Audio & Visual Design

Designing Holistic Sensory Experiences within Environments.

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by
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Abstract

What are the sensory limits of design? Will emerging technologies continue to push design into new realms of practice? How can multimodal environments adapt to users providing more holistic sensory experiences? What is the role of a graphic designer, in the growing world of multimodal design?

My thesis research investigates the ways audio and visual cues combine to create more dynamic and immersive environments. These two sensory medias may increase comprehension of information, engagement, and navigation within a designed environment experience. A preliminary investigation surrounds multimodal design, focusing on the use of multisensory interaction design. The research will then turn to the practice of designing sound and design utilizing sound. During this study I documented my process through a video diary and photos of my journey into incorporating audio media into small video base test experiments and large scale multistage designed environments.

Sound connects. It asks us to surrender ourselves and to immerse ourselves in the sensory world and in participatory experience. It incorporates and creates communion. With sounds, there is opportunity to better understand how these two medias work together, with the goal to eventually enrich user comprehension, engagement, and navigation while in an environment.
Introduction

Audio has played a vital role in the communication of information in products, entertainment, application software, brand image, vehicle interfaces, videogames, and interactive displays. Whether it is a car’s internal GPS giving you audio step-by-step directions to a location, specific genres of music being played at retail stores, or an audio beacon indicating when you have entered a room, consistent visual and auditory cues can enhance understanding of orientation in an environment, as well as the relationship between space and time. Audio can be representational of fictional spaces, psychological states, or improve brand image concepts.

Many of these forms of audio are passive interactions, we acknowledge them on a subconscious, rather than conscious, level. We are programmed to understand that certain music should create a sense of “uneasiness” and that other music reassures us that we have picked an option. The objective for this study is to move into a realm of direct, active user engagement, facilitated through the combined senses of hearing and seeing. People have become overly-engrossed in sound in their day-to-day lives, to the point that passive audio cues are missed.
Evolution of Design

Design is a constantly evolving, multidimensional field of study. At one time, a poster with artwork, dates, times, and a small amount of secondary information was sufficient to promote a concert. However, now artworks can be viewed during a video promotion, while a sample of music plays in the background. Tickets are purchased through applications that are then scanned at the doors, an event is added to your calendar with reminder alerts and GPS location can be accessed through your phone. Due to advancements in technology, as well as technology being more user friendly and easily obtained, design is in a state of needing to explore new forms of problem solving. Designed interactions have become more complex and users abilities to interact with them expand daily, creating a need for more dynamic approaches to entice and inform. With the field of design continuing to blur lines with parallel areas of studies, such as user experience design, interior design, information architecture and digital-interactive design, interpersonal examination is required to expand knowledge on process and utilize a wider field of resources.

Multimodality

The study of multimodality is an interdisciplinary approach that understands communication and representation to be more than spoken or written language. As the complexity of information grows ever more grand, so have the avenues or “modes” through which they are delivered. The online journal, MODE, a node of the National Centre for Research Methods, states “multimodal approaches have provided concepts, methods and a framework for the collection and analysis of visual, aural, embodied, and spatial aspects of interaction and environments, and the relationships between them” (2012, p.2). This has been developed over
the past decade to systematically address much-debated questions about changes in society, for instance in relation to new media and technologies. Due to advancements in digital technology, we do not interact with designed artifacts or spaces on a one dimensional, visual level. We are able to instantaneously sense, manipulate, create, and even add to individually, objects or spaces.

Multimodality at its core, is a theory of communication and social semiotics. It is a practice of communication that involves textual, aural, linguistic, spatial, and visual resources - or modes - used to compose messages. A collection of modes contributes to how multimodality affects different rhetorical situations, or opportunities for increasing an audience's reception of an idea or concept. Everything from the arrangement of visuals to the organization of the content creates meaning. The meaning of a mode can be shaped by social, geographical or cultural means. Bezemer’s study found the following:

The more a set of resources has been used in the social life of a particular community, the more fully and finely articulated it will have become. In order for something to ‘be a mode’ there needs to be a shared cultural sense within a community of a set of resources and how these can be organized to realize meaning. (2012, p. 4)

Therefore, as conveyed by Bezemer, it is people or groups who give meaning to modes. Once an individual or collections of individuals (community or culture), gives meaning to a specific mode, all interactions with said mode, by the collection or individual, are based on the previously determined meaning bestowed upon it by them. This concept is multi-sensory and part of our everyday lives. An individual raised in a rural town in America may find the sound of a busy city intersection filled with cars, sirens, chatter, and footsteps annoying or overbearing. Japanese
citizens of Tokyo would not even notice these sounds, due to them being everyday occurrences in their lives. Hearing a song as an adult that your mother would sing to you when she tucked you into bed, can take you back to that time in your life and make you feel like a child again. Or, if we see a loved one from a distance, we may recall his/her voice or laugh. These are examples of specific, sensory information, being given context that then activates related sensory experiences. This phenomenon is a fundamental operation to human cognition (Langkjær, 1997, p.3).

A key principle for multimodality is its diverse use in semiotics. Bezemer found that “multimodal studies have also been conducted that set out to understand how semiotic resources are used to articulate discourses across a variety of contexts and media for instance school, workplaces, online environments, textbooks and advertisements” (2012, p.8). This infers that the examination of multimodal studies can be found in an array of fields including: architecture, fine arts, and cinematics due to its relationship with semiotics. However, most arguably, the primary research that multimodality contributes to is the study of digital data infrastructures and tangible, three-dimensional spaces. This is due to their complexity, ability to be presented in different manners, and interactive adaptive quality.

Designing Sound & Designing with Sound

We often filter sounds through our own socio-cultural background, as sound is perceived in respect to the context within which it is presented and is subjectively associated with semantic and cognitive patterns. What we hear and the setting in which it takes places give contextual background to the sound and affects our interpretation of it. Hearing a song sung in Spanish in
China, would be a different experience than hearing it in Mexico due to the environmental and cultural understanding. Individuals who share cultural backgrounds will most likely have a similar perception of sounds, as conveyed by Koutsomichalis who claims, “notwithstanding, connotations are further forged with respect to individual idiosyncrasy and emotional state, unique mental representations, imagination, and personal memories” (2013, p. 5). However, the experience of a sound at a pre-cognitive level is still not considered completely uninfluenced, a conscious level of understanding based on the setting and situation plays a factor in interpretation while hearing the sound.

Complex sounds are separated by the brain into two distinct subsections; they are either perceived as a set of foreground or background sounds. Foreground sound are considered ones that a listener is more aware of, such as a fire alarm in a crowded space. Background sounds are ones that a listener is not consciously paying attention to, such as chatter at a crowded restaurant. The two sounds are able to switch cognitive position though, based on needs. Though the two sections of sound are most often found working in conjunction, it is not unusual to for them to infringe on one another, creating a breakdown in comprehension of either. Our perceptual system may even attempt to realign or fill in diffused sections of sounds, if the situation is necessary. If a song you are listening to has a consistent, simple, rhythmic drum beat that stops for a portion of it, even with no musical expertise, your cognitive processes can continue the pattern of the sound in your mind giving you the capability to clap your hands without having auditory cues.

The use of sound for designed communication can be found in an array of products, services, applications, and experiences such as mobile devices, self checkout counters, automated doors, and amusement park rides. The use of audio feedback ultimately leads to improvement of tasks, engagement, and comprehension. In particular, sound plays a role by
helping to immerse the audience in media, to stimulate emotional investment, anthropomorphize objects and create attachments (Collins and Kapralosp, 2014, p.3). We tend to empathize with characters or situations when viewing movies. If we are in a theater and we hear a loud sound or see a manic visual, such as a quick camera move, we react with a flinch or jump in our seat. We imagine ourselves in those situations and experience parallel emotions for which are being conveyed in front of us (Langkjær, 1997, p.11).

Graphic design-oriented higher education institutes are most likely to have instruction and curriculum focuses on visual based modalities. In a growing trend, audio can be found in the use of digital technologies in both the realms of art and design, but students are commonly under-taught how to fully utilize the sensory medium due to granular knowledge being contained within other degrees of study. Applications, video games and motion animation all rely on audio cues to increase meaning of visuals. However, sound is often treated as a secondary feature to support or at the expense of showcasing visual forms of modality. Karen Collins, and Bill Kapralosp state:

Despite the importance of sound within multimedia applications and the fact that digital art, video games, film, branding, and product design today all require some understanding of the sonic realm, art and design students often complete their degrees without following a single class related to sound and its perception (2014, p.15).

The lack of consideration of sound within multimodal design can be contributed to the lack of curriculum materials in the world discussing it, besides specific business practices, such as cinematic production or audio-acoustic engineering. Rarely will you find teachings on theoretical implementations or conceptual usage within the fields of science or design. Visuals have privilege in these fields of study. The most difficult issue is that the information on
educational study of sound is spread across multiple professions such as music therapist, psychologist, marketing analyst, linguistics, acousticians, and audio engineers. Meanwhile, the study of sound in media practices can be found prominently in the areas of film and entertainment. George Lucas has even suggested that “Sound is 50 percent of the movie-going experience, and I’ve always believed audiences are moved and excited by what they hear in my movies at least as much as by what they see.”(p.2)

The question “in what ways” interaction design should incorporate and use sound as an element within a situation is inconclusive. In other fields of study that employ sound and the designing of it, the sensory mode is cultivated and mastered. Within the field of game design, sound designers commonly specialize within their field base on their focus interests. Musicians can be found as contributors to a spectrum including environmental soundscape installations, commercial music production and cinematic scores. Sound designers for radio and theatre are primarily trained in recording engineering, live audio practice, and cinematography.

Within the past ten years, sound has become a prominent component within the territory of interaction design. Designers must first develop criteria for their design of sound in order to evaluate and properly weigh its impact. What aspects of sound are most important? How do we determine the success of user experience of sound? Concentrations can be focused on: spatial characteristics of sound, dynamics/aesthetics, the use of sound as background noise versus foreground audio. In interaction design, designers of auditory displays are concerned both with sounds being considered informative as well as creating appropriate acoustical properties (Brewster 2008; Buxton 1989).

The two most dominant forms of sound interaction designs that exist are soundscape and auditory displays. There is no standardized definition for either form, due to their interpretive
qualities. A soundscape can be defined as the surrounding auditory environment that a listener inhabits (Porteous and Mastin 1985; Rodaway 1994; Schafer 1977). Over the years though, the term has been constantly reexamined and debated. The concept of soundscapes currently plays a key role in the crossing of multiple sound-related fields of study. Though soundscape can be a ubiquitous term, it can be broken down to core concepts and divided into three main categories due to its use and fields of practice: ecological/anthropology, musical/sound design, environmental/urban planning. Indeed, we are literally immersed into sound. In this sense, a phenomenology of listening, delving deeply into the philosophical and psychological aspects of sound perception is mandatory in order to clearly understand the specific features of “auditory events” with respect to other perceptual modalities (Valle, 2010).

Auditory displays are perceived as an interface between users and computer systems using sound and are considered a natural extension of the way in which sound is used in the physical world (Brewster, 2008). Auditory displays can be split into the user interface audio and audio used in visualization. User interfaces include: earcons, auditory icons, sound enhanced word processors (text to speech), and other applications, whilst sound in visualization includes audification, sonification, and auralization (Buxton, 1989) (Gaver, 1989).

**Project Methods and Outcomes**

Two methods were developed to gather data for this study. The first was a digital video experience to test audio and visual manipulation, as well as gauge base findings for the sensors user impact. The second method was an audio and visual immersive environment experience that was developed to collect participants’ insight on the use of the two medias working together
within a physical space. The primary objective of these pieces of research were to study user comprehension, engagement, and navigation. A secondary study was an interpersonal examination of my own knowledge base to incorporate multiple areas of design (environment, user experience, digital interface, kinetic, and experiential graphic design), in order to develop a cohesive and practically built environment for research.

**A.V. Experience Video: Reflection/Feedback**

The first piece of my primary research was a very raw video study utilizing audio and visuals in order to obtain base knowledge on the process of creating with these two mediums. The scope of the artifact was kept small in order to examine simplistic attributes associated with the sensory comprehension of seeing and hearing. Within this project there are five targets or nodes I designed as well as beacons in which some form of action is intended to be taken: Enter (move into the space), Engage (interact in some manner with an object or platform), Continue (move forward, through the space), Entice (motivate contemplation, or reflection), Exit (leave the space).

The first phase explored was the audio development. Three stages were devised going into designing the sound for this experience: Users should move, stop, and experience some emotion. With that in mind, I began working with organic, ambient or commonly heard noises to establish a sense of location, while creating a feeling of motion. This took the form of shuffling commuters in subways, children walking on gravel, and public noises city intersection. The next challenge in creating the sounds was determining what would cause a user to pause, and ultimately to experience an emotional response. “There are several ways to vary urgency in a sound, including repetition speed, number of repeating units, fundamental frequency,
inharmonicity, and loudness which appears to be one of the stronger cues for urgency” (Aramaki, Ystad, Kronland-Martinet, Jensen, 2009, p.15). Incorporating these principles, organic, semi-naturally occurring sounds, with mechanical, higher-pitch, noises were coupled together.

The second phase investigated strictly visual interpretations of emotions or feelings. This was done only with colors and shapes. I wanted to keep the visual aesthetics minimal in order to not over-power the audio cues. Colors can be grouped together and categorized by their distinct attributes. Most commonly, colors are separated in “warm” or “cool” colors. Colors such as red, orange and yellow convey a sense of warmth, excitement and stimulation. Whereas blue, turquoise and green are perceived as cool, calming or relaxing. Some researchers have criticized these studies and suggested that the effect of hue on warmth and excitement is an intellectual one, involving cognitive processes, and not based on physiological processes which affect the whole organism” (Best, 2012, p.22). Nevertheless, this was truly the most simplistic implementation of the audio and visual senses being studied. This low-fidelity research allowed for a quick and simple trial study of the two senses working simultaneously.
Figure 1. A.V. Video Experience - graphic development
Figure 2. A.V. Video Experience - Phase 2

Figure 3. A.V. Video Experience - Phase 2
A.V. Experience Video: Feedback

The two version of the video experience (one with just the images and one with images and sound) were sent out to individuals personally known to me, with the simple prompt “watch the video without sound first, write down your thoughts and feelings. Then, watch the video with sound and write down your thoughts and feelings on it.” Response options were left purposely open in order to gather raw, core reactions. As the researcher, I wanted to keep this initial data gathering simplistic in order to get a ground level understanding of how to best work with incorporating audio into visual designs as well as provide a light framework for my future physical research space studies.

Several interesting findings were discovered from this study. Viewers had a basic understanding of the simple shapes they were being shown, but had no real context for them besides ambiguous forms. Long moments of black screens in complete silence at the beginning and between scenes during the video experience were reported by participants as “jarring” and added to what one participant conveyed as an already somewhat “ominous feel.” Though the beginning and end were recognized as such, there were issues with other sections such as “What should I be looking at? What do I focus on?” Two participants attempted to make interpretations of the visuals without sound. One made the interesting statement “Am I looking at a location, scene, setting, or are these just shapes to be shapes? What about representations of objects or are they intended to provoke feelings or memories?” The other participant stated they could see the “start of a logo” in the abstract shapes. The final participant did not comment on the non-auditory video.
When videos were watched with the incorporation of sound, viewers found them more engaging. Participants felt as they were gaining a better understanding of the intentions of the visuals and therefore could conclude more refined assumptions. The idea of the beginning and end were solidified. Sections felt more defined and had distinct sensations. A recurring issue participants remarked on was how they felt as though the sound and visuals did not always align or have the same emotional feeling to them. One participant specifically commented on the fourth section of the video having audio and visuals that felt as if they do not belonged together.

Audio and Visual Immersive Environment: Reflection/Feedback

This primary investigation for this study used audio and visual cues when designing environments/experiences, but an exploratory methodology. I intended for this study to be a purely exploratory investigation into these two senses. The basic question I had when going forward was: do multiple sensory experiences improve cognitive understanding when navigating new environments? Through my primary research, there was an opportunity with this ambiguous subject to shed new light on developing technology such as: virtual reality; advancements in motion censors; and sonic projection devices and their capabilities to connect fringe fields of studies including architecture, interior design, environmental graphic design, cinematography, advertising, audio engineering, and animation.

The first phase of the research, after performing media reviews, created more questions and possible directions for the study to move in. At this point I decided to change my research methods to a more cylindrical process of primary and secondary research looping around each other. I began researching techniques in audio engineering and sound design, and then attempted to recreate them through test practices. I then investigated practices used by retail stores or
commercial spaces on how they incorporated sound into their environments and attempted to map that implementation into different spaces.

The second phase of research was ideating scenarios in which the combination of audio and visuals were currently used as I continued performing secondary literature reviews, primarily on experiential and interaction design. My focus of interest was broken down into four categories: retail, entertainment, navigation, and digital interface. These categories were then organized into passive or active experiences a user would have with each of them.

An experience plan was formulated for a space in the Kent State University Art Building. Specific themes were decided on for the user experience of the environment (navigation, interacting, engagement and entertainment). These themes were more distinctly defined as the stages, which would be reminiscent of environments or interactions participants would have experienced in everyday life including a retail space, some form of art display, navigational indication, and digital kiosk interface. Supplies were collected and the space rented was mapped out. This led to several hiccups within the flow of process. The first was that the room was not ideal. It had poor, harsh, non-adjustable lighting, lack of segmentation to the room, and relocating of furniture caused me to have to step back and reevaluate my approach. The conclusion to this was that I had to work with the room, as opposed to making the room work for me. This was somewhat of an epiphany, due to the fact that it gave the experiment more of a real world gravity.
Mixed emotions were prominent during construction of the space. The second day working in the space all of the “rough” building was completed. I was weary, however, that all construction details would not be finished in time for testing. The environment was worked on in small amounts, every day over the course of the next week. Some days it was for several hours; others it was just for 30 minutes. By the end of the week everything in the environment was in place.

Issues with light pollution, lack of materials, and sound pollution continuously set back construction. Frustration arose from not being able to find a suitable app mock up service that incorporated sound. It seemed every time I came upon a problem, compromises had to be made to resolve them and another one would pop up right behind it.

At the end of the week I realized that the sound aspect of the environment really hadn’t been given much attention. This was upsetting in that this contradicted what I had set out to
study. With a final push on construction the space was finalized in time for user testing the next day. Attempting to build what had been envisioned, with the architectural, electrical, and environmental knowledge I had as well as maintaining it all on the budget was difficult, but rewarding it the end. All of these issues, along with me building the space with minimal help, only added to my initial idea of designers breaking outside of their comfort zones in order to create something that is more dynamic.

Stage Descriptions

Retail: In a collage format, printed visuals indicative of what an individual may encounter related to retail, including magazine spreads, billboards, and in store graphics, were posted on a wall. The prints were collected from the internet and magazines. All prints contained individuals ages 18 – 30, modeling modern fashion. The music playing was “Top 40” radio hits including pop, rock, indie, rap, and dance.

Museum: Three paintings were hung high on a wall with dim, pin spot lighting directed on them. The paintings were each in a different medium and stylistically diverse. The music playing with them was a collection of classical and orchestral music.

Kiosk: Prototyped on an iPad was a simple website whose interface consisted of a questionnaire. The design was minimal with the focus of this stage not being about the interface design nor the questions themselves, but participants’ reactions to the ambient-nature sounds playing during the questionnaire and audio cues buzzing when questions were answered.
Figure 5. A.V.I.E. - Retail Stage

Figure 6. A.V.I.E. - Museum Stage

Figure 7. A.V.I.E. - Kiosk Stage
Audio and Visual Immersive Environment: Feedback

Out of the ten participants, four of them said the first station (retail) reminded them of a retail store one would find in a mall with specific comparisons to American Eagle, Hollister, and Abercrombie & Fitch. Three of the four participants that suggested the comparison, made observations that the station felt “over sexualized, immature, and reminiscent of high school or teenagers.” Two participants said the the first station made them think of the general concept of “advertising or advertisements.”

Two participants compared the second station (paintings) to that of a museum, stating that the lighting, music and selection of artwork invoked a sense of sophistication. However, two participants also stated that the first station also felt like it could be an installation in a museum, specifically a more modern gallery space.

Eight out of the ten participants stated that the music was the most interesting attribute to the experience of the environment, due in most part, to them feeling as though the music selection fit correctly with the visuals they were viewing. Three participants stated that the second station was the least interesting with one other saying they were least interested in the third and first stations.

One finding from the study was that the music element of the experience was not only what participants found most interesting, but also what caused them the most discomfort. This was intriguing due to the duality a participant could experience during the study. At points in the environment participants commented on the music adding to the mood, creating an atmosphere, simply that they just enjoyed listening to the music. However, at other times during their experience, audio from opposing stages conflicted with one another, creating chaotic or irritating sounds. Two participants said that the overlapping of music from station or the “bleeding” of
music over from station to station was semi-unsettling due to the nature of the music. With several participants this occurred back and forth throughout their experience in the environment. Next to the lack of navigation and overall lack of lighting within the space, people commented the most on the conflicting audio or sound pollution between stations. Several participants expressed that this sound pollution made it hard to enjoy the experience of a given station because you could hear music from the one on the other side of the room. One participant stated “It motivated me to move throughout the room to see ‘what was next’ though.”

Seven of the participants said that they felt “confused” at some point during the experience of the environment. A lack of directional navigation was the most common trait leading to confusion. Several participants stated that dim lighting was a little “uneasy” feeling, and at time they were unsure on what they should be doing or what else there was to do within the space. The most common trait that I found, was that nine participants stated that the experience of the room was “too short” or “not engaging enough.” Several participants stated that they were expecting more stations within the environments and for them to be taking part in more actions (both tactile and mental).
Evaluation Impact

The first finding from my studies was that audio is reminiscent of locations or experiences. Cool colors and ambient, gentle sounds reminded participant in the A.V. Experience Video of being on a beach with waves and a breeze being interpreted by the colors and music combination. A majority of A.V.I.E. participants stated the first stage in A.V.I.E. reminded them of a retail store, one would find in a mall due the imagery being of over sexualized, young adults, convey a sense of a “lifestyle.” The music selection for this stage reinforced this idea that the songs felt like one they would presumably hear in a retail type environment, with current, upbeat pop music, with positive melodies. More than half of the A.V.I.E. participants stated that the second stage of the study reminded them of a modern museum exhibit space with conflicting comments about it feeling upscale to some, while other saw it as industrial in nature.

Within the same vein as audio recalling participants to somewhere, another key outcome of the studies was the creation of atmosphere or a state of being. The retail stage of the A.V.I.E study was interpreted by participants as stores such as Abercrombie or Hollister, which was then perceived by participants are being for younger individuals. This stage, using images of sexualized young people as well as radio friendly, mainstream music, reminded participants of themselves shopping at these stores when they were younger, conveying a feeling of immaturity or adolescence. The music within A.V.I.E. fostered a sense of fun and enjoyment during the retail stage while the museum stage had a feeling of refined, sophistication. All three of the stages were perceived as feeling like a “modern” experience due to visual elements, music selection and use of technology.

During the A.V. Experience Video, emotional sensations were felt by participants. Warm, bright colors with higher pitched music conveyed a feeling of passion. Black, long transition
screens (or absence of imagery) with subtle audio invoked a sense of fear. Colors including red and yellow with loud mid range pitched audio loops provided a participant a feeling of warmth or something being inflamed. Shades of blue created with soft ambient sounds created a state of Zen, or tranquility.

In addition to the positive outcomes I found during my study, were an ample amount of negative occurrences. Participants during the A.V. Experience Video conveyed they felt a disconnect between the audio selection and visuals they were viewing. High pitched sounds came off poorly, specifically during black screens. Participants stated that the audio felt intrusive or distracting at times. Sounds that participants felt did not align with the perceived visuals caused issues with interpretation and engagement with the phases of the video. Sound pollution was by far the largest problem during the A.V.I.E. study. The element of most frustration that was commented on by participants was the lack of separation of sound between stages within the environment. This led to a decrease in focus by participants of the stages themselves. Sounds from opposite sides of the room were very different in nature and when blended together caused “uncomfortable” audio. Competition of sound distracted participants and caused attention to be drawn away from the stages. This in turn created confusion in navigation. Participants were motivated to move onto the next stage due to over hearing music from it. Participants were also interested in the middle structure of the environment due to its absence of sound. Participants commented on the audio lacking in directional use when moving through the room, except in the case of drawing them away from one stage due to hearing the audio at the opposite stage.

What I found most interesting from the studies was the overall lack of interest participants took in ambient sounds. I was surprised that none of the participants commented on the constant, ambient music that played during their interaction with the kiosk stage of A.V.I.E..
Though the music section could be considered relaxing and was minimal, no participant noted its existence at all and instead only commented or inquired on the questions they had been asked. The questionnaire, interestingly enough, had no significance. The questions were essentially arbitrary, with the goal of them being to examine participants feelings on contemplating the questions with music playing in the background, as well as a audio feedback cue happening when selections were made. One participant commented on the sound cues playing when an answer to a question was picked. They stated “it felt as though the sound implied they had made the wrong selection” due to the sound being a lower pitched noise. This was another element I added into the study to see if the sonic attribute of the audio feedback made participants react in any given manner, but once again, it was largely overlooked.

Participants were adamant and immediate with their interpretation of the audio and visuals. The process of creating meaning for audio cues was swift. With the A.V. Experience Video participants were quick to make assumptions on the meaning or connection between the audio and visuals. Participants felt confident in their interpretation of the two mediums during both studies. Connections or meaning, in some cases, were forcefully made. In the A.V.I.E. study, participants felt as though there was meaning to the sound pollution they experienced.
Framework

The results of my studies have been compiled into a framework for professional practice and education. The framework is based on research from my A.V.I.E. study and A.V. Experience Video. This framework provides findings that can be implemented and avoided in the practice of using audio and visuals within designed environments.

Why would someone want to hear audio when in a space?

Audio has the ability to add another level of depth to both physical space and emotional connection. Specific audio selections can be used in conjunction with visuals to create the branding or atmosphere of an organization. As executed by current retail stores such as Hollister or Abercrombie & Fitch, and showcased by the A.V.I.E. study above. The precursor in these scenarios though, is to determine how you want to portray the experience. With hearing being such an immediate sensory experience, participants are quick to create their interpretations, formulating them based on their own cultural experiences, to ultimately identify and give meaning to the audio. In line with that idea, audio also as the capability to inspire participants to recall memories of both locations or experiences. By manipulating this ability of audio, a space can transcend its physical and spatial limits.

How will you benefit from the use of audio in your space?

Besides audio creating another level of depth to branding, sound can add to task and orientation-centered interactions through feedback loops. Providing even the slightest higher-pitch sound informs a participant they have made a decision or interacted in the correct manner. Whether reassuring a user on an interface they have selected an option with a soft “beep” or
indicating through loud sirens to move away from a location, sounds inform people. Participants are quick to react, infer connections, or presume meaning to sounds and have the aptitude naturally to respond to them, given the individual and contexts of the situation.

**What are the important things to keep in mind when utilizing audio?**

The audience you are interacting with and what you are attempting to convey is the primary driver when using audio in any fashion. Just as in the practice of print or web design, the questions of “how is this being absorbed?” and “who is the user?” as well as “what is the message of the experience?” need to be considered. It is also crucial to understand that an audience's cultural or individual background can affect the interpretation of audio. Knowing your audience, knowing what it is you want them to do, how you want them to feel and in what space it takes place determines what and how you utilize audio.
Conclusion

The research presented in this paper outlines and demonstrates the benefits of using audio and visual sensory design within environments to improve user experience. The results of this study conveyed an increased state of immersion and interaction within a space when audio is incorporated with visual and environmental design. Though findings depicted both positive and negative participant feedback to audio use, the failures can be interpreted as example of practices to avoid. The greatest strengths audio provides in the context of this practice are its malleable quality, universal user understanding and complementary nature. Evidence from both my primary and secondary research create the argument for multisensory design to continue to be explored in order to create the most holistic experiences for an audience. Furthermore, the research showcases the usage of multimodal thinking when designing solutions. It can be said with certainty that multimodal design is the most comprehensive way for executing a dynamic experience within an environment. Since both technology, and user comprehension of said technologies, are rapidly growing all the time, a continuation of new practices in which to implement sensory elements within design increases. Herein lies the challenge of continuing to push pedagogy which infuses aspects of parallel fields of design, and advocate for more experimentation within the practice, ultimately improving the overall body of knowledge of design.
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Appendices

A.V. Experience Video: Feedback

User A.

Okay… In the video without sound, the viewer definitely recognizes the images presented. They are simplistic and almost iconic, due to their design and contrasting colors. The black dead space between each almost jarring, but does allow each image to be given a separate identity. The repeat of the opening image at the end likely signifies the finish of the sequence.

In the video with sound, the viewer definitely recognizes the images presented, but now in a way that more fully engages. The images do not lose any of their impact with the addition of the music/sound, and if anything, are granted more. For instance, the opening/closing image have a more defined quality thanks to their accompanying sounds. Perhaps most importantly, each image still registers as its own unique design, but the transition between them flows far better now than with silent black dead space.

User B.

It’s definitely interesting concepts. I liked all the visuals; they would probably make good starts to a logo or something else. I don’t think the sounds specifically selected for each image necessarily went along with what they looked like though. The sounds with the fourth one probably the closest that makes sense: As your research is probably going to indicate, choosing a sound motif to go along with a designed image is going to be a whole new thought process. The whole concept of combining visuals and sound, like putting an ad in the window of a store, and having small directional speakers that you can only hear when right in front of the ad is a hugely creative concept that I’ve seen in a lot of sci-fi future stuff. Maybe if you try explaining.

User C.

I went through a bit of a thought process when watching both of these videos. They are both quite strange and in a way peaceful. I’m not exactly sure what you're looking to get from me on this so I may give you way more than necessary but I want to help out.
Without Sound:

When watching the only thing to focus is the images. With so much ambiguity with the shapes, I bounced back and forth on figuring out what I was looking at. Am I looking at a location, scene, setting, or are these just shapes to be shapes? What about representations of objects or are they intended to provoke feelings or memories?

- These were the types of questions that I thought about.

The first image (light blue, radiating circles) seemed to scream "beach" to me. My imagination was all I was left with to further explain the images I was seeing. I seemed to cycle from memory to memory to find things that matched. I interrupted the second image to be a few things never settling on a final decision. I went from abstract fire, speaker, sound, feelings/memories of warmth, even feelings of anger or passion. The third image immediately gave me a cool, refreshing, splash of water feeling. Maybe even a spill or sorts. Seemed to stay on this for a while. The fourth image made me think of an Indian Prince palace, a setting sun, on the dessert. Very dry, very hot, very... alone. The last image reinforced the thought of the first one. Even with the colors inverted I still went to a warm, humid beach feeling.

With Sound:

Ending the first video and moving the second video I was hoping, looking for more information on what I had previously viewed. I wanted more clues so I was able to draw better conclusions of the scenes/shapes. Right away with the subtle sound of what seemed to be waves, I was comforted with the beach feeling and glad that I was hearing what I expected to hear. Then I was surprised with the random beeping that seemed to stand out and not fit with the scene.... on to scene 2.

The second image + audio left me even more confused but then the pulsating noise came in and left me anxious and anticipating, stuck in suspense for what was next to come. The visuals sort of took a back seat to the audio and I started to focus more on the sound that the image - that seemed very strange that I was disregarding the imagery, relying solely on the sounds to guide me.

The third scene placed me into a park, birds chirping, people walking on sidewalks, a slight breeze... no water
splashing though. I was once again paying more attention to the sounds I was hearing than the image that was in front of me. The palace scene did align with the sound I was hearing. Same hot, suspenseful sound left me in anticipation just waiting. Then at the end, that "horror film" sound almost made me shudder just envisioning what bloody murder scene I could be looking at. Lastly, I was reassured to hear what seemed to be seagulls squawking, with a breeze and waves flowing. The anomaly was very unrelated and almost uncomfortable to hear. It was a very odd juxtaposition with the scene and single, loud beep. I'm not sure if I did exactly what was asked or if I gave you too much. Hopefully you can make some sense out of what I was talking about and I didn't proofread anything so sorry if I left words out or it doesn't make 100% sense.

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Audio and Visual Immersive Environment: feedback

Participant A

Q: What was the first thing you did when you walked in the room?
A: I looked left and then right, and then I went right

Q: What was the first thing you thought when entering?
A: Which way should I go first?

Q: What task did you perform?
A: I studied the stuff on the wall and was trying to interpret them.

Q: At any time did you feel confused?
A: No, the path was clear and you didn’t have many options where to go.

Q: Did any of the stations (or environments) remind you of anything?
A: Yea, the first one was like an Abercrombie store. The lighting, images, and over sexualized pictures. The second one reminded me of a gallery in like Tremont, CLE because of the ceiling of the room and the kind of artwork. The third one was like a science center. It was more high-tech and interactive.

Q: What did you like the most and least (paid the most/least attention to)?
A: The music I liked the most, and paid attention to the most.

Q: At any point were you uncomfortable?
A: no

Q: What did you think about the time it took to go through?
A: It was really quick. It could be longer.

Q: Would more tasks be a problem?
A: No, I would be interested in doing more.

Participant B&C

Q: What did either of you know about this project before you walked in?
A: b. You told me it was like a haunted house… And you told me it was a visual and audio experiment
A: c. I knew nothing at all

Q: What did you first do when you walked in the room?
A: b. I went to the wall of magazine ads.

Q: What was the first thing you thought when you walked in the room?
A: c. Confusion

Q: Did you perform any task or do anything while in there?
A: c. We did stuff on an iPad.
A: b. It was like a questionnaire.

Q: At any points did it remind you of anywhere else you have been?
A: b. Defiantly the first one I felt like I was in a mall. Shopping at a preppy store.
A: c. The music sounded like a boy band that was playing. I think it would appeal to teenagers.
A: b. And the over sexualized of all the people on the wall.

Q: Were you confused through the whole thing?
A: c. I think I was confused the whole time.

Q: Did anything out of the three sections stand out more/less?
A: b. The art with the individual light. I liked it the most. ALSO when I was looking at one exhibit I could kind of hear the music from the other and that was drawing me away. I was thinking “WHAT’S NEXT”?

Q: Did you feel weird of uncomfortable at anytime?
A: b. yeah
A: c. At the beginning, just because I didn’t know where to start. I didn’t know what to expect so I was like “am I doing this right?”

Q: What did you think about the time it took?
A: b. It was a good amount of time
A: c. I didn’t know like, because I’m not an art person, should I sit here and soak it in longer or what? I left confused. How long are you suppose to look? I followed b’s lead.
A: b. Also the camera was a little bit distracting, because I was kind of thinking about getting good shots.
A: b. It could be a little longer, a little more engagement as far as that goes. Just a little more though.

Q: Final comments?
A: c. On the last thing (iPad), I double clicked and may have messed it up.
A: b. Keep that in mind with your data

Participant D
Q: What was the first thing you thought when you walked in the room?
A: It was kind of dark.

Q: Which way did you turn?
A: I went to the stuff on the right. The posters and then to the iPad

Q: Did you feel confused or disoriented at any point?
A: Not disoriented, but I was a little confused on what I was witnessing.

Q: Did you perform any actions or task while in there?
A: No, not really.

Q: Did any of the stages remind you of anywhere you have been, places, or environments?
A: The one in the back was like a museum and I guess the one up in front was just a bunch of magazine stuff. Not so much there. The music was all different though

Q: What did you find the most engaging (pay the most/least attention to)?
A: I think I paid the most attention to the music. But there were two different things playing, up in front. I was trying to relate it to the photography.

Q: what did you think about the time to go through?
A: It didn’t take me very long, like 5 minutes. I thought it was going to take longer.

Q: Would you be down to do more task or experiences?
A: Yeah, I would have been more inclined to do more engaging things.

Participant E

Q: What was the first thing you thought when you walked in the room?
A: I wasn’t sure what direction to go and I wasn’t entirely sure what I was suppose to be looking at or how many stations, but I figured it would just go in a circle.

Q: Did any of the stations remind you of any other places you’ve been or environments?
A: Not really, but I haven’t been to many museums. The collage environment reminded me of other similar kind of things with just advertisements, just different magazines. It was such a basic collage set up, but had no real technique so it looked kind of immature.

Q: What did you enjoy the most/least?
A: The one thing I had a hard time not paying attention to, I don’t know if it was intentional or not, but there wasn’t quite enough buffering between the music, so they kind of clashed. I went around twice to get a better idea and in the collage section it was kind of a weird feeling, awkward, because I could hear the classic music overtop of the music from other section. It was a very clashing sounds, with moaning from the classical and then these semi nude people and a little opposite the other way. But when I went around again the music balanced out and it made more sense. Very modern sounds and then classic sound.

Q: Was there any feeling of discomfort or annoyance while going through?
A: Other than the clashing music, that was the only annoyance. No discomfort other than the music either. It’s a little strange with the tarps in the middle, but I feel like you had o have them. Nothing really off putting though.

Q: What did you think of the time? Would you have done more interaction?
Participant F

Q: So what did you think when you first walked in?
A: It was interesting as soon as I walked in, I had to take a moment and decide where I’m going to go and how I’m going to go about looking at things.

Q: Was there any confusion on where to go?
A: When I first walked in I looked forward to see if I should go that way, but I saw the iPad and I naturally tend to go to the left. I think most people go to the right, and I like to go against that trend.

Q: What task did you perform if any while in there?
A: I did a lot of pondering. I listened to the music, which I think established a mood, especially with the paintings on the wall. The music had an elegance or higher class feel. As I continued in, I felt more of a poppy, advertising feel and it was reminiscent of a commercial for those kind of products or style on the wall.

Q: Did any of the stations remind you of any other environments or places you have been?
A: I would say the corner with the paintings reminded me of something you would see at an art museum. It was dim, but lit nicely. Something you would see in like a modern art section. I’ve never seen music player in an art gallery though, which was interesting.

Q: What did you find the most/least interesting?
A: I really liked the classic music, it reminded me of Clockwork Orange. I really like classical music. That was a cool aspect. I wasn’t a fan of the pop music section. I just don’t really like that music and the objectification of the advertisements that they go for. Like, I find myself comparing myself.

Q: At any points did you feel annoyed or confused?
A: I wasn’t sure with the tarp in the middle, and I wasn’t sure if I was supposed to interact with it. The wayfinding wasn’t really there.

Q: what did you think about the time? Would you be okay If you went through it again and had to do more?
A: Yeah, I mean if their was more to analyze, I would go in and spend more time.

Q: Did you think it took too long or not long enough?
A: Well I think it is almost suggestive. It would probably take different people different times. I went in pretty general and went pretty fast, I could have spent more time looking over things.

Participant G

Q: What did you first think when you walked into the room?
A: From what I had known, I expected it to be more involved and not as immediate as it was. I was just kind of looking around and the first place I went to was the wall, and it immediately reminded me of an Abercrombie, or Hollister or American eagle. Even the lighting as well.

At first I was kind of confused because I could hear the sound pollution of the opera music from the other side of the room, so I stood there and I wasn’t sure what I was suppose to be hearing, or was I supposed to be hearing all of it. I tried to figure out if the sounds were coming from the same place, but I realized it was just temporary music.

Then I walked around and saw the paintings and the opera music and it was the same kind of thing. And I kept asking myself was that it? I was wondering what you had going on in the center of the room, but I guess it was just like to create a hallway system.

Q: Did you do anything on the iPad?
A: Yes I did, I answered all five of the questions.

Q: Why did the first place remind you of an Abercrombie and Fitch?
A: I didn’t go in much in high school and the couple of times I did, it kind of struck me when you first walk in you don’t see clothes you just have image, lights and clothes. Besides all the imagery you had.

Q: At any point were you confused or annoyed?
A: Not really annoyed. I didn’t know what to expect walking in, but their wasn’t much of a route or direction. Just kind of no one is telling me what to do. It was off putting at first.

Q: What did you find more/least interesting?
A: Least interesting was the classic images and music, it felt under-welling coming from the retail station. I wonder what it would have been like had I gone the other way.

The iPad was the most interesting thing. How do these questions relate to each other?

Q: What did you think of the time it took to walk through it? If you were to do it again, would you be willing to do more or engage more?
A: Yes, it was kind of short. I was shorter than I expect. More immediate than I expect, not at all what I expected. I was expecting to do more.

Participant H

Q: What did you think when you first walked in the room?
A: I liked the music that was playing. I didn’t know what to expect at first because it was dark and the lighting was scary. But the music made me feel more comfortable, so I just started walking.

Q: Were you confused at any point?
A: I was confused after I did the iPad. Well, I was excited to go into the middle area with the tarp, but I realized there wasn’t an entrance so I walked around it two times. That was the only confusing part.

Q: Did you perform any task or do anything while in there?
A: I put the headphones on for the iPad and did the questionnaire. Everything else I just looked at.

Q: Did anything about that room remind you of anywhere you have been, places or environments?
A: Well the first part with all the photos, I realized it was all Hollister and Abercrombie and stuff. They all had sexual appeal so that is what I thought it would be about, but it was more about fashion. It reminded me of being in Abercrombie, uhhh maybe more like American Eagle actually, because they play fun music. I shop there sometime now, but not really. I notice that American Eagle has music and videos in the back and I’ll stop and watch it because I like the music or visuals. The one with the paintings remind me of a museum with the lighting, paintings, and music.

Q: At any point did you feel uncomfortable or annoyed?
A: The music for the paintings was kind of hard to hear over the music in the first section, it wasn’t annoying, but it was kind of creepy. It was kind of hard to ear and the lighting, it wasn’t uncomfortable.

Q: What was the most/least interesting?
A: The most interesting was the song that was playing with the fashion stuff and I related to that section and I liked looking at the pictures. I looked at all the big prints, people and kids and it fit with the music. The Least interesting was maybe the frame pictures. The iPad was interesting too because the questions had to do with stuff but at the same time it was like why is this a question?

Q: what did you think about the time it took? If there was more interaction would you have done it?
A: Yeah, I thought their was more with the middle section and I’m wondering if their was something inside… But yeah I would have done more and the last section where you put the headphone on was cool.

Participant I

Q: What was the first thing you thought when you walked in?
A: First thing I noticed was the darkness of the room and music playing. It invoked a sense of retail store. The first place reinforced that with the images. Like the design layout was that of a high end clothing store. Then the second area was museum-like, I would say that the music from the first area overpowered the music in the second. With that being said, I could hear it in the second, but I had to get close, which I guess may have been a way to draw people in.

Q: At any point where you confused where to go or what to do?
A: No, not really. There weren’t any directions, or something spelled out to know where to go. I guess I could have gone in and hung a left, but that seemed unnatural.

Q: Did you feel uncomfortable or annoyed at any point?
A: I was annoyed when I couldn’t hear the noise at the second spot over the first. I was kind of confused by the dim lighting in the center piece. I didn’t know if I needed to go in there or not. I looked around to see if I needed to go in.

Q: Did any of them remind you of anything?
A: The second one was definitely museum or lobby-like. Maybe like bank or hotel. The third one, I don’t really know.

Q: What was most/least interesting?
A: The most interesting was the first one, just mainly because of the loud, up-tempo music. The least would be the second one with slower music, darker lighting. The third one was interested because there wasn’t context given what it was for. At one point I answered what seemed to be incorrectly going off the tones. So that one had its own interest.

Q: What did you think about the time it took to do it?
A: I expected it to be more intense, and longer. I kind of liked that it was short and sweet.

Q: Would you be willing to do it again with more interaction/engagement?
A: Yes.

Participant J

Q: What was the first thing you thought when you walked into the room?
A: Well first off, I’m a little bias because I helped construct it, so the first thing I thought was, it came together. I can see the full effect you wanted with everything out of the room.

Q: Which way did you turn when you walked in?
A: I went right.

Q: Did you perform any actions/task?
A: I leaned in and looked at the collage in the first station, I leaned up and checked out the paintings to see what you had selected and where the speaker was located (I couldn’t tell where it was). And then I did the third station with the little interactive display piece.

Q: At any point did you feel confused, annoyed or disoriented?
A: No, again, I’m a little bias, but at the first station I could see it felt like an inside of a store. That sound definitely helped the simulation of it being a store. The particular music was young, hip, modern. Where the paintings, was for sure a feeling of an art instillation with the music and light. The only critique I have is that the music with the paintings was a little higher pitched, so you could hear it at the front station with the collage. But if I stood between the speakers, I could block them out.

Q: What was the most/least interesting?
A: The first station I found the most interesting because it had the most going on, and I really did feel like the audio and lighting totally made me feel like I knew what it was suppose to be. The light for the paintings was a little off putting, I understood the music though. I understood the purpose of the audio cues with the interactive piece, but I guess I was expecting more at that point, but I can see the purpose was to show what had happen

Q: What did you think the purpose of the interactive piece was?
A: It was kind of like just a questionnaire about audio use in your daily life. But their wasn’t true audio, it was more like sound effect.

Q: What did you think of the time it took? Would you be willing to do it again with more interaction?
A: I think it could be a bit longer. Three stations I think worked for an initial concept, but it think it could be expanded, because it was a little quick. I would totally go through like a revision of it.

Q: Final comments?
A: Just finding that perfect balance of audio within the space.