A Sound You Can Touch

This paper describes the on going tech-tile project: an exploration of visual and sonic texture enabled by a mapping of textile images into sound and virtual patterns. This is performed live and 'translated' into new forms of material research through the jacquard process, itself a functioning conceptual machine within the analogous mechanism of the loom. The version of Swarm Tech-Tiles presented here differs from previous versions. A much larger swarm is used, and the sonifications follows a different scheme. The dynamics of the large swarm relates more closely to the notion of insect swarms. The assimilation of the image by the swarm is accomplished by erasing a small amount of texture at each rendering. As the texture diminishes, particles find it increasingly hard to deposit attractions, until the pattern is completely washed from the image and the particles fly endlessly over the barren landscape.

Out of the sonic translations that unfold in 'A Sound you Can Touch, new material research is being produced. Whilst sonic variables are activated via live performance and the potential interactivity of the user, the generated virtual, textile patterns are 'captured' and worked into new jacquard cloth. The re-interpretation of sound into the image and woven material references Blackwell's 18th March 2005 performance and the retinal charge (assimilated into the textural and tactile) of Mondrian's Broadway Boogie-Woogie (1942-43)
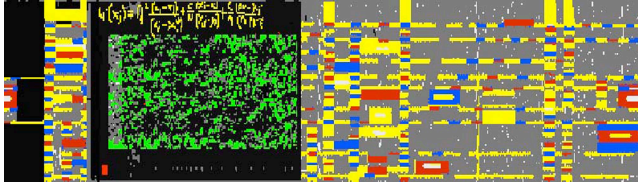
Figure 1- Ave Maria (18th March 2005) crossed with Broadway Boogie-Woogie (1942-43) in Jacquard.

In an unpublished, on-line essay, *Edison's Teeth: Touching Hearing* (2001), Steve Connor makes a useful distinction between sound and sight and sound and touch. He suggests that relation between sound and touch tends to be mimetic: touch performs sound rather than translating or defining.

Of all the various forms in which the senses are said to operate, sight has been historically the most privileged cognitive organ In a culture of visuality in which the eye is privileged over the ear and the skin, sound has been perceived as extra musical. However just as sound has saturated the arts of the 20th century so touch has emerged from it's once historically considered place as an archaic sensory remnant. Between them the Italian Futurists produced over 210 manifestos, those by Luigi Russolo on *The Art of Noises* (1913) and F.T. Marinetti on *The Manifesto of Tactilism* (1921) are the most pertinent. Russolo envisioned an all-inclusive music with the introduction of noise –the sounds of life- into a living framework:

> We want to give pitches to these diverse noises, regulating them harmonically and rhythmically. Giving pitch to noises does not mean depriving them of all irregular movements and vibrations of time and intensity, but rather assigning a degree or pitch to the strongest and most prominent of vibrations, (F.T.Marinetti, 1921).[1]

F.T. Marinetti, *The Manifesto of Tactilism*, read at the Theatre de l'Oeuvre (Paris) the World Exposition of Modern Art (Geneva) published by Comoaedia, January 1921.

Marinetti created the first educational scale of touch, which he considered to be a scale of tactile values or the Art of Touch

Touch now appears to be the most versatile of the senses, partly because it threads through all the other modes of sensory apprehension and, following Connor, it also seems itself to be formed differently depending on the particular kind of apprehension it delivers. This would be shape, texture, weight and volume. All these characteristics can be found in Marinetti's manifesto. Textiles, specifically woven, are most closely associated with these attributes.

In interaction, they exhibit dynamic behaviour and display micro and macro geometry when representing complex weave patterns.

In ' A Sound you Can Touch", we explore visual and sonic texture. A mapping of textile images into sound enables this. The images are scanned from complex weaving patterns generated by the jacquard loom. Multi-stranded, coloured textures are digitally represented and are translated into sonic experience. As audience we can engage in an unrestricted play of associations that are called into consciousness and can run riot there. What do we sense? What is to be touched as the sound touches us? What do we attend to and how do we hear?

Attention becomes a volatile concept since we as we look or hear things for too long attention can break down. Following Crary (1998) attention proposes fragmentation of a visual field no longer coherent or unified. [1], Now, at what point does attention or perceptual identity break down? In some instance (like sound) does it disappear altogether? In respect of touch, how far does the tactile trigger memory? Could attention be about forgetting? If we are totally absorbed, as if the world was forgotten, how do we re-engage? Attention includes the possibility of being distracted, diverted and as if in a daydream. Crary argues that such states mark a shift between a socially adaptive subject to a performatively roaming one.   This has a logic as the audience is invited to interact with 'A Sound you Can Touch'.
 There are several simultaneous performances. Firstly, the audience can experience the virtual warp and weft as new

textile patterns emerge and mutate into new threaded textures, secondly, the swarm and sounds that move over the texture of the virtual surface are played with and improvised in live performance. These effects permeate the sounding posture of mobile bodies in time and in space. Outside of the body, vibration is also operative as the prioceptive sense connects to the body's surface and to the sonic textures produced. What is being suggested is that there is a plane of feeling and potential experience that is distinct from actual contact. A surface texture stimulates sensation on the outside of the body (hence the expression making one's hairs stand on end) but inside the skin, it is introception, an aspect of the haptic sense, which perceives viscerality. Both haptic/tactile and auditory faculties operate at a vibratory level.

Swarm Tech-Tiles

```
for (int i = 0; i < n; i++) {

    if (i < swrmSize && i != ID) {

        temp = ((SwarmParticle) swarm.get(i)).getPosition();
        double sep = position.distance(temp);

        if (sep < radiusOfAvoidance) {

            temp = Vector.subtract(position, temp);
            temp.normalise();
            avoidAccn.add(temp);
            numToAvoid++;

        } else if (sep < radiusOfAttraction) {

            temp = Vector.subtract(temp, position);
            temp.normalise();
            partAccn.add(temp);
            numToAttract++;
        }
    }

    if (i < attrsSize) {

        Attractor attractor = (Attractor) attractors.get(i);
        temp = attractor.getPosition();
        double sep = position.distance(temp);

        if (sep < attractor.getRadiusOfAttraction()) {

            hasFoundAttractor = true;

            attractor.addVisit();

            temp = Vector.subtract(temp, position);
            temp.normalise();
            attrAccn.add(temp);
            numAttrFound++;
        }
    }
}
```

Figure 2- Code for Swarm Tech-Tiles

Swarm Tech-Tiles is responsible both for weaving sound and the sonification of weaves. Incoming sound is mapped to a textile pattern by weaving, as warp and weft, two linear sequences of audio samples (left and right channels). A simple re-scaling converts samples to pixel values. The sonic texture, which is one dimensional and temporal, is therefore related to a two dimensional visual texture. Micro-textures can be explored by clicking the mouse at various points on the pattern, causing a small tile of image texture to unweave into a grain of sonic texture, which is immediately heard.

It would appear that the time domain is lost in woven sound, frozen in a static image. However our shifting attention reconstructs a narrative from pictures and images. In our model of attention, a viewer's gaze moves between regions of strong micro-texture, sometimes returning to local areas of interest, sometimes exploring more dilute textures, until the pattern as a whole is assimilated. This model is implemented with a swarm of tiny particles, flying over, and interacting stigmergetically with, the image.

The swarm as a whole is seeking areas of high micro-texture, as defined by a mathematical function. Each particle assesses texture at a small tile centered at each location it visits. If the micro-texture is larger than any previously being exploited by the swarm, an attractor (depicted as a green disc on the simulation) is deposited at this site. In an analogy with the biological process of stigmergy [2], other particles flying within the disc will be drawn towards the attractor (food source). However, the attractor's resources are partially consumed at each particle visit until the attractor vanishes and the captured sub-swarm scatters, to begin searching again. The consumption of the attractor followed by re-exploration of the image models (and, in this instance, drives) the shifting nature of our attention. And, of course, new attractors might be placed at previously visited sites. According to the unpredictable configuration and history of the swarm, there might be periods when no attractors are present, and the swarm wanders aimlessly over the image. Momentarily we are unable to find anywhere to hold our attention. When this happens, attractors will eventually be created, even if the local textures are comparatively weak.

The version of Swarm Tech-Tiles presented here differs from previous versions of the program [3,4] in a number of respects. A much larger swarm is used, and the sonification follows a different scheme. The dynamics of the large swarm relates more closely to the motion of insect swarms. Additionally, the rendering of image micro-texture to sound utilizes "self-organized criticality" [5] to define sonic events. Previously, every location visited by a particle was rendered into a tiny sound grain: a stream of texture is produced by the continuous motion of the swarm.

In the current implementation, sound only emanates from the regions of interest, as defined by the attractors. Each particle, replenished after visiting an attractor, has an increased desire to render any good texture it may later discover as a sonic micro-event. This desire grows with each attractor visit, until the particle becomes 'critical'. At the next visit, the particle will certainly produce sound, and in doing so will pass on some of its criticality to other neighboring particles. These other particles may then become critical, more texture is rendered, criticality is passed to other neighbors, and the avalanche continues until no neighbor is critical. This model departs form the normal form of self-organized criticality by the use of a social rather than a spatial neighborhood (although a social neighborhood might also be spatially confined), allowing micro-events from different attractors to constitute a single macro-event.

The assimilation of the image by the swarm is accomplished by erasing a small amount of texture at each rendering. As the texture diminishes, particles find it increasingly hard to deposit attractors, until the pattern is completely washed form the image and the particles fly endlessly over the barren landscape.
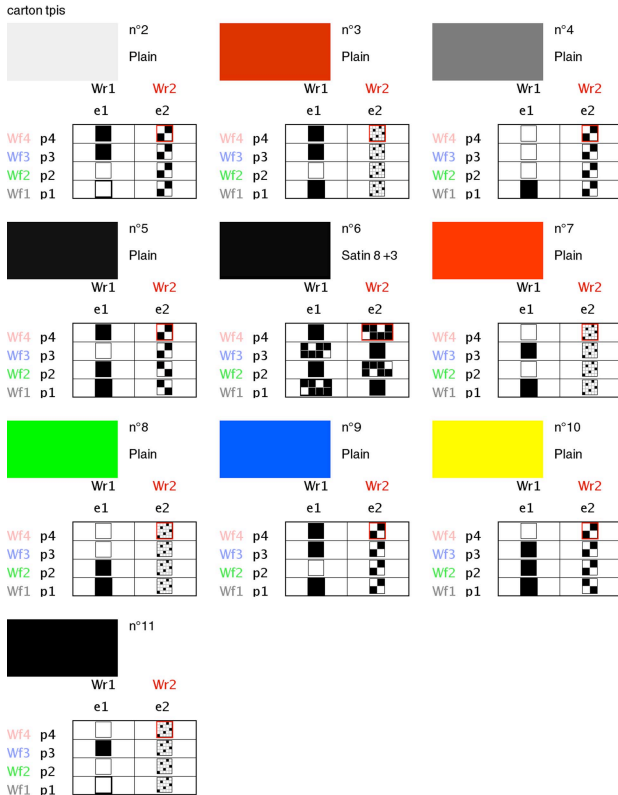
Jacquard and new material research

Figure 3- Weave structure for Ave Maria (18th March 2005) crossed with Broadway Boogie-Woogie (1942-43) in Jacquard.

What has been described has, in part, been an example of the translation of one aesthetic practice into another via a computer-media process. In citing initial production via the jacquard loom, one can arguably trace the genealogy of the computer from the first patterns of weaves to the fabric of communication; images comprised of pixels[2].

2
The jacquard loom is a mechanical loom invented by Joseph

The jacquard loom has been described as exhibiting "the selective powers of the human brain and the dexterity of living fingers" (Blum 1970: 4)[3]. An aesthetic conception is transposed into a language, which the analogue machine can read.

This intricate process actually starts when an artist draw a sketch when finished, it must look like the pattern will appear in the cloth. Each has a meaning as to the weave effects and color selection, and these all have to be translated so that the loom understands them.

In her 'Notes by the Translator' written to clarify the work *Sketch of the Analytical Engine Invented by Charles Babbage*, Ada Lovelace emphasises the word 'translator' in her title, which could be applied to the translations of woven texture into sonic output[4]. Lovelace's work with Babbage's Analytical Engine in the 1880s explored the manifestation of symbolic logic via the encoding of the punched cards as used, then, in the jacquard process. The punched cards of the Analytical Engine function as a

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Marie Jacquard in 1801, which used the holes, punched in pasteboard punch cards to control the weaving of patterns in fabric. Each punch card corresponded to one row of the design and the cards were strung together in order. Each hole corresponded to a hook, which either raised or lowered the wrap thread (vertical) cards so that the weft (horizontal) would either lie above or below it. The sequence or raising or lowering the threads is what created the pattern. It was the first machine to use punch cards to control a sequence of operations. Although it did no computation on them, it is considered to be an important development in the history of computing hardware. Debate about the history of the jacquard being the first computer can be found in Sadie Plant's *Zeros + Ones: Digital Women + the New Technoculture* (New York: Doubleday, 1997) and the argument against in Martin and Virginia Davis' Mistaken Ancestry: 'The Jacquard and the Computer' in *Digital Dialogues 2: Textile: The Journal of Cloth and Culture* (ed.) Janis Jefferies, Berg Publishers, Vol. 3, Issue 1, Match 2006), pp. 76-87.

[3] Herman Blum (1970) 'The Loom Has A Brain' quoted in Bill Seaman PhD thesis (1999): *Emergent Constructions: Re-embodied Intelligence Within Recombinant Poetic* (p.4), Daniel Langlois Foundation archives, Montreal.

[4] Ada Lovelace (1842) Notes by the Translator o (f Sketch of the Analytical Engine), L.F. Menabrea, Bibiloteque Universelle de Geneve, October 1842, no. 82 and cited in Seaman, op.cit 3.

'translation, just as the new software programme Pointcarre 'translates' sketches and the structures of satin and twill weaves into readable code for the modern jacquard looms.' This might be described as an aspect of contemporary computer-art practice and a generative process. There is a direct analogy to punch cards functioning as "conceptual machines" within the analogue mechanism of the loom, to the software/hardware paradigm in computers. Code functions as a creative vehicle of the translated aesthetic and perfomative conceptions of the artists.

Out of the sonic translations that unfold in 'A Sound you Can Touch, new material research is being produced. Whilst sonic variables are activated via live performance and the potential interactivity of the user, the generated virtual, textile patterns are 'captured' and worked into new jacquard cloth. The re-interpretation of sound into the image and woven material references Blackwell's 18th March 2005 performance and the retinal charge (assimilated into the textural and tactile) of Mondrian's Broadway Boogie-Woogie (1942-43). Touch has performed sound and sound generated new rhythmic pulses and vibrations 'translated' into further haptic/tactile readings.

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