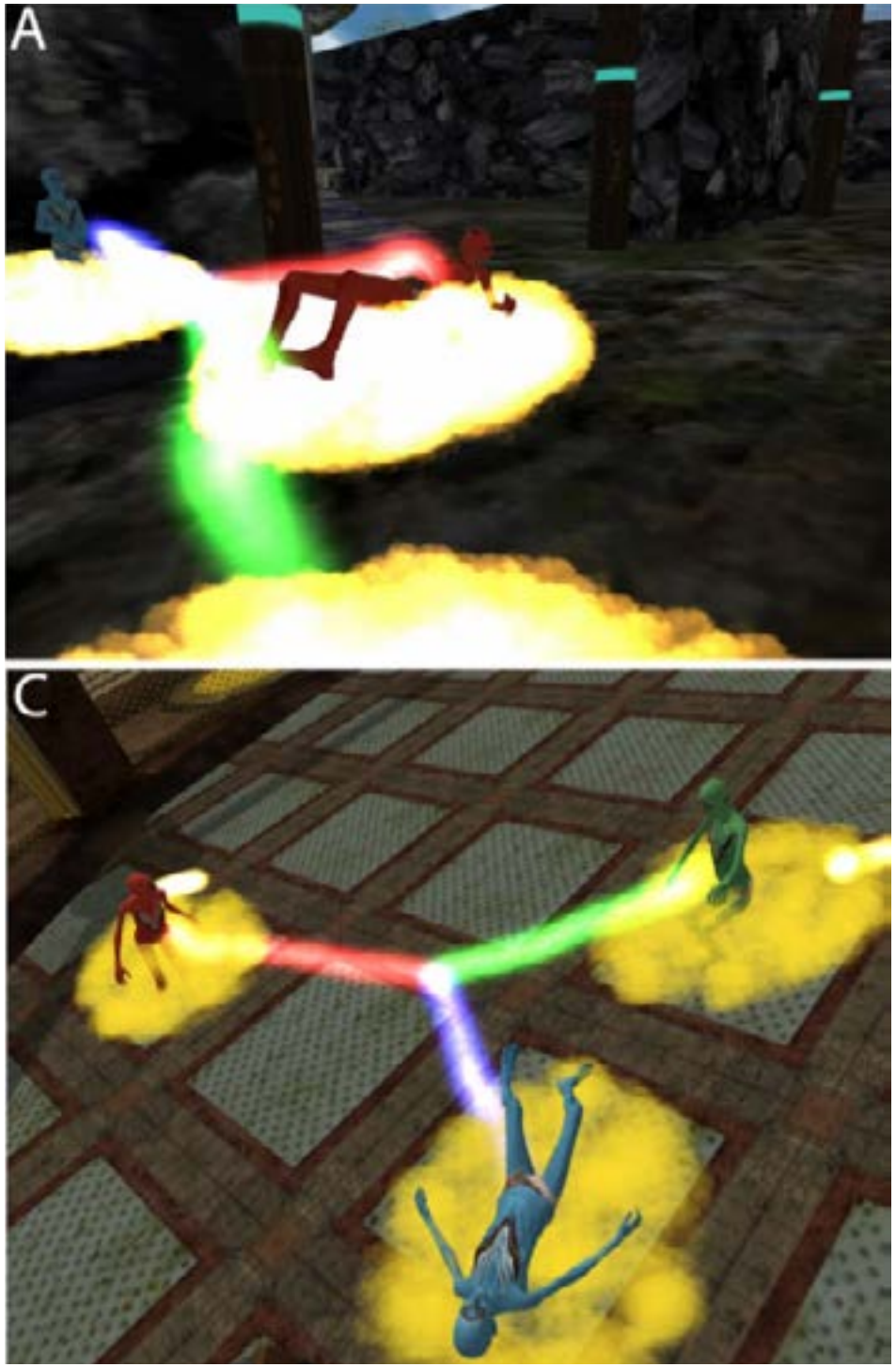
Mel Slater is a distinguished Investigator at the University of Barcelona in the Department of Clinical Psychology. He has a background in computer science in the field of computer graphics and virtual reality.

In this lecture, students explored multiple of Mel Slater's research projects on virtual reality immersion, body ownership, place illusion, plausibility and Illusory agency.

"Enhancing Our Life with Immersive Virtual Reality, Virtual Reality can break out of the boundaries of physical reality and achieve useful results through quite novel paradigms."

Student Reaction: "It was great to be exposed to a number of Mel Slater's researches. Each sparked a different idea about possible virtual experiences and mechanics. Perhaps the fundamental difference between virtual reality and other kinds of media is that unlike film which strives for voluntary suspension of disbelief, virtual reality can achieve involuntary suspension of disbelief."

Virtual Reality Out-of -body Experience
https://aplus.com/a/virtual-reality-out-of-body-fear-of-death?no_monetization=true



Virtual Death Experience
https://journals.plos.org/plosone/article/file?type=printable&id=10.1371/journal.pone.0203358

LORI LANDAY (Berklee)

Lori Landay is a professor of cultural studies at Berklee College of Music and an interdisciplinary scholar and new media artist exploring the making of visual meaning in 20th and 21st century culture.

In this lecture, students explored the evolution of narrative with the use of technology as well as implications of virtual worlds such as Second Life and High Fidelity.

“With audio, you are always simultaneously processing 360 degrees spatial information, with a video we can only process 180 degrees at the time.”

Lori Landay
https://www.berklee.edu/people/lori-landay

Student’s Reaction: “We should think more about how to create third-person experiences in VR.”

TOPIC 3:
Spatial Audio and 3D Sound

YAO WANG (Berklee)

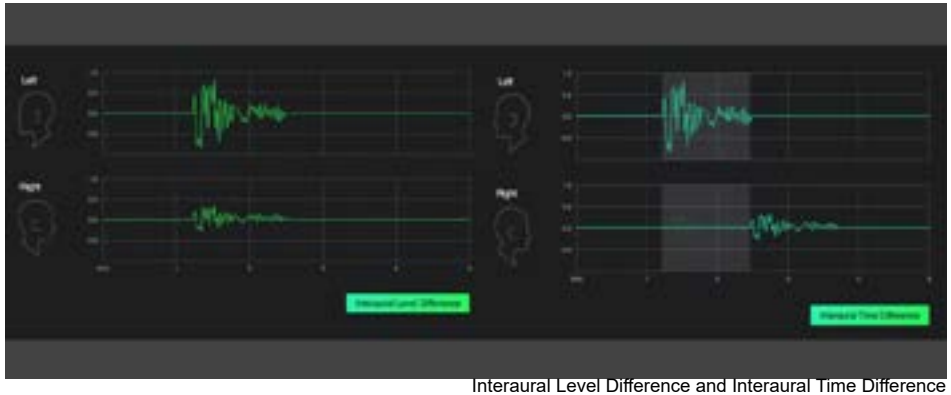
Yao is an award-winning producer, composer, sound designer, and artist. She holds a Bachelor of Music Degree in Electronic Production & Design and Film Scoring from Berklee College of Music. Passionate about immersive worlds and storytelling, she aspires to use new technology to elevate artistic experiences, highlighting the core message and value that creators embody.

Yao Wong

In this lecture, students were exposed to the inner workings of spatial audio from acoustics and technological perspective.

“Sound is crucial to bring realism to virtual reality”

“Spatial audio involves real-time binaural rendition of ambisonics as it tracks your head movement.”



Interaural Level Difference and Interaural Time Difference
Class slides from Yao Wang

VR, Sound and Cinema: Implications for Storytelling and Learning

This event hosted by MIT Open Learning explored the future of storytelling and learning through virtual and augmented reality. Panelists examined the human perception and the senses, haptics, and embodiment: the ways in which we express and experience ourselves and others through many forms of media.

The event started with a panel of faculty and industry experts in virtual and augmented reality, cinema, and storytelling. The second half of the event featured an interactive deep dive into 3D audio and psychoacoustics of sound spatialization with pioneers in the field Edgar Choueiri andMark Mangini.

Topics: Storytelling and Immersive Learning, Human perception and the senses, Haptics and embodiment, Psychoacoustics and 3D audio.

ABOUT THE SPEAKERS:

Shekhar Kapur is an Indian film director, actor, and producer, known for his works in Hindi cinema and international cinema. He gained international recognition with the 1994 Bollywood film Bandit Queen, which won the National Film Award for Best Feature Film in Hindi and Filmfare Critics Awards for Best Movie and Best Direction for that year. His historical biopics on Queen Elizabeth, Elizabeth (1998) and Elizabeth: The Golden Age(2007), won the BAFTA Award for Best Film and two Academy Awards.

Dr. Fox Harrell, Ph.D., is Professor of Digital Media & AI in both the Comparative Media Studies Program and the Computer Science and Artificial Intelligence Laboratory (CSAIL) at MIT. He founded and directs the MIT Imagination, Computation, and Expression Laboratory (ICE Lab).

His research explores the relationship between imaginative cognition and computation. He develops new forms of computational narrative, gaming, social media, and related digital media based in computer science, cognitive science, and digital media arts. He aims to push the boundaries of how computers can be used for creative expression and social empowerment.

Susan Rogers
https://www.radionz.co.nz/national/programmes/nat-music/audio/2018657684/susan-rogers-on-her-four-intense-years-working-for-prince

Susan Rogers holds a doctoral degree in experimental psychology from McGill University (2010). Prior to her science career, Susan was a multiplatinum-earning record producer, recording engineer, audio mixer and technician, working with a roster that includes: Prince, Barenaked Ladies, David Byrne, Jeff Black, Crosby, Stills, & Nash, Tricky, The Jacksons, and many more. She is currently a Professor at Berklee College of Music, Boston, teaching music cognition, psychoacoustics, and record production.

She is the director of the Berklee Music Perception & Cognition Laboratory where she studies auditory processing in musicians.

Edgar Choueiri

Edgar Choueiri is a professor of Applied Physics at Princeton University where he is Director of two research laboratories: The Electric Prolusion and Plasma Dynamics Propulsion Laboratory (where he works on advanced electric rockets for deep space spacecraft), and the 3D Audio and Applied Acoustics (3D3A) where he works on spatial audio. He is the author of more than 250 scientific articles and publications and the recipient of numerous awards, including a knighthood.

More information and Readings:
http://markmangini.com/Mark_Mangini/Blog/Blog.html

Mark Mangini is an Academy Award winning Sound Designer, Musician, Re-recording mixer and Lecturer. He has made his life's work creating unimagined aural worlds and fabricating sonic realities for theatrical motion pictures. Born in the suburbs of Boston, Mark dropped out of college at 19 to move to Los Angeles and pursue a career in film.

His first job was as a cartoon sound editor at Hanna Barbera Studios followed by a 25 year run as owner and operator of the successful Post Production Sound Company, Weddington Productions Inc. His studio is part of the Formosa Group, in Hollywood. Mark has worked on such notable films as Raiders of the Lost Ark, Gremlins, Die Hard, Star Trek, Beauty, and the Beast, Aladdin, The Fifth Element, The Green Mile, Warrior and Jack the Giant Slayer. He is currently (2015) a Governor of the Academy of Motion Picture Arts and Sciences representing the Sound Branch.

Student reactions: "As technology gets closer to imitating reality our content gets further from showing reality. Fake life can be preferable to real life. What happens if VR gets so close to reality that we don't care about it."

"...If you could have one method to remember someone you lost would you choose a photograph or an audio recording? After touch audio is the most visceral connection."

"The main problem is to create the proximity effect. For that, it is necessary to cancel crosstalk."

"Binaural audio is what 3D glasses do your eyes done to your ears. They prevent the left eye from seeing the right eye projection."erable to real life. What happens if VR gets so close to reality that we don't care about it."

TOPIC 4: 3D Video and Storytelling

ROB JACZKO (Berklee MPE)

Rob Jaczko is an Internationally recognized Recording Engineer and Educator. He has received Platinum and Gold Record RIAA certifications for his Engineering work on Major Label projects from around the world.

Field Trip at Berklee and Class Lecture Series

Field Trip at Berklee
Photo taken by Luís Zanforlin

Students explored Rob's collection of over 150 years of head-mounted displays. This lecture covered the importance of resolution on spatial storytelling, the history of stereography and the commercial trend of devices such as stereography viewers (invented in 1838).

"Stereography came before audio recording which is why people very limited with their entertainment options."

Student reaction: "Today taking 3D photos is too complicated which is why most people are no longer able to figure out how to do it."

"Images in 3D can be better than video because you can linger on it."

Rob Jaczko
http://www.janshapiro.com/wp/?page_id=7

CHRIS BOEBEL (MIT)

Chris Boebel is a filmmaker trained at NYU's Tisch School of the Arts. He is currently a filmmaker at MIT, where he co-teaches classes on documentary film. He co-directed the award-winning feature-length documentary "Containment: Life After Three Mile Island."

Chris Boebel prepared a presentation about virtual reality's market potential and difficulties for the technology's mass adoption. Students were able to analyze adoption trends of 360 videos and head-mounted displays and evaluate what would it take to make virtual reality a commercial success.

"360 degree videos should be a cautionary tale"

Student reactions: "Would any of us put headsets in the train? Would we wear it in bed with our partners?"

"Perhaps we underestimated the importance of being able to eat while watching a VR film"

Chris Boebel
https://openlearning.mit.edu/about/our-team/chris-boebel

TOPIC 5:
The True History of VR

RUS GANT (Harvard)

Rus Gant is a well-regarded international 3D artist, computer engineer and educator. Currently, on the Research staff at Harvard University and the faculty at Tokyo's Showa Women's University, he is currently pursuing work in the future of real-time 3D computer graphics and virtual reality. He is the Director of the Visualization Research and Teaching Laboratory at Harvard and the Lead Technical artist for the Giza 3D project at Harvard reconstructing the pyramids, temples and tombs on the Egyptian Giza Plateau in virtual reality. He is a past fellow at the MIT Center for Advanced Visual Studies and the Center for Creative Inquiry at Carnegie Mellon University.

Field Trip at Harvard's Geological Museum

Students took a field trip to Harvard's Geology department for prof. Russ Gant's presentation on the history of virtual reality going back to the cave paintings.

Chinese VR Class
http://www.shinecon.fr/news/how-vr-ar-education-broke-out-on-the-occasion-11176099.html

"...Virtual Reality has always existed. Caveman used wall textures to make their paintings seem real, they used sounds and acoustics to tell their stories as well as incense and hallucinogenics. To a certain degree, the cave is a form of VR headset in that it separates the real world from the virtual one."

"VR has an unexpected ability to relieve pain. In fact, it is the most effective pain relieving drug used in hospitals today. Pleasurable environments are so overwhelming and baked into our brains that it can really activate it."

Student reactions: I was amazed by his lab and the endless amounts of VR technologies he has collected and tested.

“It wasn’t the first time someone had suggested to me the idea that humans have been creating technologies and content for virtual reality since the beginning of record taking, it was, however, the first time I was convinced on how similar their intentions and ours are.”

TOPIC 6:
Composing Images

FELICE FRANKEL: (MIT)

Felice C. Frankel is an award-winning science photographer whose photographs have appeared in many publications. A research scientist in the Department of Chemical Engineering at MIT, she is the author of Envisioning Science (MIT Press), No Small Matter (with G. M. Whitesides), On the Surface of Things (with G. M. Whitesides), and Visual Strategies (with Angela H. DePace).

Felice Frankel
https://www.felicefrankel.com/about/felice-frankel-bio/

In this lecture, Felice Frankel explored the process of telling stories with photography and the process of composing beautiful meaningful images.

Student reactions: “I was surprised with the similarities between Felice’s process for taking photos and my process for capturing sounds, layering and editing them.

“I wonder what would happen if a photographer taught a class to sound engineers changing the words camera to microphone, light to sound, color to tone and brightness to loudness.”

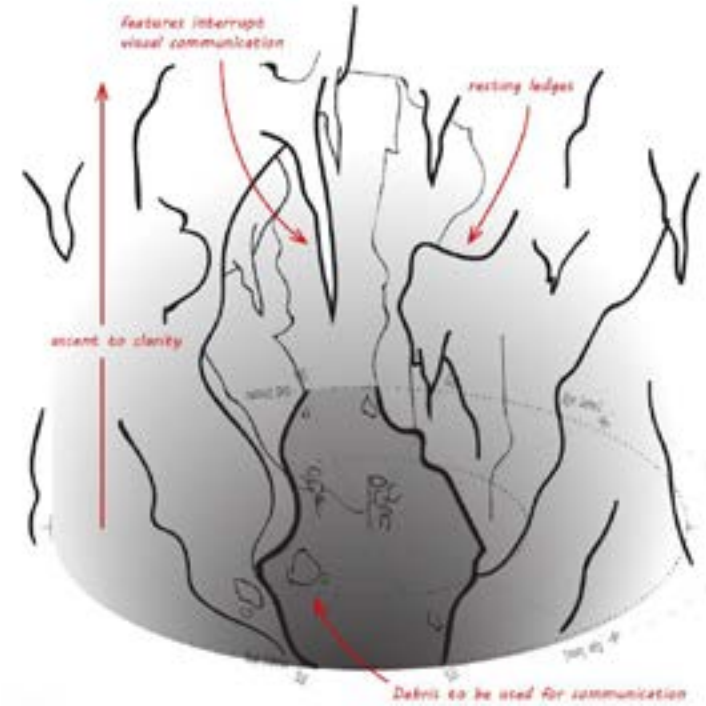
STUDENT PROJECT

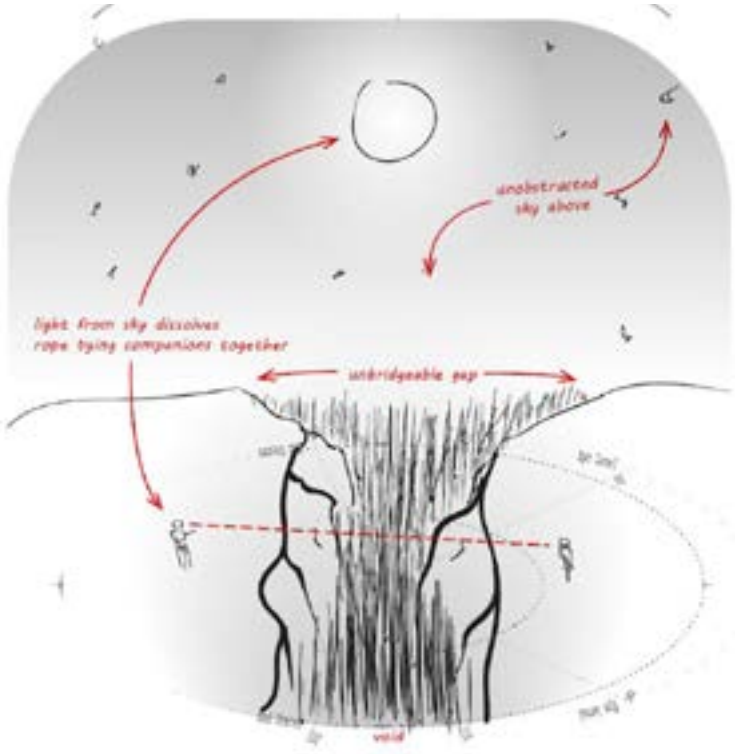
Project One: Ascent

Ascent is a multi-player virtual reality cooperative rock-climbing game. In Ascent players are placed on separate cliffs and are tasked to share their climbing tools in order to reach the top. A random subset of the total required tools will be assigned to each of the players; therefore, players must collaborate to progress. Players will be presented in the overlapping visual range, but no verbal communication is permitted. The game's interactive spatial music reacts to the player's height, pace and cooperativity in order to stimulate players to help each other in them ascend. The game's audio uses an empirically derived reverberation system that helps players to accurately gauge their distance from the ground and each other as well as increase their virtual immersion. Players will have to use non-verbal communication as well as gage the other's progress in order to properly share their tools and reach to the top. The goal of this experiment is to use virtual reality exclusive systems in order to stimulate cooperation and render a pleasant and meditative experience.

Massachusetts Institute of Technology

Berklee

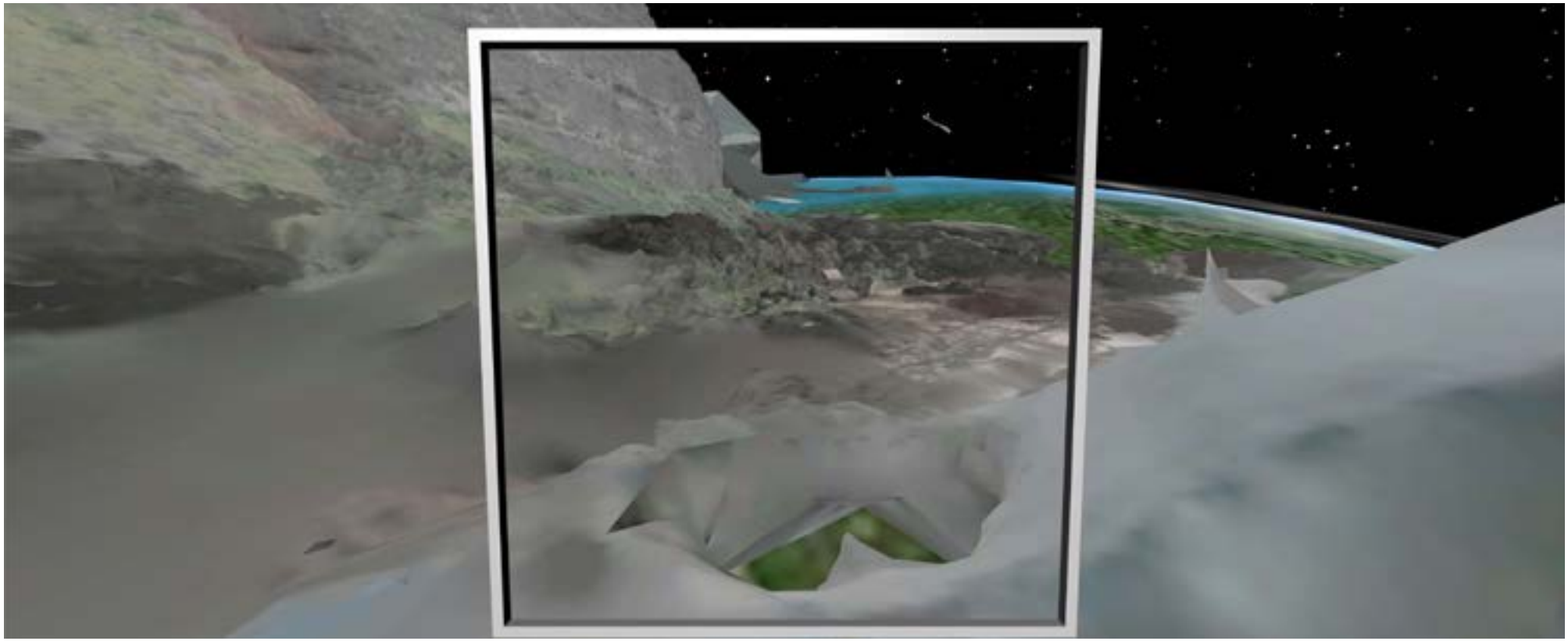

features interrupt visual communication
resting ledges
ascent to clarity
Debris to be used for communication

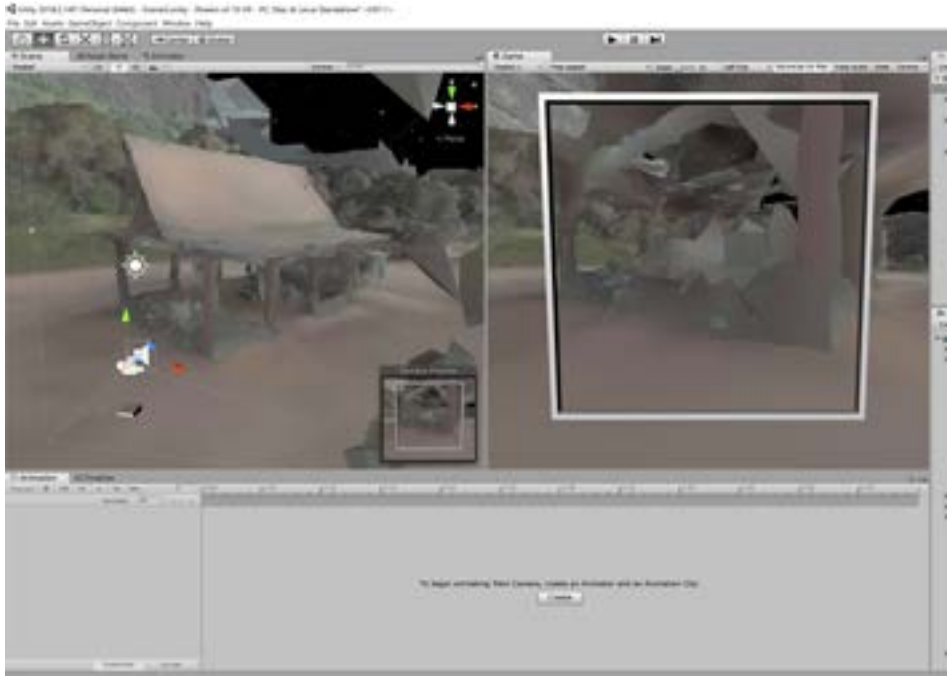

unobstructed sky above
light from sky dissolves rope tying companions together
unbridgeable gap
void

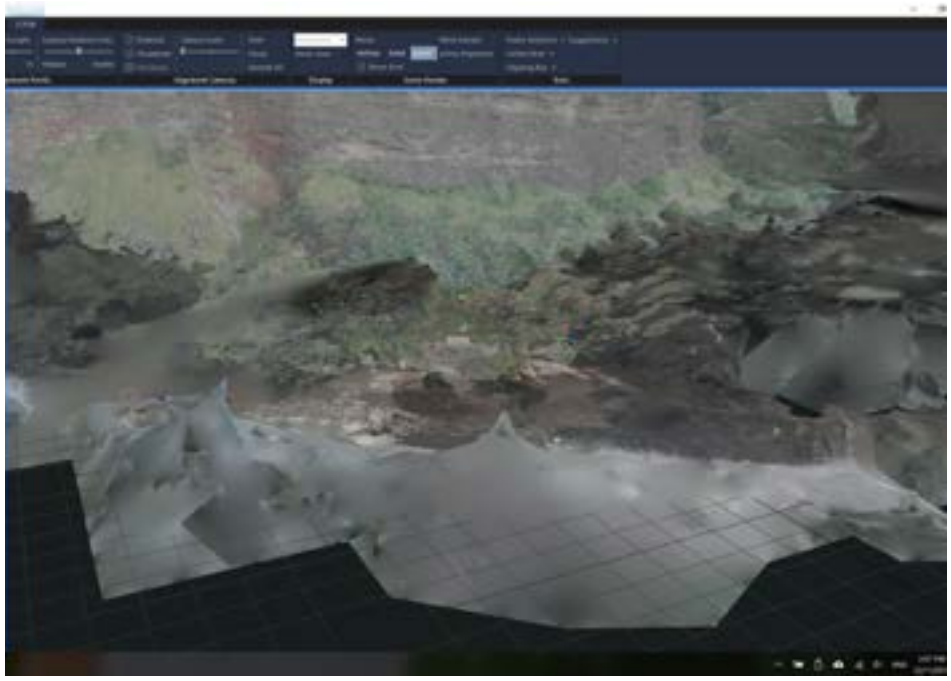

1 Ascent 310 - 325
2 Rebalance 325 - 340
3 Powers of 10 340 - 355
4 Mind of Child 355 - 410

Project Two: **Powers of 10**

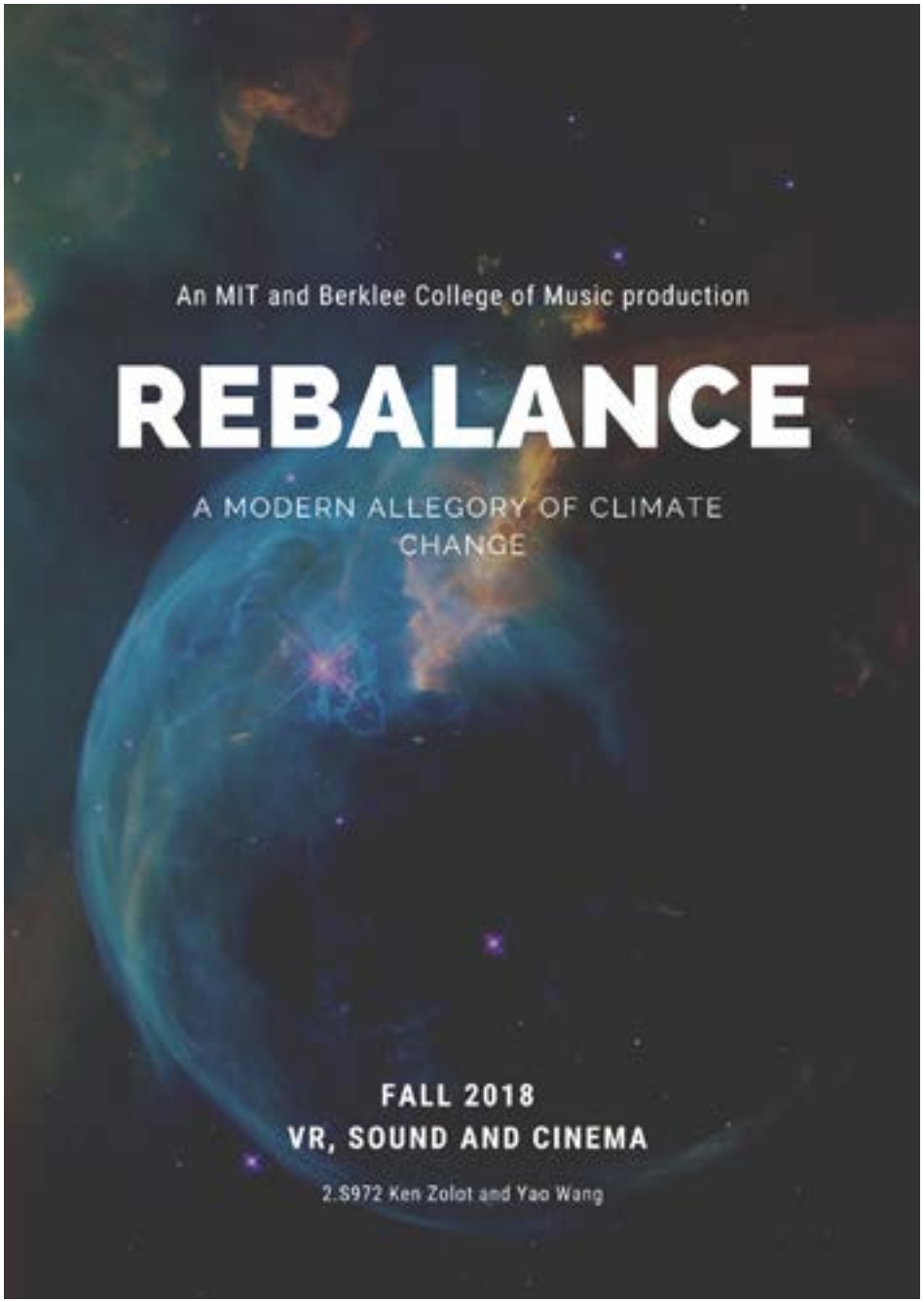
Powers of 10 is a VR adaptation of a 1977 video about the scale of the universe. When I first saw this video it blew my mind because it offers a new perspective on the relation of all things. Last year when I started working on VR I noticed that one of VR's strengths is conveying scale -- so I wanted to create a piece that lets you feel like you could hold the whole universe in your hand.



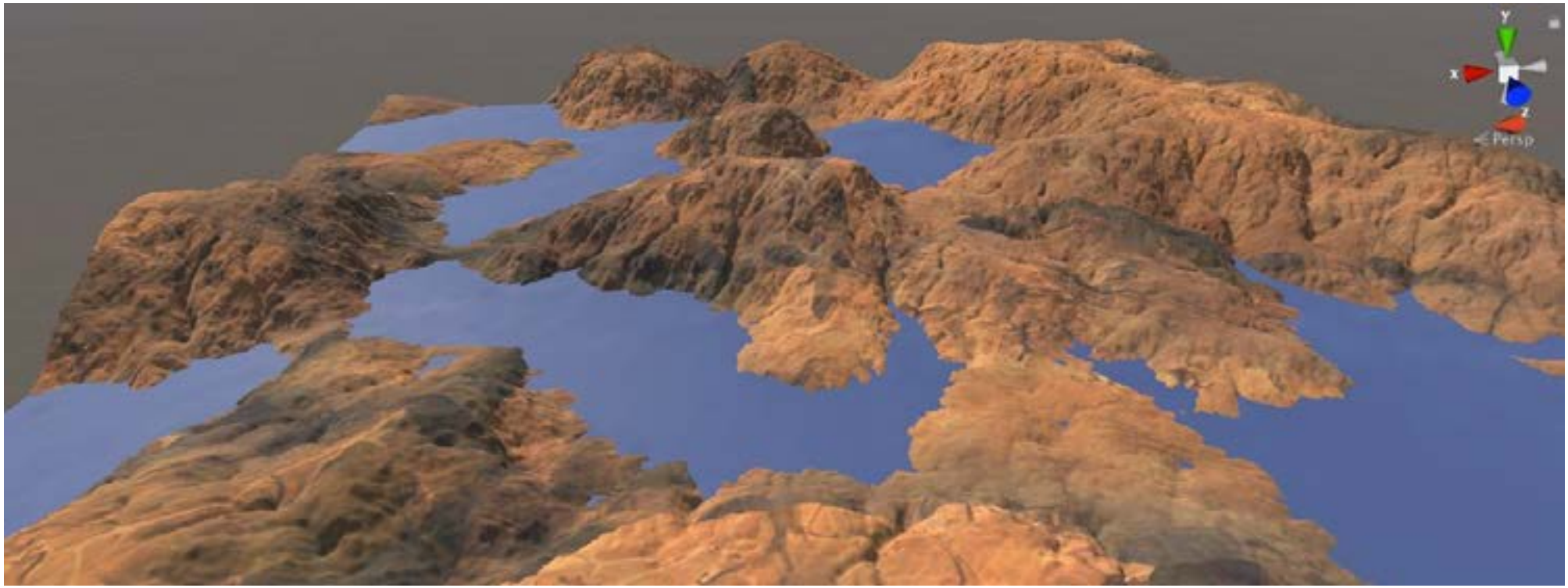


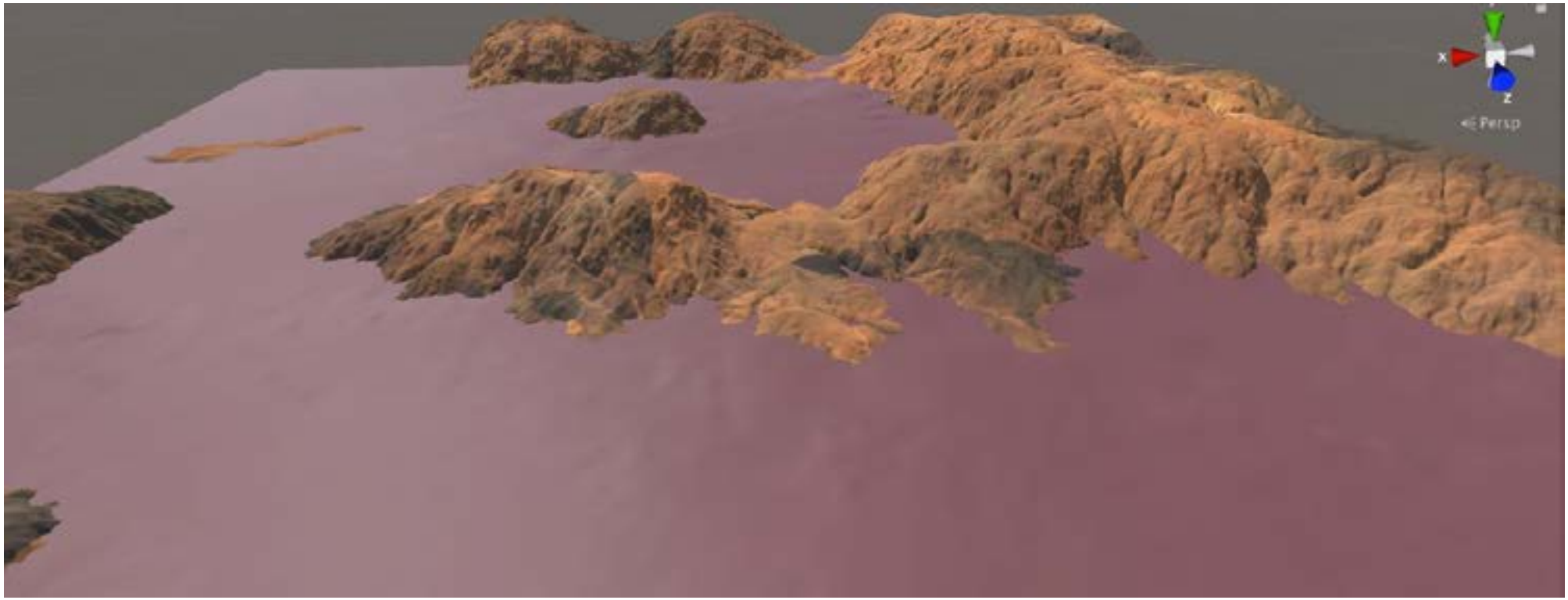


Project Three: Rebalance



Massachusetts Institute of Technology Berklee


Y
X
Z
Persp


X
Z
Persp


CREDITS
Writing and design
Jeff DelViscio
Pakinam Amer
Maya Van Wingerden
Music
Roberto Prado
Sandy Chen
Pablo Mirete

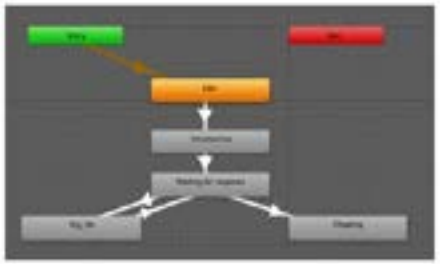
Project Four: In a Mind Of a Child

Children have amazing ability to study new languages. Our projects is design to give adults the sandbox that allows children to study languages efficiently.

We want to create a virtual reality environment that would let you play as child, in an immersive environment of people who doesn't speak your language. The player would try to communicate with the characters in the game, and try to achieve a flow of conversation. After the player masters the first set of skills, new words would open up and the player can learn and acquire a new language by practicing actively in a child sandbox environment.

Implementation

unity



Massachusetts Institute of Technology

Berklee


Speak first
Learning environment
Themed house
Help

COMMENTS FROM STUDENTS:

“Putting students from Berklee, Harvard and MIT in the same classroom and stimulating them with articles and great speakers creates a very fertile ground for ideas and this was exactly my experience in this class.”

“I learned many new ways of thinking, and it was a very inspiring experience for me. […] It was nice listening to many different experts sharing their knowledge in their own different fields.”

“A wonderful lesson on presentational pacing and educational improvisation. I also loved getting the opportunity to see people from different fields of study come together and present ideas and projects that they are most passionate about.”

“The class was all about the interplay between science and technology through storytelling.“

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