


Body Storytelling and the Performance of Memory: Arts-Based-Research and Human Enhancement

Maria Manuela Lopes^{1,2} 

¹ ID+ Instituto de Investigação em Design Media e Cultura,
Universidade de Aveiro, Aveiro, Portugal
mmlopes@ua.pt

² Instituto de Biologia Molecular e Celular, I3S,
Universidade do Porto, Porto, Portugal
maria@manuelalopes.com

Abstract. Since the late 1990s a new tendency has emerged in contemporary art whereby artists deploy archival research and scientific practices to explore the mechanics of historical representation, the location and material of memory and evoke the past. As a visual artist working with video, photography, film and scientific strategies and technologies (e.g. BCI's Brain Computer Interface and Biology/Bioengineering) Lopes explores the historical and personal representation and notions of memory materiality. Technologies, for memory preservation and enhancement of our humane bodies, are developing at a fast pace, and the corresponding dystopic and utopic future scenarios are constantly presented in speculative news reports, science research studies and popular culture such as science fiction. In this paper Lopes intends to examine two on-going artwork PostDoc research projects Enhancing the Mind's I and Emerging Self that address notions memory and representation, self-identity and the greater cognitive capacities promised by transhumanism and neuro-enhancement technologies.

Keywords: Art-based research · Neuroscience · Memory enhancement · Experiential cognition · Empathy · Embodied observation · Affect · Varela · Foucault · Latour

1 Introduction

We are facing a moment in time when our curiosity and technical possibilities (alongside some anxiety and fears) are propelling us to move from using the created techniques to restore our bodies to “normal” functioning, to using them to increase our innate abilities and, conceivably, add new body and mind capacities. Lopes' believes that, our use of enhancement techniques will increase in frequency, in the sophistication of the technologies and in the purposes for which they are currently used.

It's difficult for humans to live in the present; we are mind wired to be anxious about the future, and to dwell upon the good things of the past. These instincts allow us to carry on, since overestimating negative future possibilities better prepares us for them, and having nostalgia for the past suppresses memory of pain, hardship, making life overall seem better and more worth investing in. As the author investigates more about

emerging technologies, alongside the experience of the Doctorate research in connection with the Dementia patients (that showed the fragility of memory and cognition), Lopes' [1] located what was looking for in terms of ethics, philosophy, aesthetics and the ability to have tangible tools for bettering the world. The author instills the spectator's natural fire in them to drive innovation, cooperation and life preservation, The provocation and complexity presented in the installation art works intend to ensure innovation gets pushed forward, defending empathy, better communication and outreach for these fields. These works are ultimately about the fragile and contingent nature of memory and human futures; they invite the audiences to ponder the different dimensions, costs and unintended consequences of enhancement. Lopes' work extends and challenges this entwined relationship.

This paper is an exploration of the issues raised on the development of several artwork projects during the course of the author's Postdoc research, when in residency at a molecular biology institute - I3S, dealing with distinct studies and scales on memory (functioning and enhancement).

Lopes paper is a bid on critical evaluation of the production of the art works; departing from an understanding that the observer is not independent of reality [2] and that observation and experience are constructed [3]. In this understanding Lopes' explores the possibilities that memory and knowledge do not reflect a real exterior world, but a real interior world and attempt to play with possibilities to create empathy and affect in the audiences. Damásio [4] recognizes consciousness as resulting from the organism capacities to understand its emotions and the surrounding to interact with them; in line with his claim the art projects emphasize the need to clearly include emotions and affects that context triggers in humans.

Throughout the development of the text and artistic experiments concepts of self and memory emerge, for which the approach to the past experience does not appear as a sentimental and diverting nostalgic fantasy but, on the contrary, as a strategy to reflect critically on the present and re-imagine the future. The projects proposes a reflection on the ethical sides of Human Enhancement and the technologies, such as BCI or new digital tattoos (NT), promising a permanently refining the human form and mind by technological enhancement and to raise questions surrounding memory and identity through art installation and possible next steps in the human body's evolution. The author explores whether is it possible to translate ones emotions directly into an object as a memory of a certain moment.

The idea behind *Enhancing the Mind's I* is to design with the mind (both metaphorically and literally in a performance incorporating drawing, video, neurofeedback and brain computer interaction) multiplying ways in which memories become embodied and externalized, by using Lopes brainwaves as tools for a new humanistic arts based-approach.

Emerging Self explores the sensorium of surrounding space through innovative (artistic bioengineered) body tattoos that are perceived differently according to the body reactions to the surrounding space. Body perception, emotions and memory are expressed in skin – allowing differing selves to emerge.

Both art works attempt to expand on Foucault and Varela's challenge of surpassing the 'limits of representation' by allowing the mind that remembers to observe itself in

the act of remembering. Lopes paper seeks to establish a speculative framework to inform holistic design choices from the perspective of philosophical and culturally relevant debates and a solid understanding of the art installations and Human perception, viewing perception as an active process and rejecting the Cartesian separation of body and mind. This approach is aligned with the ideas of phenomenology about embodiment – seeing the body, action and movement as the basis for experience and meaning (memory). This includes a consideration of the use of metaphors and living matter as synesthetic drivers of meaning, understood in and across different sensory modalities. The result is the opening of a critical gap between the way sciences produce knowledge about the subject and the affect produced by the experience of the viewer on the installation art works.

2 Art Making with Memory Matters

2.1 The Laboratory

The unique method/structure of the research presents an innovative holistic model for practice-led research: negotiating the interests of the involved institutions and NERRI (Neuro Enhancement Responsible Research and Innovation) project, schedules, bureaucracies, funding, and the public dissemination of its results in educational workshops, conferences, performances and exhibitions. It brings together understandings of the institutional and cultural framing of visual strategies, archiving and therapies; interrogating the possible application of scientific practices/inscriptions in subjective/visual discourse on memory but also assessing how are the novel technologies and practices (or the knowledge of their existence) for neuroenhancement reaching the general public.

The installation art projects correspond to a broader universe of research on different areas of memory, from technologies and techniques for memory enhancement, to strategies of acquisition (astrophysics imaging), preservation (archiving, recording, sampling - Botany) and communication (drawing, writing). Testing the boundaries, mixing old methods (such as mnemonics) with the current new technologies (such as Brain Computer Interface or Neurofeedback) Lopes makes the audiences wonder whether we should enhance ourselves, or seek to modify our children? What is being modified? There is no ground zero once many of the dimensions of human enhancement are evolving with the species subtly and pervasively.

While the press and the laboratory environment surrounding Lopes' practice covers the advancements on biotechnology and biomedicine the author finds the discoveries entwined with material seductions and ethical and social implications, thus her practice explores the subtle permutations of technology and aesthetics, utility and perils that inform and mediate the biotechnological creation of meanings. Memory practices and technologies of replication, processing, emergence and reproductions are ingrained both in the laboratory and the author' art practice, sharing semantic models of representation rooted and embedded in traditions of practice and available to novel arrangements as the frontiers of meaning, material shift, traces and matter.

The daily molecular biology and bioengineering laboratorial works reminds the author of the recent understanding of life's molecular architecture and the ability to

control its workings adding a subtle promise to the understanding and control of memory and emotions and extension of the body timeframe. Since polymerase chain reaction (PCR) discovery and the readings of the genetic codes of living systems that scientists can read, alter, copy, edit and splice the genes bringing with it the panoply of dreams for reshaping the world we live in (internally and externally). The techniques are nowadays used to human applications in numerous forms such as genetic diagnostics, assisted conception, tissue engineering, and regenerative medicine, bringing about a new genre of human body repair or enhancement through technological assistance. Hence, if concepts such as truth, vision and knowledge are already complex in science and art fields, they seem to be contested in the future scenario when vision may be altered towards a more cyborg like performance (with x ray or infrared possibilities). If in the near future, neural implants could improve our ability to perform physically and mentally, at present researches are exploring ways to improve athletes' performance with gene doping (i.e. enhancing performance by adding or modifying genes), creative surgical enhancements (e.g. using skin grafts to create webbing between a competitive swimmer's fingers and toes) and mechanical prosthetics (e.g., the prosthetic legs used by double-amputee, athlete and top model Aimee Mullins). If in the research domain new cases of enhancement possibilities and promises burst frequently, in the public domain we were recently presented with an advance form of neural interface in the manner of the exoskeleton that allowed the paraplegic to kick the ball at the beginning of the Brazil world cup in 2014. With the concomitant advances in the digital domains, the increasing number of artificial, synthetic and biological extensions and processes are used to rebuild dysfunctional organs, to reconstruct damaged ones and to enhance others. The author asserts that biotechnology is remaking human bodies and identities and that it is important that art reflects on that stance.

The biological laboratory presents a labour-intensive (craft like) and visual world, with the guesses, hints or concepts and principles being translated into designed protocols that when followed reveal the abstract domain that preceded all the synthesizing, apparatus, labour, instruments and 'inscriptions' [5].

2.2 The Embodied Mind

The embodied approach, taken by Chilean researchers Maturana and Varela [2] or Dreyfus [6], deeply re-evaluates the role that subjective experience plays in the construction and expression of cognition and knowledge; following that it adjusts the research interests and methodologies useful to investigate the so-called embodied mind, the mind that is ontologically expressed by the connection with the body and the environment, the mind that has an ontological first-person dimension. It is the switch in the paradigm from a behavioural and computational one, towards an holistic and 'ecological' one (able to consider the central question for the science of the mind: the problem of 'Who', the problem of the subject and of the subjective perception of the world; the introduction of the term 'experience', which takes together the subject/object relationship in an ongoing, real, live modality and which offers a completely different perspective on the mind and the way to study it), that inspires this empirical and explorative search.

From the embodied perspective, as well as in Merleau-Ponty [7], the cognition is not considered only as the results of a series of cerebral functions that somehow and somewhere interface with the body of the thinking subject. Instead, it has to be better seen as the result of the constant and structural interface activity with the body and the environment, the result of the sensory-motor information that create the background from which the mind can emerge and the horizon to which the mind can watch [7]. The body constitutes the cognition itself, it generates it, and it is its phylogenetic and ontological matrix.

Thus memory, consciousness, self, all may be said to emerge both evolutionarily and biographically from the relationship of the mental and bodily aspects of the human nature, and with the environment, creating the lived experience [8]. To know an object, Varela [9], pointed out, is to know the moment that generates the knowledge, being the mind of the knower in the process of knowing. One needs to go out of oneself to observe oneself in the act of knowing or observing. Subject and object co-specify and modulate each other. Knowledge depends on being at/on the world on the enactment of subjects in the world, upon the material, on its embodied condition.

In this line of thoughts, consciousness might be considered as the awareness of what is happening in a specific context in a specific moment: Then what are we precisely aware of? The body is the first object of four perceptions. Even when we don't intentionally often pay attention to the kinetic sensations the sensorimotor system creates what António Damásio calls the proto self [4]. The body gives us the autobiographical memory continuity, or the common sense of self; the awareness of being the person we are, the same person of the day before, in a certain environment in a certain moment.

To Maturana and Varela [2], context is not independent of the subject but a background to intrinsic facts, therefore it is not objective and may not be conceived and understood independent from the ontogenesis of organisms. The environment and experience shape the mind; the thought does not merely relate to the body as an object of the outside world but is made from it [7], it does not result solely from the interactions in the brain, which is a specific organ, but in person, that is the organism. Foucault demonstrated that the knowing subject is the result of historical and social constructions, emerging from a set of rules and relationships that work in his/her body. The self is then not a determined or specific entity but an emerging result of the body enactment in/through the world (to the author the self is co-constructed by memory).

2.3 The Art Projects

'Humans are cyborgs in the more profound sense of being human-technology symbionts: thinking and reasoning systems whose minds and selves are spread across biological brain and nonbiological circuitry'.

Andy Clark (2003: 3) [11].

Enhancing the Mind's I. If the idea we have of ourselves is to be projected onto a material to be assessed by others (as in neuropsychology assessment) what is being judged? The communication skills, the capacity to lie and perform as expected by the viewer, the speed on which the task is performed, the imagination or the embedded

memory? L. on participating as witness in several clinical neurological assessments, found visual plasticity and conceptual challenge on the relationship established between the complexity of the functioning of memory and the personal and constant construction of identity and also the strategies used by different fields of research to explore this entwined relationship. As an artist the researcher shares some tools and technologies with scientists, such as drawing, human-computer interaction and techniques of biotechnology; similarly L. is interested in understanding the materiality of memory, its functioning and the extension of remembrance, thoughts and personality from personal to collective engagement. If the preserved memory is intended to be passed on to others, it needs to be extracted from one's own mind and presented in a way that would make it accessible for others to perceive. The author explores whether is it possible to translate ones emotions directly into an object as a memory of a certain moment.

In cognitive science, visual mental imagery or 'seeing with the mind's eye' has been the subject of considerable controversy, especially concerning the underlying neural processes. Are mental images intrinsically different from thoughts expressed verbally? Is image information represented in a spatial format? How much is a person's perception of the blue sky due to memories of early visual experiences? Does mental imagery involve the activation of representations in the brain's visual cortex? Does an ability to generate strong mental imagery contribute to creativity? While in the last two decades there has been an intense effort to resolve these questions, most of the answers still elude us. In summary, seeing is considered a complex and mostly intellectual exercise, whether expressed pictorially or verbally. The physical act of seeing is strongly influenced by memory, visual perceptions and cultural experiences. The ability for this multilevel interpretation might be acquired at an early age, or even embedded in our genes but mostly it is a learned process. In the sciences clarity of expression (or interpretation) is essential.

Nevertheless, fine arts accommodate subtlety, and occasionally deliberate obscurity. In all instances, the image-maker is a communicator. An understanding of the act of seeing is pertinent in the process of mental image creation. Although it appears now, that visual mental imagery and visual perception share common underlying mechanisms, there are several reports, which show them to be dissociated, reflecting the basic modular organization of the visual cortex. Quoting Koster (1998): 'the binding of cellular activity in the processing-perceptual systems is more properly envisioned as a binding of the consciousness generated by each of them. It is this binding that gives us our integrated image of the visual world.'

The result is the opening of a critical gap between the way sciences produce knowledge about the subject and the affect produced by the experience of the viewer on the installation art works. The idea behind *Enhancing the Mind's I* (Fig. 1), is to design with the mind (both metaphorically and literally!) multiplying ways in which memories become embodied and externalized, by using L. brainwaves as tools for a new humanistic arts based-approach.

L.' explores unpretentious ideas of enhancement, such as the invention of the writing itself, as a development that simultaneously extended and impaired human memory, by providing an externalized written record but diminishing people's ability to memorize by removing the necessity of learning by heart. Husseyn [10] inquires about the

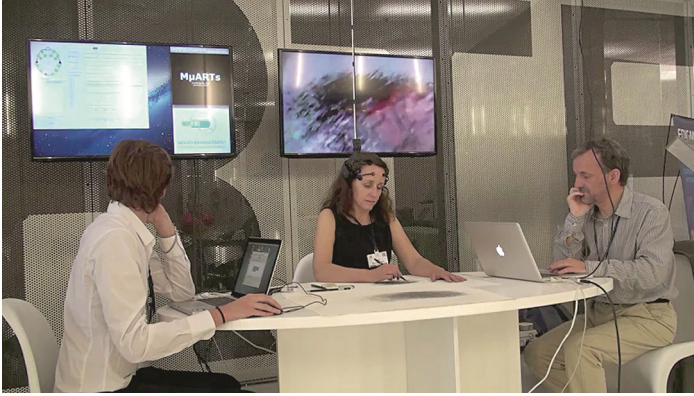


Fig. 1. Enhancing the Mind's I. Detail; Performance, Brave New World, Casa da Música, Porto, (Portugal). (L., in collaboration with Bastos, Marques & Teixeira 20) Source: L., 2015.

consequences of writing for human memory and further on the role technologies impact on our natural skills providing examples for contemporary discussions around human enhancement through technology and how external memory aids and other new technologies such as brain computer interfaces, are always double-edged, extending or fixing certain powers while eroding traditional skills.

Although the use of Brain Computer Interfaces (BCIs) in the arts originated in the 1960s, with the pioneering performances of Alvin Lucier, there is a limited number of known applications in the context of real-time artistic performances and accordingly the knowledge base of this area has not been developed sufficiently. Among the reasons are the difficulties and the unknown parameters involved in the design and implementation of the BCIs.

However today, with the dissemination of the new wireless devices, the field is rapidly growing and changing, and it is visible that artists work are harnessing the electroencephalogram (EEG) signals, bridging various methods and technologies and arising questions both in art/technology and in human experience. This project aims to develop cross-disciplinary relationships and encompass their evolving research to interrogate societal, artistic and ethical attitudes to neuroenhancement, memory and the preservation of the body, exploring the potential of neuro-stimulation/neurofeedback and EEG for artistic research.

A BCI is a system that captures the brain electrical activity in the form of EEG signals; further it translates those specific features of the signal that represents the intent (or unconscious desire) of the user into computer readable commands, Allowing its user to control a machine (e.g. a computer, an artificial limb, or any other machine) solely with brain activity rather than the peripheral nervous system. A typical BCI combines neurophysiological measurement technology with machine learning software to automatically detect patterns of brain activity that relate to this specific mental task. Control with a BCI is originated when a user performs a specific mental task.

Exploring ‘drawing with the mind’ (through the body action and possibly literally through thought and memory) by using the performer/artist’s memory brainwaves as tools for a new humanistic arts approach, is driven by several questions, such as;

- Is it possible to measure something intangible as memory and creativity?
- What can we learn from what brainwaves show us?
- Will wearing an EEG device influence the drawing process?
- Will clinical neuro-enhancing through neurofeedback expand the drawing capacity?
- Can one translate his/her emotions/memories directly into an object as a memory of a certain moment/place?
- Can new technologies allow us to observe the acts of remembrance and memory while forming new memories of that experience?

In the performances L. produces a series of Drawings following a neuroscientific/psychological guideline for psychological assessment on identity and sense of self (i.e. The TST – twenty statements test protocol is to complete the 20 times in a row the sentence ‘I am ...’). The drawings are constructed by writing, in graphite, sentences starting by ‘I am’. After 20 sentences there is an interruption in the flow and the artist erases partially the resulted drawing. Immediately after that effacing action L. counteracts enacting the procedure of writing another set of 20 sentences. Each event is performed after sessions of neurofeedback (Fig. 2) for cognitive enhancement (memory and creativity stimulation) and while having the author’s brain being sensed for the different waves it produces. EEG measures frequencies of L. brain activity (Alpha, Beta, Delta, Gamma, Theta) relating to her state of ‘consciousness’ while wearing it. The data collected from EEG is translated in real-time to the computer that uses software to detect the brain waves and then transforms that information into data sending it to another computer which performs further actions (such as sending information into Processing or Arduino, which is linked with Max/MSP to receive data and generate sound or video or even controlling several printing and embroidering machines that produce further drawings). The EEG records the ‘drawings’ that L. brain is producing while thinking ‘who she is’ (i.e. who ‘am I’) and the production of the drawing is recorded in real time video. That video file is feed into the computer that edits it accordingly with the coordinates dictated by the performer brainwaves while drawing. The audience has access to the performance scenario and also to the video images of the brain waves captured by the first computer and furthers the projection of the final edited video. The drawings will endure until exhaustion of the material surface, her memory or other unpredictable enforcement.

Spaces, places and objects hold presences, experiences, wishes and memories that are constantly reshaped. We conceptualize our memories, verbalize them and confine them to the boundaries of a narrative (or several and in distinct moments, contexts and materials). Is art able to hold memories without deforming them by rationalization? Is BCI able to confirm that if as an artist L. is able to externalize her memories whilst remaining faithful to their own fleeting emotions, paradoxical, liminal and conflicting feelings, sorrows and joys, all those irreducible inner events that constitute the nature and identity of a person.



Fig. 2. Enhancing the Mind's I. Detail of Neurofeedback session performed at Neurobios, Clinica Professor Doutor Marques Teixeira, Porto, (Portugal). Source: L., 2015.

Emerging Self. In *Emerging Self* the materials that in biotechnology are used to mark a specific gene or any other technique used to investigate the inner workings of human bodies will be turned to reveal the boundary surface presenting in the skin the internal reaction to an inside or outside trigger.

Skin and touch, although primordial, are often undermined and veiled with conventions and taboos, but humans need touch to prosper psychologically and maintain health. L. emphasizes that we tend to be illiterate in terms of haptic memory and touching vocabulary, that even the proximity gestures invading personal space engender, sometimes, social awkwardness. The skin as a self expression canvas through the medium of decorative, protective, religious or medicinal tattoos dates far back and evidence of its instruments has been found from the Palaeolithic Period [12] with tattooed human bodies recovered from the Neolithic Period [13]. Traditional tattoo methods inscribe permanently the marks in the skin limiting future interventions and the reversal of the process.

New experiences and technologies provide ground for, in a similar way to the laboratorial apparatus, our own skins to become the inscriptive devices as well as matter that will allow narratives to unfold. As tattoos and scars are conceived as traces of emotional experiences, the expectation of the project is to produce tattoos that react according to environment conditions (interior or exterior variations), transforming the user body in a visible dynamic network organism. This is a concept of 'Dynamic Tattoo' [14].

This reversal of the power of the understanding of the network of reactions to sensitive environment might be considered an equivalent to the enabling of a seeing gift that substitutes empathic recognition or medical inspection. The attentive gaze could be substituted for a glimpse, and that would bring about a new set of human/human and human/machine relationship paradigm. Rather than being what we produce or the results of what our body produce (such as illness symptoms or actions driven by feelings) the subjects of observation, the proposed explorative art projects with the human machine interface bring about the possibility that memory itself is the object of scrutiny literally

presenting itself through the visible reactions on the surface of the skin or the results of the performance.

This unveils potential new dilemmas that are connected with culture, experience and environment rather than biological roots or racial identities if memory and feelings ought to be revealed at the surface of our actions or skins, as well as the empowering of the utopic controller of the settings that manage the coding of the interface relationship.

Skin and touch are often considered as minor in terms of sensing and learning. Skin may sense temperature, reacts to emotions and senses texture and other features conventionally attributed to vision, such as perception of different color through their electromagnetic frequencies. The conventions of representation and the visual culture have developed over decades both in art as in science. Further and further the scientific and technological visual culture defines the future scenario in terms of health, consumption, energy but also on the sense of humanness and the relationships we establish with the surrounding context.

Skin not as just a breathing organ but as a material 'membrane as liminal state of transience', as a metaphor for the exploration of what is natural or artificial, duration or memory. In contemporary life [15], skin, membranes and tissues rest in a pervasive cultural position positioning as an instrument and metaphor across theory and praxis.

In the beginning of this century wearable's field of research [16] promised to be a revolution offering opportunities for the creation of smart clothes that could perform functions according to the body's needs and adapting to the environment. Reminders of things to carry (such as keys or wallet), performing temperature feedback and adjustments in the clothes accordingly, or wearable medical devices that could monitor body conditions, was amongst the potentials. Although research on these fields is still expanding, to the author, those investments were surpassed by the research into new materials such as e skin or e ink that could transform the photonic or electronic technology that clothes/objects we transport could be made of, into something that could be made onto or under our skin and therefore be always present and not depend on the context or remembering of carrying the 'special jacket'.

In the past decade e skin research as exponentially grown [17] and the capacities and progress resemble science fiction narratives with sensors and circuits exceeding the properties of biological skin in many aspects (e.g. stretching further, superior spatial resolution.). The challenge still rests in its connections to the neural interface, something that the BCI are expected to solve in a near future [17].

New biocompatible materials and technologies are being developed and keep surfacing in the scientific magazines and the news, some of them belong to the areas of software and electronic engineering, materials and computer science, and other to biology, nanotechnology and bioengineering. With the development of new technologies, new kinds of dynamic tattoos are envisioned, enabling new types of situated and 'embodied multi-modal communication' [18] and body/machine, body/environment relationships.

Some art projects such as (Tanguy Duff – Viral Tattoo; Art Orienté objet - Artists' Skin Culture; Amanda Wachob – WhipShade; Jill Scott - E-skin: Somatic Interaction or Wim Delvoye – Tim) already explore the techno-scientific scenarios, biocompatible materials and ethical considerations and cross modal potential expansions of communication through tattoo based projects and skin. This project leans on the existing ground

of technological advances and conceptual context and is based on collaborations taking bioengineering materials outside the laboratory into the cultural domain. Apart from the dynamic of mass production or even desired consumption, this biological art project presents a speculative prototype for memory and imagination consumption. However the approach and discourse are those of arts and design in the fusion of objects, materials, social dynamics, production aspirations and the converging network of ‘actors’, an inquiry in the field of interaction between ‘humans and nonhumans’ [3].

If in the bioengineering laboratory the biomaterials are researched for health purposes, this project, at the interface of science, culture and technology explores the biological artefacts as well as all the surrounding dynamics of its construction encouraging new modes of engagement with the contemporary understanding of the fluctuating range of life forms and matter.

The *Emerging Self* deals with the dialogical relationship between the body and its representation and how the current bio-surveillance techniques have subtly undermined the conceptual parameters of this exchange. New technological tattoos may be considered an innovative field where cutting edge scientific and technological experimentation meets imaginative and speculative scenarios of creativity. The possibility of a real skin tattoo that would reflect and react to the emotional states and the environment plays on the inverted observation point that visualizing technologies in medical research have been exploring in recent decades (i.e. foregrounding the interior over the exterior). With dynamic settings possibly adjusted to each user the seeing through the skin process would become a malleable subjective process reversing the image process of the medical arena where expertise and converging fields are necessary to produce and interpret access to ones bodily structures and functioning’s.¹

3 Conclusion

Within Lopes research, the recognition of time and memory and the role these play in the construction of definitions of memory workings or loss and cognitive enhancement have come to the fore. The chosen approach is a poetics of time; identity and fragility, which explores the past, present and future of the memory studies portrayed within the scientific archive. The structure of the practice as a temporal bricolage displays a fragmented, multiple, jumbled narrative, where chronology itself is disrupted. Her explorative works intervene within the scientific/popular discourse to contribute to expanded ways of thinking about and looking at construction and validity of memory and identity, body and normality, and representation versus mediation, using art as a tool to enhance public awareness of several anxieties, disorders and technologies, raising ethical

¹ The continuous monitoring of biometric data that could be acquired from these extended tattoos and Human Computer Interfaces in an ordinary life situation (in line with the technological devises mentioned above being presently researched) explored as context in the art projects, holds a seductive appeal in terms of aesthetics giving rise to functionality; but furthermore to author it presents an unsettling future life style of bio control, demanding new elaboration of interpersonal exchanges between humans, biotechnological entities, computers and archival strategies.

dilemmas and questioning norms of behavior. The ambiguity of historical/personal time and the myth of authenticity are considered through an exploration of how the archive is assembled. The fragmentary nature of the practice ensures that no complete meaning can be fixed. The interlocking of historical and personal time, and the conjunction of both facts and fiction, enables a plurality of voices to be heard, contesting any dominant scientific or historical linear narrative.

The biological act of neural reprogramming through memory and learning and the parallel biotechnological and human, non-human relation in the irreversible collapse of the boundaries between interior and exterior, self and other, natural or artificial implied in the explorative art projects suggest the self reformulation of memory process, more evident in the era of the digital archive and the brain computer interface.

Acknowledgement. FCT Grant SFRH/BPD/98356/2013).



References

1. Lopes, M.M.: Representational strategies on Alzheimer's disease: a practicebased arts research in a neuroscience laboratory. Doctoral dissertation, University of Brighton and University for the Creative Arts - Farnham, UK (2013, unpublished)
2. Maturana, H.R., Varela, F.J.: *Autopoiesis and Cognition: the Realization of the Living*. Springer, Dordrecht (1980)
3. Latour, B.: *Pandora's Hope: Essays on the Reality of Science Studies*. Harvard University Press, Cambridge/London (1999)
4. Damásio, A.R.: *The Feeling of What Happens: Body and Emotion in the Making of Consciousness*. Houghton Mifflin Harcourt, New York (2000)
5. Latour, B.: *Science in Action: How to Follow Scientists and Engineers Through Society*. Harvard University Press, Cambridge (1987)
6. Dreyfus, H.: *What Computers Can't Do*. MIT Press, Cambridge (1972)
7. Merleau-Ponty, M.: *Phenomenology of Perception*. Routledge, London (2002)
8. Gallagher, S.: *How the Body Shapes the Mind*. Clarendon Press, Oxford (2005)
9. Varela, F.J., Thompson, E., Rosch, E.: *The Embodied Mind: Cognitive Science and Human Experience*. MIT Press, Cambridge (1993)
10. Huyssen, A.: Present pasts: media, politics amnésia. *Publ. Cult.* **12**(1), 21–38 (2000). Winter
11. Clark, A.: *Natural Born-Cyborg*. Oxford University Press, Oxford (2003)
12. Gilbert, S.: *Tattoo History: A Source Book*. Juno Books, New York 2000. (2005)
13. Dickson, J., Oeggl, K., Handley, L.: *A Saga Revivida De Ötzi, O Homem Do Gelo* (2003). http://www2.uol.com.br/sciam/reportagens/a_saga_revivida_de_otzi_o_homem_do_gelo.html
14. Bitarello, B., Queiróz, J.: Embodied semiotic artefacts: on the role of the skin as a semiotic niche. *Technoetic Arts J. Specul. Res.* **12**(1), 75–90 (2014). doi:10.1386/tear.12.1.75_1. Intellect Ltd. Article. English Language
15. Jens, H.: Who's afraid of the in between? In: Hauser, J. (ed.) *Sk-In Exhibition Catalog*. Fact Liverpool (2008)

16. Tao, X.: *Wearable Electronics and Photonics*. Woodhead Publishing Limited in Association with the Textile Institute Abington Hall, Abington, Cambridge (2005)
17. Hammock, M.L.: 25th anniversary article: the evolution of electronic skin (E-Skin): a brief history, design considerations, and recent progress. *Adv. Mat.* **25**, 5997–6038 (2013). Wiley-Vch Verlag GmbH & Co. KGaA, Weinheim. [Wileyonlinelibrary.com](http://www.wileyonlinelibrary.com)
18. Bitarello, B. Fuks, H.; Queiroz, J.: New technologies for dynamic tattoo art. In: *Tei Fifth International Conference on Tangible, Embedded and Embodied Interaction*. ACM, Funchal (2011). ISBN 978-1-4503-0478-8. <http://doi.acm.org/10.1145/1935701.1935774>