In and Out, Over and Under: An Interactive Audio-Visual Installation Responding to Percy Grainger’s Free Music and the Grainger Museum

Roger Alsop
Victorian College of the Arts
University of Melbourne
ralsop@unimelb.edu.au

ABSTRACT
This paper discusses processes used to develop an interactive, participatory work that attempts to exemplify many of Grainger’s philosophies, goals, and approaches to creativity. In and Out, Over and Under, referencing Grainger’s “hills and dales” description of the scores for the Kangaroo Pouch instrument, integrates the author’s approaches to Grainger’s New Music Machines, the Grainger Museum (where In and Out … was first performed as part of NiteArt2014), and presents a possible interpretation of what Grainger may have made if he had the options currently available. It discusses the systems used and how they represent aspects of Grainger’s philosophies regarding interaction, democracy and music. These ideas informed approaches to participatory music creation, interaction between audio and visual participatory creation and response, and introducing a major part of Australia’s musical history to a new audience.

1. INTRODUCTION
In 1938 Percy Grainger said “in nature we hear all kinds of lovely and touching "free" (non-harmonic) combinations of tones. … [This] world of tonal freedom was suggested to me by wave movements in the sea. [This is] the goal that all music is clearly heading for now and has been heading for through the centuries … the only music logically suitable to a scientific age” [1]. In 1933 he believed “that the music of the future will be more soul-satisfying—more melodious, more many-voiced, more complex, more rapturous, more angelic in mood—than any music of the past.” [2]; and in 1915, he discussed music with these attributes in the folk music of many cultures. [3] This implies a desire Grainger had for some form of transcendence, which it could be argued he tried to attain through his music and other activities.

There were opportunities to create such music, and had been for many years. The traditional orchestra, for example, allows this, with the potential to have around 100+ individual voices playing individual melodies, and many of them not stuck to traditional pitch systems. However this is unusual now and was less likely when Grainger stated his goal, this may be due to traditions, taste, the capacity to perform and/or comprehend that variety of difference, and so on.

If we consider Grainger’s comment in relation to electronics based music, he demonstrated considerable prescience. While instruments such as the Theremin, for which Grainger composed, and ondes martenot that allowed the type of music making available, they did not fill his needs.

2. GRAINGER’S LEGACY
Grainger saw music as the most inclusive art combining deep interests in English and Danish folk music with new music, inventing instruments unique in concept and intention. When seen from above, the interconnecting nature of the Grainger Museum, seen in Figure 1, is a metaphor for Percy Grainger’s life, the arc connecting to its centre by four spokes. He had the ability to work successfully within the constraints of his times but not be subject to them, paying little heed to the mores often placed on the successful artist, doing so knowingly and with grace and deference.

Figure 1. Grainger museum aerial view

He considered his ‘Free Music’ as his work of greatest importance, his legacy of consequence. He wanted to make gliding tones, close intervals, not be constrained by rhythms, and for all parts to be independent. He saw that this emancipation was hinted at by the innovations of other composers, but that he was the one who combined them...
into ‘Free Music’. Grainger believed that his new creations would reflect the freedoms seen in nature and provided by technological innovations lacking in the mosaic-like determinism of much music.

3. GRAINGER’S ELECTRONIC INSTRUMENTS

Grainger saw that for “Too long has music been subject to the limitations of the human hand, and subject to the interfering interpretations of a middle-man: the performer.” [1] He went to extraordinary lengths to ameliorate this, working with Burnett Cross to make instruments with great expressive capacity; a process requiring innovative, creative, approaches. Unfortunately, he could not see his concepts and inventions developed to their potential. Were he alive in the age of digital art/technology he would have used the vast range of possibilities now available to express his creativity and invention, expanding current mores with the grace and deference he showed while alive.

In and Out, Over and Under takes the Cross-Grainger ‘Kangaroo-Pouch Tone-Tool’ seen in Figure 2, and the incomplete ‘Electric-Eye Tone-Tool’, as the starting point of its musical inspiration.

The Kangaroo Pouch used a ‘score’ made from paper cut to form undulations fed between ‘feeder’ and ‘eater’ spools and operating levers corresponding to frequency and amplitude. Like the Kangaroo Pouch the Electric Eye “worked on the principle of a moving roll … of clear plastic. A row of spotlights projected light beams through the plastic roll and onto an array of photocells, which in turn controlled the pitch of the oscillators. The undulating shapes … were now simply painted onto the plastic roll with black ink.” [4] A diagram of the intended instrument is shown in Figure 3.

Warren Burt remade, as best possible, Grainger’s Tone Tools in 2006 [5]. Figure 4. shows Burt and Schieve’s score for the Electric Eye, titled “Hands and Samples” which was “manually played, controlling [an] AudioMulch patch with antique computer music samples” [5]. This approach provided a contemporary version of Grainger’s idea using the technologies available.

Figure 5 shows the reconstruction of Grainger’s tool Burt and Schieve used, this is very different to the original design, Burt’s variation is in keeping with Grainger’s tradition of being at the cutting edge.
audience. When they entered the museum courtyard they and Out … which was created in situ by the participating in their fingers” [7]. This aesthetic was essential to mind performer with more music in their hearts than in their fingers” [7]. This aesthetic was essential to In and Out … which was created in situ by the participating audience. When they entered the museum courtyard they were given a torch and asked to shine the light at one of the three walls. Handing the participants a torch immediately involved them in the creation of the work, and when they heard an instant response to their action they became immediately engaged in making the work with collaborators of equal skill. Grainger wished “that [music] could be played with satisfaction even by mediocre players. He has had in mind performer with more music in their hearts than in their fingers” [7]. This aesthetic was essential to In and Out … which was created in situ by the participating audience. When they entered the museum courtyard they were given a torch and asked to shine the light at one of the three walls. Handing the participants a torch immediately involved them in the creation of the work, and when they heard an instant response to their action they became immediately engaged in making the work with collaborators of equal skill. The piece began with very simple harmonies based on the C major pentatonic scale ascending from C60 in discrete pitches over one octave C, D, E, G, A, C. Over time fast glissandi between pitches were introduced, the range was extended upwards to 2 octaves, the speed of the glissandi slowed. After this, a descending mirror inversion of the pitch classes was introduced: C B flat, A flat, F, E flat, with quick glissandi between pitches that also gradually slowed. This sequence looped four times over 4 hours and is outlined in Table 1. Table 1. Showing the original then final pitches heard when light is shone on a wall. 

<table>
<thead>
<tr>
<th>Time</th>
<th>Wave Pitch lowest to highest C60</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wall 1</td>
</tr>
<tr>
<td>0 – 15</td>
<td>Sine C - Eb D - F E- Ab G - Bb A - C</td>
</tr>
<tr>
<td>15 – 30</td>
<td>Rect E - Ab G - Bb A - C C - Eb D - F</td>
</tr>
<tr>
<td>30 – 45</td>
<td>Tri G - Bb A - C C - Eb D - F E -Ab</td>
</tr>
<tr>
<td>45 – 60</td>
<td>Wall 2</td>
</tr>
<tr>
<td>minutes</td>
<td>Rect A – F C - Ab D - Bb E - C G - Eb</td>
</tr>
<tr>
<td></td>
<td>Tri C - Bb D - C E - Eb G - F A - Ab</td>
</tr>
<tr>
<td></td>
<td>Sine E - Eb G - F A - Ab C - Bb D - C</td>
</tr>
<tr>
<td>30 – 45</td>
<td>Wall 3</td>
</tr>
<tr>
<td>minutes</td>
<td>Tri D - Ab E - Bb G - C A - Eb C - F</td>
</tr>
<tr>
<td></td>
<td>Sine G - C A – En C - F D - Ab E - Bb</td>
</tr>
<tr>
<td></td>
<td>Rect A - F C - Ab D - Bb G - C A - Eb</td>
</tr>
</tbody>
</table>

Table 2. Showing the original then final pitches heard when light is shone on a wall.

These represent the areas on the walls; for example, on wall 1 there were 15 areas, with the top left hand corner producing the pitch C60 as a sine wave when illuminated, and the bottom right hand corner producing the pitch E64 as a triangle wave. As the amount of glissandi increased participants were able to create more complex sounds as the frequencies of the areas illuminated glided from pitch to pitch and wave shape to wave shape. These represent the areas on the walls; for example, on wall 1 there were 15 areas, with the top left hand corner producing the pitch C60 as a sine wave when illuminated, and the bottom right hand corner producing the pitch E64 as a triangle wave. As the amount of glissandi increased participants were able to create more complex sounds as the frequencies of the areas illuminated glided from pitch to pitch and wave shape to wave shape. As the amount of glissandi increased participants were able to create more complex sounds as the frequencies of the areas illuminated glided from pitch to pitch and wave shape to wave shape. These represent the areas on the walls; for example, on wall 1 there were 15 areas, with the top left hand corner producing the pitch C60 as a sine wave when illuminated, and the bottom right hand corner producing the pitch E64 as a triangle wave. As the amount of glissandi increased participants were able to create more complex sounds as the frequencies of the areas illuminated glided from pitch to pitch and wave shape to wave shape. These represent the areas on the walls; for example, on wall 1 there were 15 areas, with the top left hand corner producing the pitch C60 as a sine wave when illuminated, and the bottom right hand corner producing the pitch E64 as a triangle wave. As the amount of glissandi increased participants were able to create more complex sounds as the frequencies of the areas illuminated glided from pitch to pitch and wave shape to wave shape. These represent the areas on the walls; for example, on wall 1 there were 15 areas, with the top left hand corner producing the pitch C60 as a sine wave when illuminated, and the bottom right hand corner producing the pitch E64 as a triangle wave. As the amount of glissandi increased participants were able to create more complex sounds as the frequencies of the areas illuminated glided from pitch to pitch and wave shape to wave shape.
Often participants would enter the courtyard and see the images and wonder where the sound was coming from, not understanding that they had agency in creating the music. However when their attention was give to the play of lights on the other walls they began to intuitively see a relationship between the lights ad the sound heard, they then began to join in on creating sounds and to experiment with casting shadows on the projection wall.

Figure 6 shows two participants creating shadow on the projection wall and therefore creating sounds by blocking the light rather than illuminating a wall section.

![Figure 6. Interacting with images projected in the Grainger Museum.](image)

6. TECHNICAL ASPECTS

The technical aspects of In and Out, ... are simple. MaxMSP was used to generate the audio, sense light and to mediate the images seen. Vision input was done with off-the-shelf web cameras feeding the image into 5 * 3 grid rectangles, as shown in Table 2 and 3; and the amount of illumination in each rectangle affected amplitude. When shadow was used, as in Figure 6, a negative image was fed into the Max program deriving the same effect.

As participants illuminated different rectangles the same information, light presence and amplitude, was used to affect the images, including increasing or decreasing pixilation or resolution, magnification, color alterations, and orientation. This process created an integrated experience for the participants, and one in which they were able to develop a sense of agency that could be developed to a level of expertise depending on effort an application.

7. CONCLUSIONS

The first presentation of In and Out, Over and Under, discussed here, had many varying aspects, each relating to Grainger’s philosophies. By allowing easy conceptual access, using attractive imagery and simple compositional tools participants were able to engage with the environment, and in the creation of music that was initially simple but developed in complexity. It expressed Grainger’s desire for many-voiced, more complex, more rapturous music created with tonal freedom. As the performance developed some participants began to explore the melodic possibilities available through shining a light, in one case a participant attempted to play ‘Shortening Bread’ with some success, and another showed friends the melodies they could create.

While the possibility of mastering the instrument to a point of predictability was low due to the time frame and the shifting pitch possibilities, many participants saw and took the option of rapidly creating music that for them that they said was satisfying and in some cases was described as more than what they had anticipated or thought possible from the engagement they transcendent. While observing the participants this seemed to be the case, based on body language, willingness to ask others to join in, and conversations during and after the event.

These issues were significant in Grainger’s musical ethos, providing a tonally free, melodious, many-voiced and complex in pitch, due to the use of glissandi, and timbre due to the blending of wave shapes. This allowed a, potentially rapturous, and angelic, audio/visual environment, that could be generated without great musical or technical skill.

Grainger’s ethos was to be inclusive and transparent in the creation of music. While his inventions seemed complex due to the times they were conceptualized and created, they were expression of simple concepts and systems, here transducing light to sound in the creation of accessible music. This may be thought of as lacking currently in the systems used in creating music, and the outcomes of those systems in a ‘scientific age’ with technologies and opportunities he may have found difficult to imagine.

8. REFERENCES