

GLOBAL MIND FIELD – A CYBERNETIC PERSPECTIVE

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Abstract

This paper examines the process and outcomes of a workshop event Global Mind FIELD presented at ISEA2013, Sydney. The workshop was conducted and facilitated by Karen Casey and Harry Sokol, with assistants Damian Smith and James Power. The researchers aimed to initiate and test for instances of neural synchrony between participants using creative visual stimulus, enabled by proprietary software program Viseeg (Sokol/Casey) and wireless EEG (electroencephalograph) headsets (Emotiv). The paper further examines to what extent the process of neuro-feedback and the resulting neural synchrony produced through the 'hard' and 'soft' interfaces can be viewed as indicators of a cybernetic mode of practice.

Keywords: Neuroscience, EEG, Brainwaves, Neurofeedback, Cybernetics, Neural synchrony

Introduction

Global Mind FIELD is a development of the ongoing Global Mind Project, an arts and cognitive neuroscience initiative developed by artist Karen Casey in collaboration with software designer Harry Sokol. Drawing on a prior research investigation into creative brainwave activity, conducted by Casey in 2003 at the Brain Sciences Institute in Melbourne, Global Mind Project is at once an exploration of technological possibilities for generative hybrid art forms and an interrogation of consciousness and creativity. At the centre of the Global Mind Project is a digital effects and animation software / interface Viseeg, developed by Sokol with Casey, which audiovisually interprets real time neural data.

To date artworks developed in the context of Global Mind Project were entirely artist driven and did not involve direct audience interaction. However, they were devised with the idea of eliciting related brainwave activity in the viewer, and it has always been a key objective to create future works that involved audience interactivity through neuro-feedback [1]. Works such as *Meditation Wall*, 2011[2] and *Dream Zone*, 2012 [3] for example, were relatively 'one way' affairs to the extent that

pre-recorded brainwaves were used to generate artworks that were viewed by audiences in a conventional subject-object sense. On the other hand, *Spectacle of the Mind*, 2010 was a performance event featuring artists Stelarc, Domenico de Clario and Jill Orr, which harnessed the brainwave activity of these well-known performers. As a stepping-stone to interactivity, *Dream Zone* involved Casey generating a feedback loop in the process of recording her brainwave data, thereby positioning herself as both spectator and creator of the work. Following these pieces, and in an effort to further develop artworks that harnessed neuro-feedback techniques amongst audience participants, Casey conceived of a workshop process that would require pairs of individuals wearing Emotiv neuro-headsets to engage in partnered exercises while observing on-screen visual effects created with or affected by their EEG data. The material would change or vary when neural synchrony occurred between the participating pair, thereby providing a visual queue that could be registered by the subject's brain.

In the logic of neuro-feedback, the brain naturally seeks stimulus and will register when a frequency range, such as *Alpha* (8-13 Hz) or *Theta* (4-7Hz), is correlative with external information. Throughout the workshop the more the brain aligned with a predetermined goal as programmed with the Viseeg software (in this case synchrony with a partner), the more feedback it received, thus creating a neural feedback loop.

The title *Global Mind FIELD* was a way of evoking the idea of a 'field' of consciousness; the field being the sum total of all the contributing minds, both in a specific context such as the workshop itself, but also more generally across the whole of human consciousness, be it temporally or geographically. The idea of a 'consciousness field' raises a number of complex questions, and unsurprisingly it has been a source of deep fascination throughout a range of disciplines, not least of all psychology, philosophy of mind and many spiritual traditions. Global Mind Project engages with the notion of this field, as was highlighted by arts writer Dr Julie Clarke in her essay 'Spectacle of the Mind' [4] (2009), where she states: "Casey's 'Global Mind Project' seeks to reveal how mind extension, enabled by technology, floods the receptive field and generates an inter-textual dialogue of fluidity, continuity and reciprocity that

unites us all and displaces the boundary between artists and audience, mind and world" [4]. From the position of the artist however, the urge to create artworks is not only a question of philosophy. It equally takes shape around a feeling of connection – a sensation of being linked to others and the world, both physically and mentally.

Fig 1. Stelarc, *Spectacle of the Mind* 2010. Photo © Malcolm Cross

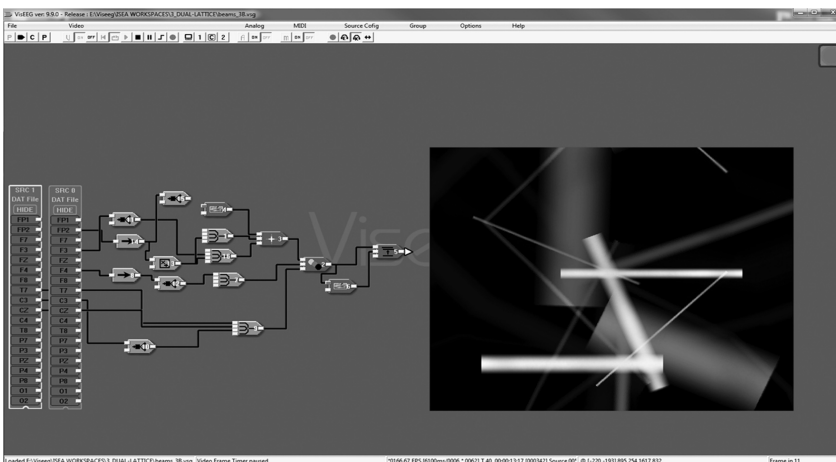


While the artworks produced through Global Mind Project are reliant on sophisticated software and technology, the project has more broadly been driven by an interest in three interlinking areas: creativity, cognition and the connections that arise and multiply when groups of people are engaged in creative pursuits. This triad of creativity, cognition and connection has come into focus through observing creative practitioners over many years, especially in collaborative and group settings. While this has arisen through personal experience and reflection, the authors have looked to a range of sources as a means of contextualizing some of the drivers behind Global Mind Project. Physicist and philosopher David Bohm's essential theory of the "unbroken wholeness of the totality of existence as an undivided flowing movement without borders" [5], for example, has resonance with the 'connecting', 'synchronizing', 'interrelating' features of the Global Mind Project. At a more immediate level, however, the simple desire to establish relationships through creative endeavor and to explore the potentials within those relationships remains very much to the fore.

Workshop

In conducting the workshops the research question was twofold: Firstly, can interpersonal neural synchrony be achieved and witnessed while it is occurring? Or to borrow a familiar phrase, can we observe when two people are ‘on the same wavelength’? Secondly, can creatively conducive brainwave activity be cultivated and enhanced via neuro-feedback techniques?

Fig 2. Viseeg dual participant workspace



The motivating factor behind these questions is grounded in creative process, and more importantly, creative inspiration. Creative thinkers, artists and scientists alike often speak of those ‘Aha’ or ‘Eureka’ moments when inspiration suddenly sharpens or crystallizes into focus. Though by no means universal, such moments can be both heightened and accelerated when realised through the interactions of two or more people. Artistically therefore, the workshop was designed as a situational arrangement, through which moments of synchrony might be witnessed precisely as they were happening. In this way instances of neural synchrony were the intangible ‘artifacts’ produced in the workshop while the ‘tangible’ on-screen imagery was merely a conduit to that formation.

The workshop consisted of a morning and afternoon group, of twenty-two participants in total, with two being casual observers only. Following a brief overview of the Global Mind Project workshop attendees were introduced to the concept of neuro-feedback, provided with Emotiv headsets and paired together at a laptop containing a series of visual mental exercises. The visualisations, as determined by Viseeg software, are constructed as a series of programmed ‘workspaces’ with specific ‘fixed’ pre-

etermined settings and certain variable parameters, which are affected by the various streams of input data, in this case both participant EEG data and stored imagery. The fixed components generally relate to the specificities of form and action while the variable data controls effects such as spatial/directional orientation and visual surfaces, colours and effects.

Although it might be argued that some form of visual data mapping might be crucial to the interpretation and therefore success of EEG driven work such as this, it was not our intention for either the aesthetics or the reception of the work to be overtly influenced by schematic representations of actual data. This was partly because it is not in keeping with the objectives of Global Mind Project and also because it would have been counterproductive, given that the intention was to engage in a free flowing observational process of creative and connected interaction as it occurred. For the purpose of these exercises, however, and to give participants a good indication that the desired goal was achieved, some simple graphic elements were employed, such as stylized oscilloscope effects, floating discs and intertwining trails, in such a way that indicated when synchrony occurred.

The aesthetic parameters as they are programmed and defined by the Viseeg software were determined either partially or entirely by the raw EEG data of participants. EEG data calculations were done on a percentage basis in order to establish a base reading and account for the variables in different subjects. According to Dr Geoff Mackellar, CEO of Emotiv Research, who attended the first workshop session, neural simultaneity calculated at a variable of 0.5% would be

within an acceptable range to be considered as synchrony.

In addition to frequency settings, the data was isolated according to regional areas of the brain, such as left / right hemisphere, frontal, temporal and occipital lobes. The brainwave frequencies Alpha and Theta [6] were alternately designated for the purpose of the exercises. Heightened creative mental states, and in particular creative inspiration and improvisation, are associated with elevated Theta frequency activity.

Although the notion of artistic creativity being a right brain dominated process has been questioned in recent times, it is still generally considered that the right side of the brain is responsible for many of the cognitive functions associated with inspiration and intuitive creative thought processes. According to neuro-scientist Professor Allan Snyder, Centre for the Mind, University of Sydney, transcranial magnetic stimulation of the left anterior temporal lobe can temporarily inhibit analytical reasoning processes, enhancing activity in the right temporal region of the brain, thus causing heightened creative and intuitive states not unlike that of artistic savants [7]. So while participants were monitored across the whole of their brain regions, for the purpose of the stimulating creatively conducive brainwave activity, attention was also directed to right hemisphere activity for several exercises.

These parameters set the stage for registering regionally specific brainwave frequencies and neural synchrony; however such factors alone were not enough to ensure that all of the workshop data was captured. Rather, a number of unforeseen technical issues diminished the amount of recorded information. Problems associated with the headset signal prevented the loading of alternative workspaces by participants; a factor that will be rectified in the future. Limitations notwithstanding, the available samples by no means repudiated the idea that two individuals using visualization effects as stimulus in a neuro-feedback process can result in neural synchrony between participants. Using this setup we find it is entirely possible to indexically signify (rather than ‘observe’ in the proper sense) neural synchrony in real time using digital visualization techniques.

While the size of the groups was insufficient to formulate definitive conclusions about neural synchrony, the results were characterized by surprisingly high instances of correlative brainwave activi-

ty, ranging from prolonged passages to fleeting and sporadic. At least one of the participants was circumspect about the exercises, stating, "I still felt my responses were quite random most of the time and that left me wondering about the exercises and/or the equipment." Conversely, another was strongly convinced, saying they were "Fascinated that the brainwaves could be controlled visually and as I discussed the same interests [with my partner] our brainwaves synchronized" [8]. Curiously, as the post-workshop surveys revealed, where most were 'pleased' with the resulting neural synchrony this did not necessarily translate into feelings of 'rapport' with their partners.

Cybernetics and the Global Mind

ISEA2013 proved to be an especially productive context in which to present and conduct the workshops and to consider the work of other artists and researchers. One such perspective that came to our notice was that of artist, theorist and historian Stephen Jones, who presented the paper 'Cybernetics, Conversation and Interactive Art' as part of ISEA's Latin American Forum.

Jones highlights the importance of 'conversation' as a contributing factor by which cybernetics [9] finds its proper meaning, suggesting that cybernetics is "about systems 'talking' to each Other". [10] Jones further states that "information has to change something within the 'receiver' while the response or the 'feedback' they provide has to change something in the original 'sender', thus modulating / moderating their response".

On listening to Jones' definition it occurred to the authors that one project that conformed to the cybernetic model was the recently conducted *Global Mind FIELD* workshops, precisely because the project involved a sequence of systems engaging in different forms of communication that were both intelligible to the systems and affected change in those systems. In *Global Mind FIELD* the interacting systems were both organic and inorganic, consisting of A) the Viseeg software, B) the Emotiv Epoch neuro-headsets and C) the brains of the human participants (specifically the electrical signals emanating from within the cerebrum). Within the arrangement the headsets acted as relay stations and were not therefore subject to any real change. In contrast, the screen based visual emanations produced by the Viseeg software changed in form and behavior when neu-

ral synchrony was detected, while the neural activity of the participants adapted to the situation, seeking to sustain the feedback incentive. We therefore see that the combination of systems, interaction, comprehension and change characterized this arrangement as cybernetic process.

Jones through mention of the experimental musician Stan Ostojka-Kotowski (1922-1994) who was not only engaging with cybernetics as early as the 1970s but was considering ways to enact brainwave activated cybernetic projects as well.

While the evolution of 'Global Mind

Fig 3. Harry Sokol & Karen Casey with workshop participants 2013. Photo © Damian Smith



Contextualizing *Global Mind FIELD* within the arena of cybernetic art presents an occasion to consider the work alongside other cybernetic practitioners and to learn from their experience. For example, Gordon Pask's, *The Colloquy of Mobiles*, 1968 [11], which Jones featured in his presentation, was conceived as a 'social system', whereby the 'male' and 'female' components interacted with each other and also with audience members, who in turn affected changes within the sculptural systems. In his introduction to the show, Pask wrote: "An aesthetically potent environment encourages the hearer or viewer to explore it, to learn about it, to form an hierarchy of concepts that refer to it; further it guides his exploration; in a sense, it makes him participate in, or at any rate see himself reflected in, the environment"[12]. Pask, it seems, was talking about a process not unlike neurofeedback, but also about our natural tendency to be excited by aesthetically rich environments, which turn stimulate and heighten our keenness of mind. This close association between cybernetic systems on the one hand and the workings and tendencies of the human mind on the other was alluded to by

Project' has occurred at a distance from other artists working in this arena, arising instead out of Casey's earlier interests with projects such as *Dreaming Chamber*, 1999 [13] and *Meditation in Alpha* 2004, we note nonetheless both a rich pre-modern history and contemporary field of arts and neuroscience cross-overs, which should be acknowledged here [14]. In our examination of artists working with similar themes we recognise the 2003 work by Mariko Mori, *Wave UFO* [15] that united and immersed three participants at a time in a visual interpretation of their brainwaves, and the recent collaboration project from Marina Abramovic, Dr. Suzanne Dikker and Matthias Oostrik, *Measuring the Magic of Mutual Gaze*, 2011 [16]. This project visualises synchronous neural activity that occurs between couples while they are looking into each other's eyes (which in itself provides a form of neural feedback).

While Abramovic's project is driven by feelings of empathy and mutual connection, *Global Mind FIELD* is determined by visual stimulus as a direct result of participants being able to measure or gage their responses through neu-

ro-feedback. As our observations attest, synchrony in this instance was not specifically linked to reciprocal feelings but rather to the suggestion of a desired outcome.

Conclusion

Global Mind FIELD was designed to be both an exercise in neural synchrony using creative visualization, and a situational process for enhancing creatively conducive brainwave activity; however, due to technical issues and time constraints a decision was made to focus on the neural synchrony aspect for the workshop. The responses from participants and the evidence captured suggest that neural feedback is achievable through visual devices as incentive triggers, wherein the brain will 'detect' and respond to the visual queues accordingly. While the aim of the project was to extend an ongoing investigation of the interplay between 'creativity', 'cognition' and 'connection', the multi-system components used in *Global Mind FIELD* can also be seen as a cybernetic mode of visual art practice.

In developing the neuro software interface Viseeg, Global Mind Project has attempted to capitalize on recent developments within the field of neuro technologies such as the Emotiv Epoch headset and also in the arena of neuroscience generally. In light of the combined developments since the late 1960s in art practices incorporating both neuro-interfaces and alternatively practices that make use of cybernetic methodologies, Global Mind Project is revealed as intersecting with both arenas of practice. As Global Mind Project progresses it is intended that future artworks will advance the cybernetic attributes of *Global Mind FIELD* with a view to involving multiple participants in co-creative visual, auditory and performance strategies.

Lastly, while it is possible to observe the brain's electrical activity, it remains impossible and most likely improbable that we might ever observe the processes that constitute mind, other than in the solitary confines of our own inner universe. The actions that constitute mind nonetheless can be indexically signified, deduced and communicated convincingly to others. While creativity is not alone as a signifier of mind, it maintains nonetheless a rather potent position, precisely because it serves to unite a constellation of processes and to bring into existence forms and concepts that were previously unavailable to our awareness.

References and Notes

1 Neurofeedback, sometimes referred to as neurotherapy or neurobiofeedback, was pioneered in 1962 by American researcher Dr Joe Kamiya. Neurofeedback works by providing or denying stimulus (usually auditory) to the brain when certain *in vivo* frequencies are present, thereby establishing an 'incentive' by which specified frequencies might be cultivated or inhibited.

2 O. Sahin, *ISEA2011 Istanbul Uncontainable*, exh.cat. (LEA Volume 18 Issue 5, 2011) <<http://www.leoalmanac.org/wp-content/uploads/2012/08/ISEA2011Uncontainable-Casey.pdf>>

3 P. McKay and A. Slack-Smith, *National New Media Art Award 2012*, exh.cat. (Brisbane, AUS.: Queensland Art Gallery 2012).

4 J. Clarke, *Spectacle of the mind - Global Mind Project*, exh.cat. (Melbourne, AUS.: Federation Square, 2010).

5 David Bohm, *Wholeness and the Implicate Order*, (London, UK.: Routledge, 1980).

6 Neurohealth Associates, *The Science of Brainwaves*, 2004, <<http://www.nhahealth.com/science.htm>>, accessed 1 September 2013

7 Allan Snyder, *Explaining and inducing savant skills: privileged access to lower level, less-processed information*, Phil. Trans. R. Soc. B (2009) 364 p.1399 <<http://rspb.royalsocietypublishing.org/content/364/1522/1399.full#sec-10>>.

8 K. Casey, *Global Mind FIELD - Workshop Survey*, contributor de-identified, 2013.

9 Although a relatively recent area of research, Cybernetics has a complex pre-modern history dating to Plato's 'First Alchibiades', where the term 'kybernetikos' (κυβερνητικός), 'good at steering' was introduced to convey a concept of 'governance'. Though the term is popularly associated with hybrid human/machines, it is correctly used to describe regulatory systems, their structures, constraints and possibilities. The term was coined by American mathematician Norbert Wiener in 1948, when he published *Cybernetics: Or Control and Communication in the Animal and the Machine*. (Cambridge, USA, Paris, FR.: MIT & Hermann & Cie Press, 1948). In the context of the Latin American forum Stephen Jones focused on the work of Anthony Stafford Beer and Fernando Flores, who worked for the Salvador Allende administration in Chile in the early 1970s and applied cybernetic theories to governance and industry.

10 Stephen Jones, *Cybernetics, Conversation and Interactive Art*, Latin American Forum, ISEA2013 <<http://www.isea2013.org/events/latin-american-forum-presents-1/>>, accessed 30 June 2013.

11 See: Rosen (undated) <<http://www.medienkunstnetz.de/works/colloquy-of-mobiles/>>, accessed 30 June 2013.

12 Gordon Pask cited in Peter Bentley, David Corne (eds), *Creative Evolutionary Systems*, p235, (Burlington, USA.: Morgan Kaufmann, 2001).

13 M. Neale, *Beyond the Future the Third Asia Pacific Triennial of Contemporary Art*, exh. cat. (Brisbane, AUS.: Queensland Art Gallery, 1999).

14 Composer Alvin Lucier's (b.1935) important *Music for solo performer*, 1965 is one of the earliest pieces of music, for instance, that responds to alpha brainwaves, detected through electrodes attached to the scalp. Again in the music arena, David Rosenboom (b.1947) was an early user of neurofeedback. (See for instance, *Brainwave Music*, A.R.C., 1976 - EM, 2007). In recent years there has been a proliferation of both sound and visual artists working in

the field, and significant symposiums such as 'Tangible Feelings' at the Centre for Digital Cultures and Technology, Brussels in 2011. Included were works and papers by practitioners such as Peter Beyls, Christophe De Boeck (*Staalhemel*), Thierry Castermans (*Numediart*), Mattia Casalegno & Enzo Varriale (*Unstable Empathy*), Alexis Chazard (*Post traumatic voyager*), Kiel Long (*The static organ*), Luciana Hailil (*IBVA*) and Valery Vermeulen (*EMO-Synth*).

<<http://www.imal.org/activity/tangible-feelings>>, accessed 1 July 2013. Notable also is Stephen Bar-rass and Diane Whitmer's *Baroque Duet for Cello, Violin, Two Hearts (ECG) and Two Minds (EEG)*, which premiered at the University of Pompeu Fabra, Barcelona, 2010.

15 Public Art Fund (2003), <http://www.publicartfund.org/view/exhibitions/5825_wave_ufo>, accessed 1 July 2004.

16 Soft Control (2012), <<http://kiblix.org/kiblix2012/softcontrol/?p=4>>, accessed 1 March 2013.