

Devised Project Proposal

Synopsis

For this project my goal is to exhibit the phenomena of swarm intelligence, specifically the defensive behaviours of the Japanese honey bee, in the form of an abstract, generative and interactive audio-visual installation.

The focal point of the piece will be generated video, taking the appearance of white noise, rear-projected onto a large screen, which visitors will be encouraged to touch. Behind the screen there will be a high-resolution camera which will capture and track the shadows of the visitor's hands as they move them across the projection surface. Information about where the surface is being touched will be used to manipulate the points of white noise being projected onto the screen, allowing visitors to manipulate the "cloud" directly, in real-time.

To the visitor the projected video will look similar to white noise, when in fact it will be a cloud of fast moving white particles on a black background, whose motion will appear random when no interaction is occurring. These particles will react in several different ways depending on the circumstance of the interaction, mimicking the collective intelligence of hives, flocks or crowds. For example, when a visitor touches the projection screen, the hive particles regard the point of contact as an "intruding object", and in the case of a small contact surface area, they will continue to move around the object, avoiding and "ignoring" it. However, in the case of a large point of contact, the "hive" will treat the intrusion with hostility, swarming around where the visitor has touched the screen, and for as long as they remain touching it.

If I implement the above visual component into a working system in good time, then I plan to add sonic elements to the piece, both audio input as an interface for interaction and audio output as an additional user feedback device. The audio input would utilise two or more microphones to listen for, detect and record either transient or ambient sounds. Upon detection of transient sounds the projected "hive" would react, exhibiting hostility by swarming toward the source of the sound, detected by measuring the inter-aural intensity or time difference from the microphones. The audio output would be a time-stretched regurgitation of ambient sounds recorded by the piece, which, when the screen is touched causing the "hive" to be agitated as described above, would morph into louder, more aggressive sounds until the hive is no longer agitated.

The software tools I will be using to create the piece will be *Processing* for the particle visuals and swarm behaviour, *openCV* for detecting and tracking interaction with the screen and *Pure Data* for the sonic elements of the project. I have chosen *Processing* for the visual elements as it is an object-oriented programming language and development environment which is more efficient and better-suited for particle systems and flocking algorithms than environments such as *Puredata* or Cycling74's *Jitter*, which have the added convolution of a visual programming environment to contend with. Other resource implications include the sourcing or building of a rear-projection screen, the hire of a high-powered projector and high-resolution video camera.

Schedule

By February 1st 2011 I plan to have fully completed the visual component, and begun work on the motion-detection system, which should in turn be completed by mid-February. In March I will source all the hardware required for the installation, whilst working on the audio component and tying the entire system together in time for exhibition in May.

Contextual Awareness

The underlying rationale of the project is inspired by the behaviour of Japanese honey bees, *Apis cerana japonica*, who when faced with a hornet intrusion in their hive, use around 500 worker bees to crawl over the hornet, and use their flight muscles to elevate the hornet's core temperature to 46°C, and the CO₂ concentration to 3.6%, killing the intruding hornet (Sugahara & Sakamoto, 2009). Initially I researched human crowd psychology, only to find the related behaviours to be uninspiring and cumbersome to implement, from both a visual and code perspective.

In Lev Manovich's *The Language of New Media* he writes about the relationship between the content and the interface of a new media object, stating

"... ' in new media the connection between content and interface is motivated; that is, the choice of a particular interface is motivated by a work's content to such a degree that it can no longer be thought of as a separate level. Content and interface merge into one entity, and no longer can be taken apart." (Manovich, 2001)

This is true of my proposed piece, where the interface is the sensing of the presence or absence of objects in contact with the same screen that is being used to display the content. Manovich also articulates a concern for interactive installation pieces, saying

"When we use the concept of "interactive media" exclusively in relation to computer-based media, there is the danger that we will interpret "interaction" literally, equating it with physical interaction between a user and a media object '...' at the expense of psychological interaction." (Manovich, 2001)

The major aim of my project will be to convey the idea that what at first appears to be white noise is in fact an intelligent hive of entities, who will react to different stimuli in various, but consistent ways. This requires the project to not only be interactive in the physical sense, but to encourage the user to psychologically engage with the piece, and learn of the hive's intelligent behaviour and its parallels in the natural world.

The inspiration for the visual aesthetic of my project came from the multimedia firm Moment Factory's work with the band *Nine Inch Nails* for their *Lights in the Sky* tour in 2008. Moment Factory created an interactive audio-visual system incorporating two partially transparent stealth LED video screens, positioned in front of and behind the band members, along with motion and presence detection equipment (Bessette, 2010). This allowed, among other features, for *Nine Inch Nails'* front-man Trent Reznor to "repel" white video-noise from any area of the video screen that he was in close proximity to, allowing the audience to see him through the unlit, transparent screen. This created a striking visual effect, where the noise would part for Reznor's presence, which could be likened to the parting of the Red Sea in the Biblical story. While this effect is dramatic, there are few

implications of any meaning beyond the random video noise itself, which is where I intend my project to build upon; to give meaning and purpose to the visuals.

The piece *Bodymaps - Artifacts of Touch* created by the media artist and designer Thecla Schiphorst shares several of my project's intentions and features. A video of the artist is projected onto a sheet of white velvet, underneath which sensors detect the movement of visitors hands as they touch the velvet, manipulating the video's playback parameters. Accompanying the visual element is a complex soundscape, which also responds to visitor's hand movements, and is "*constructed in such as way as to create an intimate local sound response based on movement of the hand over the surface*" (Schiphorst, 2007). Though Schiphorst's work involves tangible manipulation of audio and video, she uses an array of capacitive sensors, where I intend to use computer-vision techniques to detect the hand movements, eliminating the need to build circuitry for my piece. Additionally, while her work includes video manipulation, the video Schiphorst uses is pre-recorded, whereas in my project the video will be generated in real-time, in response to the user interaction.

In Gerald Hushlak's work *SwarmArt 2002*, he attempts to explore and incorporate basic mechanisms of swarm intelligence into an interactive installation (Jacob, Hushlak, Boyd, Nuytten, Sayles, & Pilat, 2007). Using a video projector, screen, computer and video camera, visitors to the installation are able to affect the movement and flocking behaviour of projected dots, by moving within the frame of the camera. Software running on the control computer would detect and track visitor's movements, using the data to manipulate the swarm particles. The main problem Hushlak identified with the installation was that adult visitors to the installation "*behaved as though they were self-conscious and tended to move very little, [and] thus, the swarm system seemed to "ignore" adults, who then quickly lost interest in the swarm*". (Jacob et al. 2007) However, he goes on to say that young visitors would "*run into the installation and continue to move*" who were then rewarded when the swarm visuals followed their motion. This will be an important consideration when implementing my project, as the interactivity of the piece is central to its functionality. For example, if visitors to the installation do not realise that they are expected, and required to touch the projection screen, then my piece will never reveal that it is more than just white noise and a generative soundscape.

In Julie Andreyev's recent work **glisten) HIVE*, snippets of text anthropomorphising animals contributed by visitors, are made to move in a way reminiscent of the swarming patterns of insects across four projection screens, accompanied by a generative granular soundscape (Andreyev, 2010). While **glisten) HIVE* is interactive in the sense that visitors can submit text which will be used in the installation, the audio and the visuals cannot be directly manipulated in real-time, which could detract from the engagement of visitors to the installation. Videos of this work show strings of letters slowly flowing across the screens in such a way that it is both difficult to read the original text, and also arguably unrelated to insect swarming patterns. Andreyev's intent with this installation is to "*raise awareness about animals' complex states of being (so often distanced by a culture which thinks of animals primarily in terms of consumption.)*" (Overstall, 2010) which, while noble in intention, her work in practice only offers fictional human opinions of what animal intelligence is or could be. This is in stark contrast to my project, wherein only empirically gathered facts will be used to demonstrate the collective intelligence animals possess. I believe this is an important attitude to take for my work to hold any gravitas, and to achieve my goal of accurately demonstrating swarm intelligence.

Word count excluding quotes, citations and bibliography: 1,488.

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