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THE SOUNDS OF WORCESTER POLYTECHNIC INSTITUTE

An Interdisciplinary Qualifying Project
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Abstract

The Sounds of WPI Project worked to identify and preserve the characteristic sounds of Worcester Polytechnic Institute through a series of surveys, focus groups and direct observations. From there, the Sounds of WPI Project developed the framework for an online sound submission system whereby people across the world can contribute the characteristic sounds of their cities to a growing online community.

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1. Executive Summary

Imagine a soundless world. It is a vapid world and eerie to envision. However, the history of our world is very much mute. Only with the advent of photography can one get even the simplest insight as to what the world was like in days gone by. But the other half of the story is left untold: the sounds of history left to the imagination. The appreciation of the sounds of today's world has yet to be encouraged to the point where they will remain to be heard for days to come.

To encourage this importance, the Sounds of WPI Project set an overall goal to develop a simple and repeatable methodology to determine and identify characteristic sounds. Using the most available environment, WPI was the test site. In taking strides to produce these guidelines, an interactive website was developed that concurrently takes the user on a virtual tour of the WPI campus, playing the characteristic sounds where they were determined to exist.

Continuing the work of the Sounds of Venice Group, the Sounds of WPI Project hoped to further explore the concept of characteristic sounds and their value, but further building on their work to develop a website. More precisely, the Sounds of WPI Project developed a methodology for the following objectives:

- **Identify Characteristic Sounds** – This objective focused on the recognition of particular sounds that carried with them a certain essence of a given location, then providing a means of eliciting these sounds from the area's occupants.
- **Evaluate and Prioritize Characteristic Sounds** – Here, the Project studied how best to appraise each sound's worth in terms of how distinguishing it is to its origin.
- **Construct the Framework for Emergent Web System** - The jewel of the project lay in this objective, determining a means of building a forum for the sonically aware to best determine for themselves the most characteristic sounds of cities around the world.

In an effort to develop a frame of reference for this project, there were four specific steps taken to orient the Sounds of WPI Project in an effort to develop its

methodology studies.

- **Group Discussion-** The Sounds of WPI Project and its advisors discussed the idea of characteristic sounds and reviewed previous materials. Initial suggestions and predictions were made as to characteristic sounds of WPI.
- **Face to Face Interviews** – The Sounds of WPI Project set up shop in WPI’s campus center to get a feel for the opinions of the general student populous concerning what a characteristic sound was and some specific sounds that distinguished their college campus.
- **Focus Group-** Sitting six sonically-conscious individuals down at a table, a discussion was led by a moderator that discussed ideas about characteristic sounds, gathered sound suggestions specific to WPI, then elicited ideas for a successful and attractive website.
- **Follow Up Interview-** This survey delved further into the idea of a web-based community where sounds would be shared and evaluated. It tested the potential for individuals to participate in and support such a website. More characteristic sounds of WPI were taken.

The feedback was positive. Although confused by the concept of a characteristic sound, many suggestions specific to WPI were given that helped to shape the remainder of the project.

Prioritization was the next step in the archiving process. First, a means of judging a sound was developed in order to methodically evaluate the sounds collected to represent a given area. These criteria were then placed in the hands of an emergent online community who needed its own regulations to ensure integrity in the sound prioritization process.

- **Set of Criteria-** The qualifications explored whether some sounds carried more importance due to potential of extinction. Also, does the physical association bear any weight?
- **Online Evaluation-** The system for the website’s rating process was determined. A balance between an open website to encourage usage and a regimented system to deter nonsense was realized here.

The above research method allowed the Sounds of WPI Project to hit the test site full force. The remainder of the project was merely following the suggestions of peers surveyed. The campus was canvassed with a studio microphone for the students' top choices and naturally, most sounds were easy to find. Simply speaking the sound's title into the microphone before recording into the DAT player, a piece of WPI's history was captured. The clips were edited and separated in a post-production session. Later, corresponding pictures to the sounds were taken on digital camera to maintain a vision record of the sounds' sources. This audio and visual data was burned to a disc and documented as the first Sounds of WPI Project Center.

Finally, the Sounds of WPI Project left an interactive manifestation of the work completed, combining research, methodology, web framework, pictures and sounds in the form of a Virtual WPI campus. Beginning with a campus map, a user selects a building and is placed at the corresponding location on campus. It is then possible to navigate from one end of campus to another, as if walking through a virtual world. The characteristic sound suggestions of WPI's students are brought to life on the virtual campus and can be played by clicking on their physical source. The framework is left open to encourage the idea of constant peer evaluation and improvement to the site. However, each iteration of the virtual WPI campus is cached so users in the future can finally satisfy the curiosity of: "I wonder what it sounded like back then..."

2. Introduction

What would art be without music? How would the human race differ if man had no voice? Would coffee be enough to make a morning commute bearable if there were no car radios? The importance of sound is undeniable, and has been the inspiration for such inventions as music software, telephones of all kinds, radios that now link to satellites and can be taken with a person from car to foot to home. Some of the most impressive structures in history, though massive and stunning to behold, were designed to create a perfect acoustic environment for its patrons. Concert halls and churches were spawned from minds that recognized the importance of sound. For just as one goes to view the flawlessly detailed muscle cars at a cruise night, the experience is not complete without hearing the rumble of their motors.

Similarly, a city experience would be as empty and unfulfilling. The sound effects in a movie are what bring the movie off the screen and into the living room. But the question is: do we pay the same attention to the natural sound effects around us? With eyes closed, walking through Manhattan would be no different than traversing through a crowd at a packed arena concert, should the respective noises of traffic and music be removed. People would be brushing by hurriedly and talking loudly, but without the immediate visual recognition, the sounds of a city suddenly become crucial to its identity. Contrary to popular opinion, not all busy cities sing the same song. Similarly, the rural areas across the world have different animals that would be quick to inform the ear if it is listening to Middle America or a South American farm town. Sounds are the undeniable soul of a city.

This sentiment is especially true today with increases in noise pollution and growing technology. Noise pollution is making it harder everyday to hear the distinctive sounds of cities. Furthermore, the sounds change every day -technological sounds of today become history in short order. But often overlooked is that while there will always be photographs to remind us of the landscapes of decades prior, the soundscapes become extinct as often as they change. Currently under development are city sound initiatives where sounds are cataloged by independent organizations. In Venice, a group of students were able to put together a great representation of what natives determined to be

characteristic and endangered sounds. These sound recordings were organized by location and recorded with appropriate metadata. The collection will be available forever. Similarly, a student team and Boston recently followed in the Venice team's footsteps by recording the characteristic sounds of that city.

While those projects achieved much in the collection of characteristic sounds in their respective city, there still exists much more work to be done. Those projects were completed under strict time constraints, whereby the sense that they only had time to record "the *most* characteristic sounds" was truly heightened. Furthermore, their determination of which sounds of their respective cities constituted being characteristic were either entirely dependent on their own opinions (as was the case in Venice) or on the opinions of a small group of surveyed individuals (as was the case in Boston). These two problems, strict time constraints and highly subjective determination of characteristic sounds, represent the gap that the Sounds of WPI project is filling.

The development of a sound submission system is the primary goal of the group. The system will be modeled around the concept of emergent systems in order to make it self-perpetuating and low-maintenance. The World Wide Web is the best vehicle for exposure to the system as it will be available anywhere in the world. Citizens from cities around the world will be able to asynchronously submit characteristic sounds of their own environment to share with others across the globe. No longer will individual teams such as Venice and Boston work independently towards the goal of preserving characteristic sounds – the new era of preservation lies in the hands of the general public, working together through the World Wide Web to preserve the characteristic sounds of cities everywhere.

3. Background

Extensive research was done in the following areas of study in order to gather the necessary information pertinent to our project. Topics such as sound and the various classifications of sound, noise pollution and its effects, the history of sound preservation initiatives, and finally emergent systems were all explored. While at first this may seem like a mere bulleted list of topics with only cursory ties connecting them, to label it as such would ignore the goals of this project. Since the project's overall goal is to preserve characteristic sounds from cities around the world, and develop an online system that emerges from user participation and submissions, each of the topics found below adds greatly to that initiative.

3.1 Sounds

When asked to describe an environment, humans generally tend to attempt to create a visual representation: tall trees, dry sand, towering buildings, or murky waters. It is easy to overlook, but there is an entire dimension that brings this picture to life: sound.

3.1.1 Environmental Sounds

Environmental sounds are those common to an acoustic environment, which is an environment comprised of all of the sounds in specific location. This encompasses all sounds created by circumstances, objects, or conditions by which one is surrounded. By definition, there are two acoustic environments. The first is what is called ambient sound. No meaning can be discerned from ambient sound. It is the 'background noise' created by any and all sources of sound in a large given area. Ambient sounds can be further classified by their origin. Simply, there are human made sounds, and naturally occurring sounds that are properly referred to as environmental sounds. Examples of these natural sounds include a waterfall, the wind, and thunder. Human made sounds are generally products of industry such as planes, heavy machinery, or the noises of rush

hour traffic.

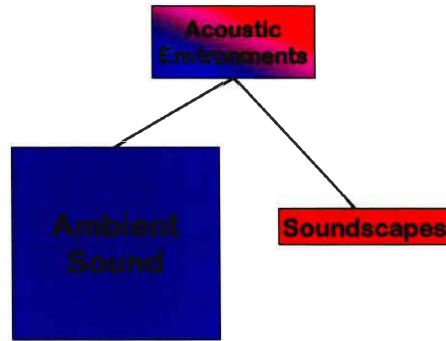


Figure 1: Dividing Acoustic Environments
Into Ambient Sound and Soundscapes

3.1.2 Soundscapes

Conversely there are certain groups of sounds that tell a story of a particular place. Wearing a blindfold, it is still undeniable to recognize if one is standing on airport runway or a Sunday mass. The same could be said for Times Square or the heart of Chicago. Enter the concept of a soundscape. Although they need not be constant or heard from each and every point in the designated boundary, the sounds must originate from that defined locale. Secondly, the selected sounds must relate some information about the designated area. Implied is that a soundscape is much more meaningful than plain ambient sound. Also, the given area will likely be much smaller.



Figure 2: Soundscape Analogy

This cityscape image illustrates the analog between landscapes and soundscapes

Further exploring the soundscape concept, it is important to examine its perspectives. There is a foreground, comprised of signals and soundmarks, and the

subconscious soundtrack known as the background. The drone of city traffic is an ignored background which exemplifies a keynote. Keynotes distinguish an environment but are given little deliberate consideration. Quite the opposite, among foreground noises, a signal is designed specifically to gain attention. Although the keynotes of tire noise, brakes squeaking, and engine noise, a signal such as a siren will cut through all of this and bring drivers and pedestrians alike to attention. And lastly the soundmark, an audible landmark, is a defining foreground noise unique to a particular area. The same as the Michelangelo painted on the ceiling would suggest the setting of the Sistine Chapel, Big Ben's tune would carry the same weight in its implication.

3.2 Noise Pollution

One day, the citizens of New York City woke up not to bird songs or the wind blowing the leaves around but instead to the milk delivery truck making its morning run and the engine and pistons of the garbage trucks. Most every sound that could be heard was caused by some sort of mechanical or man-made operation. There are hardly any naturally occurring sounds in the loud din of unnatural noise.

Noise has become more and more obtrusive ever since the start of the Industrial Revolution. The most popular description of noise is an unwanted, loud, or disturbing sound. Although this definition is broad in a sense, most people will agree on what is noise and what is sound. Noise in an urban environment can be detrimental to peoples' health as shown by Regecova and Kllerova in their research on preschool children. They concluded that “[m]edium- and high-level urban traffic noise [> 60 dB(A)] near kindergartens is associated...with a higher incidence of children with blood pressure values above the respective 95th centiles.” This was attributed to “to the rise in peripheral vascular tone and the decrease in heart rate, possibly owing to activation of a baroreceptor mechanism.”¹

While many people live most of their lives surrounded in a sea of noise, they have learned to accept the environment. But since the public is just accepting this excess noise,

¹ Regecova, V., and Kllerova, E. "Effects of Urban Noise Pollution on Blood Pressure and Heart Rate in Preschool Children," 1995.

we have become unaware of the potential dangers that are still inherent with noise. Research done by Maschke and Harder of Robert Koch-Institute has set permissible values for traffic noise that, while well under the limits of bearability, may pose health hazards when exceeded.

3.2.1 Reducing Noise Pollution

The effects of noise was apparent to New York early in the Twentieth Century. By 1930, laws were already being created to control the spread of noise. However, one sound may be a noise to someone while un-distracting to another person or there may be certain times or places that you would find some noise a nuisance. “Americans seem to believe that the freedom of speech also includes the freedom to make noise”, but this would also lead to their freedom of quiet.

When 1930 rolled around, provisions had been set in the New York Code of Ordinances with regards to noise. “Motor vehicles were required to have mufflers, exhaust horns were prohibited, and the use of an automobile horn at an unreasonable or unnecessary time was prohibited.” Peddlers and newsboys were prohibited from making cries before 8 am and after 9 pm except on Saturday nights.

There was a flaw in the system and it was in the fact that court proceedings needed to take place for any real enforcement of the ordinances. Most average citizens didn't want to waste their time or money on what were basically considered “nuisances.” But there were still times when a group of citizens got together to put a stop to unwanted noise. A shop owner was taken to court by people in the neighborhood because of the loud speakers he would blast from his shop from 4 to 10 pm everyday. While the citizens proved their case with the help of a psychiatrist statement describing the effects the noise had, most people aren't willing to go out of their way to get a stereo turned down.

3.3 Preservation of Sound

As long as mankind had developed the technology to record sound, he was immediately been fixated with the preservation of music. For over a century, various

recording methods from vinyl records and its myriad of precursors, to all the various classes of analog tape, to more modern day mediums like Compact Discs (CD) and MP3's have been utilized in the preservation of music. However, only recently has man started to take interest in the area of recording the raw sounds of his environment for the sole purpose of preserving characteristic sounds.

3.3.1 Characteristic Sound Preservation

As of today, a small group of initiatives has taken place in the field of preserving characteristic sounds. Some have been more nature oriented, and they have focused on topics such as preserving the characteristic sounds of various bird species. The most famous example of this is Cornell University's bird sound library.² Others have been more focused on the preservation of an entire urban soundscape, akin to painting a landscape picture of a city to preserve its visual identity at a singular moment in time, however; in this case the acoustical identity of the city has been recorded. One such example of such an initiative was the Vancouver Soundscape Project. Most recently, one initiative that was organized through Worcester Polytechnic Institute recorded the characteristic sounds of the city of Venice. It sought to record not just natural sounds, or broad soundscapes, but rather, to record the full spectrum of discrete and continuous sounds that composed the sonic fingerprint of Venice.

3.3.2 Characteristic Sound Archival

One unifying characteristic of each of these three initiatives was that they were all entirely self-contained. Each initiative cared only about the narrow boundaries of its intended subject, and the recorded results of each was archived in the personal collections of its participants. This has been the fate for all preserved characteristic sounds up until this point. Until this point, characteristic sounds have been archived into database software, where only a staggeringly small amount of individuals would ever be able to access them. Our project hopes to change the face of the archival of sounds by utilizing

² Cornell Lab of Ornithology. Cornell University, 2004

an online system to share the results of characteristic sound preservation initiatives from all over the world with each other. The way this will be accomplished is by utilizing the concept of emergent systems.

3.4 Emergent Systems

There comes a point in the lifespan of every idea at which time it can either begin to flourish or wither into obscurity. Those that wither are simply forgotten; millions of them are born and die everyday. However, those that flourish often become the bedrock of an emergent system. An emergent system is a system in which a set of strict rules and rewards has been established, however, the end result cannot be known. The end result grows out of these rules and rewards into its own macro-organism. Emergent systems surround people wherever they go, and most of the time they exist completely unidentified. The most famous examples of the emergent systems are things like anthills, cities, and most recently, the Internet. Every ant follows basic rules, yet each ant is independent of one another, and from this ground-level organization arises a well-oiled, efficient machine of food collection, reproduction, and territorial spreading. Similarly, cities emerge from individual human beings simply going about their own unique lifestyles, and from their daily interactions like-minded neighborhoods surface and mutually beneficial business-sectors arise. The most pertinent examples of emergent systems with regards to the goals of the Sounds of WPI Project, however, are those that exist within the Internet itself. Many sites utilize a rule and reward-based submission system for dealing with their various topics of interest. The creators of the sites produce very little of their own content, however because of the attractive incentives that they establish, the users themselves create and submit the content, and because of the rules the creators form, the level of quality in content remains satisfactory for the users. This is precisely the model that the Sounds of WPI Project should hope to follow. At its current rate of sending out an annual team of students to one city around the world to collect sounds, it could take centuries to establish a truly global! collection of characteristic sounds. Therefore, it is necessary to establish an online emergent system, whereby

<<http://www.birds.cornell.edu/MacaulayLibrary/>>

individuals from all over the world will be able to simultaneously submit their sounds, and thereby advancing the Sounds of WPI Project far beyond its original boundaries.

3.4.1 Emergent Online Submission Systems

The most notable examples of online submission systems are the three websites, eBay, Slashdot.org, and Wikipedia. Each of these three sites has their own unique take on the notion of a submission system, and each site utilizes the concept in their own way. For example, eBay allows its users to submit physical items for auction.³ There are strict rules to lay the basic foundation for all auctions to be run by, and a highly visible feedback system creates the rewards and punishments needed to maintain an extremely low level of fraudulent sellers and buyers, as well as foster honest and even-handed ones. From these rules and rewards emerges a thriving marketplace where vast quantities of real transactions take place everyday.

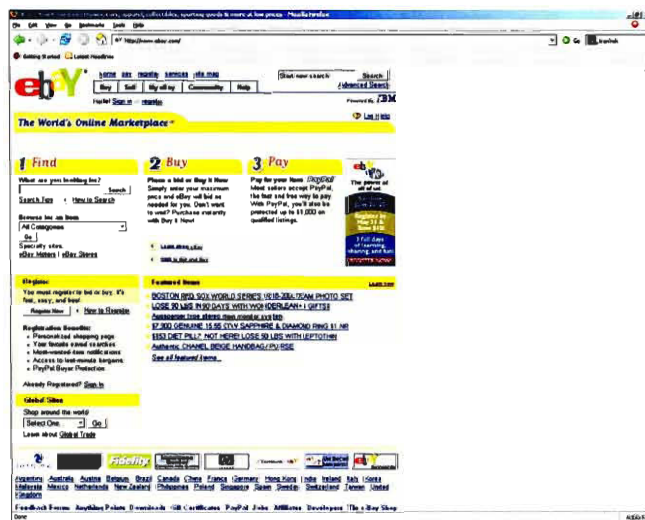


Figure 3: Ebay Main Page
Millions of people have contributed to the success of Ebay

The technology news site, Slashdot.org, uses the concept of a submission system to enable its users to comment and discuss at great length every article that is posted on the site.⁴ Mindful of the all-to-often chaotic environment of Internet message boards, Slashdot.org utilizes a complex system of reward-based privileges to encourage higher-

³ Ebay.com, 2005 <<http://www.ebay.com>>

level discourse with thoughtful and constructive comments. What this has led to is a stark departure from the harsh, immature, and virulent world that previously defined the Internet discussion board, and what has emerged is a place where those willing to respect other people's opinions are allowed to have their words seen by more people, and where those with interesting and informative postings are greatly encouraged over people who only wish to hurl insults and start petty arguments.



Figure 4: Slashdot Main Page

Slashdot serves as a model for a successful online community

Lastly, Wikipedia is an extremely popular online encyclopedia, which relies on the submitted information of its users to generate its content.⁵ Wikipedia is fascinating in that absolutely anyone can compose entries for the encyclopedia. More impressive, however, is the fact that anyone can alter existing entries, regardless of how drastic or minuscule the changes are. Massive records are kept archiving not only every current entry in the Wikipedia, but also all previous versions of the entries as well. This way any major adverse changes can be reversed. Furthermore, human nature dictates that most people enjoy their words and ideas on topics that interest them being seen by large numbers of people, and so Wikipedia has grown rapidly through the few short years of its existence. Furthermore, the level of quality in its entries has been consistently high, as

⁴ Slashdot.org, 2005 <<http://www.slashdot.org>>

⁵ Wikipedia, 2005 <<http://www.wikipedia.org>>

even the smallest error is seen and corrected by one of Wikipedia's myriad of visitors. Everything from spelling errors to gross historical inaccuracies are kept in check by Wikipedia's feedback loop of self-regulation, and the result has been a flourishing emergent encyclopedia.

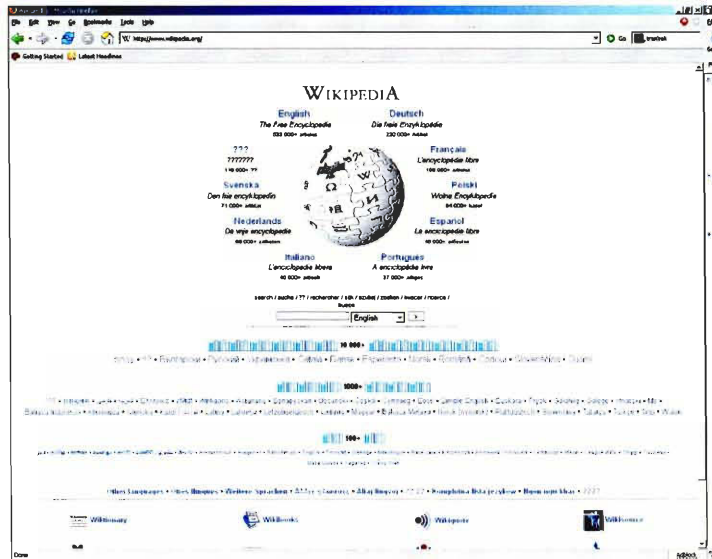


Figure 5: Wikipedia Main Page

Wikipedia is an online encyclopedia driven entirely by user submissions

In conclusion, the aforementioned online submission systems serve as shining examples for the feasibility of an emergent system to find success in cyberspace. With a firm set of rules and a user-friendly system of rewards, everything from online marketplaces to digital discussion boards to encyclopedias have found success. Taking advice from eBay, the Sounds of WPI Project could reward honest sound submitters and discourage fake ones, from Slashdot.org, quality submissions could be filtered to the highest level of visibility, and from Wikipedia, universal usage could ensure historical accuracy in all potential metadata related to the sounds. If the Sounds of WPI Project would follow the paths forged by these aforementioned systems, it could truly succeed.

4. Methodology

An acoustic snapshot of the environments of cities and locales is a healthy source for historical reference. However, no criteria has been set to determine which sounds are characteristic, historical, or natural and what is unnecessary noise intruding on the actual locale. Our group provided the guidelines to determine the criteria for preserving the audio environments of cities around the world.

The Sounds of WPI Project had three clear objectives:

1. To determine the criteria for the identification and prioritization of characteristic sounds.
2. To accomplish the first objective through a small-scale implementation of the Sounds of WPI Project at Worcester Polytechnic Institute by identifying and recording the characteristic sounds of the campus.
3. Create a web-based sound storage-submission system designed around the principals of emergence.

The determination of criteria for characteristic sounds is an important goal for our group. The criteria will help form a guideline for future groups to work upon in determining the characteristics sounds of their city or particular environment. Additionally, the determination of prioritization methods for the organization of characteristic sounds is a similarly important goal for our group. The prioritization methods will prove invaluable to both future characteristic sound recording teams as well as for users of the online submission system. These two goals, the identification of criteria for identifying and prioritizing characteristic sounds will not be accomplished theoretically. By testing various techniques in the field through a “Sounds of WPI” sub-project, these criteria will be determined in a very real way, from real practical experience.

An online submission system for sounds is a way to connect people around the world and to preserve audio snapshots from cities around the world. The system will be designed to hold a large database of sounds along with metadata of the sound. Furthermore, it will provide access to users such as artists and musicians to use the sounds in recordings of their own. Lastly, it will act as a springboard for creative competitions in order to promote the awareness of sound preservation around the world.

4.1 Identifying Characteristic Sounds

The first sounds captured serve as the foundation of the project. This groundwork will determine blueprint. Thus it is important to accurately represent the sounds that will establish direction of the project early on. Representative sounds must be identified in an efficient and encompassing manner. Surveys, interviews, and focus groups and direct observation feed into the most important method of sound collection: user submissions. It is important that the Sounds of WPI Project give due diligence to the evaluation of all forms of identification. Each of these techniques was explored in real world experimentation around campus through the Sounds of WPI initiative.

4.1.1 Determining Survey Methods

Through careful observation, it is plain to see that the student body of WPI spends a great deal of time on campus and the buildings see heavy traffic. These patrons have the best insight into the significant sounds that make up the soundtrack to their day to day activities at the campus. A survey was drafted, and in accordance with research, was kept short and to the point. The questions were open-ended so that no preconceived notions or biases were conveyed. The survey was designed to give an insight into both historically significant and characteristic sounds of the WPI campus. In order to access a healthy cross section of the student population, the Campus Center was the site chosen to canvass the students. Upon their completion, the surveys were filtered and tallied. A strong survey should lay the appropriate foundation for the rest of the test process.

4.1.2 Determining Focus Group Methods

To gain insight into the thought process of the WPI student in terms of processing the idea of characteristic sounds, a focus group was held. Sonically conscious individuals were selected from the student body and with the goal of this IQP a mystery to them, they were observed to gain perspective into what thoughts arise from the concept of sound as

an important descriptive device to their environment. The session was be comprised of six individuals, videotaped and noted thoroughly. Once a better viewpoint on student psychology was gained, it was time for the final test in the sounds of WPI microcosm.

4.1.3 User Submission Methods

The goal of the Sounds of WPI Project is to develop a self-sustaining system that keeps a continuous record of the sounds in a city; holding onto the sounds of yesterday and immediately recognizing changes in the air. The residents of a city know the environment best. Therefore a system of voting on submissions proves to be the most direct way of determining what sounds are truly characteristic. The system must be accessible to as many as possible. The Internet is the state of the art in terms of connecting the world, so a website lends itself well to the cause. The sonic consciousness of any user must be represented. Factors considered should be time spent in an area, activity on the site, amount of ratings posted, and number of sounds submitted. A community of involved users will yield an authentic representation of a city. With this in mind, a very small-scale test of the potential for user submissions was be explored in the Sounds of WPI project.

4.2 Evaluating and Prioritizing Characteristic Sounds

Although in an ideal world the Sounds of WPI Project would be able to preserve every sound ever produced in every city around the world, such a scenario is both grossly impractical as well as far outside the scope of the initiative's objectives. Beyond simply determining the broad criteria for what could constitute a characteristic sound in a city, our group also developed a system for prioritizing those recorded sounds to ensure that those sounds which are truly valuable receive the attention they deserve. This process was modeled in our own WPI test tube experiment. The sounds were actually prioritized on two separate occasions and in two separate but similar ways --first when a project group such as the "Sounds of Venice" or "Sounds of Boston" collected a large number of characteristic sounds all at once, and secondly when the sounds were entered into the

online submission system, where they were prioritized for exposure and usage alongside characteristic city sounds from all over the world. WPI, with its technologically inclined student body, lent itself well as a testing ground.

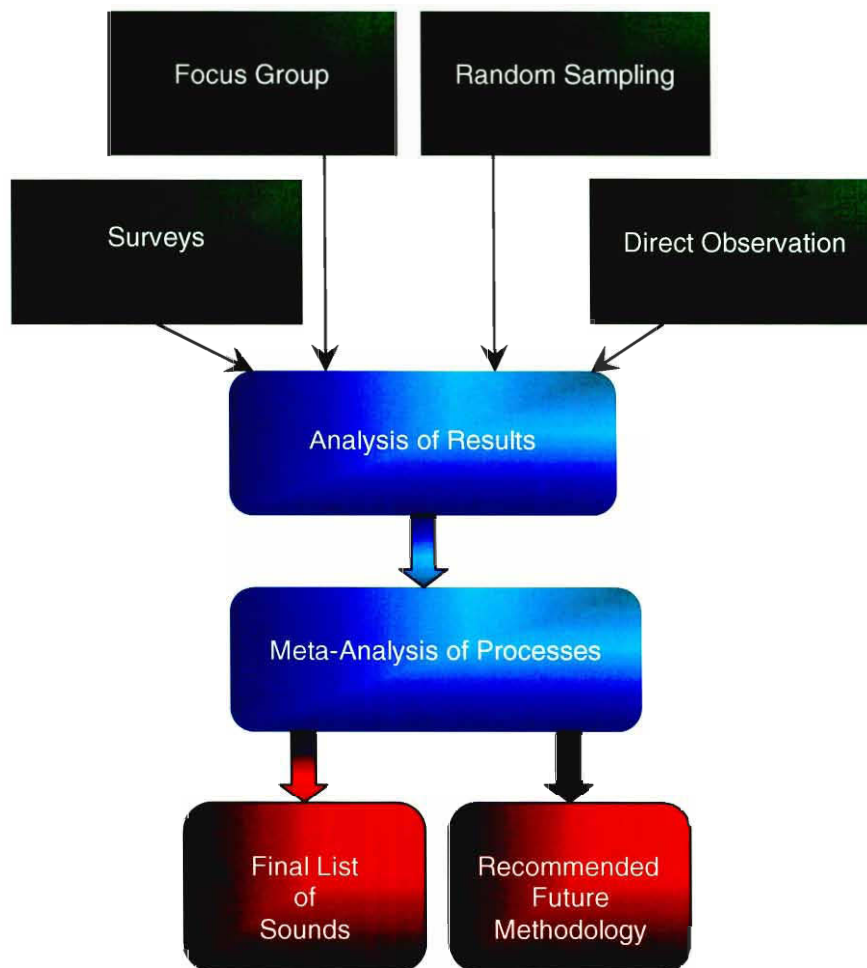


Figure 6: Characteristic Sound Identification Flow-Chart

The Project not only analyzed the physical results, but also the processes used to achieve those results. As such, the Project determined the most effective methods.

4.2.1 Developing a Method for Prioritizing Characteristic Sounds in the Field

As learned from the “Sounds of Venice” IQP group, as many as 400+ characteristic sounds can be determined in the early stages of recording. Just as one may treat any other piece of art, whether it be a painting, a poem, a song, or in this case a

natural sound, it must be critiqued in relation to its peer sounds around it. This judging with respect to other sounds formed the basis for prioritizing characteristic sounds during the field recording process. The Sounds of WPI Project will create a guide to allow future characteristic sound recording endeavors to best know how to ensure they are recording the most valuable sounds.

A number of viable methods for organizing and prioritizing characteristic sounds was explored and tested by the Sounds of WPI Project. One such method already tested by the Sounds of Venice IQP group was the use of weighted attributes and group voting to prioritize sounds. This multi-step process has a number of positive and negative attributes, and it was examined by the Sounds of WPI Project along side other viable methods for prioritizing. Two other such methods represented the analytic extremes of prioritizing sounds. On the extreme scientific side, all voting will be eliminated, and the sounds will be prioritized on statistical data alone. This may prove to be a superior method of prioritizing sounds for future characteristic sound recording teams, as it eliminated all subjectivity in the process, mathematically ensuring that the most viable sounds are given recording priority. On the other hand, perhaps future characteristic sound recording teams will discover that subjectivity is at the very core of preserving sound, and so all mathematical weighting will be eliminated, and sounds will simply be prioritized on their raw popularity among the team members. These are only a few examples of the various methods for prioritizing sounds our group will examine. At the end of the Sounds of WPI Project's investigation, a recommendation was made for all future characteristic sound recording teams to use when determining how to prioritize their inevitably long list of sounds.

4.2.1.2 Utilizing Surveys to Prioritize and Evaluate Sounds

Specifically on the WPI campus, we pooled suggestions from music students via survey. This way, there was input from sonically conscious individuals who were also capable of capturing and submitting quality samples. The results from all methods explored were scrutinized before a final recommendation was made.

The one of the major breakthroughs of the project was the second survey. The

second survey focused more on eliciting ideas on encouraging user participation in the online submission system, and less on the notion of pinning down exactly which sounds were the most characteristic of WPI. This change in focus on the second survey reflected the team's growing realization that determining which sounds were truly characteristic was simply unimportant. As more and more users recorded and contributed sounds to the online system, the most characteristic sounds would simply emerge as a function of their popularity.

4.2.2 Developing Methods for Prioritizing Sounds Online

Since the greater goal of the Sounds of WPI Project is to create an online emergent system capable of serving as a collective for all future characteristic sound recording enthusiasts to submit their sounds to, another method for organizing and prioritizing that ultimate collection. Since the system was designed from the ground up with emergent theory in mind, the Sounds of WPI Projects had no intentions of physically designing a method for the online system that would prioritize the submitted characteristic sounds in the way that they felt was best. Doing so would have violated the very meaning of an emergent system. The actual prioritization occurs as a macro-function of the system itself. Our group simply laid the foundational rules and incentives to encourage appropriate prioritization. The prioritization will occur from the ground up as a function of the desires of the system's users.

The Sounds of WPI Project explored all the various techniques that have been previously applied in similar online emergent systems as well as experimented with some never before seen. The best way to ensure that the users of the online submission system naturally prioritize and organize their sounds is not yet known, but our group strove to determine it. Our group explored techniques such as prioritizing the sounds online based on the number of times they have been downloaded. This way only pure subjective popularity determines which characteristic sounds are most valuable. A rating system was devised whereby users would apply a numerical score to each sound. These two systems, raw popularity in downloads and numerical ratings were examined both as independent sub-systems as well as simultaneously functioning ones as well.

4.3 Framework for Emergent Web System

Because of the concept of emergence, we have no idea how a system will develop; it is supposed to happen naturally and on its own. Therefore, we can only provide the base of such a system and let it grow on from that starting point into a self-sustaining database for sounds.

The methods by which this emergent system will take hold needed to be determined from a larger group of possibilities. There are many ways in which users could submit and listen to sounds but in order for such a web-based system to survive, an optimal arrangement of features is necessary.

4.3.1 Sound Submissions

Since the overall goal of the system was to get people involved, users were be allowed to submit their own sounds. Our group determined the minimum criteria for a sound to be eligible for submission and posting. This will help keep the database clean and ensure only the most viable sound samples are allowed.

1. Sound that is considered unique by standards to a city or locale
2. Sound recording that is of a certain quality
3. Recording contains little or no background noise, dependent on environment
4. Sounds that further the diversity of the collection

4.3.2 Sound Organization

In order to make the database logical and easy to navigate, organization was an important key. Our group determined the best methods to organize the sounds in the system by experimenting with various techniques such as organizing by city, submitter, similar groups, or a number of other possibilities. Since the system is based on emergent properties, the best method for organization will reveal itself with time.

By looking at other websites, we compiled a listing of the various methods of organization and compared which are the best suited for each type of site (news, video,

opinions, etc). We narrowed the list down to the most promising setups.

4.3.3 Sound Retrieval

The database needs to allow for the retrieval of sounds by users. Our retrieval system can serve a number of purposes beyond allowing users to listen to other submitted sounds. By monitoring the traffic of the sounds, popularity of specific sounds, users, cities, or other groups can be determined and can be factored in to the organization of the database. Access to the entire database can serve as a gateway for artists or any creative person to participate in creation and submission of musical compositions.

The overall decision we made concerning sound retrieval is what format or formats the sounds is offered in. A format that is compatible on both PCs and Macs is preferable while still accounting for the fact that not every person has a broadband Internet connection. The most suitable format is one that is both highly-compressed and cross-platform compatible.

4.3.4 User Involvement

To keep the database operational, user participation is critical. People provide the input that is needed for the system to maintain itself. Without any, the system would grow stagnant and cease to function. Our group determined a basic system of incentives to reward users of the system for participation and also rules to keep order and maintain quality with little high-maintenance operations. These rewards can be given based on a variety of criteria that our group determined. Rewards such as giving people moderator status, greater control over the database, or just general recognition in the system were all be considered as incentives to get people involved.

Competitions are an effective source to help foster creativity in the user community. Guidelines can be set for each competition as criteria outlining such things as the sounds that can be used, the theme for the piece, length, and any other variables that can be restricted. As a result of such competitions, musical compilations can be formed and distributed via CD or online music store for promotion not only of the system but also for the recognition of the artists. Furthermore, this provides positive feedback that

encourages even greater participation and involvement in the system.

5. Results and Analysis

The crux of the “Sounds Of” projects has been determining characteristic sounds. Test subjects have shown that processing the idea of a ‘characteristic sound’ is no easy task. This has been the largest bump in the road in terms of gathering the sonic essence of a given environment. Some may infer that a characteristic sound is any audible signal that would remind the listener of a particular area. Others would argue that it is an authentic sound as long as the origin is a defining element of the chosen setting. Still, some view a sound as characteristic if its removal would take away from the surroundings.

Although these illustrations can be helpful, it has later further concluded that there rarely is one truly characteristic sound that stands alone to define an environment. Rather, it is the combination of sounds that build the soundscape of a location. As alluded to earlier, sirens sound alike the nation over, but the addition of a droning rain and accents heard in the discussions of citizens would place the listener in Seattle rather than Phoenix. Characteristic sounds are the ‘little things’ of a city, different shades combined to paint the big picture.

Following the identification process, the next logical step was prioritization. The Sounds of WPI Project has realized two perspectives that would shape the focus of the prioritizing process. The first emphasizes an accurate historical portrayal of the selected site. From this angle, holding onto the sounds of a quickly developing world is the objective. Technology is ever-changing. The telephone rings of from only a decade ago sound archaic to the ear accustomed to today’s pervasive digital technology. No sooner will more ‘modern’ sounds be replaced by the sounds of a not too distant future. The other school of thought places emphasis on the imaginative capabilities of a city’s sounds. The artistic possibilities that would attract such a user range from music compositions sound effects. These sounds will likely be selected for their creative potential rather than historical relevance.

These points of view do not represent opposite ends of a spectrum, rather two points on the circle comprising a myriad of perspectives, unique to each individual. Just as a ‘characteristic sound’ conjures a distinctive definition in each person, a sounds importance will follow suit. The important idea is that there are sounds all around the

globe as long as its travelers are opening their ears.

5.1 Identification of Characteristic Sounds

We have identified a list of sounds that represent the various subtypes of sounds previously described. Utilizing the various techniques prescribed in the methodology, we recorded and preserved the characteristic sounds of Worcester Polytechnic Institute.

5.1.1 Compilation of Sound Ideas

The very first step in the process of gathering the characteristic sounds of location was the collection of ideas of what those characteristic sounds might be. Four methods were implemented: group discussion, face-to-face interviews, direct observation, and classroom surveys.

5.1.1.1 Group Discussion

Through a series of weekly discussions between the three members of the Sounds of WPI IQP team, a preliminary list of sounds was compiled to be recorded. While this method was not viable in the Sounds of Venice project, due mostly in part to the group's lack of familiarity with the location, it was a very viable option for compiling characteristic sound ideas for us, as each of the Sounds of WPI team members is familiar with the school. Furthermore, in the future, when individuals are going out into their home city and recording characteristic sounds to upload to the online submission system this project hopes to outline, such a method will also be viable for them, as the city's residents will, obviously, be familiar with their recording location. This method of compiling sound ideas yielded 59 sound suggestions.

5.1.1.2 Face-to-Face Interviews

An open-ended, three-question interview was conducted on 30 WPI students in the Campus Center. The questions posed were:

1. Where is a characteristic sound of WPI?
2. What is a historically important sound of WPI?
3. What are some everyday sounds you hear at WPI?

The interviews received 26 unique responses in total to the questions and a high number of repeated answers from multiple subjects. For example, 8 individuals all cited the hourly Alden Hall bells as a characteristic sound, while 10 people cited the sound of typing on keyboards as an everyday sound. The open-ended nature of the questions proved particularly problematic, with many people refusing to answer the questions due to the required amount of thought.

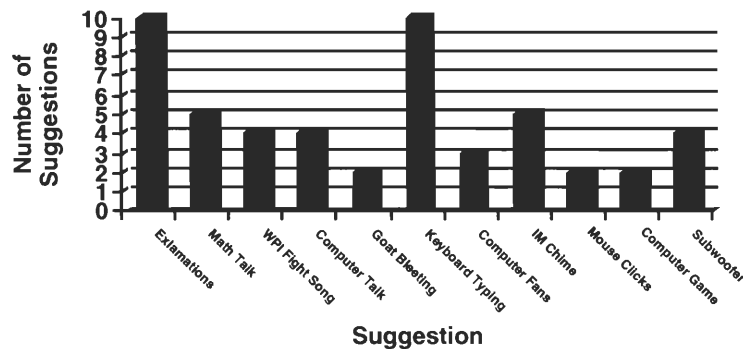


Figure 7: Top Ten Most Frequent Sound Suggestions

Keyboard Typing and various human phrases were the most commonly suggested sounds

5.1.1.3 Direct Observation

Another method of compiling characteristic sound ideas involved simply walking through the areas of Worcester Polytechnic Institute's campus and recording the sounds one would naturally observe. This technique achieved maximum effectiveness when all three members of the group were together. This technique has not been exhausted and will continue into D-term. 20 characteristic sound ideas were generated using this technique, and all of them have been recorded.

5.1.1.4 Follow-Up Interviews

To further develop an understanding of the type of user that would be interested in an online representation of the Sounds of WPI Project's work, a second survey was conducted on 70 WPI students in the Campus Center, then 28 electronic music students before a weekly class meeting. The questions posed were:

1. Have you participated in self-sustaining online communities (i.e. Slashdot, Wikipedia, etc.)?
2. Have you contributed material to an online community?
3. What draws you to participate in these online communities?
4. What would draw you more to participate in these online communities?
5. Would you use an online system to browse and possibly upload various sounds and collections of sounds?
6. Have you ever composed music before? - If yes, would you participate in an online contest for composing music from a collection of sounds?
7. Would you be interested in hearing other people's music that has been composed from a sound collection?
8. Do you have access to sound recording equipment?
9. Do you have an iPod or other mp3 player? - Do you have access to a still photograph camera?
10. What sounds characterize WPI?

Overall, the second interview was done to test a cross section of the student population, and then explore the possibility of finding the targeted demographic. Represented by the electronic music students, the interview of a small gathering of musicians best simulates the success of a website if it can be marketed properly to the desired group of people. These students are inferred to have both an interest in music, and a developed technical aptitude.

Universal to the entirety of the surveyed group, online communities were an

overwhelming interest. The interaction, recognition and simply the fun of being involved in an online community drove over half of those surveyed to contribute various media such as music, pictures and stories to these sites as well as build a network of other forums by posting links. An increased interest is clearly developing and the group interviewed seemed to be waiting for the newest and most exciting site to come along, not cowering from the idea of some reward-based competition. Building on this enthusiasm, the idea of an online browsing and submittal system was proposed. As expected, the music students would be overwhelmingly interested in such a system, and surprisingly, half of the general student group feels the same way. While a vast majority of those surveyed would be interested in listening to submitted compositions, half of the music composers in both groups would go as far as to compete in an online competition on such the site. Helping to facilitate the idea of wide scale user submissions, most individuals had access to some kind of sound recording device. The devices ranged from midi-disc recorders to cell phones while half of the group had some kind of mp3 player. Corresponding pictures would help to make the site more appealing and user friendly. This seemed possible due to two thirds of the interviewees owning a camera. The photographic application also lends itself well to a more historically driven website.

It was very refreshing to see that the idea of a sound based website was appealing to many different people for various reasons. The timing is perfect for such a site to receive a massive interest as the appeal of online communities is reaching more online surfers than ever with the advent of 'Facebook'⁶ and 'MySpace.'⁷ The site is intrinsically attractive if music is involved as it appeals to an artistic appreciation found in nearly every culture. Most importantly, the second survey showed that with the technological literacy and utility of those surveyed, if the proper encouragement can be offered, the possibilities for a completely emergent user-run sound submission website is very present.

5.2 Evaluating and Prioritizing Characteristic Sounds

⁶ The Facebook. Mark Zuckerberg, 2005. <<http://www.thefacebook.com>>

⁷ My Space. 2003. <<http://www.myspace.com>>

While a person or a group of people can come up with an extensive list of sounds corresponding to a largely populated area, it is inconceivable to be able to catalogue and record each sound. Therefore, it is necessary to arrange the sounds in order of priority so as to ensure the more important and characteristic sounds are captured and documented. There are two distinct steps to this process of prioritization; first when a project group such as the “Sounds of Venice” or “Sounds of Boston” collects a large number of characteristic sounds all at once, and secondly when the sounds are uploaded to a semantic database for browsing through. It will ultimately be the public largely recording and submitting sounds for entry into the database so a reliable method for prioritizing characteristic sounds was an important goal of our group. The following sections are our results for various methods of evaluating and prioritizing characteristic sounds within a largely populated community.

5.2.1 Methods for Prioritizing Characteristic Sounds in the Field

The best way of finding candidates for characteristic sounds is to actually be in the field where the sounds are. Sometimes, sounds are discovered on the spot that would have otherwise remained elusive had we never explored the field. Our work in the field helped us learn how sounds can be perceived in different environments, both locally and temporally.

Earlier we discussed using a method presented previously by the Sounds of Venice IQP involving weighted attributes and group voting to prioritize sounds. It proved useful for the Sounds of Venice IQP, being a short process of addition and subtraction followed by a vote. We also mentioned two extremes to this method of prioritization; objectivity versus subjectivity. Objectivity would involve statistical analysis of data and the sound's priority would be based off the results. Our group was never able to obtain much statistical data from our surveying methods so our prioritization was not very objective.

However, just because we weren't objective in our prioritization of collected sounds doesn't mean our resulting list of sounds was under par. It may be discovered by future 'Sounds of...' groups that pure subjectivity is the only way to go when prioritizing

important sounds. To the general public, statistics don't matter as much as what everyone else around them says. As a community, they all hear the same sounds and can usually reach a consensus on their own.

5.2.2 Methods for Prioritizing Sounds Online

The online world is a swiftly growing community of people from cities and countries around the world. Everyone is connected to the same information and has the same opportunity to view it, allowing for anyone to have a voice who wishes to express their opinions. By allowing people from around the world to get in on the prioritization of sounds, a more comprehensive and concise list will develop based on how the community as a whole feels towards various sounds

Because our web-based submission system is not yet functional, we set about first to examine existing web-based communities that involve submission of news articles, pictures, and other documents. Slashdot.org is one such online community, reporting news stories on recent scientific, technological, and other 'nerd' matters. People can not only browse the news stories posted but can also sign up for free as a member and contribute to the site themselves. Members participate in various polls and message board discussions, interacting with people from across the globe. It is known that message boards will inherently attract what are known in the online community as 'trolls', people who use their anonymous status online to incite arguments and create general discord in the community. These 'trolls' are frowned upon by the rest of the community so the owners of Slashdot developed a message rating system and karma level for members. When a member posts a message, it is given a default rating which can later be changed by a moderator, either higher or lower, depending on the contents of the posts itself. The more messages you post with a positive rating, your karma will go up. When your karma reaches a certain level, you are eligible to be a moderator for a short time and then get to rate other members' messages.

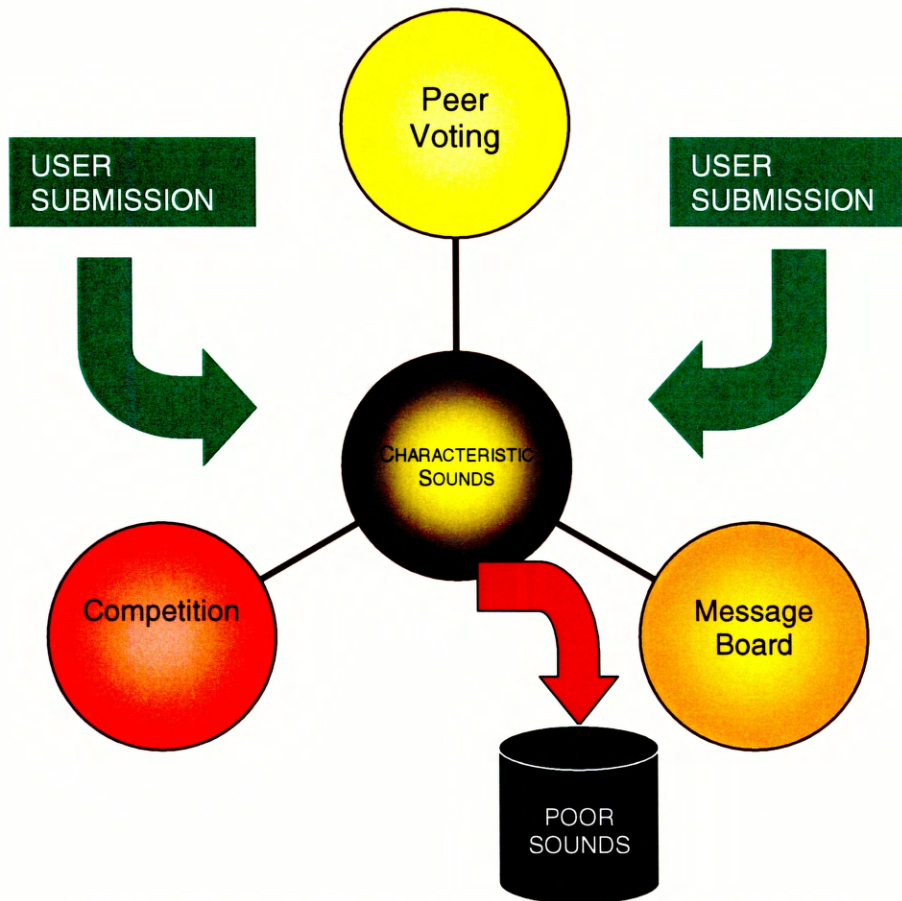


Figure 8: Basic Online Submission System Flow Chart
 Showing User Input Loosely Determining Characteristic Sounds

This system of rating both members and their postings is a very effective system that can easily be ported to a sound submission database. Users will review each others sounds, ensuring that the quality of the archives remains high. Once going, the website will need minimal maintenance, being self-sustained by the users who contribute to the project.

5.2.3 Methods for Recording and Archival of Sounds

While we may have determined what our most important characteristic sounds are, there is still the task of actually capturing the sound for future storage. There are many methods that can accomplish this task but we wish to determine the ones that yield

the highest quality sounds with the least amount of mental stress and recall.

In order to get good quality sound a stereo microphone was used in conjunction with a Digital Audio Tape (DAT) recorder. The AT822 Stereo Condenser microphone allows us to record the sound in almost the exact way a person would hear it. By storing the sounds on the TCD-D8 DAT recorder, we ensured that the quality would not be diminished compared to a standard tape recorder. There was still one problem with the DAT recorder. Since it was tape-based, we needed to play back the sounds one by one while connected to a computer that could capture the audio. This task was manageable but very tedious.



Figure 9: Stereo Mic



Figure 10: Portable DAT Recorder

Two important recording devices that produce professional quality recordings

Our recordings of the WPI campus yielded 80 tracks of raw sound from one DAT tape. In total we obtained sounds from 14 of 18 locations around campus ranging from dormitories to dining halls to various majors' buildings. There was a fairly equal divide of keynote and signal sounds constituting the recordings.

There were several options for recording the sounds to a PC such as the Windows Sound Recorder and commercial software like Cakewalk Guitar Studio 2.0. Windows Sound Recorder was rejected due to the fact it could only record one minute clips, a strange arbitrary limitation. Cakewalk Guitar Studio allowed for multiple tracks, stereo recordings limited only by your hard drive space. With this, one could let the DAT recorder play straight and the PC will capture all the audio in one pass. We then went back and cut the tracks where needed and then did some post clean-up work.

Recently, MP3 players have been gaining in popularity, especially Apple's iPod.



Figure 11: Apple's iPod
Possibly the future of recording characteristic sounds

Numerous accessories have been released that can be used in conjunction with an iPod, including several voice recorders. After researching the two top brands, we determined to go with a voice recorder from Griffin called the iTalk. The iTalk was chosen for its small profile and better microphone. While the microphone is not a stereo one, we were able to hook up the stereo microphone we already had to the iTalk. The voice recording features of the iPod automatically tag your sounds with a time and date so you know exactly when you recorded them. All that was needed was to take notes on the different dates and times so we can easily go back and organize the sounds efficiently.



Figure 12: Apple's iPod with iTalk Recording Attachment
A \$20 attachment that could empower anyone to begin recording characteristic sounds

The obvious choice for future groups would be the iPod due to its high functionality and ease of use. With the iTunes software, any user can easily transfer the sounds they record with their iPod to their computer for submission to an online sound submission system. While not everyone will be able to get a high quality microphone, people who wish to participate will still be willing to spend a small amount of money for a decent microphone that is still capable of capturing sounds.

5.3 Framework for Emergent Web System

With the completion of this project, we are leaving behind an emergent web-based submission system for the uploading and downloading of sounds from various cities and locales. Our hope is that this system will continue to grow and be self-sustaining once we leave it behind. We also expect the system to help contribute to the awareness of sounds and how they shape the environment around us.

There were four major concerns facing us with the building of this web-based submission system. We had to flush out the logistics behind submitting sounds and also downloading sounds to listen to; the structure of the database had to have a logical flow and organization as to ensure quick and easy access to specific sounds. The involvement of the users was a top priority in the development of this emergent system as the more user involvement there is, the more resilient and longer-standing the system will be.

5.3.1 Sound Submissions

The submission of sounds to the system from users will help to keep the database alive and growing, and keep people involved in the project. Anyone who signs up through the website will be able to upload any sounds that they have recorded and classified. With the more sounds that are uploaded into the database there arises a greater need to keep submissions viable.

It has been determined that in order to upload a sound, the user must provide a minimum set of descriptors for the sound clip. We have determined that this minimum set will be:

1. Name of sound/short description
2. Location recorded
3. Date recorded

Along with the required attributes, the user will be able to define more attributes for the sounds they upload. A small set of such attributes will include:

1. Time recorded
2. Weather
3. Sound quality (bit rate, sample size)
4. Distance from source
5. Surrounding environment (indoors, outdoors, hard v. soft-walled room)
6. Technological v. Natural
7. Background noise, soundscape, singular sound

By allowing users to define as many attributes as they want, we ensure that the database will remain descriptive enough so as to allow a user to search for very specific sounds.

5.3.2 Sound Organization

Currently, the submission system we have is based off of browsing through maps and images of various cities and locales and clicking on boxes surrounding objects in certain pictures to listen to a sound clip of the object. While this setup is intuitive and has very good intractability, some users wish to have more control over browsing the database for sounds.

The database setup of the submission system will allow for easy storage and retrieval of sounds. Sounds will be sorted depending upon attributes that are given by the submitter. Attributes can also be easily added into the database at anytime, allowing for even more descriptive entries and more specific sounds, should users be looking for them. The largest problem the system may face is too many similar sounds, meaning the users are not going to be able to distinguish between sounds enough. The more organized the sound database is overall, the easier it will be for users to find a certain sound and for the users to distinguish slight differences between very similar sounds. This problem will

be addressed more in section 5.3.4 User Involvement.

5.3.3 Sound Retrieval

Since the storage of sounds is based off their attributes, we can easily perform searches on the database with simple SQL statements. While we wouldn't have the users writing out their own SQL statements, a search function was planned to allow more advanced users the power to find specific sounds that they wish to hear. Being easy enough for even novice users to use, the search feature will allow quick access to any sounds in the **database for all users in the community.**



Figure 13: Screenshot of the *Sounds of...* website

Note the navigational boxes leading the user to other campus images and sounds

Along with being able to search for certain sounds, users can browse through the cities that the sounds were recorded in and see where exactly they were recorded. Besides sounds, users can submit photographs taken of various locations in the city where some sounds were recorded and create links in their photos to the actual sounds. The setup provides a unique and highly interactive way to browse the sounds in the database, letting you experience both the sights and sounds of various cities worldwide.

When retrieving sounds, a user wants to be sure that they are able to listen to the

sound. The format of the sounds that are uploaded will be limited to the most common of audio formats: MP3, WAVE, and WMV. MP4 may be considered farther down the road due to its increasing popularity in conjunction with the iTunes© software from Apple Computers®.

5.3.4 User Involvement

To ensure that the database continues to grow, it needs to be maintained and organized. Such maintenance tasks would require full-time commitment from the people running the site, not a very promising job to look forward to. Instead of having one or more designated people maintain and update the site, the users who are using the system can help to police and watch the database to ensure quality across the boards.

As noted before, there is always a high probability for having the same sound in multiple times. Such redundancy will be a nuisance to both users and administrators; therefore some form of maintenance is needed. Users of the submission system, especially the more experienced ones, are quite capable of finding redundant sounds, sounds that are of poor quality or sounds that have too high a noise-to-sound ratio(unless specified in a descriptor that the noise is intentional).

Users of the website will start off with a certain ranking. As they participate more in the site, such as uploading sounds, rating sounds, and creating visual walkthrough for sounds, they will increase in rank. At a certain rank, they are given the privilege to remove sounds and pictures that are either considered offensive, poor quality, or otherwise unworthy material for the site. By allowing users who reach this rank to maintain the database of sounds, the system will stay clean and organized and not turn out like a pile of dissonant sounds all thrown together in one place.

This user involvement will be self-reinforcing, meaning that as the database continues to be updated and maintained, users will want to participate more in the system because it continues to be easy to browse and understand. The opposite is also true as where if there is no users maintaining submitted material, the archives will grow too large and complex with redundancies all over the place, turning users off from wanting to use the database system at all. The system will then become stagnant as user involvement

quickly drops off, leaving no one around to update and maintain the system.

Another activity for user involvement is the addition of competitions that involve the creation of musical composition from sounds in the database system. Creative users are given the chance to let others hear what they compose and the addition of musical pieces to listen to is another appealing element to many people. Various guidelines and rules can be developed for many different types of competitions, allowing users of different styles and tastes to still participate in a competition that is interesting to them.

6. Conclusions and Recommendations

While having worked for over 5 months on the Sounds of WPI initiative, the grand scope of the project has left much work to be completed. Thus far we have identified and recorded dozens of characteristic sounds and soundscapes around the WPI campus, furthered the research into defining the notion of characteristic sound, and built a functional hub for all future “Sounds Of…” initiatives to interact with. In this section, we will outline the future plans for the recording of characteristic sounds and most importantly, the future of the emergent online submission system.

6.1 The Future of Recording Characteristic Sounds

Until this point, isolated teams of students and researchers have done the recording of characteristic sounds. As one can imagine, the progress has been slow, and the results have been modest. The WPI Sounds of Venice team recorded the characteristic sounds of Venice; the Sound of Boston team recorded the characteristic sounds of Boston, and so forth. The future of preserving characteristic sounds does not lie with more of these teams, repeating the methodologies of Venice and Boston. The future of preserving characteristic sounds lies in the hands of people across the world. Future “Sounds of…” initiatives should not preoccupy themselves with their own recordings, but rather, the focus of future “Sounds of…” initiatives should be to encourage the general public to record their own characteristic sounds.

In the ideal future of this initiative, people from cities across the world would go out on their own and record what they personally believe are the most characteristic sounds of their cities. Then, they would take those sounds and add them to the ever-growing online submission system for which we have laid the groundwork. These users would then see what their fellow city dwellers considered characteristic and in turn they would be further encouraged to record even more. The creative chain reaction that could potentially ensue by people sharing their own characteristic sounds which each other is what would tip the “Sounds of” initiative from a small college project series, into a self-

sustaining emergent system.

There are countless advantages to having the general public record their own sounds in comparison to isolated teams recording. Until now, one of the main focuses of these Sounds of WPI Projects has been determining exactly what the characteristic sounds of a city are. The Sounds of Venice team developed a ratings system to develop a ranking of exactly *how characteristic* each individual sound was, and the Boston team took the next logical step by developing an even more complex “verification” system to measure how characteristic a sound was. These methodologies are fine, and they give the illusion of an objective measurement, however, the very nature of characteristic sounds will always prevent it from truly ever being objective. Furthermore, because these projects (as well as our own) have been completed under rigid schedules with strict deadlines, the sense that “we only have so much time to record the absolute most characteristic sounds” has been extremely heightened. When the “Sounds of” Initiative switches to an emergent online system where potentially thousands of users could continually submit their notions of what the characteristic sounds of their environments are, those arbitrary deadlines melt away. “How characteristic” a sound is will no longer be determined by a point system decided on by a handful of individuals (as with the case of Venice), or by a slightly larger number of people (the case with Boston’s ‘Verification’ system), but rather the notion of sonic characterization will emerge from the opinions of the entire community. The most characteristic sounds will be the sounds most frequently uploaded, downloaded, and used. This is the main benefit of the emergent online system, and future projects will have to determine exactly how to harness this.

The true challenge of future projects will be developing a plan to get users to record on their own. Everyday portable MP3 players grow more and more popular, and many of them already have built in microphones for recording. Additionally, many cell-phones have recording capabilities. Future IQP teams should work strongly on a method to entice people to use the devices they currently own and use to record sounds, upload them to the emergent online submission system, and become members of that community. A sizable portion of our survey and focus group research was devoted to determining what it would take to get people to use a sound submission system. As mentioned before, future IQP’s should focus on attracting technically savvy music

enthusiasts, as these seem to be the type of individual most likely to be naturally interested in participating. Regardless of how they achieve their goal, one thing is for certain: future projects should clearly focus on the high task of enticing the general public to start considering recording characteristic sounds for their own benefit and entertainment.

6.2 The Future of the Online Sound Submission System

In its current state, the online submission system is in its infancy. As previously mentioned, sounds and pictures can be uploaded, but no checks are made to monitor what is being uploaded. User names and accounts can be created, but currently they serve no real purpose. Most importantly, there is currently no way to search the database of sounds that have been uploaded, and there is no sense of community due to the lack of a message board or other integrated communications system. The future of the currently humble “Sounds of” website is grand, and it will take the hard work of future projects to see its full vision realized. In its ideal form, the online submission system will actually consist of three separate but highly intertwined subsections: a more advanced visual kiosk for navigating around virtual cities and listening to the characteristic sounds people have added, a search engine for browsing the database of uploaded sounds and images, and a message board for users to discuss and compare their submissions and possible host online competitions for user compositions.

6.2.1 Online Virtual Cities

The heart of the website in the future will be a global map capable of expanding to contain the images and sounds of any city in the world. Similar in nature to the system currently in use by Google’s “Keynote,” a single, globally coded map will be used to hold all of the visual information. From there, users will be able to upload their own images. Future groups will need to develop a system for integrating all of these images together –should the users be expected to enter global coding information with every

picture they upload? Should the system somehow intelligently organize the pictures? Or should the users simply be allowed to organize the pictures themselves, and based on faith in emergence, hope that order emerges. Regardless, the way the current system works is simply inadequate for the task of managing dozens of cities simultaneously, and thus future projects will need to work on developing this aspect of the system the most.

This aspect of the website is the most important based on our research. Our research has shown us that the general public is more attracted to having fun with the website more than any other enticing aspect such as rewards, notoriety, or competition. As such, the virtual city section of the website is the most “game-like,” and having spent many hours building a virtual WPI campus to move around in and listen to sounds in, we can strongly attest that it truly is a “fun” feature. As shown by the success of games such as SimCity and The Sims, people enjoy building little worlds (basically emergent systems), and the virtual city section of the website offers the most promise to offering a genuinely fun thing to do with recorded characteristic city sounds.

6.2.2 Searchable Database

Our research has shown us that people also strongly value getting good information and media from websites, and so developing a comprehensive search engine of all the uploaded sounds and images will be something that future projects will have to tackle. This is also one of the most difficult tasks of creating the website, because the more comprehensive the search engine, the more metadata must be attached to each individual sound and image. This has the noticeable downside of creating a larger burden on each user to not only record their own sounds, but also keep a record of all the metadata we require a sound to have in order to be uploaded. With this in mind, it is very important that the required amount of metadata be kept to a minimum. Luckily, both our team and the Sound of Boston team have experimented with this problem already, and by using our projects as starting blocks, future “Sounds of” projects will hopefully be able to further this aspect of the website.

6.2.3 Community Forum

Second only to “fun,” our research has shown that people strongly look for a sense of community in their websites. Even if the website had an excellent virtual city tour system and an exhaustive search engine, it would still never feel complete without some sense of community to connect people. Future projects should focus their research into what separates successful online communities from others, and they should work to improving our site to contain those features. The forum section of the website will be the location where people will come to talk about what sounds they feel are most important to their city, where they will share recording tips, where they will debate which recording equipment is the best, and where musical competitions could staged. It is absolutely vital that future projects work on developing this aspect of the online system to reach its full potential.

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8. Appendices

This section contains the numerical results of our two surveys.

Appendix A: Survey 1

This survey was centered on finding out what most people thought were characteristic sounds of the WPI campus. As we found out, most students were confused about what a characteristic sound was. They didn't know how specific we wanted them and so set about thinking too hard about answers instead of the general sounds right around them. Regardless, we still came up with results that proved to help us select which sounds to initially record.

We divided the sounds up into 2 categories: natural sounds and technological sounds. All suggestions for characteristic sounds fell into one of these categories. In all, 30 surveys were given out and completed.

Natural sounds:

- Exclamations: 10
- Math-talk: 5
- WPI Fight Song: 4
- Computer-talk: 4
- Goat bleating: 2

Technological sounds:

- Keyboard typing: 10
- Computer fans: 3
- IM chime: 5
- Mouse clicks: 2
- Computer game: 2
- Subwoofer: 4
- Shuttle bus: 1
- Alarm clocks: 1
- Coffee machines: 1
- Cell phone: 1
- Old fashion tape drives: 1
- Alden Bells: 8
- Campus Center noise: 1
- Dining hall noise: 1
- Machine shop: 1

Appendix B: Survey 2

Our second survey focused more on what students used online community websites for. We wanted to find out the reasons for people using these websites and also to see if people were interested in some of the ideas we had for our own site.

We passed out 50 surveys to students in the campus center and 60 surveys to two music classes on campus. The results showed that most people liked online communities more for the social interactions while the other things on the site are somewhat secondary.

1. Have you participated in self-sustaining online communities (i.e. Slashdot, Wikipedia, etc.)?

Yes - 67

No - 31

2. Have you contributed material to an online community?

Yes - 56

No - 42

If so, what have you contributed?

11 -sounds

40 -pictures

25 -music

25 -stories

28 -web links

2 -Journal

1 -Facebook

1 -commentary

1 -info

1 -video

1 -game modifications

1 -animation

3 -other

3. What draws you to participate in these online communities?

6 -recognition

3 -rewards

43 -social interactions

46 -fun

6 -competition

- 17 -other
- 4 -nothing

4. What would draw you more to participate in these online communities?

- 2 -invitation/word of mouth
- 1 -more Info
- 5 -community Interactions
- 1 -instant validation
- 1 -large # of uses
- 4 -prizes/incentive
- 1 -Google search result

5. Would you use an online system to browse and possibly upload various sounds and collections of sounds?

- Yes - 68
- No - 30

6. Have you ever composed music before?

- Yes - 57
- No - 41

If yes, would you participate in an online contest for composing music from a collection of sounds?

- Yes - 28
- No - 29

7. Would you be interested in hearing other people's music that has been composed from a sound collection?

- Yes - 76
- No - 22

8. Do you have access to any sound recording equipment?

- 48 -mp3 players
- 47 -cell phones
- 29 -personal voice recorders
- 8 -mini disc player w/mic
- 2 -tape recorder
- 14 -computer

9. Do you have an iPod or other mp3 player?

- Yes - 48
- No - 50

-Do you have access to a still photograph camera?

- Yes - 64

No - 34

10. What sounds characterize WPI?

- construction
- really bad nu-metal
- alma mater
- foam swords/groaning
- goat
- technology, video games, TV, calculator
- birds
- fountain
- squirrels
- Alden bells
- talking
- computer noises
- "I hate calculus"
- pool balls