Edinburgh University’s Situated Ecologies DMSP group exhibited their first audio/visual installation on April 1, 2014 in the Innocent Railway tunnel. The display featured a combination of live performance aspects and audience interaction. The theme for the installation was the history of the Innocent Railway tunnel from its original incarnation to its current purpose as a cycling path. The tunnel’s was represented through animated visuals; audience triggered audio samples and abstract musical performances.

Brief History

The innocent railway tunnel was the first railway tunnel to be built in the United Kingdom. Built in 1831, the tunnel replaced the old method of having the train car pulled by horse and stationary steam engines. The pathway’s name derives from its impeccable safety record, as no fatalities were suffered during a time where accidents on steam engines were commonplace. The tunnel was re-opened as a pedestrian/cycle path in 1981 after it’s closure in 1968.

Today with the technologies that have been advancing people can capture audio and visual imaging with the click of a button. Portable audio recording technology allows us to make high quality recordings of natural environments and man-made environments. Cities, the underground, forests, and underwater are only some of the things that can be captured with these technologies. Visual imaging can be added to these captured sounds, which adds another dimension to the performance. We can then take these audio and visual recordings and present them in a concert, exhibition, or performance setting. Conversely, when we use this method, we take the sound and visual away from its natural environment altering our perception of it in relation to the new space. What this creates is a portrayal of what that environment was like during the extraction process.

With that said, Situated Ecologies’ has a different goal. What this project aims to achieve is to present the audio and visuals of a space within the original space and use that to alter our perception of those audio/visual aspects. The work created allows us to interact with the given space and its atmosphere resulting in a site-specific experience that changes the way in which we perceive the projects location. Whilst discovering the connection between technologically, the environment and human perception we are also performing using the environment as a stage.

The Installation

Our installation consists of 4 major aspects; visuals, sensors, manipulated sounds, and performance which are split between the group members. The installation incorporates historical aspects of the tunnel and encourages participation from pedestrians and bike riders alike. At both ends of the installation we have a surface with a contact microphone attached. This acts as a trigger that sends a signal as people walk or ride their bikes into the installation area. This signal then triggers historically relevant sounds through a set of six speakers. For example if someone were to ride their bike through the installation area they might get sounds of horses trotting along side them, or a steam train coming towards them head on. Along side the installation, is the aspect of live performance as well. The presence or rubbish in the tunnel allows the group to make use of certain objects such as dripping water and opportunistically placed drinks cans, the audio of which can then be processed in real-time. During testing, it was discovered that the dripping water was inconsistent so an additional performance aspect was added in the form or Vanessa’s flute. The playing is not traditional flute playing but more abstract sounds intended to simulate train whistles. Vanessa constantly moves around the space playing from both ends of the
tunnel with the direct sound of flute being picked up by a radio microphone, the signal of which is then manipulated in real time, along side the other aspects of the performance. The real-time audio manipulation is done via Ableton Live, which Nick controls manually. The final feature of the installation is the projections, a set of images and animations created by Yao. The animations were related to the various sections of history the installation focused on in regards to the tunnel.

Designing the Presentation Layout

![Sketch of the basic project layout.](Image)

The basis for the Situated Ecologies Installation was formed from the combination of the location that was chosen by the group in the early stages of the project and the wide array of skills each member possesses. As a result of this, a design was made that would showcase each of these aspects, resulting in a varied and engaging experience for the viewers/listeners.

This system proved to be the best format to take forward and build due to its potential for expansion and its incorporation of visual and audio aspects, audience participation and the large system of speakers allows for a great deal of variation and experimentation with the performance and delivery of the project. The setup consists of 3 sets of speakers, placed 5 meters apart from each other, giving an overall area within the tunnel of 15 meters that audience members could move around in. Each speaker can be individually controlled allowing for additional creative and spatial potential in the audio aspects of the installation. At each end of the installation space, there is a contact microphone that will register someone walking or cycling into the installation area. This information can then be used to trigger specific sounds that can follow them as they move past each speaker array.

**Designing and Implementing the Technology**

The first aspect of the project to consider was the location and the limitations it presents. The immediate limitation was the lack of a stable and constant power source. Because of this fundamental problem, all aspects of the projects technology are designed around efficient and minimal use of power. Due to concerns among the group over the feasibility of a generator, the decision to use multiple battery packs was chosen. With the use of 2 portable 12v inverter batteries, the project is able to run for around 60 minutes giving plenty of time for a significant amount of visitors to travel through the installation space.

As the installation is largely based on audio, the decisions regarding the speakers were of great importance to its success. With the intention of portability and minimal cable usage, the group decided to use converted car speakers as suitable and practical solution. The available speakers don’t have a particularly good frequency response or volume level. To improve these aspects they were converted into vibration speakers so they could be placed on an objects surface to achieve a louder level of audio and increased

![Microphone picking up water dripping on cans](Image)
low frequency response. The process used to convert the speakers can be viewed in the link at the end of this article.

Once the speakers were converted, experimentation took place to find a suitable surface to attach them to. Whilst working extremely well on solid and dense materials such as plywood sheets and glass panes, these materials are cumbersome and difficult to transport safely and easily. As a compromise, medium sizes cardboard boxes provided a sufficient level of audio and low-end response as well as being light and easily transportable. As these speakers are passive, they require a system of amplifiers to power them.

The amplifiers that were chosen are comprised of a TDA7297 Dual-Channel Amplifier Chip and are able to supply 15Watts of power per channel. These provide sufficient power to the speaker arrays and are extremely small and light. They also require a minimal amount of power to function.

As the source of the audio in this installation will be coming from laptops running Ableton Live and Max/MSP, an audio interface with a minimum of 6 outputs is required to provide each of the amps with two channels of audio. The advantage of using laptops and the interface to provide the audio is that the internal laptop batteries can be used to power the devices, allowing more power for the Amplifiers, speakers and projectors. An additional 2 channel audio interface was used to patch the output of the laptop running Ableton Live into the output of the laptop running Max/MSP so that all the audio for the installation originates from the 6 outputs of one audio interface.

Creating the Max/MSP Patch

The basis of the patch was to provide a variety of historically related samples that refer to the past uses of the location as well as incorporating audience participation in the playback of these audio samples. To begin with, a library of source files were created to represent each historical period of the tunnel. The patch was then built around these samples, using the input from the contact microphones to trigger them. The samples are randomized and played back a fixed number of times before changing to another historical period. The purpose of this is to allow the patch to be self-running, requiring no additional information or control from any of the group members.

The patch was also set up to playback a constant loop of audio ambience relating to the current historical set of samples so that the installation is never fully silent. As there is also an audio performance aspect to this project, using Ableton live to manipulate recorded and live sound in real-time, a function for gradually turning off the output of the max patch at the touch of a button was added so the performer could mute the max patch to focus on the performance sounds and vice versa at any time.

The Max/MSP patch is included as an attachment to this article.
The Visual Effects

The visual effects of the project were created and managed by Yao. Yao’s main goal was to combine the visual design with the real world environment. The 3D animation software Blender was the primary instrument used for design and animation of the visuals. The overall theme of the animations would be the evolution of transportation that the tunnel has been a part of. From walking to riding to the birth of the steam train, it is a piece of history about speed. In the first animation, the speed changes when the 2D animated figure begins to run instead of walk. The idea for the next evolution of the visual was to have the projected wall bread down and smash, switching to 3D animation. The brightness of the animation also changes significantly at this point. The instant change is not only a visual shock, but also represents the rapid development of locomotive technology and the birth of the steam train accelerating humanity into the industrial age.

The Visual Technology

The group tested three types of projectors for use within the project. The first one was a 3M MP180. The size of the projected image was ideal for this project’s needs but the resolution wasn’t as high as to be expected. It does however have the advantage of built in battery source allowed it to function more than two hours on its own. The other projectors tested were two desktop Panasonic projectors. Their resolution was significantly higher than the 3M projector but due to their size, the power consumption was far greater than could be supplied with the portable batteries powering the other technology used in the project so the conclusion was that in the absence of a fixed power source, these larger projectors weren’t feasible. Due to demand among the DMSP group for the portable projector, the 3M projector wasn’t available to use on the day of the presentation and the less powerful Pico PK301 Portable projector was used as a compromise. The projection size was considerably smaller than the other devices, but the clarity turned out to be very good within the tunnels low light conditions. During the presentation however, the projector suffered from technical faults and couldn’t be used despite various attempts from group members. The final compromise of the visual section of the installation was to display the animations on a raised laptop. In some ways, this system was beneficial to the installation because it allowed audience members to interact with the visuals more.

Live Sound and Processing

Nick’s main role within the team was to be responsible for how the live sounds were to be treated in the performance setting and play a key part in obtaining pre-sourced sounds. Nick and Richard spent time at Edinburgh Waverley train station recording the ambiance of the location, the sounds of the public announcer, the noise of people navigating their way around the station to their trains and the sounds of trains departing from the platforms. One issue that they encountered on one of their outings was being approached by stewards who questioned whether they had obtained permission to record inside the station. As they didn’t have such permission they asked them to meet with them next time to perform a
health and safety briefing however, as they had already recorded all of our desired sounds this wasn’t necessary.

The pre-sourced sounds and the audio recorded were put into an Ableton Live session to allow for live effects manipulation. Each audio file was given its own rack with its own set of effects. The master track also had its own effects rig in order to reduce CPU load by loading certain effects such as a limiter onto each track creasing multiple instances of the same plugin.

Separate audio channels were created for the two microphones we had set up for live playback and manipulation of Vanessa’s flute performance and the sound of water dripping water. For Vanessa’s flute performance Nick utilised a pitch shifter effect plugin to raise the pitch to recreate the sounds of a steam train whistle. A delay effect was also added to Vanessa’s channel to create a rhythmic pattern reminiscent of a train running along the tracks as she tapped her flute. This delayed effect on the flute tapping when panned across the six speakers created an immersive experience of being on a train.

![Nick manipulating sounds via Ableton Live](image)

The effects on the master channel were controlled by a Fader Fox MIDI controller. Nick made use of the controller’s sliders to control the volume levels of each track, and the knobs to operate the wetness of each effect and certain parameters of each plugin such as delay time and distortion level. Apart from a limiter, he used a resonator effect, Ableton beat repeat glitch effect control and two delays; a grain delay and a Ping-Pong delay. Using two different types of delay allowed for more creative freedom and produced interesting rhythmic patterns that can be easily altered by the Fader Fox controller.

Ableton

Everything for the Ableton Live part of the performance was set up without any problems although there was a slight issue with Ableton not picking up the microphone set up next to the tin can. This was solved by resetting the input in Ableton Live’s preferences and adding another limiter to that particular track. Due to the unpredictable nature of controlling so many effects certain noises were created that didn’t fit into what Nick was attempting to generate, however he felt this added to the raw performance aspect and the sounds were altered to their desired state in enough time so that they didn’t affect the overall ambiance we were creating.

There was some ambiguity over whether our project was an installation or performance. We wanted it to be a hybrid so that people could experience it as a sound installation by walking round each speaker and encountering the different aural sensation that each speaker position possessed. We also wanted it to have a performance aspect so that the sounds could evolve in a way that wasn’t predetermined and was put under human control. The performance was originally set to evolve with the visuals however as we were unable to provide visuals the performance nature was a response to the human interaction with the installation.

Overall he thinks the performance went well without any major problems affecting how he could use Ableton and how the audio sounded in the space. Apart from the minor issue with audio inputs I was allowed to execute the performance as I had done in previous rehearsals. As mentioned previously, there was some ambiguity over when the project actually started and whether it was a performance or installation. For future attempts Nick feel this would need to be cleared up and have a concrete time for when the performance/installation begins. This ambiguity could have been made clearer if we had visuals to keep cohesion and provide a definitive stop cue, however as we didn’t have any visuals this added to the uncertainty surrounding the project.
“An engaging installation with audience interaction, stimulating sounds and stunning visuals. A thrill ride for all the senses.” - Travers P, an audience member.

We hope installation will be put on again later in the year during the festival season.

*The Situated Ecologies Group Members.*