***Noise Floor*: Merging Theatrical and Themed Entertainment Design to Create an Immersive, Interactive Multimedia Gallery Exhibit (On the Cheap!)**

by

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Abstract:

The worlds of gallery art, theatrical design, and themed entertainment design are often thought of as distinct practices that do not overlap. However, as a professional who has worked in all of these fields, I see them as points on a continuum, and feel that experiences in one can inform work in another. In 2016, I set out to create an immersive, interactive, multimedia gallery installation that drew from my work in all of these fields, both to demonstrate that they are not as separate as sometimes imagined, and to create a project that would (however temporarily) shatter the barriers between art and audience.

Introduction:

Fine artists don't often think of themselves as "designers", and often think of design as more inherently instrumentalist than a "pure" exploratory art practice[1]. This division is not as strict as it sometimes seems: many fine visual artists have worked in theatrical design, from Munch to

[1] In fact, I once heard a faculty member (who shall remain nameless) at Yale School of Art say: "it isn't art if you have some idea of what you're trying to make in advance", which tars anything "designed" as not being art from the get-go. I am not implying that all fine artists share this sentiment, but merely that it is a fairly common sentiment in the fine art world—this is far from the only person I've heard express such thoughts.

Hockney[2]; there are several theatrical sound designers who also work as fine artists, from Bruce Odland[3], to Vincent Olivieri, Brad Berridge, and Davin Huston (who work as a collective called Push the Button[4]). I am a theatrical and themed entertainment designer who also has created gallery art for decades (having shown paintings and films at Galapagos Art Space in Brooklyn, at Anthology Film Archives in Manhattan, at salons in Oakland, and elsewhere). As such, my own practice has led me to see these oft-separate worlds as points on a continuum, rather than wholly distinct practices. As someone who has long been fascinated by the world of installation art, and particularly multimedia art, I have long harbored an interest in creating installation works myself. As someone who often finds the distancing effect of gallery art ("Don't touch! Don't speak! Don't breathe too hard!") alienating, I decided to create a piece of interactive, immersive multimedia art that could be housed in a gallery, that would use tools of the theatrical and themed design trades, that would not be prohibitively expensive to mount, and that would shatter the barrier between art and audience. To that end, in 2016 I created *Noise Floor*, a gallery installation that ran in the Rozsa Center for the Performing Arts "Gallery A". The creative and technical process of creating this piece (which incorporated scenic and prop design elements, video design, and sound design, as well as a custom interactive control system) is the subject of this paper.

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[2] See an enlightening Guardian article on some of the more notable crossovers between the two worlds: https://www.theguardian.com/stage/2012/jul/17/collaborations-visual-artists-theatre

[3] http://bruceodland.net/

[4] https://www.facebook.com/PushTheButtonGroup/

Conceptual Background:

Noise Floor was born from a fascination with life in an industrialized society. In observing that so much of contemporary western life is predicated on the technologies accessible to us, I sought to create a space that reflected some of the substantial inventions of the 20th century, and ruminated on their significance, both intended and otherwise, both positive and negative. It started with a refrigerator. I had the image of a 1940s refrigerator in my head, isolated in the center of a room, humming ominously. Refrigeration is one of the most significant inventions in all of human history, changing the way people could live and allowing the growth of non-farming professions all over the world. At the same time, old refrigerators relied on toxic stews of chemicals to achieve their electrified chill, and caused devastating damage to the ozone layer upon release of old refrigerant. In this first image, I found the crux of the piece—technological innovation has allowed the growth of much opportunity (my own career would not exist without it), but often with drastic costs. Once I chose to center the exhibit on the refrigerator, illuminated by pools of downlight[5], the other objects I wanted to use came to me rather quickly. I wanted to represent the automobile, and to that end I sourced enough parts to build the front 1/3rd of a real automobile in the gallery (hood, wheel wells, steering column, dashboard, gear shift, front row of seats). I wanted a wall of electric lights. A wall or shelf full of iconic mass-produced toys. An old radio. And a wall of surveillance screens, connected to cameras hidden around the exhibit. These items became totems of the 20th century, automobiles led to huge changes in the way humans lived, as did electric lights and wireless information transmission. Consumer toys

[5] I found a phenomenal old fridge to use, and once isolated in its pools of light, it reminded one of the monoliths in Kubrick's *2001*.

represented the age of mass-production, as well as the use of highly toxic materials and energy-intensive processes to create innocuous throw-away items for children. And surveillance cameras acted as an emblem of the transition from the 20th to the 21st century, and our pervasive surveillance state.

Beyond selecting iconic items and assembling them, though, I wanted to create a flexible narrative space. We live in a noisy era, and each of these objects can be associated with various sounds and noises that help populate the environment in which we find ourselves. Additionally, I wanted to create an exhibit that encourages the audience not just to look, but to touch and interact with objects in the space. I also wanted to play on the idea that any space, any building we find ourselves in will have a "noise floor", a baseline set of tones that is always there that most of us never notice—whether it's HVAC hum, the whine of computer equipment, or other sounds, we are seldom in a space that is actually "silent" in our current technological era. As such, even when no audience members were interacting directly with the objects in the space, there would always be a baseline "room tone" playing, one that shifted with each new entrant in the space.

Each object or set of objects would host a series of interactivity points. For some, this was simple: you could open the fridge, and open the freezer compartment inside the fridge. Each time you opened the fridge, a new fridge compressor sound would play (from a randomized library of old fridge compressor recordings), and each opening of the freezer would trigger additional sounds (sounds of the freezer itself, crackling ice, and other such). Some were more complex: in the

automobile you could sit and turn the engine on or off, step on pedals, use turn indicators and wipers, and shift gears, all of which would produce a range of triggered sounds (again, randomized); the vintage wooden console radio would play (over its vintage speaker driver) content I selected or produced, and the volume and tuning controls would work appropriately as you would expect, even though those controls were triggering computer playback systems, rather than actually receiving any radio broadcast. Headphones were hung next to each surveillance screen station, playing custom recorded content (conspiratorial whispers, performed in a variety of foreign languages); the wall of electric lights would allow guests to switch each one on or off, and would trigger sounds to accompany each light turning on. The toys could all be picked up, and lifting them would trigger a host of sounds. Entering the gallery would trigger a voice welcoming you to the exhibit, and would also trigger a new "room tone" to act as the baseline noise floor of the space. Exiting via the gallery's rear exit would trigger the voice of a three-year-old girl[6] saying "Are you sure you want to leave? Don't leave" in an imploring tone.

Beyond the one-to-one interactivity points, I also wanted to make it so that when the gallery had more than one guest in the room at once, a certain combination of triggers (four different points at four different objects, all active at once) would invoke a cataclysm. The playing sounds would all shut off, overtaken by a robotic countdown voice, and huge heavy rumbling. A projector would snap on focused on one of the space's blank walls, showing either the marching of an

[6] Thanks to Sophie Cyr, and her parents Kent and Mary, for being so game and performing this for me!

army, or a missile launch, or industrial explosions, and as the countdown built, the engine roar grew until the entire space was overwhelmed with the roar of technology and fire. After this sequence, the room would fall dark for a moment, and slowly, a new room tone would fade in. This sequence was programmed to not be repeatable within 30 minutes of having been triggered, such that even if guests figured out how they had triggered the sequence, they would second guess themselves, because they couldn't immediately do it again.

In all, I wanted to create an environment that was unsettling, but also exciting. The automobile was outfitted with a large point source speaker where the engine would normally be, a narrow coverage point source aimed directly at the passengers' heads, and a vibration transducer under the seats, to convincingly portray the start of a powerful car—though because this content was randomized, whether one experienced the roar of a well-tuned Dodge Charger, or the sputtering failure to start of an old Hyundai, was not something one could predict. The electrical lights mostly played sounds associated with both electricity and lights—hums, buzzes, transformer explosions, and so on—except for one lamp that had as its base a cast ceramic caricature of an Asian woman that was so racist in its drawing I programmed its switch to only play sounds tied to racism: from George Wallace's "segregation now, segregation forever" speech, to Dave Chappelle saying "this racism's killing me inside". The toy shelf mostly played sounds of the toys telling you to put them down and stop touching them inappropriately, though occasionally they also played clips of Donald Rumsfeld ("known unknowns") or of myself reciting the words of J. Krishnamurti. The radio broadcasts ranged from an all-American baseball broadcast to classic

swing music, to the horrifying rantings of Charles Coughlin. Every object was shiny and exciting and also dark and kind of awful.

Technology:

It was critical that no one experience this piece the same way twice. Much as we all form attachments to and relationships with the important objects in our lives[7] that are based on our experiences and biases, each guest in the gallery would have to form their own impressions, and those would vary not just because of each guests' predispositions, but because every trigger, every piece of content, was part of a randomized bucket of content large enough that the exhibit would always provide a different experience. In addition, the experience of exploring the exhibit as a lone guest on a quiet day would be drastically different from experiencing it on a crowded day. At the opening reception, there were more than 100 attendees, and with all of the guests playing with every object and trigger point, the piece was a true noise floor, reaching a real cacophony at times.

When I set out to create this piece, I considered my technological needs by breaking them into four general categories:

1) Triggers/Sensors
2) Control

[7] I know plenty of people who have named their cars, and thought of them as having distinct personalities.

3) Playback

4) Reproduction

Triggers[8]/Sensors: this category is the direct layer of devices (whether hidden or otherwise) that guests would interact with. Some of these, by design, would need to be hidden (for example, I wanted the toy shelf to trigger sounds simply whenever anyone picked up one of the toys, without having to consciously flip a switch). Some of these could be more explicit (the electric lights could be operated by simple toggle switches, with no pretense of hiding the switches). The sensors would need to be hidden by default. Selecting this kind of gear can be daunting for anyone who hasn't done so before. A quick glance at the internet reveals hosts of industrial switches and controls, ranging in price from the quite inexpensive to the very costly, in many sizes and shapes and with many wiring and power configurations. For each item, the method of interaction had to be determined first, then the actual props had to be acquired and assessed in order to figure out what industrial controls would best suit the particular operation. In the original plan, we had intended to use some of the literal switches built into objects for the computer triggers, such as the electric lights. However, when push came to shove, it was easier to use external toggle switches that we rigged both to trigger our playback systems and to turn the lights on and off[9]. Entry and exit sensors were optical trip sensor that sent an invisible beam

[8] Note that I use the term "triggers" here to refer to a range of electrical devices that provided data used for triggering content playback. These ranged from toggle switches to rotary encoders, contact closures, pressure sensors, and so on.

[9] We certainly could have made our original plan work, given enough installation time, but our installation period was quite brief, so there were some choices made for implementation that came down to expedience rather than ideal operation. As it happened, this choice ended up

of light across the passages, and when the beam broke, the sensor tripped. There are more advanced arrays of sensors that would have provided more indication of whether someone was entering or exiting via a given doorway, but those were costlier and more challenging to implement, so we elected a simpler plan.

Control: These sensors and triggers needed to send their data somewhere. Since I knew I wanted to use a personal computer-based playback system[10], I also knew that no personal computers we had available would directly accept or interpret two-wire switch data, nor provide the 5V power source needed to energize those devices. In a theme park design, I would elect to use professional show-control equipment, whether a Medialon rack-mounted unit, or small AMX distributed devices (or something else along those lines), but my budget precluded purchase or rental of a dedicated show controller for this project. Thus, I elected to use microcomputers[11], which are very small (often single-circuit board) computers, available for as little as $50 apiece. These devices feature a range of ports and pin connections, and are able to handle GPIO (general purpose input output) data, which is to say, the data generated by the switches and toggles I had selected. However, while this would suffice to take in my trigger data, that data would still need to be passed to a playback system, as no tiny single-board computer could hold or serve the mass amount of audio and video data that would make up this installation.

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being fortuitous, and it meant we didn't have to worry about guests knocking the lights over when they tried to reach under lampshades or the like.

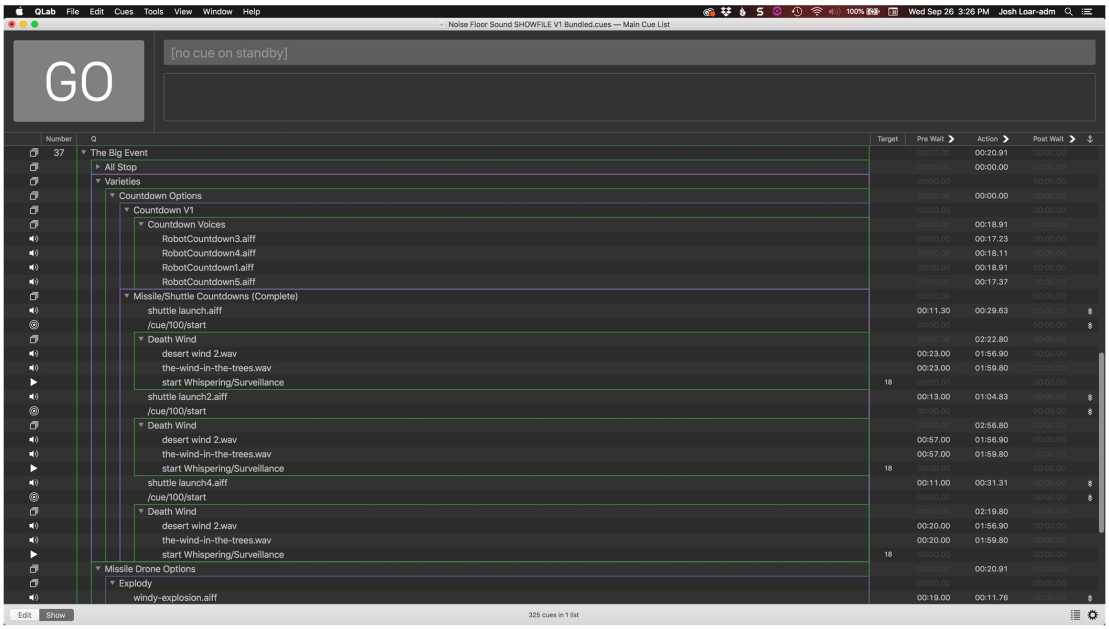
[10] More on this in the next paragraph.

[11] Many thanks to Mike Schmitz and Paul Bristol, my student assistants on this project, who steered me in this direction, and whose own knowledge of programming microcomputers removed any barriers to this solution in my system flow.

Playback: In a fully-funded themed installation (or even a well-funded gallery project) I would probably have elected to use a dedicated media server for playback. Media servers are hardware devices running custom software. They are dedicated solely to storage of media and to playing that media out a range of output ports when triggered to do so. However, such servers are very expensive, and well beyond my meager budget for this project. The next solution would be a software solution running on a well-appointed personal computer. Many gallery installation artists are fond of the Max/MSP software platform, as it is highly customizable and flexible, but I wasn't creating generative music[12], I didn't need each sound piece to be modified in real time, I just needed randomized selection from among a batch of pre-prepared sound and video content. Because of this, and because the programming of the platform is much simpler than Max, I elected to use Figure 53's QLab software (the most common theatrical sound playback software). By creating group cues (which allow you to place a host of different content within the group, and then select "Start Random Child" as the group cue's "Mode", when fired, that group cue will play a random choice from among the media files stored inside it. What's more, by nesting group cues inside of group cues inside of group cues, one can randomize to a very deep level, creating

[12] Generative music is music created by structuring a set of parameters and then setting a program loose to bounce around against those parameters making whatever sounds your configuration is designed to make. Brian Eno is a notable proponent of generative music, having used some form of generative music in many of his ambient compositions, dating back to the late 1970s. One of his more recent albums, *Reflection*, was made by a generative app he and his assistants/partners created that runs on iOS (he generated hours of music then edited it down to the most interesting bits, which became the album). He discusses generative music on his website: http://www.brian-eno.net/ (click the link at the top left, "Eno on Reflection").

whole sub-sequences that are selected among at random, and varying lengths of cues, and the like.



(Above) Screenshot of part of the QLab workspace for *Noise Floor*

QLab is not capable of reading direct high/low voltage signals as trigger data for cues, but it is capable of reading OSC (open sound control) commands. The job of my microcomputers would be to take in switch/sensor data, convert those discrete messages to OSC commands, which it would then send to QLab. QLab's cues would have OSC commands programmed as their triggers (which is to say, the impetus for playing any given piece or group of content). QLab would then play video directly out of the computer's video card, and audio via Dante (a digital audio over Ethernet protocol that allows us to play audio from a computer, sending many channels of audio over a network cable.

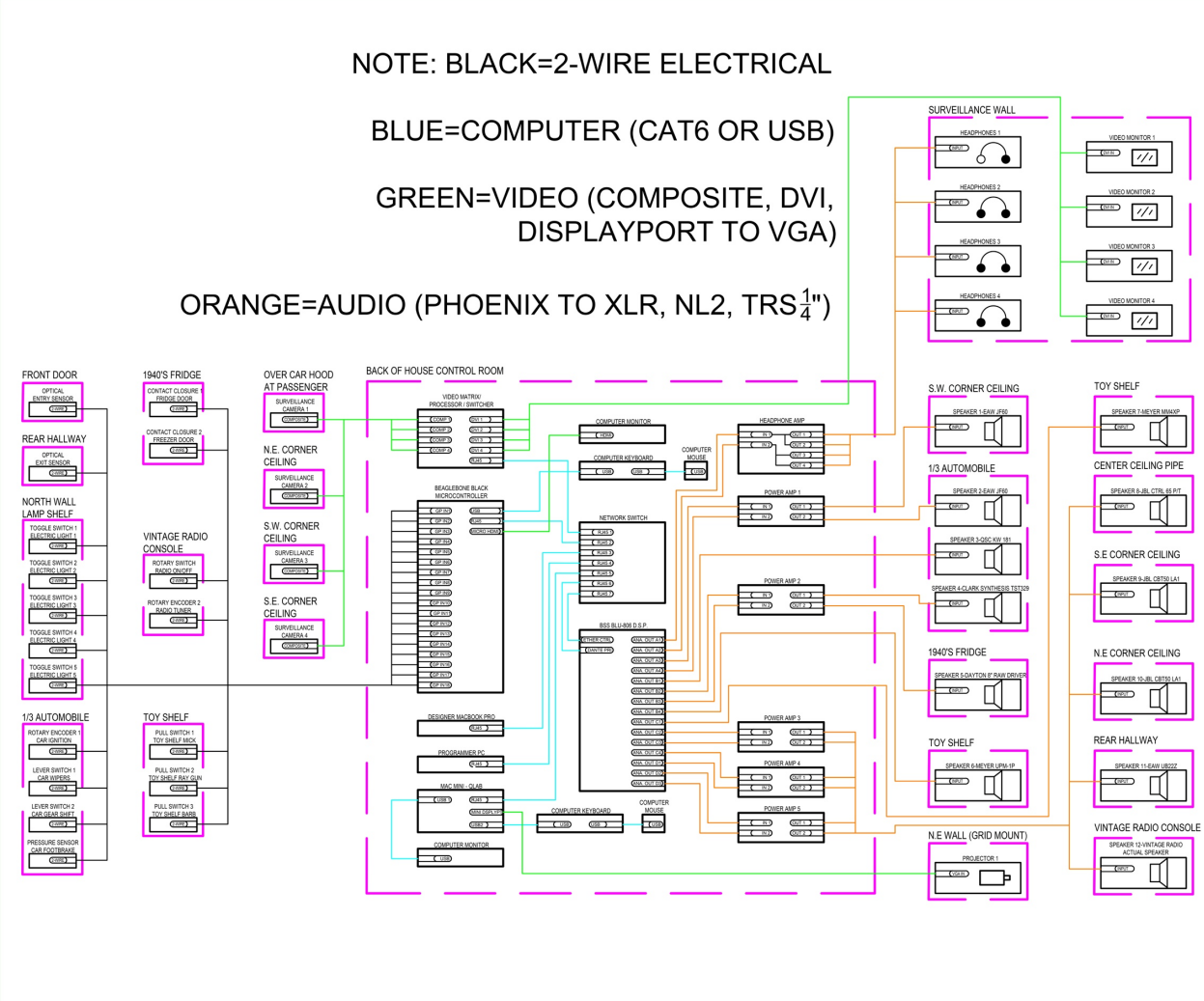
Reproduction: this category is where I was most blessed with available resources that came to me at no cost. Because I was creating this installation for the professional gallery at the university where I am a faculty member, I was able to borrow a host of gear that would have cost a fair amount to rent or purchase had I needed to source it independently. Audio would be processed by a BSS Dante-enabled DSP (a digital signal processing unit, a piece of hardware that allowed me to customize my signal paths even farther, and to calibrate my speaker system for the highest-fidelity audio results), sent into a rack of power amplifiers, and then onto the speakers hidden around the gallery. Video would be sent to a digital projector. All of this gear I was able to pull from our existing stock, which was a great boon to us. Of course, rigging all of this gear in a gallery space that had no theatrical pipe or other grid would prove a challenge, but we're getting ahead of ourselves.

In a single-room gallery space, with dimensions of roughly 13'x33', we used one projector, four video monitors (connected to four surveillance cameras via a video matrix switcher we also borrowed), 12 speakers, and four sets of headphones.

The automobile featured three speakers (one large point source under the hood, one narrow-coverage point source aimed at the front passenger seats, and one vibration transducer bolted underneath the seats). Each other action area featured one dedicated speaker, and then there were some surround and overhead speakers, as well as one exit hallway speaker. In such a small environment, this effectively created an immersive system, with enough positions, angles, and

varieties of speakers that guests could be swallowed by sound, disoriented, drawn to (or away from) certain objects or locations, and experience any of a variety of emotional, narrative, and spatial states.

(Below) Signal flow block diagram for *Noise Floor*



Installation and Testing:

Installation was a stressful process. We had less than a week to install all of the scenic/prop and multimedia system items. While I had two student assistants, one was only available a very small

amount of time due to his class schedule. We did have a few other "overhire" students[13] who each put in a few hours running cable with us, which enabled us to meet our deadline, but we ran into a few issues along the way.

1) Lighting: originally, I had conceived of this exhibit also featuring a host of LEDs, set into props, that would also be triggered in a customized fashion based on trigger input. However, the student lighting designer I had originally planned to work with had an emergency arise that prevented her from working on the installation and programming. While I am also a lighting designer, I had enough on my plate with the audio and video and scenic/props items, so the interactive LED parts of the exhibit were cut.
2) Rigging: as previously stated, there were no theatrical-style rigging points in the space, so every item had to be custom-mounted. We bent flatstock steel, hung aircraft cable from unistrut, and used a host of other solutions to get our items in place.[14]
3) Beaglebone Blackened: the original plans called for two Beaglebone Black microcontrollers, and a series of other sensors and triggers that I haven't mentioned. However, the *night before the show was to open*, one of our two microcomputers was victim to a power surge, and the central processor was fried. With approximately 16 hours till opening (it was *very* late at night), one of our two microcomputers was toast. My trusty assistant Mike Schmitz and I took 5 minutes to formlessly panic, and then set

[13] While I would have loved to be able to have paid my assistants, no one was being paid for this work, they all did so either for practicum course credit or because they were interested in the work. I am grateful for all of their help.

[14] I am grateful to Kent Cyr, who advised us in our rigging, and who created framing pieces that allowed us to install our 1/3rd automobile. He also donated his time, which was quite kind of him.

about cutting the least necessary triggers and sensors, and then re-running all remaining wiring to the single Beaglebone. While Mike worked on consolidating the programming into a system that would work on one computer instead of two, I frantically ran cables to new locations and reterminated leads on the single board. By about 10am, we had successfully rescued the operation, and I staggered off to shower in our theater's dressing rooms before going to teach my class for the day.

Opening and Run:

The show opened that night, and more than 100 people (as well as local TV news) were in attendance. The show was a resounding success. Not only were people thoroughly excited about the work, but many later recounted that they returned to the exhibit several different times over its open run to experience the exhibit in many different states (as mentioned earlier, the exhibit had quite a different effect depending on how crowded it was and how many triggers were being fired at once).

The exhibit succeeded in creating the effects I intended. It was an interactive, immersive exhibit that both broke barriers between guests and the artwork itself, and (at least as reported to me by various attendees), caused people to reflect on our current technological era, the seeds of it in the last century, and the consequences of our choices.

Conclusion:

Noise Floor provided technological proof of concept, in that I created a highly flexible exhibit, using primarily software that is generally used for creating linear experiences. *Noise Floor* also whetted my appetite for this kind of elaborate multimedia gallery experience, such that I am planning further advancements of the concept both in hopes of remounting this piece elsewhere (it can be hosted anywhere, and can scale up or down based on size and resources), and in new works I am in the process of creating. As Meow Wolf[15], and others, have demonstrated, there is a lot of interest in this type of work (combining themed entertainment, high art, and interactivity/immersion). I am delighted to have been able to work in this medium and look forward to creating further!

[15] Meow Wolf is an art collective working on much higher-budget projects of this sort, combining themed entertainment and art to generate unique multimedia experiences. https://meowwolf.com/