12 Rainisto: 2004, Where is Place Branding Heading? Place Branding, 1 (1), pp. 12-35.
13 Vermeulen, M: 2002, City Branding, Image Building and Building Images, NAI Publishers, Rotterdam.
14 Patton, P: 2005, Imaginary Cities: Images of Postmodernity, in Watson, S and Gibson, K (eds): 2005, Postmodern Cities and Spaces, Blackwell Publishers, London.
15 Anholt, S: 2005, The Anholt-GMI City Brands Index, Place Branding Journal, 2, pp. 18-31.
16 Ibid.
17 Pavitt J (ed): 2000, Brand. New, V&A Publications, London.
18 Klein, N: 2001, No Logo: No Space, No Choice, No Jobs, Flamingo, London.
19 Monbiot, G: 2001, Captive State: The Corporate Takeover of Britain, Pan, London; Klein, N: op. cit
20 Anholt, S: op. cit.
21 Ibid.
22 Frost cited by Pavitt, Pavitt, J (ed): 2000, Brand. New, V&A Publications, London.
23 Rijkenberg, J: 2001, Concepting, Creating Successful Brands in a Communication-Oriented Era, WARC, Henley-on-Thames.
24 Kotler, P and Gertner, D: 2002, Country as brand, product and beyond: A Place Marketing and Brand Management Perpsective, Journal of Brand Management, 9 (4-5), pp. 249-261.
25 Baudrillard, J: 1970, op. cit.
26 Rijkenberg, J: op. cit.
27 Ibid.
28 Ibid.
29 Ibid.
30 Ibid.
31 Ries A & L: 1998, The 22 Immutable Laws of Branding, Harper Collins Business Publishers, London.
32 Pavitt, J (ed): 2000, Brand New, V&A Publications, London.
33 Anholt, S: op. cit.
34 Rijkenberg, J: op. cit.
35 Dovey, K cited by Dean, P: 2005, The Construction of Sydney's Global Image, Future City, in Read, S et al (eds), Spon Press, New York.
36 Place Branding is now the subject of a professional marketing journal titled *Place Branding* published by Palgrave MacMillan.
37 Dinnie, K: 2004, Place Branding: Overview of an Emerging Literature, Place Branding Journal, 1 (1), pp. 106-110.
38 Kotler, P and Gertner, D: op. cit.
39 Cited by Dinnie, K: 2004, Place Branding: Overview of an Emerging Literature, Place Branding Journal, Palgrave MacMillan, 1 (1), pp. 106-110.
40 Papadopoulos, N: 2004, Place Branding: Evolution, Meaning and Implications, Place Branding Journal, 1, pp. 36-49.
41 Ibid.
42 Dinnie, K: op. cit.
43 Mooney, GV: 2004, Local Economy 19 (4), Nov 2004.
44 Aaker, D: 1991, Managing Brand Equity: Capitalizing on the Value of a Brand Name, Free Press, New York.
45 Papadopoulos, N: op. cit.
46 Ibid.
47 Rainisto, S: 2004, Place Branding Journal, 1, pp. 14.
48 Zukin, S: op. cit.
49 Scott, AJ: 1997, The Cultural Economy of Cities, Blackwell Publishers, London.
50 Florida, R: op. cit.
51 Cuthbert, A: 2006, The Form of Cities: Political Economy and Urban Design, Blackwell Publishers, London.
52 Gospodini cited by Sklair 2005, pg 498)
53 Cuthbert, A: 2006, The Form of Cities, Political Economy and Urban Design, Blackwell Publishers, Oxford.
54 Scott, AJ: 1997, The Cultural Economy of Cities, Blackwell Publishers, London.
55 Anholt, S: op. cit.
56 Pavitt, J: op. cit.
57 Marshall, R: 2001, Remaking the Image of the City: Bilbao and Shanghai, in Marshall, R (ed): 2001,Waterfronts in Post-Industrial Cities, Taylor & Francis, London.
58 Ries A & L: 1998, The 22 Immutable Laws of Branding, Harper Collins Business Publishers, London.
59 Anholt, S: op. cit.
60 Baudrillard, J: op. cit.

SONIC ISLANDS
SOUND AND RESPONSIVENESS EXTENDING THE DIMENSIONS OF SPACE

KIRSTY BEILHARZ

Designing space is an activity for all the senses. This chapter unpacks multi-dimensional designing, new ways to think of designing architectures and spaces using sound and interaction (or responsiveness) as additional dimensions in negotiating and experiencing space and hence in its conception. Islands are unique and exciting. This discussion raises three different possibilities for integrating the sonic and interactive potential of space to elaborate the essence of the Urban Island.

ONE: ACOUSTICALLY SYMPATHETIC ARCHITECTURES

Acoustically sympathetic architectures preserve, augment, amplify and enhance natural acoustic phenomena that contribute to our sense of place and space. One example is Nikko, the ancient World Heritage site of temples, shrines and majestic Cedars outside Tokyo in Japan. What is immediately striking is the obvious visual beauty of the place but also very memorable is its acoustic atmosphere. The atmospheric characteristics can be identified quite precisely: the sound of quietness, remoteness, refraction of sound bouncing off the Cedars that resulted in an enclosed space enveloped by mountains, all affecting the humidity and the wetness of the acoustic profile. In this way, one could hear the lichen and greenness, the remoteness of traffic or mechanical sounds contributing to the timelessness and spiritual presence.

Due to their industrial texture, disconnectedness and abandoned condition, urban islands are special and distinctive acoustic locations. Acoustic sounds play a very important role in capturing this essence of place and architecture, as well as fabricated synthetic site-specific sound works that amplify this experience. From Friedrich Handel to John Cage, via Marcel Duchamp, the Fluxus movement and Raymond Roussel, water sounds, drips, rivers, washes and waves, have been an integral part of musical and conceptual sound.[1]

Surfaces can be selected to bounce and capture the reverberations to reduce or enhance the gusty urban air or to resonate the mighty, low, carnal sounds of city rumble, the flying gulls and other blended natural and man-made imposing sounds. Concave surfaces focus sounds, even serve to amplify them; dappled, dimpled, irregular surfaces diffract sounds; cavernous shells of old turbine halls and ship yards echo to the sounds of both inhabitants and nature. In the same way that optic fibres can channel light through layers of concrete, parabolic ceilings can convey sounds from one side to the other and narrow physical corridors/conduits convey sounds from one location to another. One could insert auditory channels/corridors from the exterior to bring the outside to the interior, sonically equivalent to light-wells or optic fibres, to further mesh nature and materials, the greater city and the occupants. Especially in urban island locations where the soundscape is so remarkable, it is useful to consider this extra dimension in designing for it.

On visual and acoustic space, Marshall McLuhan considers that acoustic space is the 'dwelling space' "...for anyone who has not been conquered by the one-at-a-time, uniform ethos of the alphabet."[2] This balance of inner and outer ear experience and the polyphony of the everyday world is much more acutely perceived in the Third World. Developing a greater awareness of the contribution of sounds to spatial awareness could reinvigorate and renew the balance of the senses, simultaneously enriching the experience through various modalities. Acoustic space is natural space in which humans are capable of detailed and complex spatial acuity. It is a question of adjusting focus so that this dimension of spatial and architectural perception can be maximised and contemplated.

As new structures and architectures are designed, rather than old structures transformed, there is more substantive scope for integrating the structural purpose, program flow and physical form with sound qualities. An example of integrally tied relationships between architectural structures and sound structures or musical form, can be found in works by Iannis Xenakis, both composer of international renown and architect, who at one time was an assistant to Le Corbusier involved with his serial and Modulor systems.[3] Xenakis designed building structures, such as the Brussels World Fair Pavilion, that shared its parabolic geometry with the pitch contours in his orchestral work, *Metastasis*.[4] In Xenakis' graphic summary, the x-axis marks progression of durations over time and the y-axis indicates pitch gradations (frequency slides) distributed across the range of orchestral instruments. The overall impression of curves in this graphic depiction follows the geometry of the conoid shell of his Philips Pavilion architectural design. Serial and stochastic distributions and values for proportions can equally be applied to dimensions of sounds such as granular density, distribution, and grain length as their architectural counterparts of measurements for length, periodicity, and proportion.[5]

By using shared structures, i.e. mapping equivalences in sound and space and systems of generativity to cross boundaries of medium or dimension that are traditionally divided [architecture/sound/space/lighting] and by using bi- or multi-modal mapping equivalences; designers can tightly knit their design thinking to fuse ideas across the pervious, permeable distinction between design domains. Shared sonic and spatial design that makes us listen augments and reinforces our awareness of a place.

TWO: SITE-SPECIFIC SOUND

While the previous section proposes architectures and spaces that moderate and utilise natural sound phenomena, the focus of site-specific sound shifts to man-made sound design (an extra dimension) affecting spatial perception, experience, decoration or ambience. This can be considered as a dimension of spatial design. Sound installations have many purposes and possibilities, ranging from peripheral ambient display to decorative or entertaining. The site-specificity refers to those

particular characteristics that uniquely identify the work with the space and place, location and context (social, spatial and geographical) in which it is set. The sound designer or composer can do this in various ways, e.g. by capturing local sounds and using them literally and processed as the fabric of her/his construction and/or by responding in real time. This real time aspect makes each work specific to people and place by using them partially in the fabrication of an auditory response. These are computationally viable with contemporary technology and provide a seamless juncture between environmental sounds and created ones.

Part of the reason for working in sound is to stimulate our consciousness of the beauty, uniqueness and contribution of the sonic attributes of a place. In the 1960s, John Cage's contentious *4'33"* 'musical work' scored for 'silence' raised several poignant issues surrounding environmental sounds. Firstly, there is no such thing as silence in our daily experience, much less within an urban island. Secondly this composition invites us to concentrate, obliterating visual distraction for a short time, and really deeply take in sounds that compose our environment. Obviously, no two 'performances' are alike, and I believe any sonic work that integrated or focused our attention on the environmental sonic landscape of the urban island would be rich and experience-altering. Thirdly, Cage's piece raises the inevitable and perennial debate about the position of the boundary between noise and sound, which it might be said, is largely a perceptual and inferred one, revealing something of the thinker's open-mindedness. The difference would appear to be the inference that noise is a negative term while sound is neutral or positive.

In Paris, an encounter with works, *Oto-Date* ('Hearing Awakening') and *Nuit Blanche* the nocturnal version of the piece by Akio Suzuki, engaged the participant to wander around the small district of Montparnasse to a number of listening points, indicated by ear-shaped feet painted on the pavement, where our ears could discover what the artist wanted us to perceive or notice.[6] Suzuki is motivated by the pace of modern urban life that is too quick to permit serious receptiveness and listening. His work forces the participant to slow down and to listen thoughtfully, becoming increasingly balanced and conscious of the city as an auditory, as well as visual and olfactory, mine. The kind of listening it requires is similar to that state achieved when suddenly we experience timelessness and

awareness, enveloped by wilderness or in nature. This type of listening encourages an intimacy with the city and re-connection with our place that can too easily become lost in everyday mind-chatter and superficiality.

Auditory awareness is a spatial paradigm often under-utilised.

> As I penetrate the deep drone of the bulldozer with my ear, the mind opens and reveals the high-pitched whine of my nervous system. It reaches out and joins the flight of an airplane drone, floats down the curve of the Doppler effect.[7]

Murray Schafer was a key figure in the early 1970s for bringing to society's attention the notion of the soundscape, i.e. in his terms, 'acoustic ecology,' once again describing the acoustical environment, qualities of sounds and their affect on experience. He worked with environmental sound artists who found their material in environmental sounds, the basis for creative works, e.g. Hildegard Westerkamp, David Dunn, Douglas Quinn and Chris Watson. These artists worked long before the contemporary generation of electronica and post-industrial artists developed hypnotic ambient music fabricated from found sounds with the convenience of modern technology for synthesizing and splicing, sculpting and filtering to produce a plethora of phantasmological sound blocks.

An important aspect of contemporary soundscape, like other forms of landscape, is its rapid transformation to include more machine- and man-made sounds. The fascinating incidence of Cockatoo Island is the way in which the man-made and the natural sound concur, blend, transfigure in the wind, the anarchic combination reiterating the natural and manmade building structures, natural and synthetic materials of architectural structures with comparably different resonant and reverberant characteristics that capture, dampen, reflect and diffract sound waves. The disembodiment of the natural and man-made sounds through walls obliterating natural light and our visual contact with the source, contribute to a complex experience of sounds from without, whilst from within enclosed spaces, edifices, walled buttresses and building shells. Due to the isolation from the density of usual urban noise levels, almost surrounded by sea, the audibility

and poignancy of natural wave and wildlife sounds heard from inside constructed architectures is magnified, thereby intertwining these elements.

Robert Coontz unfolds the way in which the deeply ubiquitous yet subconscious "...background subsonic [inaudible to human ears] oscillations of the earth [that] have no obvious source... not earthquakes, not nuclear explosions... vibrations triggered by cataclysmic events fade away to nothing but the Hum continues, regardless..." have led to composers' theories about free oscillations in the atmosphere. For example Naoki Kobayashi and Toshiro Tanimoto have turned the environmental concept into music obsessed with throbbing air pressure, drops, fluctuations of atmospheric pressure, humming and drumming.[8]

> From beneath the frenetic, threshing rhythms of jungle, a very different vibration has fermented, feeding off the technical errors and unplanned outcomes of electrified society - the world at the mercy of glitch. Crackles, pops, pocks, combustions, gurgles, buzzes, amplitude tautenings, power spikes, voltage differentials, colliding pressure fronts, patterings, jump-splices, fax connections, silent interjections, hums, murmurs, switchbacks, clunks, granulations, fragmentations, splinterings, roars and rushes have overwhelmed the soundscape - as if the Ambient soundfields on the Cage-Eno axis have been zoomed in on until we are swimming amid the magnified atoms of sound. Characterised by colossal shifts in dynamics, tone and frequency, this is an urban environmental music - the cybernetics of everyday life - that reflects the depletion of 'natural' rhythms, in the city experience, and in the striated plateaux of the virtual domain.[9]

In this quotation the onomatopoeic description palpably stimulates the aural imagination to appreciate the compositional value and potential of man-made and machine sounds, a subset of urban environmental sounds that have been principally plundered by the glitch scene in contemporary electronic music. Some examples of modern sound designers who have utilised such electro-environmental sounds and their inherent site specificity include: Haco *Start Up + No Wave* [2002/3] in performance capturing oscillating sounds emitted by electronic mechanisms of her computer's minutiae, scaling the normally sub-audible or ambient. Lucier Sferics uses natural radio frequency emissions in the ionosphere, caused by electromagnetic energy radiated from nearby or distant lightning and

amplified natural phenomena to challenge our understanding of proximity and perspective. Toshiya Tsunoda records environments by placing the microphone inside resonators like bottles - *Bottle at Park* [1999] producing distortion, perspective and acoustic images filtered by the bottle and the nuances of the local environment. Others, such as Chris Watson, develop their soundscapes from environmental recording, e.g. his remarkably iconoclastic adaptation of recorded Icelandic glacier, *Vatnajokull* [2003] reconfiguring our personal relationships to enormity and time by auralising or sonifying it. Ryoji Ikeda's *Dataplex* series is concerned with magnification, machine sound, repetition, periodicity, rhythm, phasing, regularity/irregularity, frequency extremes, perceptual thresholds, again uncovering a resolution of hearing not normally given attention.[10]

Certain frequencies, due to their periodicity, refraction and other acoustic phenomena, highlight psychoacoustics characteristics of a space. For example, Ikeda's minimal glitch electronica ambient pieces constructed from subtly transforming yet repetitious machine noises, cover a gamut of frequency so wide that some of the highest and lowest tones are perceived only as blips and vibrations, respectively as physical experiences of a corporeal nature. Some of Ikeda's pieces intended to be audited in specific environments, exaggerate or isolate the relationship between the body, mind and the sense of hearing, such as *Matrix* "for an anechoic chamber." In various performance manifestations, it has also exemplified experimentation with the bimodal effects of vision and sound exploding synchronicity, phasing, pulsing and space/silence in periodic rhythms. Some audiences are captivated by the visceral and powerful effect of the minimalist and unrelentingly sparseness - no performer on stage, darkness, seeming emptiness.[11] Sporadically charged by simultaneous pulses of light and sound, pervasively anonymous, dark, free of time measurement though regulated by patterns of irregular impulses: unpredictable and erratic. The designer with an acute awareness of the psycho-acoustic effects of frequency bandwidths and architectural acoustics, can harness a level of physical energy through sound not normal, cultivated and the composer/sound designer working together with the architect can develop a synergistic physical spatial experience.

Roger Reynolds highlights the notion that art as process, not art as event, can

include experimentation across the threshold of public and private, and with altered states of consciousness. Disrupted thought processes, a disturbed sense of time, changes in emotional expression [and impression] and perceptual distortions could be among those dimensions affected by sonic interaction with architecture.[12] Reynolds, an influential composer of the late twentieth century, identifies space as the last dimension, meaning the least explored yet most modern dimension of musical expression for contemporary composers and sound designers. The dimension is one that has only fully become accessible through the sound production systems and spatialisation technologies, software and 'architectural' thinking of composers in the last 40-50 years. Composers differentiate between points and their radiating area, between different refractive surfaces and they move sounds in spaces as dynamic dimensions of time-based communication.

Much earlier, composers started to experiment by using spatially unusual positioning of players in orchestras on the stage and distributed displacement in performance venues. However, tele-interactive and electronically controlled spatial fine-tuning are luxuries of recent times that afford a new realm or dimension of expression. Examples of early pioneering in this new frontier include Joji Yuasa's *Icon* for directional sound composed in 1967 for 5 speaker channels; seminal works for electronics emanating from the French School of Pierre Boulez, Edgar Varese, Iannis Xenakis, Philippe Manoury, Georges Asperghis; and didactic theatre/opera composers such as Louis Andriessen, Philip Glass and Karlheinz Stockhausen. Stockhausen produced the opera *Licht*, which demands spatial interaction and dynamic motion during performance and presents a scale of venue unprecedented in classical performance. It is outshone only by his own tele-immersive *Helicopter Quartet* for airborne string quartet members each in separate helicopters, first performed by the Arditti String Quartet. Yuasa's *Icon* for 5 directional loudspeakers (1967/8) involves a lyrical high section then narrow, complex, constantly inflected noise bands, interlocking in opposing rotational patterns and slow, circular low bands indicated graphically in a representation with striking resemblance to architectural elevations.[13] Hence, the potential for linking these structures across disciplines is obvious.

The idea that technologies are prostheses, expanding existing organs and fulfilling

desires "...continues to legitimise vast swathes of technical development."[14] This idea was also presented by Ben Shneiderman[15] and William Mitchell (*The Cyborg Self*).[16] Marshall McLuhan might well provide us with a way of conceiving of augmented bodies, networks and distributed or disembodied capillaries, conduits of communications and their communities as extensions of ourselves.[17] However, it is necessary to recognize that these technologies, in turn, mutate and transform the affecting body[18] and that our augmented, extended self might also describe the spaces and architectures we occupy. Contextualised in this way, built structures and architectural spaces form a filter or moderator between our body and senses and the external universe. The sympathetic architecture proposed here serves to clothe us in a permeable, sonically porous, environmentally attuned cladding that mediates, even articulates, the topical acoustic surroundings.

> Visionary artists of all kinds, from tribal Americans to Shakers to vernacular [or 'outsider'] artists to the avant-garde, depend on some connection with the spiritual side of 'nature', but specific places play minor roles in vision quests, transcended by the experiences produced there ... [in Land Art] the viewer is affected by the space as by the object, often more so. The artwork is endowed with the emotional power of the space or place.[19]

Beyond creating a permeable interface between the environmental sounds and experience, site-specific sound installation and site-specific sound-capture can re-focus and shape the spiritual connection with nature and the spiritual quality of place. Sound as a dimension of architecture has the potential to mingle natural and fabricated, to build on the site in ways that make the listener/viewer/experiencer more conscious of the interrelationship between structures and context, of the integration of urban and isolation. Harvesting real environmental sounds of the place composited with synthetically constructed sound worlds is one material methodology for bringing these parts together. As the term 'ambient' music might imply, as well as utilizing somewhat peripheral attention, sound can create 'ambience', atmosphere, environment – to transform or, as here, to reinforce and illuminate interesting features.

By raising awareness of inherent environmental sounds and layering on top of that designed sounds, the composer or sound designer can bring an additional

dimension that affects our conception and perception of place. The *Soft Inversions* installation by the Responsive Environment Studio group, using projected light and sound in the Turbine Hall on Cockatoo Island, demonstrated how eloquently and effectively different sensory and designerly dimensions can synergise to transform our awareness of a space. Thus it is the purpose of sound installation or site-specific sound to convey 'geography,' in which the subject and practice can be situated, temporal and constructing a new social space.[20] In the same way that it might be argued that 'architecture cannot exist without the body', and 'how does the body and architecture form a spatial conversation?'– it might also be asked, 'can sound resound without a listener?'[21] This is the oscillation between sound and architecture as the object or, sound and architecture as the result of the presence of bodies, the experience. Drawing on Zen thinking: does the physical architecture and sound exist without its being experienced? Responsive sound spaces (discussed in the following section) epitomise and make essential the presence of the person, the body and interaction to elicit contextualised site-specific sound.

THREE: RESPONSIVE SPACE

Integrating technology in spatial and responsive, reactive design is a new and current phenomena enabled by inexpensive pervasive computing, increasingly ubiquitous wireless networking and other features that allow rapid data collection and responsive display. For example, environmental information about habitat, climate control, lighting, etc. and socio-spatial data concerning the number of people in a space, timing, motion, specific regions of activity, proximity to specific objects, can ethically (anonymously) be collected and used to provide a reflexive informative ambient art-work derived from place-specific and people-specific information flows.

According to William Mitchell, in *Placing Words,* the nature of architecture, its function and the places at which certain activities occur, is being quite radically disturbed or transformed by the ubiquity of modern technologies.[22] This need not be perceived as a destructive element but may equally be utilised to cocoon rooms or 'wallpaper' transitional spaces with informative, data-rich visual and

auditory representations. Information display is the purpose of the domains of visualisation and sonification. Often the data display is solely for complex data-driven industry solutions. This chapter advocates the use of architectural, environmental and site-specific data as the platform for artistic, aesthetic ambient visualisation and sonification, not simply to optimise deciphering abstract data, recognising patterns, flocking and eccentricities. Socially, it can trigger discussion, social interaction, to articulate points of convergence and social curiosity, as well as to promote better understanding of dynamic flows of people, information and responses to environmental controls in buildings and space (that can equally occur in distributed or exterior spaces). Computer vision, gesture or motion capture, auditory, visual, proximity, temperature and touch sensors are just a handful of these readily available technologies derived from more insidious practices of surveillance and tracking that can be utilised for socially benevolent and curiosity-provoking engaging responsiveness.

FIGURE 1

EMERGENT ENERGIES: AN AMBIENT RESPONSIVE VISUALISATION AND SONIFICATION IN A SENSATE ENVIRONMENT, GENERATING AN EVOLUTION TREE THAT GROWS ACCORDING TO ARTIFICIAL LIFE (LINDENMEYER-SYSTEM) RULES, TRIGGERED BY ACTIVITY ON PRESSURE MAT SENSORS.

FIGURE 2

SONIC TAI CHI: (SYDNEY POWERHOUSE MUSEUM) INSTALLATION RESPONDING TO DIRECTION AND RAPIDITY OF MOTION CAPTURED USING COMPUTER VISION (CAMERA TRACKING) TO POPULATE THE SCREEN AND SOUND SYNTHESIS WITH VIRTUAL LIFE.

In our earlier works for exploring socio-spatial interaction in sensate (sensor-enabled information-gathering) space, features of population, traffic, proximity, temperature, position, rapidity of movement were utilised, e.g. in Beilharz, Vande Moere and Scott's *Emergent Energies* installation to provide a responsive, evolutionary (growing using a Lindenmeyer tree system of branching rules) reflection on socio-spatial activity in a place (Figure 1).[23] Jakovich and Beilharz's *Sonic Tai Chi* at the Sydney Powerhouse Museum generated a dynamic microcosmic environment of 'pixel-creatures' that colonized, moved and formed patterns on screen according to rules from Conway's (generative Cellular Automata) Game of Life, triggered by the lateral direction and intensity of motion of visitors to the space (Figure 2). Responsive environments such as these induce active and reactive human behaviour, acute consciousness of space and, applied in an architectural context, could stimulate new ways of thinking of the space, prompting more vigorous exploration of presence and consequence. Further, Jakovich presents kinaesthesia as an innovative modality through which architecture can be explored.[24]

There is no question that current technologies including sensors, wireless computing, non-tactile interaction, gesture-sensing, motion-capture, derived from arts performance and music (hyper-instruments),[25] the movie business (motion capture) and surveillance (tracking, sensing), compel a new application meshed with site-specific responsive architecture (Figure 3). Jon McCormack even suggests that sensors themselves, the receptor devices, might one day

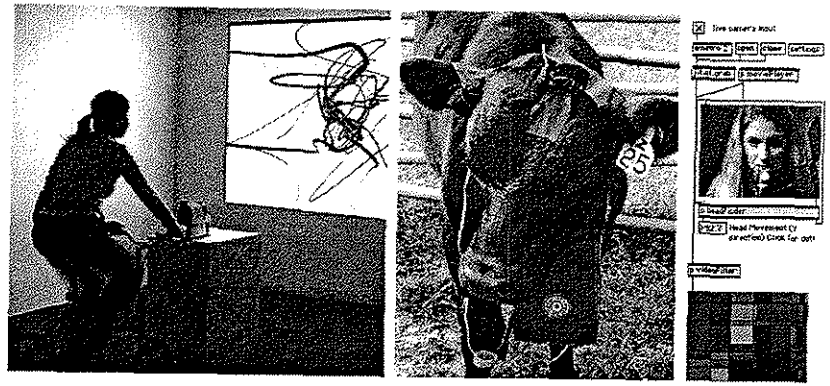

FIGURE 3

FLUID VELOCITY INSTALLATION (LEFT) AND *SENSOR COW* SONIFICATION (CENTRE) USING WIRELESS GYROSCOPIC, ROTATIONAL, BINARY AND PRESSURE SENSORS TO CAPTURE MOTION DATA. *HYPER-SHAKU* SONIFICATION AND VISUALISATION USES SOUND AND COMPUTER VISION TO TRIGGER GENERATIVE RESPONSES.

undergo Artificial Evolution to reflect their situated artificial environment. "Can an artificial system display creative emergence by constructing a sensor in a manner analogous to evolution? ... this requires plastic artificial systems that can develop their structure on the basis of their interactions with their environmental niche:"[26]

This is exactly the paradigm of adaptive interaction.

The described interactivity is equivalent to adaptive and generative architectures that could physically transform according to environmental and social stimuli, akin to the conceptual work proposed by R&Sie(n) architectural group comprising architects/artists/engineers: Francois Roche, Stephanie Lavaux, Jean Navarro, & Benoit Durandin. Their exhibition *I've Heard About* at the Musee d'Art Moderne de la Ville de Paris [2005] extrapolated a process for extruding a city/colony of organic-looking structures, i.e. a generative architectural city. The work proposed using genetic and other algorithmic generative processes (e.g. modified L-systems and stochastic aleatory, Brownian Serpent, etc.) to produce designs fabricated in real time by a self-

propelled 3D polymer printers at the ends of morphing tendrils (Figure 4).

If a building is an organism, living and breathing, its sensory perception, intelligence, expression, responsiveness and informative feedback are modes for enabling architecture's humanity and digital aesthetic. Jin Hidaka and Satoru Yamashiro present soft architecture as a paradigm shift. Perhaps the argument here echoes the same idea: not only that spaces are continuous, they are not limited to the fabric of hard architecture. Spaces can share intelligence and personality and spaces can have user-awareness and ears. Spaces expanded in sonic and interactive digital dimensions extend the impact of their embodied experience.

FIGURE 4

SELF-PROPELLED POLYMER 3D PRINTING FABRICATES GENERATIVE ARCHITECTURAL STRUCTURES IN RESPONSE TO SOCIAL INPUTS.[27]

1 Kahn, D: 1999, Noise, Water, Meat: a History of Sound in the Arts, MIT Press, Cambridge, Massachusetts. pp. 245-292.
2 Cox, C and Warner, D: 2006, Audio Culture: Readings in Modern Music, The Continuum International Publishing Group, New York, p. 71.
3 Beilharz, K: 2005, Integrating Computational Generative Processes in Acoustic Music Composition, in Edmonds, E., Brown, P. and Burraston, D. (eds) Generative Arts Practice '05: A Creativity and Cognition Symposium, University of Technology Sydney, pp. 5-20.
4 Xenakis, I: 1971, Formalized Music: Thought and Mathematics in Composition, Indiana University Press, Bloomington, pp. 1-11.
5 Roads, C: 2001, Microsound, MIT Press, Cambridge, Massachusetts.

6 Suzuki, A. and Zadkine, O: 2005, Resonances: Installations pour le Musée Zadkine, Les Musées de la Ville de Paris.
7 This excerpt from Pauline Oliveros' 'Some Sound Observations' unpacks a small instance of observant hearing in Cox, C and Warner, D: 2006, Audio Culture: Readings in Modern Music, The Continuum International Publishing Group, New York, pp. 102-106.
8 Coontz, R: 1999, The Planet that Hums in New Scientist, U.K. 2203: 11, September.
9 'Digital music, electronic disturbance' description of glitch by Rob Young, in Young, R: 2002, Undercurrents: the Hidden Wiring of Modern Music, Continuum, London. pp. 45-56.
10 *Dataplex* and *0 Degrees* are two works on Touch Records CD recording built up from sounds of data packets or grains of data comprising internet flow.
11 Toop, D: 2004, Haunted Weather: Music, Silence, and Memory, Serpent's Tail, London, p.14.
12 Reynolds, R: 2005, New Forms of Musical Experience, Routledge, New York.
13 ibid. Reynolds, R: 2005, pp. 97-100. Reproduced sound directional version of Joji Yuasa's *Icon* 'score' produced at NHK Studio, Tokyo and assigned to Ongaku No Tomo Sha Corp. Tokyo, Japan. The 'score' shows frequency range, dynamic levels, time passage, distribution of the sounds among the 5 channels corresponding to 5 loudspeakers spatially separated.
14 op cit. Toop, D: 2004.
15 Shneiderman, B: 2002, Leonardo's Laptop, MIT Press, Cambridge, Massachusetts.
16 Mitchell, W J: 2003, Me++: The Cyborg Self and the Networked City, MIT Press, Cambridge, Mass. USA.
17 op cit. Cox, C and Warner, D: 2006.
18 Plant, S: 1998, Zeroes + Ones, Fourth Estate, London, posits: "quite beyond their own perceptions and control, our bodies are continually engineered by the processes in which they are engaged".
19 LaBelle, B, Vitiello, S and Ehrlich, K: 2003, Surface Tension: Problematics of Site, Errant Bodies Press in collaboration with Ground Fault Recordings, Los Angeles, p. 64.
20 LaBelle, B: 2004, Site specific sound, Errant Bodies/Selektion with Ground Fault Recordings; distributed by DAP, Frankfurt, Germany; and LaBelle, B: 2006, Background noise: perspectives on sound art, Continuum International, New York.
21 ibid. LaBelle, B: 2004.
22 Mitchell, W J: 2005, Placing Words: Symbols, Space, and the City, MIT Press, Cambridge, Massachusetts.
23 Beilharz, K: 2005, Architecture as the Computer Interface: 3D Gestural Interaction with Socio-Spatial Sonification, in Duarte, JP, Ducla-Soares, G and Zita Sampio, A (eds) Digital Design: The Quest for New Paradigms - eCAADe Proceedings, Lisbon, pp. 763-770.
24 Jakovich, J and Beilharz, K: 2005, A Framework for the Extension of Kinaesthetic Modality to the Design of Sensate Spaces, in Duarte, JP, Ducla-Soares, G and Zita Sampio, A (eds) Digital Design: The Quest for New Paradigms - eCAADe Proceedings, Lisbon, pp. 427-432.
25 Beilharz, K and Jakovich, J: 2006, Hyper-Shaku (Border-crossing): Towards the Multi-modal Gesture-controlled Hyper-Instrument in Proceedings of New Interfaces for Musical Expression (NIME), IRCAM, Paris, pp.352-357.
26 McCormack, J, Bird, J, Dorin, A et al: 2004, Impossible Nature: The Art of Jon McCormack, Australian Centre for the Moving Image, Melbourne, Australia, p.48.
27 R&Sie(n): 2005, 'I've Heard About' Exhibition, the Musee d'Art Moderne de la Ville de Paris. Images from their web site http://www.new-territories.com/I'veheardabout.htm that also details the manifesto for their new world order.