Research Presentation given by

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Fugitive Moments: Research in Progress

(This presentation, which was made 10 months into a 2-year Research Project, was illustrated by a PowerPoint slide show (sfu2.ppt) and would be better read in tandem with it.)

The experience of standing in front of a painting by an artist such as Yves Klein or Barnett Newman is undeniably powerful, but one cannot say why. The paintings are characterised an overwhelmingly dominant ground – a deep resonant blue, for example, or a brilliant red.

SHOW SLIDE 2.

A similar experience in engendered when looking at one of James Turrell's light works, where a field of red, blue, yellow light engulfs you,

SHOW SLIDE 3

or at an Anish Kapoor sculpture, whereby you peer into, or are immersed in, a void, drawn into the velvety depths of the deep colour of the interior spaces he creates.

SHOW SLIDE 4

This is what Pelli (1998) calls perception without categorisation. 'Pure' sensation, a sensation you cannot grasp, you cannot name …. merely experience. As an artist whose point of departure is the human body I began to ponder on the sources of these sensations, whether there was something happening deep in our physiological systems which cause the differences in the sensation we experience when immersed in (say) a red environment and when immersed in a blue environment*, the differences when immersed in bright red/blue and deep red/blue.* It was this that led me to the project I am currently engaged in with Dr Beau Lotto of the Institute of Ophthalmology, at University College London.

Much of my digital installation work is concerned with setting up what I call 'the conditions for becoming'[1].

SHOW SLIDE 5 (Time & Tide, 2001)

Although time-based installations they have no predetermined linear progression, and no predetermined 'end'. Rather they comprise a continuously modulating flow of imagery. Additionally, I tend to use imagery which lies on the threshold of perception, and thus on the threshold of conception

SLIDE 6 (imagery from Sensuous Geographies, 2003)

Nevertheless, although abstract, in all my work the digital imagery is derived from video footage of human movement.

*SHOW SLIDE 7 (*imagery from *Echoing Traces, 2004*)

Even the images you are seeing now

In using this as a starting point I am pursuing an artistic intuition that we can somehow sense that the abstract flow of motion we are perceiving in these images is grounded in human movement, an intuition that has been confirmed as having some validity in research being undertaken by neuroscientists (Gallese et al, 1998 – 2004; Calvo-Merino et al, 2005).

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Over the last four years my work has been intimately involved in the use of colour to create an environment which resonates with an even more liminal mode of sensation, one which does not represent, but which appears to have a real effect on the way the viewer/participant feels when in the installation space.

Participants' responses to *Time & Tide* (2001) and *Sensuous Geographies (2003)* indicated that both installations had an unexpected effect on many of the participants who entered the installation spaces.[2]

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[1] The notion of becoming emerges directly from the ideas forwarded by Bergson and Deleuze.

[2] Whilst in both pieces sound was a factor in the experience, I am of the opinion that colour itself was a powerful factor in the equation.

In both cases many of the participants surrendered themselves to sensation, in *Time & Tide* allowing a flow of sensation generated by the flows of imagery to run unchecked through their physiological body, in *Sensuous Geographies* allowing the body to behave as the sensation demanded it[3].

SHOW SLIDE 9

Those experiencing *Time & Tide* felt that it was *"primordial, mysterious, beautiful, mesmerising"* , *"very calming and serene", "a peaceful and meditative experience" but also "intense",*[4].

SHOW SLIDE 10

Participants in Sensuous Geographies noted that it was an *" intriguing, elemental, absorbing experience" "a powerful experience. More liberating than Mardi Gras - opened the senses"* that their *"imagination and sense perception were really affected"*.

It seemed to me that for the participants the responses to the installations was physiologically given rather than consciously sought. The installation space became for them less a site for a deliberate interactive experience, than a space for allowing the mind, or reflective consciousness, to take second place to feeling and sensation.

In this they are upholding the notion that consciousness constitutes more than reflective or higher consciousness.

SHOW SLIDE 11

Neuroscientists such as Antonio Damasio (1998; 2001;2004) and Guy Claxton (1997) posit that consciousness has several levels, not all of which are accessible by what we term 'consciousness'[5]. They argue that an important form awareness is activated in the deeper levels of the physiology, an awareness which cannot be

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[3] Not all participants experienced this effect, however, a sufficient number reported that they understood the installation 'better' if they allowed themselves not to think. (Participants in Glasgow, Chichester, Los Angeles)

[4] These comments, some of which run counter to the above, are taken from the visitors books which accompanied each showing of the work. Comments on *Sensuous Geographies* can be found on www.sensuousgeogrpahies.co.uk

[5] The term tends to refer to reflective or 'higher' consciousness

put into words. Experiments have been taking place for several decades which provide incontrovertible evidence that the claims made by Damasio and Claxton, and my intuitions about the nature of the response to my installations, are rooted in physiological fact.[6]

With respect to my installations, the sense that many people were responding in part through these channels of awareness remained at the level of anecdote, or self-report. I speculated as to whether the physiological effects which constituted the experience of sensation could be measured, captured as data, and subsequently used as the interface between the viewer and the installation work. As my interest as an interactive artist lies in the viewer relinquishing, rather than consciously exerting control over the installation environments[7] I wanted the behaviour of the viewer which was to affect the installation to be genuinely non-conscious, to be out of their control.

In order to continue my artistic research into this area, I needed a working environment which would allow me to undertake the preliminary research necessary to test the scientific validity of these artistic intuitions, and ultimately to see whether it would be possible to develop an artistic system which was driven by physiological response. It became apparent to me that this was a prime opportunity to develop a genuinely *inter*active installation[8] in which the dialogue between participant and installation was a two-way dialogue, with the imagery not only

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[6] , This awareness can be measured through changes in the intensity of the autonomic responses of our bodies and through neuronal activity in specific parts of the brain. e.g. skin conductivity (SCR) which measures physiological arousal, and variation in heart rate (HRV) which measure valence – or preference.

[7] One reason for my preference for working with collective rather than individual interactivity.

[8] Whereas my other installations gave the impression of being interactive, strictly they were reactive – the complexity of the systems which lay at their heart and the multiplicity of the independently operating interweaving strands in each installation giving the impression that the piece was evolving with the behaviour of the viewers. The piece was not evolving, however, rather the realtime event was, but this was not strictly evolution, merely the result of two complex systems (the computer system and the group system formed by participants) interacting with each other emerged when there was an interaction between an installation and decision-making beings. This is an issue which reveals something of the differences in the ways people understand the term interaction. In the computer sciences an interactive system is one that changes at its root when an interaction with an outside stimulus takes place. Viewers and artists, however, use the term interaction to include responsive reactions to their behaviour from one or more strands of a complex installation system that cause a momentary and reversible change in the system. Importantly, and this is why the system feels interactive to the participating viewer, this in turn causes a modification in the behaviour of the viewers. This cycle becomes like a conversation, an interaction between installation and participant.

modulated at a surface level in response to the changes in the incoming data in the visual or sonic output, but also in the dynamic structure of the programme itself. This required that I enter the domain of artificial Intelligence/Artificial Life systems, and led to my collaboration with Dr Beau Lotto.

Lotto is both an expert in the perception of colour and motion, and the director of a laboratory dedicated to the investigation of dynamic systems, including ALife systems[9]. These systems genuinely *inter*act with, rather than merely react to, the environment which impacts upon them.

After preliminary discussions Dr Lotto and I embarked on the project which is the subject of this paper.

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Our perspectives in the dialogue between sentient beings and their environment overlapped, inasmuch as we both take an ecological position with regard to the interaction between biological entities and their environment (which would include artworks), and implicitly hold that there are deep systems to which we respond that underpin biological behaviour. On my part I believe that people respond non-consciously to subtle clues in the environment, many of which might not be visible, thus adapting to it. Lotto believes that individuals and their environment are inextricably bound to each other, the affect from one to the other operating in both directions (from environment to individual and from individual to environment). Our research[10] centres on the creation of an AI installation system predicated on colour and motion, which will allow the artistic work viewers engage with to be affected and modified by the behaviour of their physiological systems. I envisage this as a contemplative, rather than a physically active dialogue.

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[9] At The Institute of Opthalmology, University College London. wwwlottolab.org

[10] Funded by the Wellcome Trust Sci-Art programme.

We are currently 10 months into the research,

SHOW SLIDE 13 then

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Much of it has been involved in

SHOW SLIDE 15

a) locating extant scientific experiments which investigate the hypothesis that the perception of colour and motion affect human physiological systems directly. These have been used to devise experiments to test out the intuition that colour and motion has measurable physiological responses, and to ascertain what those physiological responses might be,
b) developing software and finding ways of measuring this such that:
   (i) appropriate physiological systems are used to measure the responses;
   (ii) the subtle responses engendered by stimuli such as colour and legato motion can be used as data,
   (iii an evolutionary AI programme would respond to the data garnered from the viewer's physiological responses.[11]

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a) Research has shown that two physiological measures, SCR (skin conductivity response) and HRV (Heart Rate Variance), might be the most appropriate to this project REFS[12]. We needed to take several criteria on board when making this first decision:

   i) the portability and lack of intrusiveness of the measuring devices (sensors). These are required as the measurements will be taking place in an art, rather than scientific environment, and will need to be embedded in a simple garment which the viewer would put on prior to engaging with the installation. The advantage of the systems needed to acquire SCR and HR and HRV data are that both the hardware and the sensors are small and portable.
   ii) the intention of the installation, which was to have the imagery in an installation evolve not merely in response to physiological arousal responses to an image, but also to a *preference* for certain states. SCR measures physiological arousal *per se*, but does not distinguish between positive arousal and negative arousal (preference). HRV measures valence (preference). These two measures are frequently used in tandem in tests designed to measure emotional responses to imagery. (REFS)

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[11] . Although this system is being designed with *Fugitive Moments*) in mind, the intention is that the system will be a generic system, which can take in any input from both biological and non-biological systems, using any data capture system, and give any output (i.e. visual images, sound, even pure data. BEAU?

[12] The use of EEG was discounted for various reasons, including expense, the lack of portability of the systems, the intrusive nature of the electrodes used to measure electrical activity in the brain.

We are currently exploring the validity of each in a set of experiments which are designed to ascertain:

i) what the most effective, and appropriate, physiological responses for initiating and intervening in the evolution of an AI system might be;
ii) what kind of scaling needs to be written in to the software to output data with a sufficiently large numerical variation to have an effect on the progamme from responses to 'low emotion' stimuli[13].

Our original thought was that SCR would be the most effective response system. SCR measures changes in the sweat glands which indicates that physiological arousal is taking place when a stimulus picture is shown. However, any stimulus, including those which are not intended to be stimuli (a door shutting, someone entering a room, a siren sounding), can give rise to physiological arousal. As the installation will be mounted in semi-controlled conditions an appropriate threshold at which data becomes relevant to the intentions of the installation needs to be found.

We are also investigating the hypothesis that Heart Rate and HRV might be a better measure (Peng, 2004; Greenwald, et al 1989). HRV is, some say, an indicator of the valence of a response (the user's preference for a stimulus). A slower heart rate indicates a positive response to a stimulus, a faster heart rate a negative response. Inasmuch as it is not simply arousal which is needed to affect the imagery, but a direction of arousal (on a continuum of positive/negative), which will ensure that the programme evolves towards or away from some desired state, it might be that HR and HRV is a more appropriate measure than SCR.

Many of the experiments we have located have confirmed the intuition that visual imagery measurably affects the SCR and HR/HRV of human subjects (Andreas, et al (2002) Lang, Greenwald, Bradley, & Hamm, (1993) Schupp et al (2003).

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This is particularly true of representational images, which initiate a measurable level of SCR when shown to viewers. In these experiments subjects view a variety of high

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[13] The responses from low-emotion or neutral stimuli are very small when compared to those from high emotion stimuli. However it is possible to specify a more detailed scale for the former in the programming which will result in an output which is large enough in numerical terms to affect the evolution of the programme.

emotion stimuli (horrific/erotic) and low/medium level emotional stimuli (landscapes/people/animals, etc)[14], and their SCR, HR and sometimes ECG responses are measured and compared. Our first experiments used similar banks of representational images (photographs) to elicit the physiological responses. For the low/medium level stimuli the responses are very small, a factor which will be accommodated in the scaling of the data in the computer programme.

Meade et al (2000) and others argue that still images do not elicit as strong a response as moving images, and fast moving images have a greater effect than slow moving images. If the latter proves to be true modifications of scaling might again need to be made to our software programme, for the ultimate aim in this project is to use relatively slowly moving flows of variable colour (generated by the AI programme) to initiate physiological responses in the viewer. Both are low level stimuli. Whilst it would be easier to get a response from fast moving imagery, this would be in opposition to the overarching intention of the installation, which is to produce a more subtle environment which the viewer can savour, rather than provide them with an exciting psychedelic fairground ride. In spite of the potential difficulties this might present this is the goal I am currently aiming for. Any effect is not good enough from an artistic perspective, I am after a particular range of physiological motion.

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A series of experiments with moving video imagery of human movement (of dancers, sports activities, etc.), which will be processed such that instances of the same imagery becomes progressively blurred and abstracted from the representational, will be carried out to ascertain the effect of motion on the physiology. This constitutes a preliminary investigation, prior to exploring the effects that imagery derived from motion capture imagery have on the viewer, for it is intended that the default imagery for the final installation, from which the initial evolutionary system will commence, will be derived from motion capture data of a

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[14] These distinctions are similar to those made in the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 1999) housed at the University of Florida (CHECK REF)

dancing human body.

The reason for using the latter lies in the long held intuition in the dance community that viewing movement generates a physical response which is analogous to that felt whilst performing the movement which Martin (1930) termed ‘metakinesis’. This intuition has been given scientific backing through recent investigations in neuroscience which have led to the discovery of a set of neurons in the frontal cortex that have been named ‘mirror neurons’. Martin’s ‘metakinesis’ is termed ‘embodied simulation’ by these scientists, and is, they believe a contributory factor not only in the development of verbal language but of communication *per se* (Gallese 1999). Gallese and his colleagues (1996) made the first discovery of Mirror Neurons with primates, noting that a primate watching another primate grasp a stick would exhibit very similar neuronal activity in the xx region as the primate who was grabbing the stick. Similar investigations were conducted later with human beings (Gallese et al 2003; Rizzolatti, G. and Craighero, L. 2004) who, it was found, exhibited similar neuronal behaviour in similar circumstances. Buccino et al. (2004) argue that actions which belong to, or are closely related to the motor repertoire of the observer are mapped on the observer’s motor system, whereas actions that do not belong to this repertoire are mapped, and henceforth categorized, on the basis of their visual properties.

Calvo-Merino et al (2005) investigated this hypothesis but, of more interest to our project, moved from investigating functional movement to investigating the responses of dancers to videos of dance (or abstract movement). They hypothesised that neuronal activity in the somato-sensory region would be increased if the movement being observed by dancers were in their performance repertoire. To this end they undertook an experiment with two sets of dancers, one trained in ballet, the other in capoiera. Each set of dancers were shown short video clips of dancers performing a) ballet movement and b) capoiera movement. It was found that when a video of a ballet dancer was shown to a ballet dancer the activity in the mirror neuron site was greater than that of a capoiera dancer shown the same video, and v.v. This indicates that prior experience of a movement has a great deal to do with the strength of the neuronal response. However, the capoiera dancers shown ballet dancing *had* a response, albeit diminished, in the mirror neuron area, which indicates that the theory that we experience observed movement at some level through embodied simulation may yet hold some water.

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To date few, if any, experiments have been done with non-representational moving imagery, or indeed with colour. Over the next few months we will be conducting experiments using GSR/HRV on progressively abstract moving imagery which has its origin in human movement to ascertain whether the motion itself has any effect on the physiological response of the imagery. This will later be supplemented with experiments which measure responses to colour fields, and finally by experiments which combine the two.

Another area I wish to explore concerns the placement of the sensors. Most scientific experiments use the most effective parts of the body as their measurement source (the ends of the finger for SCR; the skin on the chest for Heart Rate). In this project, however, my focus is towards less obvious sites for measurement. Rather than having their attention drawn to the technological interface through placing large sensors on exposed parts of the body, we wish to use sensors which allow the viewer to forget that their responses are being measured. Additionally we wish to experiment with using different sites on the body for the sensors to see whether we can transcend the functionality factor of using the ends of the fingers and the chest.

In parallel we will be continuing to develop an ALife programme which interfaces directly with the physiology of the viewer.

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During the early part of this research project three computer scientists, Richard Clarke, Daniel Hulme and David Malpin[15] developed a prototype Alife programme

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[15] Members of the LottoLab at University College London

– which is running behind me – which evolves from a neutral state into a moving colour environment, gradually settling into a relatively stable colour field. This programme was developed through a dialogue between us over a period of 6 months. My observations, requests, intuitions as to what I was after with respect to the quality of the imagery were taken into account as the programme developed. The programme is intended to allow both for internal evolutionary progression and progression in response to interventions into that evolutionary process (which will ultimately be generated by the data derived from SCR/HRV, etc). It was built in such a way that I have been able to experiment with the different parameters of the programme (tempo of evolution, number of atoms/critters, etc) so that a starting point and evolutionary progression are established which suit my artistic needs. This programme was not tested with interventions from physiological data.

This prototype programme provided us with several valuable insights, and certain programming strategies which would allow what we wanted to happen in the installation to happen. It was, however, never completed.[16] We are, however, currently developing another programme, building on the insights gained from the prototype, with computer scientist Erwan Le Martelot. The understandings of the possibilities inherent in ALife in the context of Fugitive Moments I have gained from the collaboration with Clarke, Hulme and Malpin will be brought to bear on the new programme, as we begin to develop the system.

The collaborative process across disciplines.

During the course of this collaborative project I have been learning a great deal about ALife systems, and their philosophical underpinnings, neuroscience and the finer aspects of physiology. At the same time my collaborating partners have been exposed to the somewhat esoteric ideas which drive my work as an artist. Although not artists[17] the programmers have listened with interest to my attempts to communicate my artistic intuitions, and to transpose those into code which

[16] It was a standalone project which the programmers undertook as part of their PhD coursework in a computer science degree. On its completion they moved on to their own PhD work, and could not give the time to taking the programme the few steps further that needed to be taken.

[17] Although they have indicated to me that they have their own ideas for an art project using the ideas they have been developing as they worked with me on the Fugitive Moments project.

would manifest them in some way. Although at an early stage in the process the ground has been laid for a very productive continuation of the project through this generosity.

The other side of the collaboration has required that I engage with scientific papers and concepts which address not only issues concerning Alife, but also scientific research into the finest of the physiological systems. This has been of great interest, and is constantly expanding my understanding of the intuitions which have driven me as an artist for so many years. I have also had cause to curb my natural artistic tendency to approach my ideas in the loose, exploratory way I am used to. I have found myself designing and conducting simple scientific experiments which would test the relevance of the findings of the many scientific papers I have read to the project. The results of these, it is hoped, will enable us to build an ALife programme that will respond to extremely subtle physiological data, gleaned from non-conventional sites.

There is one final aspect of the project which is of relevance to this conference. The eventual aim is to embed the sensors in a garment (itself designed with aesthetic principles in mind) which the viewer will don when experiencing the installation. In this way the installation experience will take on a performative, as well as an experiential mode.

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