

Breathing Life into the Virtual:
Towards Intersubjective Intimacy in Mixed Reality Art

Jessica Kirsh

A Thesis
in
The Department
of
Art History

Presented in Partial Fulfillment of the Requirements
for the Degree of Master of Arts (Art History) at
Concordia University
Montreal, Quebec, Canada

September 2015

© Jessica Kirsh, 2015

CONCORDIA UNIVERSITY
School of Graduate Studies

This is to certify that the thesis prepared

By: Jessica Kirsh

Entitled: Breathing Life into the Virtual: Towards Intersubjective Intimacy in Mixed Reality Art

and submitted in partial fulfillment of the requirements for the degree of

Master of Fine Arts (Art History)

complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

Signed by the final Examining Committee:

_____ Chair

_____ Examiner
Dr. Nicola Pezolet

_____ Examiner
Dr. Cynthia Hammond

_____ Supervisor
Dr. Alice Ming Wai Jim

Approved by

Dr. Alice Ming Wai Jim
Graduate Program Director

_____ 2015

Rebecca Taylor Duclos
Dean of Faculty of Fine Arts

ABSTRACT

Breath can bridge bodily and psychological boundaries between the subject and object, Self and Other, human and computer. By creating an interactive zone between the virtual and the real, Mixed Reality artworks have the potential to recontextualize breathing as a synchronized mode of communication. The following three projects, *ALIBI* (2002) by Calgary collective The Einstein Brain Project, *Mobile Feelings* (2002-4) by Austrian artists Christa Sommerer and Laurent Migonneau, and *Coexistence* (2001) by Los Angeles-based artist Rebecca Allen, facilitate interpersonal relationships between human and machine or between two humans that contribute to a shared embodied experience and intersubjective intimacy. By experimenting with new technologies such as anatomically-lifelike body interfaces, haptic mobile devices or force feedback game pads, these artists explore ways in which a person's biological imprint can be measured through their breath, as well as how participants react and understand each other through the exchange of biodata, without any need for physical contact or verbal language. By analyzing these works through phenomenological and neuroscientific discourse, this thesis seeks to provide a nuanced discussion about the levels of intimacy, emotion, or embodied connection felt by the individuals participating in these hybrid environments in the context of today's hypermediated world.

TABLE OF CONTENTS

Introduction	1
Section One: Breath in New Media Art: From Illusion To Interaction	7
Section Two: Channeling Qi and Auratic Energy in The Einstein’s Brain Project’s <i>ALIBI</i>	15
Section Three: Communicating Feeling States in Sommerer and Migonneau’s <i>Mobile Feelings</i>	23
Section Four: Synchronizing Senses in Rebecca Allen’s <i>Coexistence</i>	32
Conclusion	36
Images	40
Bibliography	49

INTRODUCTION

This thesis examines the ways in which three Mixed Reality art works have engaged with the intersubjective potential of breathing as a synchronized mode of communication: *ALIBI* (2002) by Calgary collective The Einstein Brain Project, *Mobile Feelings* (2002-4) by Austrian artists Christa Sommerer and Laurent Migonneau, and *Coexistence* (2001) by Los Angeles-based artist Rebecca Allen. I argue these Mixed Reality works facilitate interpersonal relationships between human and machine or between two humans that contribute to a shared embodied experience and intersubjective intimacy. In the field of new media art, Mixed Reality is understood as a phenomenon that conflates virtual and physical data. In Mixed Reality environments, human perception of real space becomes augmented through virtual objects that appear to be physically present. In contrast, Virtual Reality acts as a stage for the disconnection between the body schema and the body image, as a “self-contained fantasy world.”¹ Virtual Reality intersects real and virtual world objects in a single experience in which users are fully immersed in virtual space and feel they are losing touch with their real surroundings. In the late 1980s, virtual simulation became more sophisticated because of advancements in processing graphic images in real time and increased capabilities of sensor technologies. Users started to feel more connected to computer-generated worlds in which they could surf and navigate through immersive visualization devices. With the help of technological advances such as American scientist Ivan Sutherland’s head mounted display in 1970, which allowed users to see real surroundings and virtual objects simultaneously,² computer-generated objects became seamlessly incorporated into three-dimensional space, or alternatively, real world elements became fused within a digitally

¹ Mark B. N Hansen, *Bodies in Code: Interfaces with Digital Media* (New York/London: Routledge, 2006), 4.

² Christa Sommerer, Lakhmi C. Jain and Laurent Migonneau, *The Art and Science of Interface and Interaction Design* (Berlin: Springer, 2008), 142.

generated environment. These technological advances in Mixed Reality allowed individuals to interact with virtual simulations perceived as actual things in actual space, adding or altering their experience.³ The “virtual” in these later immersive environments performs a different function: it denotes an ontological state or condition – the “liminal domain wherein existence can take place and where users can ‘be.’”⁴ The goal of Mixed Reality is for the virtual to completely converge with natural perception (i.e., sight, taste, sound, and touch).

This thesis uses a case study methodological approach to examine instances in media art where a fusion of the virtual and the actual can take place. The three artworks I have selected provide participants with the opportunity to experience breathing *with* technology and *with* each other. Taking an interdisciplinary approach, the thesis draws from different perspectives in the fields of media studies (incorporating the real into the virtual in new media art), phenomenology (experiencing touch and perception in interactive environments) and neuroscience (Affective Computing and mirror neurons), as well as addresses the cultural and ethical issues associated with breath. Research findings are based on primary sources such as email correspondence, interviews, artist statements, exhibition didactics, reports on user responses as well as secondary sources, such as scholarship in the fields mentioned, especially those that include examples of breathing in art history and definitions of intimacy. I have inserted my own observations and ideas into this contemporary discourse, which continues to rapidly evolve alongside technological advancements.

The three artworks explore ways in which a person’s biological imprint can be measured through their breath and how participants react and understand each other through the exchange of biodata. In order to understand the sensuous nature of these often intimate encounters, the

³ Lev Manovich, “The Poetics of Augmented Space,” *Visual Communications* 5/2 (2006): 220.

⁴ Frances Dyson, *Sounding New Media: Immersion and Embodiment in the Arts and Culture* (Los Angeles/London: University of California Press, 2009), 1.

thesis begins with a survey of the diverse tactile and optical senses defined by various philosophers, psychoanalysts and scientists. These theories help to discern how breath became part of this discourse as a mode of subjectivity and exchange, in which the user may *touch* or *be touched* without any physical contact. As a cosmological and biological phenomenon, breathing provided humanity with its first and primal act of communication in a “being-in-the-world-with-others-mode.”⁵ Looking at breath as a medium or mediator in Mixed Reality expands an individual’s understanding of his/her senses as well as the senses of others.

Before beginning, I would like to note how participants or users (I use both terms interchangeably) are understood in this thesis as comprised of experts, non-experts and the general public. Each of the discussed artworks is experienced differently according to the individual interacting with it, which leads to a questioning of the participatory and democratic underpinnings of Mixed Reality environments.⁶ Interacting, or, to be more precise, how to interact with such advanced technology requires a certain amount of skill and knowledge, leaving some inexperienced users frustrated and confused. In fact, experiences of and with these artworks vary greatly depending on where they are shown (i.e., science lab, museum or university) and who interacts with it (i.e., students, artists, scientists, or regular museum-goers). Since the early days of Mixed Reality, the drastic change in one’s perception of materiality and space has resulted in very intense physical and emotional reactions from participants. Today, although people in general are perhaps more accustomed to these immersive states, or at least the idea of them, newer technologies, such as the haptic technology in *Mobile Feelings*, or the game pad technology in *Coexistence*, may not yet be as familiar to some. The diverse audiences for

⁵ Lenart Skof and Emily A. Holmes, eds., *Breathing with Luce Irigaray* (New York and London: Bloomsbury, 2013), 7.

⁶ For a critical analysis of relational aesthetics and the social practice of collaborative/participatory art as “antagonistic”, see Claire Bishop, *Artificial Hells: Participatory Art and the Politics of Spectatorship*, (London; New York: Verso Books, 2012).

this kind of work is important to bear in mind because the struggle to coexist with this technology would be apparent in the user's breathing rhythm, adding an interesting dimension to the artistic experiment. Although the machine relies on a human's output to function, the user does not have full agency due to the artwork's demand for technological compliance. In addition, ablebodiedness also plays a factor in these immersive environments.⁷ Poorly-equipped bodies – such as those with who suffer from hyperventilation, anxiety, and asthma⁸ – affects both the participant's subjective as well as intersubjective experience. Regardless of an individual's physical capabilities and technological knowledge, however, the participants in interactive new media environments are often “computed by the piece rather than existing in a fluid exchange with it, such that the aesthetic interest of the environment consists primarily in clarifying the visitor-system correlation.”⁹ The participant has the potential to exert an influence on the content of the mediated communication, a supposed two-way exchange, but he/she never truly gains control over it.¹⁰ This technological predicament is what new media scholar and philosopher Mark B. N. Hansen refers to as “bodies-in-code,” where the body has “submitted to and constituted by an unavoidable and empowering technical deterritorialization.”¹¹ This thesis bears these issues in mind even though it focuses on only a small sample of user responses; it is

⁷ Note: “immersion” as a form of technological sublime devolves into a problematic and exclusionary form of transhumanism, marginalizing individuals and communities who may have limited access to technology and/or, for religious reasons or otherwise, believe in a more “traditional” form of bodily sanctity.

⁸ Anxiety is defined as a “state of tension signaling the potentiality of an impending disaster, or a warning of danger from the pressure of unacceptable internal attitudes erupting into either consciousness or action, with the consequent response of the individual personality of society to this eruption,” whereas asthma is a “frightening inability to breathe resulting from narrowing of the pulmonary airways due to edema, inflammation, and spasm of bronchial smooth muscle and mucosal wall, accompanied by an increased formation of mucous, symptoms include wheezing, cough, and shortness of breath.” Robert Fried, *The Psychology and Physiology of Breathing in Behavioral Medicine, clinical Psychology, and Psychiatry*, (New York/London: Plenum Press, 1993), 205.

⁹ David Cecchetto, “The Trace: Melancholy and Posthuman Ehtics,” In *Humanesis: Sound and Technological Posthumanism* (Minneapolis: University of Minnesota Press, 2013), 96.

¹⁰ Christine Ross, “Spatial Poetics: The (Non)destinations of Augmented Reality Art,” *Afterimage* 38/3 (2010): 24.

¹¹ Deterritorialization is a term coined by Deleuze and Guatarri, signaling a detachment of socio-cultural practices from their origin. Hansen reappropriates this term by insinuating that embodiment can only be realized in conjunction with technics. Hansen, 110.

understood that these users have been granted accessibility to the work and considered physically fit to experience the work adequately.

The objectives of this thesis are to: 1) provide a brief survey of relevant examples that focus on a user's experience of breathing in the historical trajectory from Virtual Reality to Mixed Reality art, understanding that these two forms co-exist; 2) examine the main scientific, psychological, and symbolic definitions of breath to which these works refer; and 3) present an analysis of the three case studies and their user responses. This thesis is divided into four sections. Section One provides a brief historical outline of the breathing in art, expanding upon its more recent use in Virtual and Mixed Reality. Section Two introduces *ALIBI* by the Einstein's Brain Project, consisting of anatomically lifelike model that can visually, through thermochromic paint, and aurally, through MIDI soundscapes, respond to a participant's biodata (i.e., brainwaves and breath). I will look at the different cultural conceptions of breath being incorporated through this practice. Section Three analyzes *Mobile Feelings* by Christa Sommerer and Laurent Migonneau, which deploys haptic technology, including sensors that translate pulse and respiration, in order to mediate two users' biological processes and feeling states. Here I will examine breath as a mode of communication in which a connection is created between two distant users through their biodata. Section Four discusses *Coexistence* by Rebecca Allen, an interactive two-person game that uses breath to eliminate computer-generated graphics which obstruct their view of each other. I will conclude with a discussion on way in which co-breathing may establish a sense of intimacy among the participants.

The universal, biological process of breathing is often considered a tactile, fluid sensation inherent to the human body and a solitary act. My select case studies of media artworks involving breathing, however, demonstrate ways in which new media technologies allow for the

translation of breath through a mechanical prosthetic (whether a stereoscopic helmet, breath vest or brain tracking device), enabling an intersubjective experience that no longer requires any visual, textual or audible language. In this way, my thesis seeks to contribute to the discourse of breathing in Mixed Reality art. The mediation of breathing patterns in my case studies (whether visually/aurally in *ALIBI*, or physically felt in *Mobile Feelings*) lends to a better understanding of a user's body, perceptions, emotions and relationships to others and objects: being able to witness another participant's output and interact with the artwork by being connected through a virtual simulation of bodily contact (such as in *Coexistence*) implicates them in a intersubjective exchange. This is what I mean by *breathing life into the virtual*: human and machine co-exist in Mixed Reality, a synthesis of computer-generation and visualization of biodata, thus making apparent the emotive and ephemeral workings of the body and machine.

SECTION ONE

Breath in New Media Art: From Illusion To Interaction

Spanning only two decades, the history of Mixed Reality artwork that feature breathing is a relatively short one. However, artists were experimenting with the romantic, ephemeral, and visceral properties of breath in creative practice long before new media. For instance, one of Marcel Duchamp's famous readymades was a glass ampoule filled with Parisian air exhibited in 1919 titled *50 cc of Paris Air* (fig. 1). Arte Povera artist Piero Manzoni's *Artist's Breath* (1960) featured a balloon inflated with his own breath (fig. 2). As it deflated, the rubber became stuck to the wooden base on which it was displayed. Irish novelist and playwright Samuel Beckett's directed a remarkably short thirty-five second play *Breath* (1969), which consisted of a littered stage void of actors yet filled with a loud recording of a birth cry, a long inhalation and a subsequent exhalation with the lights coordinated with the intensity of the sound (fig. 3). Serbian performance artist Maria Abramovic and her partner, German artist Frank Uwe Laysiepen (Ulay), staged a performance called *Breathing In, Breathing Out* (1977), which consisted of the two artists breathing in and out of each other's mouths for nineteen minutes while their oxygen and carbon dioxide levels become increasingly unbalanced (fig. 4). Colombian artist Oscar Muñoz has been creating portraits since 1996 that require a spectator to breathe on the surface to create condensation and reveal the image (fig. 5). Chicago-based new media artist Sabrina Raaf's *Breath Cultures* (1999) captured people's breath onto petri dishes and recorded their bacterial growth (fig. 6). Most recently, Mexican relational architect Rafael Lozano-Hemmer has created several projects that experiment with the preservation and recycling of breath, kept alive through a machine without the presence of a human body. His 2012 piece, *Last Breath*, features a small

motorized brown paper bag that inflates and deflates 10,000 times a day, functioning as a portrait or living memorial of a senior respected artist (i.e., Cuban singer Omara Portuondo in the first version) (fig. 7).¹² An extension of this piece was created a year later for the project *Vicious Circular Breathing*, installed in Istanbul, Turkey in 2013 then Madrid, Spain in 2014, which is a hermetically-sealed apparatus that invites the public to breathe the air that was previously breathed by participants before them. Local Quebec media artist Jean Dubois has made several public installations that call for the breath of participants. For example, *Tourmente* in 2015 (fig. 8), allowed passersby to interact with a series of portraits displayed on a screen by blowing air into their mobile phones; their breath appeared to be translated into a wind that blew onto the face of the displayed person.¹³ In 2008, *À portée de soufflé* (featured in several international media exhibitions, including those held in Montreal, St. Petersburg, Melbourne, South Korea and Reims) enabled participants to interact with a screen displaying two actors blowing bubbles out of chewing gum; by breathing onto their phones, the participants could adjust the air being blown into the gum, which could eventually burst (fig. 9).¹⁴ These works introduce various connotations of breath in art: as an inter-penetrable sphere of intimacy, a connection between private and public, anxiety due to bacteria in the air, as well as ephemerality and transparency. In the forthcoming cases studies, the focus will be less on the materiality of air in art, and more about the act of breathing as a synchronous exchange.

These ideas carry through into artworks that use new media technologies to *mix* reality. However, before discussing Mixed Reality art, I begin with a prehistory of cybernetics to provide

¹² Rafael Lozano-Hemmer, "Last Breath," *Antimodular Research, 1992-2015*, Accessed July 18 2015, http://www.lozano-hemmer.com/last_breath.php.

¹³ Jean Dubois, "Tourmente," Jean Dubois (2013), Accessed September 1 2015, <http://www.jeandubois.info/blog/project/tourmente/>.

¹⁴ *Ibid*, "À portée de soufflé," Jean Dubois (2013), Accessed September 1 2015, <http://www.jeandubois.info/blog/project/tourmente/>.

a brief contextual background for Virtual Reality (VR) and Mixed Reality (MR). From 1945-1960, a period which came to be known as the foundational era of cybernetics, dozens of distinguished researchers met at annual conferences to brainstorm a new theory of communication that would apply equally to humans, animals, and machines.¹⁵ By further investigating into neural information processing, the analogy of binary code to biological systems, as well as the cosmic significance of the cybernetic paradigm, the result was a new way of perceiving humans, essentially as similar to intelligent machines. As an attempt to extend liberal humanist subjectivity, cybernetics advocates that the machine “could perform like a man.”¹⁶ During the war, however, there was a strong emphasis on homeostasis, the striving for stability under strenuous circumstances. This stability extended to machines via the feedback loop, allowing for more sophisticated technology and an increased flow of information. Three actors – information, control and communication – could operate together in order to synthesize the organic and the mechanical.¹⁷ After World War II, the center of interest shifted from the cybernetics of the observed system to the cybernetics of the observer. As the field of artificial life began growing rapidly, computer programming allowed for creatures to develop and take on a life of their own (beginning a new school of thought called posthumanism, to be discussed in Section Four). This interactive relationship being formed between computers and living organisms has been helpful to understanding intersubjectivity in new media, and the cybernetic goal to synthesize the organic and the mechanical was to be considered at great length in the context of Mixed Reality.

¹⁵ Katherine N. Hayles, *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics* (London: The University of Chicago Press, 1999), 7.

¹⁶ Hayles, *How We Became Posthuman*, 7. Note: I prefer the use of gender neutral terms in my own writings.

¹⁷ *Ibid*, 8.

In 1999, Professors Paul Milgram and Herman Colquhoun of the Engineering Department at the University of Toronto came up with a diagram that illustrates the Mixed Reality range, or Reality-Virtuality Continuum (fig. 10). This continuum contains the sub-realms of Augmented Reality, which incorporates virtual elements to an enhanced perceived reality, allowing interaction in a real world environment while the user receives additional computer generation information. It also contains Augmented Virtuality, which maps real images onto virtual surfaces, including live streams and 3D geometries within the built environment.¹⁸ These MR phenomena are often used to advance fields such as mobile computing and applications, engineering, architecture, design, education, and medicine. Mixed Reality invites the application of other senses besides vision, such as three-dimensional sound and haptics in which the technology responds to tactile interactions with virtual space. Perception is no longer controlled solely by the human body in physical space, but by a designer's criteria in the space that he/she has created.¹⁹ Void of bodily spatial references, this new virtual perception in MR offers a new sensorial model. The trajectory from Virtual to Mixed Reality in art initiated a shift from illusion to interaction, altering and challenging human conceptions of simulated environments and ultimately providing a great ground for artistic experimentation.

An early example that showcases this crossover from Virtual to Mixed Reality is German artist Ulrike Gabriel's 1992 work, *Breath* (fig. 11), which created a zone where virtual and real objects can co-exist and intermingle in a more expansive form. In Gabriel's work, participants were fitted with a waist harness equipped with sensors that monitored and collected data on the

¹⁸ Xiangyu Wang and Marc Aurel Schnabel, *Mixed Reality In Architecture, Design, And Construction* (New York: Springer Science & Business Media, 2008), 4-7.

¹⁹ Sommerer, Jain and Migonneau, *The Art and Science of Interface and Interaction Design*, 141.

rate of breathing.²⁰ By regulating their breathing, participants could alter the dynamics of sound reproduced and images projected. Their breathing caused the blue polygonal edges in the computer-generated image to oscillate: the more regular the breathing, the more complex and chaotic the visual and acoustic processes became. The output of the current user built upon the data from the previous user, continually influenced by new information. New media scholar Anna Munster describes the work as:

a kind of interaction which is not direct, like one-to-one interaction, [where] you push a button and immediately something happens...you influence it slowly by putting energy in it through your breathing...this again you then perceive by watching it, which influences your breathing so you are somehow connected to outside by this current.²¹

This interaction that Munster describes foregrounds my discussion of Mixed Reality as a zone of interaction – either between humans, computers or objects – made possible through the flow of energy mediated by breath. By expanding virtual space beyond the two-dimensional resolution of a screen and transforming real space into an interactive environment, a more fluid relationship between users and interface objects could be established.²²

Another key example of this new perceptual interplay between the physical and virtual worlds involving breathing is Canadian digital media artist Char Davies' groundbreaking piece *Osmose* (1995) (fig. 12). Mark B.N. Hansen describes it as the “first major immersive VR environment to ‘resist’ simulation of perspectival space,” because it changed our relationship to cyberspace by making the virtual world a more habitable and human space, provoking a variety

²⁰ Media Art Net, “Ulrike Gabriel,” accessed August 3 2015, <http://www.medienkunstnetz.de/artist/u.gabriel/biography/>

²¹ Anna Munster, *Materializing New Media: Embodiment in Information Aesthetics* (Dartmouth, N.H.: Dartmouth College Press, 2006), 4.

²² Sommerer, Jain and Migonneau, *The Art and Science of Interface and Interaction Design*, 142. The field of Human-Computer Interaction (HCI) was also integral to the realization of Mixed Reality. Coined by IBM researchers in their foundational 1983 book *The Psychology of Human-Computer Interaction*, HCI studies how spatial design affects the interaction between user and computer interface.

of intense emotional and physical responses from its immersants.²³ As a “fluid interpenetration of realms,” constantly transforming according to the user’s navigation, Davies’ work is thus categorized as a prime example of Hansen’s definition of Mixed Reality art.²⁴ . In 1995, hundreds of visitors, invited to experience breath, interaction and movement by wearing their own physiological data, lined up at the Musée d’Art Contemporain de Montréal and signed a disclaimer before being fitted with a breath and balance vest and stereoscopic helmet resembling a life support contraption. Each participant emerged from the chamber shaking, smiling or speechless.²⁵ By controlling their breath to float up or fall down and shifting their center of balance to change direction from left to right, they were able to navigate through over a dozen nature realms which Davies’ constructed using computer generated graphics and sound (fig. 13). *Osmose* exemplifies the emotive and metaphorical quality of breath. Like sound and voice, the work’s virtual environment constantly moved from inside to outside; the fluctuating rhythm, whether deep breathing or holding one’s breath, relayed current feeling states (shock, wonder, terror).²⁶ Participants were compelled to alter their senses, displacing vision with tactility and proprioception. As phenomenologist Maurice Merleau-Ponty explains, perception is not solely attained through our eyes but through our “flesh” or senses: “we see ‘through’ our eyes only because they are visible, because they are ‘of’ or ‘belong to’ visibility.”²⁷ Sight is always in physical contact with another “look,” which suggests perception is a mode of intersubjectivity and intercorporeality.²⁸ I denote breathing in this sense as “quasi-seeing” (to borrow Alva Noe’s

²³ Hansen, 110.

²⁴ *Ibid*, 2.

²⁵ *Ibid*, 109.

²⁶ Frances Dyson, *Sounding New Media: Immersion and Embodiment in the Arts and Culture* (Los Angeles/London: University of California Press, 2009), 113.

²⁷ Sue L. Cataldi, “Chapter 3: Depth and Flesh,” in *Emotion, Depth and Flesh: A Study of Sensitive Space* (Albany: State University of New York Press, 1993), 66.

²⁸ Merleau-Ponty defines vision in corporeal terms: thickness, corpuscles, tissues, grains, waves, channels, circuits, currents, embryos, and pregnancy. Kelly Oliver, “The Look of Love,” *Hypatia* 16/3 (Summer 2001): 69.

term), a somatosensory neural activity that realizes visual experiences and does not rely on the typical parts of the body and brain uses to see.²⁹ .

By navigating and engaging with digital content in Mixed Reality environments, participants are given agency, freeing them from the passive experience of simply watching. This new type of hybrid space mirrors the effect of ubiquitous computing in our everyday life, connecting digital and physical worlds to an array of visual, social and cultural references in varying degrees.³⁰ The effectiveness of Mixed Reality is less about the digital devices that are used (whether it be video surveillance, cellphone technologies, or computer/video displays) but more about the human subject's cultural and aesthetic experience of or with them. In turn, the body loses all reference through the heightening of corporeal and affective. Embodiment no longer represents the realities of technoculture because the body has been integrated seamlessly into the atmosphere. As new media scholar Francis Dyson writes, "thinking of atmospheres also returns us to the breath, to the continuous and necessary exchange between subject and environment, a movement that forms multiplicity existing within the space necessary for sound to sound, and for Being, in whatever form, to resonate."³¹ Her observation of breath as a form of mediation of between humans and objects, in aural, visual, sensual or emotional form, is useful for my analysis of intimate and empathetic interactions in Mixed Reality environments to be discussed in Sections Three and Four.

These immersive experiences rely not only on the output of biological properties but also on the senses being pointed back onto participants by a mechanical apparatus. Touch has long been recognized as physical contact on the surface of human skin – skin being the border

²⁹ Alva Noe, *Action in Perception* (Cambridge, Mass.: The MIT Press, 2006), 26.

³⁰ Steve Benford and Gabriella Giannachi, *Performing Mixed Reality* (Cambridge, Mass.: The MIT Press, 2011), 44.

³¹ Dyson, 23.

between the bodily exterior and interior,³² and between intimacy and the outside world. This boundary marks a limitation to an individual's inhabited space, presenting possibilities of control over the body and self. In the examples I have discussed and the case studies to follow, one is offered rare glimpses into what lies beneath the porous skin. By making the invisible visible, as exemplified by artworks such as *ALIBI*, breath can translate the energy and emotion of a user – heightening his/her sense of self-awareness as well as establishing a new type of relationship with other actors involved.

³² A concept of interest here is the term “skin-ego” coined by psychoanalyst Didier Anzieu that refers to the period when the psychic ego differentiates itself from the body ego while remaining indistinguishable from it in the imagination. Didier Anzieu, *The Skin Ego*, trans. Chris Turner (New Haven/London: Yale University Press, 1989), 40.

SECTION TWO

Channeling *Qi* and Auratic Energy In The Einstein's Brain Project's *ALIBI*

The collaborative group of scientists and artists, “The Einstein’s Brain Project” (hereon referred to as EBP), whose core members include Paul Woodrow (Professor from the University of Calgary) and Alan Dunning (Chair of Alberta College of Art and Design’s Media Arts and Digital Technologies Programme), have been examining how the body performs in the world in real and virtual forms since 1996, drawing from various conceptualizations of breath as a source of energy with multisensory properties. The title is a wink at Roland Barthes’ essay of a similar name, “The Brain of Einstein,” from his book *Mythologies* (1957),³³ locating Einstein’s brain as fetishized physical object, isolated from the rest of the world and unable to account for the richness of human experience.³⁴

EBP argues that human experience is inherently Mixed Reality; technology, the world, and human embodiment all act as contributors. Breath, in this case, acts as the link between inside and outside, human and computer, Virtual and Mixed Reality. EBP speaks to a desire for technology to reveal the constructedness of everyday life, bringing to the fore invisible elements of biological existence and the dynamics of living systems. The project members believe that as technology progresses, the human body is being increasingly represented by electronic and statistical means, creating “a surrogate yet absent body.”³⁵ EBP instead creates alternative data spaces that allow for the flesh and blood body to be more fully and accurately represented.

³³ Roland Barthes, *Mythologies* (Paris: Éditions du Seuil, 1957).

³⁴ Katherine Hayles, “Flesh and Metal: Reconfiguring the Mindbody in Virtual Environments,” *Configurations* 10/2 (2002): 310.

³⁵ EBP, “The Einstein’s Brain Project,” University of Calgary, accessed January 1 2015, <http://people.ucalgary.ca/~einbrain/new/main.html>.

The EBP work *ALIBI* (“Anatomically Lifelike Interactive Biological Interface”), consisting of a life-size model of a human body was first showcased as the centerpiece of EBP’s 2000 cycle *Madhouse* (fig. 14) at TechnOoro art center in Montreal, Quebec. (*ALIBI* has also been used for their series *Dérive*, *Pandæmonium*, *the Mnemonic Body*, which generated a variety of immersive environments.) Using a brain-wave recording device, a body-interface monitors the biological and physical output of a participant’s own body, including electroencephalography data, skin temperature, electrical resistance, speech, gesture, and motion.³⁶ The life-size model of a body is painted with thermochromic paint, appearing dark blue when cool and white when warmed by human touch or breath. By looking through glasses, participants can see pre-recorded images of degraded black and white images, including distorted views of people, buildings, objects in motion, and faded memories of the city. These simulations manifest in response to their mental activity as detected by electrodes. When the participant’s brain waves are at ease, the environments and sounds are slow and smooth. As they respond, the environments and audio become jagged and fast paced.³⁷ In addition, the amplitude and frequency of brain waves are converted to MIDI (Musical Instrument Digital Interface) files, creating a soundscape.³⁸ Participants are given a real-time visual and aural manifestation of their brain and biological activity (resembling colorful lines and light spots). In a separate adjacent “viewing room,” visitors are able to observe the activity, although void of virtual simulation. To the spectators who are not immersed, the participant simply appears to be manipulating the life-like body, like

³⁶ Alan Dunning and Paul Woodrow, “Electric Flesh – The Electromagnetic Medium: The Einstein Brain Project,” *Technoetic Arts: A Journal of Speculative Research* 3/3 (2005): 163. Electroencephalography data are records of electrical activity in the brain. <http://www.britannica.com/science/electroencephalography>.

³⁷ *Ibid.*

³⁸ MIDI is a file protocol for the exchange of information between computers and musical devices, such as synthesizers. <http://www.britannica.com/art/MIDI-music-technology>.

a “pathologist examining a corpse.”³⁹ *ALIBI* acts as an interface to a diffused boundary, “neither properly here nor there, akin to a dissipating, permeable boundary reminiscent of a rapture of the deep.”⁴⁰ Thus EBP suggests that the phenomenon of virtuality is not necessarily external to the body, but can be inside the body; the interface acts as a transitional plane between the two worlds.⁴¹

In their essay, “Electric Flesh: The Electromagnetic Medium,” EBP mention they are inspired by the Chinese and Indian/South Asian processes and techniques of breathing, namely *qigong*, *tai-chi*, and *yoga*, which release the flow of peptides from the brain stem throughout the body and attempts to restore homeostasis.⁴² In *qigong* practice, the circulation of breath is used to harmonize movement and stillness.⁴³ Macro-cosmic orbit forms, or rather the circulation of light and energy cultivated in *tai-chi* and meditation, are applied to seek stillness in movement in moving as well as to seek movement in stillness.⁴⁴ *Yogic* breathing methods, founded in ancient Asian cultural and religious practice and used in transcendental meditation and behavioral medicine, advocates both breathing through the nose instead of through the mouth, and abdominal breathing in a slow and rhythmic pattern instead of chest breathing.⁴⁵ This practice is meant to facilitate the flow of an exogenous energy, or spiritual life force that circulates within and between all things (called *prana* in India and *Qi* in China). By adopting a “state” during

³⁹ The Einstein’s Brain Project, “The Mnemonic Body,” Accessed 20 August 2015, <http://people.ucalgary.ca/~einbrain/new/main.html>.

⁴⁰ Arthur and Marilouise Kroker, eds., “Digital Inflections – The Einstein’s Brain Project: Alan Dunning and Paul Woodrow in Conversation with Ted Hiebert,” *CTheory*, 1/25/2011, Accessed January 1 2015, <http://www.ctheory.net/articles.aspx?id=678>.

⁴¹ Hayles, “Flesh and Metal,” 310.

⁴² Dunning and Woodrow, 157.

⁴³ Steve Edwards, “A Psychology of Breathing Methods,” *International Journal of Mental Health Promotion* 7/4 (November 2005): 33.

⁴⁴ *Ibid.*

⁴⁵ Fried, 233.

which slow, rhythmic nasal and abdominal breathing prevails, subtler meanings of thought can be perceived.⁴⁶

The EBP collective is also influenced by the notion of bioelectromagnetics, the scientific study that “all living organisms host electrical events, and currents are present in the body that produce magnetic fields that extend outside the body.”⁴⁷ Bearing this research in mind, EBP seeks to demonstrate the concept of what they call the “bodymind” which they use to describe how the flesh, body and mind are intermingled in a tactile experience. The concept of “bodymind” is seen as the negation of dominant Euro-American beliefs that the body and mind are separate, and that the skin is the limit of human selves.⁴⁸ EBP have initiated a unique interdisciplinary, hybrid system of representation with the goal, as Dunning and Woodrow write, to “produce virtual worlds that are capable of displaying agency, effect and interaction in real-time.”⁴⁹ Through interwoven acts of viewing and participation, one’s inner and outer body’s functioning can be expressed through non-verbal feeling (biological output of the human body, heart rate, respiration, body temperature, skin resistance, body temperature, and carbon dioxide levels). Immersed in these unique Mixed Reality environments, participants can navigate through the worlds by recognizing their own biological states in relation to the virtual forms. The vital energy being exhaled – breath – acts as a bridge between inhabitants virtual and physical world, expressed aurally (through a soundscape) and visually (through projections).

Another notion important to the interpretation of *ALIBI* is “aura,” or auratic presence, which EBP claim can be viewed outside of the physical body, manifested through his/her

⁴⁶ Fried, 233.

⁴⁷ Dunning and Woodrow, 159.

⁴⁸ This mind/body dichotomy, which existed to various degrees in influential currents of thought in Europe and North America, such as Neoplatonism and Scholasticism, as well as in Descartes’ philosophy, has been criticized and deconstructed extensively in the sciences, religious cultures and philosophy.

⁴⁹ *Ibid.*, 160.

biological functions.⁵⁰ They believe that an aura can provide an actual and spiritual image of the whole body shape.⁵¹ The term “aura” derives from the Greek and Latin words for “breeze” and “breath,” subtending both proximity and distance.⁵² Breath, from several world views, symbolizes this aura as the energy, consciousness, soul or spirit of life that leaves a person at death and continues in some other form. In Judeo-Christian tradition, for example, God created man by exhaling his breath into matter according to the Bible’s Book of Genesis.⁵³ As such, breath has been poetically and spiritually attributed to notions of life-force or the presence of life in non-organic objects. In his well-known 1936 essay “The Work of Art in The Age of Mechanical Reproduction,” philosopher Walter Benjamin famously describes the shrinking of an artwork’s aura as it is reproduced by technological means.⁵⁴ The medical definition of aura brings touch and vision together through the substance of air or breath or vapour.⁵⁵ For ancient Greek physicians, aura referred to a sensory hallucination accompanying epileptic seizures.⁵⁶ Basically, in any context, to “auraticize” an object is to imbue it with the capacity to breathe and extend to them the distance accorded to living beings.⁵⁷ Art historian Richard Shiff asks in his essay “Breath of Modernism (Metonymic Drift)”: “What could be more immediate, present, and

⁵⁰ Damian Sutton, Susan Brind and Ray McKenzie, eds., *The State of the Real: Aesthetics in the Digital Age* (New York, NY: I.B. Tauris & Co. Ltd., 2007), 116.

⁵¹ The Einstein’s Brain Project, “The Auratic Body,” Accessed 20 August 2015: <http://people.ucalgary.ca/~einbrain/new/main.html>.

⁵² Richard Shiff, “Chapter 7: Breath of Modernism (Metonymic Drift),” in *In Visible Touch: Modernism and Masculinity*, ed. Terry Smith (Sydney: The Power Institute of Fine Arts, 1997), 185.

⁵³ In Job 27: 3-4, the prophet says “as long as my breath is in me, and the spirit of God is in my nostrils; my lips will not speak falsehood, and my tongue will not utter deceit.” (RSV translation). John 20:22, Jesus himself breathes on his disciples, which endows them the powers of the Holy Spirit. Breath is indeed associated with the notion of divine inspiration and of divine presence in human persons.

⁵⁴ Walter Benjamin, *Das Kunstwerk im Zeitalter seiner technischen Reproduzierbarkeit*, (Suhrkamp Verlag, 1936), trans. J.A. Underwood, *The Work of Art in The Age of Mechanical Reproduction* (London: Penguin Books Ltd, 2008), 7.

⁵⁵ Shiff, 193.

⁵⁶ *Ibid.*

⁵⁷ *Ibid.*, 185.

personal than breathing?”⁵⁸ As he states, everything in life begins and ends with a breath.

Gestures such as sighing, panting, and feigning a yawn turn breath into a sign – an autonomous sign reserved for human biological agency.⁵⁹ Through Mixed Reality devices, the immediate and ephemeral quality of breath can be translated and mediated in real time.

Examining EBP’s project and their objective of taking into consideration views other than dominant Eurocentric perspectives on breathing significantly brings forward disparities of breath in cultural discourse. In her 1999 book *Entre Orient et Occident*, feminist philosopher Luce Irigaray examined the different perspectives on breathing in Eastern and Western cultures.⁶⁰ According to Irigaray, people in the Western tradition “breathe badly.”⁶¹ People should learn through Eastern practices, such as yoga, which equate breath with life in order to cultivate a conscious sharing of air. For Irigaray, air has the most special place; the capacity to breathe in a free manner correlates to being in charge of one’s life. Irigaray theorizes the air that we breathe is already exhaled or traced by another, although each breath remains unique. Space is never empty as the density of air is continuously separating and connecting us. Irigaray’s goal is to cultivate a collective, social and cultural respiration.⁶² Interesting to this discussion, Irigaray analyzed Martin Heidegger’s ethics of breath in her essay *The Forgetting of Air in Martin Heidegger* (1983). Heidegger’s original text *Forgetting of Air* sought an alternative to the presupposition that space is empty, leading to some fundamental alienation.⁶³ By “forgetting air,” Heidegger imagines us being thrown into an empty abyss, confronting only nothingness. In contrast, Irigaray proposes that by “sharing breath,” we can be in *touch* with our differences and

⁵⁸ *Ibid*, 187.

⁵⁹ *Ibid*.

⁶⁰ Note: I have personally refrained from using these binary terms Eastern and Western being as they convey exoticism and homogenization of world geography.

⁶¹ Luce Irigaray, “The Way of Breath,” in *Between East and West: From Singularity to Community*, trans. Stephen Pluhacek (New York: Columbia University Press, 2002), 73.

⁶² Irigaray, 75.

⁶³ *Ibid*, 65.

learn to respect them.⁶⁴ Her formulation has the ability to foster a new culture of love for the other, as well as for ourselves.

By initiating an exchange of breath in interactive environments, participants are given the opportunity to communicate not through words or images, but through energy – on an intimate, biological, and emotional level, which is something that the works discussed in this thesis aspire to. Further, I consider *ALIBI* as a proposition to critique essentialist thoughts on breath. This discussion of breathing practices rooted in Chinese, Indian and South Asian traditions, in relation to “aura” most commonly used in Eurocentric modernist discourse, brings forward a consideration about the supposed universality of biological functions.⁶⁵ Although Irigaray’s geographic and cultural separation of “East” and “West” is problematic, her main objective to cultivate a sharing of air is a significant point to consider in my case studies. This leads into the next section, which approaches breathing no longer as a solitary act or as a means of navigation in an immersive environment, but instead as a means to create interpersonal relationships through haptic technology.

⁶⁴ Irigaray, 90.

⁶⁵ Key features of the human anatomy and basic biological functions that are part of the autonomic nervous system are universal. All living humans, even those that require assistance from medical machines and doctors, require a beating heart, a respiratory rate, and some level of digestive and neurological functions, in order to stay alive. However, there is a variety of ways of looking at these human functions. Biological processes like eating and waste elimination are not understood universally in the same way; they are distinguished according to how they are regulated or managed.

SECTION THREE

Communicating Feeling States in Sommerer and Mignonneau's *Mobile Feelings*

The 2002 interactive art project *Mobile Feelings* by Austrian duo Christa Sommerer and Laurent Mignonneau opens up a discussion about how networks (such as mobile phones, social networking and instant messaging systems) have the potential to increase our sense of connectivity and mobility.⁶⁶ Along with technological advances that have provided greater insight to the self, new communications technologies, such as mobile devices, interactive interfaces and affective computing, have facilitated our interactions with others.⁶⁷ Increased connectivity in the digital age has led to an immense flow of data exchange which has blurred boundaries between private and public by allowing for users to reveal their most intimate thoughts and feelings with an anonymous audience.⁶⁸ By requiring participants to interact with technology through breathing and enter into a very intimate relationship with both the device and a remote user, works such as *Mobile Feelings* prompt us to ask: where does our personal space begin and end?

The devices in *Mobile Feelings* do not transmit words or images but instead send and receive body data, or “virtual touch,” over a wireless communication network. Created for the Institute of Advanced Media Arts and Sciences (IAMAS) in Gifu, Japan, in collaboration with France Telecom Studio Créatif, *Mobile Feelings* was the first Mixed Reality project to introduce new possibilities of communication in virtual environments, particularly those which respond to

⁶⁶ The internationally renowned pair have devoted their practice to linking artificial life to genetic art while examining the social and technological conditions of these biological forms. Christa Sommerer, Laurent Mignonneau and Gerfried Stocker, eds, *Interactive Art Research* (Vienna/London: Springer, 2009), 16.

⁶⁷ Sherry Turkle, *Alone Together: Why We Expect More from Technology and Less From Each Other* (New York, NY: Basic Books Group, 2011), 284.

⁶⁸ Paul Waeider, curator, “Extimacy: The Intimate is Other”, from *Extimacy. Art, Intimacy and Technology*, Es Baluard museu d’art modern i contemporani de palma, 29.01.2011 - 01.05.2011, Accessed January 1 2015: <http://www.esbaluard.org/en/exposicions/69/extimacy/>.

the physical body – whether through touch, smell, taste, and in this case, breath. The project features six organically-shaped devices that contain various miniature sensors (pulse, touch and breath), actuators, motors, ventilators, LEDs, microcontrollers, batteries and wireless communication modules.⁶⁹ These watermelon-size devices took the form of gourds in the first version of the project (in 2002; fig. 15), and as egg shapes in the second (in 2004; fig. 16). With the integration of Bluetooth technology, direct wireless connections were established between the collected devices in a range of ten meters. The artists’ focus, however, was not on the users’ location but on the intimacy being initiated through distance.⁷⁰ After selecting a distant user on their device, participants are able to receive this person’s body sensations through, for example, a tickle, a vibration, a small wind or humidity, a pulse, a push or a slight stroke, creating a strange and perhaps erotic ambiguity.⁷¹ By placing their finger on the pulse sensor, an LED light is activated and displays the strength and frequency of the heartbeat. A second LED shows the heartbeat frequency of the remote user. Both users will feel a strong rhythmic pulsing in their palm that corresponds to the actual heartbeat of the remote user, creating a sense of bodily connection. In addition to measuring pulse, the device also features a breath sensor and micro ventilator. When a user breathes onto the device, the “heat of his or her breath is captured, analyzed and then sent to the remote user’s device.”⁷² Data is translated into a small wind, which is emitted by the device’s ventilator. Sommerer and Migonneau recognize touch as a strong “break-in sense”; especially if aroused, it can be quite emotionally and consciously demanding.⁷³ They mentioned that participants in *Mobile Feelings* felt the need to concentrate on their sense of

⁶⁹ Sommerer, Migonneau, and Stocker, 205.

⁷⁰ *Ibid.*

⁷¹ Christa Sommerer and Laurent Migonneau, “Mobile Feelings II,” 2002-2003, IAMAS Institute of Advanced Media Arts and Sciences, Gifu, Japan, in collaboration with France Telecom Studio Créatif, Paris, Accessed January 1 2015, <http://www.interface.ufg.ac.at/~christa-laurent/WORKS/CONCEPTS/MobileFeelingsIIConcept.html>.

⁷² Sommerer, Migonneau, and Stocker, 205.

⁷³ *Ibid.*, 208.

touch in order to feel the other person's breath and heartbeat, thus reducing their visual and audible senses.⁷⁴

Breath can be understood in varying connotations: as the inner atmosphere of the human organism, as a metaphor for synchronizing with one another, or as the connection to sensory nerves in the respiratory system. Yet its capacity for intimate interaction is also important. Breathing is both a vehicle for tactility and communication, connecting biological makeup with emotional qualities. Biologically, breath starts and ends in the diaphragm (the strongest muscle in the body) and serves to balance and harmonize all internal and external systems, including digestion, circulation, neurochemical and endocrine systems, central, peripheral, and autonomic divisions of the nervous systems.⁷⁵ In fact, seventy per cent of the body's waste products are eliminated through the lungs through the respiration cycle.⁷⁶ Duration, strength and rhythm of breath are drastically altered according to emotional states: grief brings short, slow, shallow sighs and sometimes halts breathing; anger causes an erratic huffing and puffing as it shifts the breath from nostrils to mouth; fear causes a gulping, swallowing withholding pattern of breath, with long retention and short, tentative exhalation; and anxiety causes the breath to rise to the top of the lungs and grow short, shallow and fast.⁷⁷ Holding one's breath or breathing deeply refers to an autonomous yet conscious act: the "nerve impulses generated in the central cortex as a result of our intention bypass the respiratory center and travel down the same path used for voluntary muscle controls."⁷⁸ In many situations, individuals have a heightened awareness of their breathing. When suffering from a cold or asthma, for example, people feel an

⁷⁴ Email Interview with Christa Sommerer, by Jessica Kirsh, Montreal, Quebec, January 8 2015 (Appendix A).

⁷⁵ Edwards, 32.

⁷⁶ Schiporst, 176.

⁷⁷ *Ibid.*, 176.

⁷⁸ Thecla Schiporst, "Breath, Skin and Clothing: Using Wearable Technologies as an Interface into Ourselves," *International Journal of Performance Arts and Digital Media* 2/2 (2006): 178.

uncomfortable constriction of the chest as they struggle to inhale. Further, humans are able to learn how to control their breathing with exercise. As a metaphor for synchronizing with one another at times of physical duress such as death, illness, distress and also intimacy, human bodies instinctually connect with another by synchronizing breath, either consciously or subconsciously.⁷⁹

Sommerer and Migonneau envisioned a more personalized version of *Mobile Feelings*, as a device that could carry the heartbeat of a loved one, allowing the user to “feel” that person’s pulse when lonely or in distress.⁸⁰ Drawing parallels to the exaggeration of haptic applications on smart phones – i.e., touch screens which call for us to “slide,” “click” and identify ourselves with the tips of our fingers – the artists point to how the potential of “touch” in mobile communication is proving to be increasingly powerful. Similar to how we upload memories and stories on social media platforms through physical contact with our devices, *Mobile Feelings* invites the sharing of biological data through a similar engagement with organically-shaped data transmitters. The ability to feel close or connected with someone, whether a complete stranger or a loved one, is made possible because of the capacity for the device to process “breath.”⁸¹ However, does this make us want to connect more with each other, or with our devices as surrogate human conductors?

The field of Affective Computing enables greater understanding of how these emotional dimensions of breath function in my case studies.⁸² Today’s leading affect theorist Brian

⁷⁹ Sommerer, Migonneau, and Stocker, 205.

⁸⁰ *Ibid.*

⁸¹ According to Irigaray, breath can serve as an entry point to the paradigm of sexual difference, and cultivating our breath can render the body spiritual – granting us a greater intimacy with ourselves and with each other. See Skof and Holmes, 224.

⁸² There have been some recent critiques about the validity of some the underlying scientific claims of “affect theorists” (in particular about the perceived “authenticity” of affects). There have also been questions about the highly mediated and re-contextualized uses of phenomenology by contemporary artists as part of these engineered

Massumi defines affect as a nonsignifying, nonconscious “intensity,” alluding to form, cognition, and meaning. He writes:

Affect is autonomous to the degree to which it escapes confinement in the particular body whose vitality, or potential for interaction, it is. Formed, qualified, situated perceptions and cognitions fulfilling functions of actual connection or blockage are the capture and closure of affect. Emotion is the most intense (most contracted) expression of that capture—and of the fact that something has always and again escaped.⁸³

By studying the emotional effects of the media, affect theorists have uncovered the physiological (variables of heart rate, respiration, and skin conductance), verbal-cognitive (i.e., “happy” or “sad”) and motor-level (facial-bodily movements) reactions enacted by a human interacting with a screen.⁸⁴ Affective Computing, a fairly new discipline being exercised most extensively at MIT, seeks to develop new technologies and theories that allow for the basic understanding and measuring of affect and its role in human experience (often through wearable sensors).⁸⁵ In short, by projecting affect onto computers, humans and machines can collaborate more harmoniously. *Mobile Feelings*, founded in the field of Affective Computing, seeks to analyze affect by “measuring physiological signals and extracting corresponding affective patterns,” such as facial expressions, gestures, voice modulations, and changes in automatic nervous systems.⁸⁶ This procedure of measuring and translating body signals (both voluntary and involuntary) is most often manifest in the form of wearable devices or ubiquitous computing. These networks

experiences in museums. For further reading, see: Ruth Leys, “The Turn to Affect: A Critique,” *Critical Inquiry* 37 (Spring 2011): 434-472.

⁸³ Brian Massumi, *Parables for the Virtual: Movement, Affect, Sensation*, (Durham, N.C., 2002), 35.

⁸⁴ Hertha Sturm and Marianne Grewe-Partsch, “Television—The Emotional Medium: Results from Three Studies,” in *Emotional Effects of Media: The Work of Hertha Sturm*, ed. Gertrude Joch Robinson (Montreal, 1987), 31;

⁸⁵ Rosalind Picard is credited for coining the term along with the description: “I have come to the conclusion that if we want computers to be genuinely intelligent, to adapt to us, and to interact naturally with us, then they will need the ability to recognize and express emotion, and to have what has come to be called ‘emotional intelligence.’” Quoted in Turkle, 140.

⁸⁶ Sommerer, Migonneau, and Stocker, 204.

arise from emotion or other affective phenomena – a dimension of computing that has long been ignored by technologists.⁸⁷

Sommerer and Migonneau’s work explores ways in which mobile phones have transformed social and individual lives, for example, how people have “grown to accept a decreasing sense of privacy in exchange for connectivity and mobility.”⁸⁸ The sharing of private bodily sensations with complete strangers provoked a variety of reactions, as Sommerer explains: “It appeared that there are really strong differences in the various users, and one could not really predict how the heart beat or breath of a person would be when just looking at this person.”⁸⁹ Some users described this experience as unusual and unsettling; others found it comforting and sensual, similar to an intimate exchange between lovers or family members. Young users of the opposite sex observed the device’s potential as a “flirting tool,” because of the erotic connotations of breath (i.e., panting, sighing) and how it initiated physical ‘contact’ without the need for conversation.⁹⁰

Here, the notion of intersubjectivity helps to unpack the affective and emotional exchange being performed through in *Mobile Feelings*. According to the phenomenologist Edmund Husserl, intersubjectivity qualifies this basic quality of shared human existence as a “mode of participation in the natural and material world that does not even require an immediately perceivable human presence.”⁹¹ A key argument of intersubjectivity is that “the absence of language does not mean that communication is not happening.”⁹² New ways interpreting, organizing and reproducing social cognition present the possibility for an individual

⁸⁷ N/A, “Affective Computing,” *Massachusetts Institute of Technology*, Accessed January 1 2015: <http://affect.media.mit.edu/index.php>.

⁸⁸ Sommerer, Migonneau, and Stocker, 205.

⁸⁹ Email Interview with Christa Sommerer, by Jessica Kirsh, Montreal, Quebec, January 8 2015.

⁹⁰ Sommerer, Migonneau, and Stocker, 208.

⁹¹ Alessandro Duranti, “Husserl, Intersubjectivity and Anthropology,” *Anthropological Theory* 10/1 (2010): 1.

⁹² Duranti, 2.

to participate in the actions and feeling of another being without actually becoming the other (the definition of empathy, which is the basis of intersubjectivity).⁹³ By channeling the behaviours of others that resemble our own, and by combining our empathetic co-presence with other living bodies, intentions of the Self and Other may be uncovered.⁹⁴

Philosopher and anthropologist Ludwig Feuerbach created his own materialist theory of intersubjectivity which denotes that “flesh and blood is life, and life alone is corporeal reality.”⁹⁵ For Feuerbach, human beings are essentially communal and dialogical beings, with respect to both our cognitive and linguistic capacities, and the range of moral sentiments we experience toward one another (a continued co-existence of the “I” and the “Thou”).⁹⁶ Although Feuerbach’s dogmatic text infers God as the subjectively relational human project, I would like to focus on the prominence he gives to sensuality and sensitivity in interpersonal relationships. The exchange of breath (and subsequently, rhythm of breath) in my case studies relates to his idea of the world as a web of individuals interacting and affecting each other. Feuerbach writes: “When others are suffering, we suffer. When others are happy, we feel their joy. If the air we breathe is clean, we may breathe more deeply. If it is poisoned, we may grasp for breath, cough, and eventually become ill.”⁹⁷ Spirituality remains a key factor in the recognition of difference and practical intersubjectivity because “ethical awareness and embodied touch are reunited with

⁹³ Amy Coplan and Peter Goldie, *Empathy: Philosophical and Psychological Perspectives* (Oxford: Oxford University Press, 2011), XIII.

⁹⁴ Duranti, 11.

⁹⁵ Ludwig Feuerbach, *Das Wesen des Christentums*, (Leipzig: Otto, 1841), trans. *The Essence of Christianity* (London: Trübner, 1881), 91. Feuerbach’s writings marked the transition from idealism to naturalism in German post-Hegelian philosophy. His essays on corporeality, the senses, finitude and drive psychology were influential to the themes and criticisms of Marx, Freud, Nietzsche, Merleau-Ponty, and others. Due to the length constraints of this text, I am only able to briefly touch upon his theory of inter-subjectivity.

⁹⁶ Paul Cecil, *Inter-subjectivity and process categorization: co-agency in a unitive paradigm*, MA Thesis, Literature, Religion and Philosophy, University of Sussex, August 1999, 9.

⁹⁷ Feuerbach, 81.

reference to the divine.”⁹⁸ Breath acts as an indicator of life as well as a means of exchange with plants, animals and other humans who share the air. Intersubjectivity could be said to be enacted in *Mobile Feelings* because the individual is perceptually, conceptually, and practically coordinated around the tasks of an Other. Not only are the user’s sensations augmented in a way that establishes a strong sense of self-awareness but also channeled to connect two people on an intimate and biological level.

An assessment of breath as an indicator of affect or feeling-states from a neuroscientific perspective adds dimension to this philosophical ideology. Brain plasticity and imaging studies enables visualization of the manifestation of feeling (intimacy) as well as emotion (empathy) in affective experience. This school of thought categorizes the brain less as a passive receiver of information about the world and more as a processor of data from the world in the synthesis of perceptions. The shape of a smile or a frown releases chemical that affect mental states; “mirror neurons” (or “mirror mechanism”) chemically fire smiles or frowns when one observes another acting.⁹⁹ According to mirror mechanism theory:

witnessing someone else expressing a given emotion like disgust or pain, or undergoing a given sensation like touch activates some of the visceromotor (e.g., anterior insula) and sensory-motor (e.g., SII, ventral premotor cortex) brain areas activated when one experiences the same emotion or sensation, respectively external stimulus (someone else’s emotion or sensation) in a personal experiential acquaintance with the same emotion or sensation.”¹⁰⁰

Mirror mechanism experiments provide scientific ground to support claims of intersubjective intimacy, specifically when one’s feeling states and biological processes are experienced visually, aurally, and tactily by both the individual and another.

⁹⁸ Skof and Holmes, 1.

⁹⁹ Turkle, 134.

¹⁰⁰ Vittorio Gallese and Michele Guerra, “Embodying movies: Embodied Simulation and Film Studies,” *Cinema 3* (2012): 184-185.

In light of mirror mechanism theory, it follows that an individual can sympathize or empathize with another person through breath because breathing patterns alter according to certain feeling-states linked not only to the body but also the brain. As such, one is able to use technology to name social and affective worlds by calculating material configurations and emotional possibilities.¹⁰¹ By focusing on intuitive and non-verbal interaction – senses that convey an emotional quality – *Mobile Feelings* sheds new light on the ambivalence towards sharing personal information with an anonymous audience on a mobile connection network.

¹⁰¹ Shaka McGlotten, *Virtual Intimacies: Media, Affect and Queer Sociality* (Albany: State University of New York Press, 2013), 8.

SECTION FOUR

Synchronizing Senses in Rebecca Allen's *Coexistence*

Like Sommerer and Migonneau, Los angeles-based artist Rebecca Allen is interested in mobile communication. Her work plays with portable digital technology that enables users to simultaneously interact with physical and digital people and spaces. For over thirty years, Allen has investigated a variety of technological forms of expression, including 3D computer animation films, music videos, large-scale performance works, interactive art installations, video games, artificial life systems and Virtual Reality. Her efforts to humanize technoculture are made possible by a critical investigation of the perceptual and cognitive processes of the viewer.

Coexistence was part of the 2001 exhibition “Mixed Realities” at the Interaction Design Institute Ivrea Gallery, Italy. It consisted of a head-mounted display equipped with a small camera and head-tracking device, as well as a hand-held interface device combining a breath sensor with modified force-feedback game pad (fig. 17).¹⁰² Facing each other, participants were invited to interact with computer-generated forms by blowing them away using their breath until clearing the space enough to make the other visible (fig. 18). Their breath were felt by one another as vibrations in the hand-held force feedback device, and heard through the headphones in the head mounted display. This exchange of human biological functions forms a unique type of communication as “a shared experience between two people in a world that is both real and virtual.”¹⁰³ Allen experiments with breath and touch as the “ultimate expression of our physicality,” that is, of the non-verbal and sensual connection of our physical body to other

¹⁰² Ross, 23.

¹⁰³ *Ibid.*

human presence in Mixed Reality.¹⁰⁴ By positioning two people to synchronize their breathing patterns in order to reach the same goal in an environment where breath is not only seen virtually but also felt physically, this work, I argue, can contribute to feelings of intimacy.

In a literal sense, intimacy denotes a feeling of closeness, familiarity, connection or belonging between at least two people, often through embodied and carnal sensuality that is inward to one's personhood.¹⁰⁵ A variety of ideologies and institutional practices have transformed this emotional force into a socio-cultural pressure. In his book *Virtual Intimacies: Media, Affect and Queer Sociality*, Shaka McGlotten explores the world of virtual intimacy, particularly what it feels like to either succeed or fail to connect in a technophilic age in which intimacy has gone virtual. Early cyberspace discourses were mostly utopian and optimistic in their promise of infinite pleasure and freedom.¹⁰⁶ These discourses are now challenged by new anxieties that identify failure in intimate virtual belonging. New technologies have opened up more possibilities for casual or anonymous hookups, role-playing, and masturbatory aids, and although these playful new intimacies were vital in the formation of queer social networks and non-identitarian relations, identity politics demanded a different type of belonging – one achieved through community rather than anonymity.¹⁰⁷ Anxieties began to surface in these systems of interconnectivity; desire was replaced by activities such as porn, obsessive gaming, and antisocial behavior. Communal spaces, such as train stations or cafés, are now simply places of social collection where people come together but do not speak to each other. Each person is

¹⁰⁴ Rebecca Allen, "Coexistence," Last Updated 2013. Accessed January 1 2015: <http://rebeccaallen.com/v2/work/work.php?isInstall=1&wNR=11&wLimit=3>.

¹⁰⁵ McGlotten, 1.

¹⁰⁶ For example, in 1994 media theorist Mark Dery described cyberspace as "the upside of incorporeal interaction: a technologically enabled, postmulticultural vision of identity disengaged from gender, ethnicity and other problematic constructions." Mark Dery, *Flame Wars: The Discourse of Cyberculture* (Durham: Duke University Press, 1994), 2-3.

¹⁰⁷ McGlotten, 3-6.

tethered to a mobile device which serves as a portal to other people and places, social relations having given way to technologically-mediated ones.¹⁰⁸

In Mixed Reality, the participant is initially given agency by being offered a new proprioceptive sense in navigating immersive environments. By introducing interpersonal relationships in Mixed Reality environments, critical issues arose regarding race, gender and sexuality. It demanded an anonymous yet localizable participant – reflecting an unknowable and unpredictable dimension inherent to new media. Although the work cannot exist without the presence of a subject, his/her particular desires, backgrounds, or preferences were not accounted for. In both *Mobile Feelings* and *Coexistence*, one's encounter with the other begins as anonymous – it is only through breath that his/her identity can be revealed. Breathing is no longer simply a natural function but also an act that is inflected by diverse sets of discourses about the body. This brings up some probing questions, such as who has the right to participate, who is alienated by technology, and most importantly, whether or not intimacy is still possible through these mediated encounters. These artworks suggest a response in the affirmative, that intimacy is possible.

The notion of virtual intimacies brings forward several issues for consideration in relation to my interpretation of the three works of arts and their intentions. Intimacy has been rendered as a “structure of feeling” – according to social, political, personal and sexual paradigms.¹⁰⁹ Through experience, intimacy has the capacity to build affective engagement with others and the world. This framing does not diminish intimacy as “real,” but instead argues for its expansion. Not only can the mass public recognize their own intimacies on a universal scale but also witness the failures and successes of others' intimacies. Online gaming, for instance, encourages players

¹⁰⁸ Turkle, 155.

¹⁰⁹ McGlotten, 11.

to play with each other, thus making intimacy instrumental and necessary, although not always positive as in the case of cyber-bullying. Intimacy as a virtual experience – whether celebrated or mourned, loving or nourishing – allows for the feeling of being connected, even at a distance. *Coexistence* seems to bring these aspects that proliferate in game culture into new media art. The “players” use their own creativity and social knowledge to make a mod (modification); in turn, they also invest the mod with their own emotions and affectivity.¹¹⁰ The concept of “cheating” in a playful game-oriented sense takes on new meaning in a mode of mobile intimacy. Online gaming and social media platforms provide solid grounds for projecting a new digital identity, allowing for one’s gender, sexuality and political views to take on new life.

As discussed earlier, the experience of *Coexistence* would be unable to be initiated without both participants interacting and working together. By co-breathing, the participants not only “conquer” computerized simulation and regain a solid grasp on reality, but also form a connection with his/her partner on a physical level. This work starts from the inside out; by synchronizing their interior biological functions, the participants can co-exist in virtual as well as physical reality. However, just like in every game, power relations take a toll. In this case, there is a chance that a participant’s breath or bodily capacity is stronger than the other, leading to him/her to “win” in a sense. Regardless of the outcome, the sensing of the other subject through air that *Coexistence* facilitates, where breath is visualized and materialized virtually, perpetuates a feeling of intimacy.

¹¹⁰ Gaming and art, as mediums of exploration and expression, have been inextricably linked for decades, directly reflecting the politics, social structures, economies and culture in which they were created. Larissa Hjorth, *Games and Gaming: An Introduction to New Media*, (Oxford: Berg, 2011), 35

CONCLUSION

This thesis has attempted to open up a discussion on the communicative and sensorial possibilities of breath through technology as explored in media arts. The inherently participatory or collaborative nature of new media art initiates an exchange with disparate communities, bringing to the fore questions of agency and authorship concerning the creator, user, public, audience, as well as to what extent control is mediated.¹¹¹ Breath can bridge bodily and psychological boundaries between the subject and object, Self and Other, human and computer. Lungs expanding and contracting, hearts beating, and pulses throbbing, need no longer be ascribed to the Self but instead can be seen as dually capable of being subjective/objective, internal/external. This gives phrases like “you take my breath away” or “you’ve stolen my heart” new meaning: they express the ability to appropriate another’s visceral organs in an action that is entirely not-self.

The intersubjective encounters enabled in the three artworks discussed perpetuate an emotional exchange of feeling states, but they also bring forward a consideration of how the sensing of another through air affects a material change in the nature of the environment.¹¹² This world has recently battled fatal airborne diseases, such as the 2003 Severe Acute Respiratory Syndrome (SARS) and 2009 Swine Flu (H1N1) virus, that have led to an increased anxiety about the sharing of air. This anxiety has been compounded by new pollutants, such as radioactive plumes (Chernobyl), toxic clouds (Bhopal), killer smogs, second-hand smoke, sick building syndrome, radon gas emissions, chlorofluorocarbons, ozone depletion, and free radicals, as well as chemical agents as air weapons, such as butyric acid assaults, incapacitating stink bombs, and

¹¹¹ Sommerer, Jain and Migonneau, 164.

¹¹² Irving Goh, “Touch Today: From Subject to Reject,” *SubStance* 40/3 (2011): 120.

deadly attacks with sarin gas, ricin, or anthrax.¹¹³ This negative view of breath as harmful has conditioned bodies to touch with discretion, exemplified through the increase in public hand sanitizers and hand-free faucets and toilet flushes. The invention of the gas mask was a key moment in the regulation of air and its technological interface with the human body. This device was a frequent source of inspiration, both utopian and dystopian, for twentieth and twenty-first century artists. It was often used a symbol of horror/anxiety vis-à-vis the mechanization of society, especially after the first World Wars, which saw the first use of chemical weapons.¹¹⁴ The mouth – a fleshy orifice that has the potential to carry many germs – plays an integral role in all of my case studies: as a mode of transference through mobile devices (*Mobile Feelings*), as a tool of interaction with a game pad (*Coexistence*), and as a mode of physical connection between human and robot (*ALIBI*). Anxieties in sharing equipment thus become an issue. By sharing the air and touching each other through breath as opposed to skin, the participant is given insight into not only his/her interior bodily functioning but also someone else's. Even though the participants are interacting at a distance, the traces of participants before them linger on the wearable devices. New rhythms occur according to how each participants react to the technology as well as the each other.¹¹⁵ Instead of avoiding the act of forgetting air as Heidegger suggests, or sharing air as Irigaray suggests, perhaps one should try to avoid air altogether.¹¹⁶

Through recent advances in technoculture, the body has been integrated seamlessly into the atmosphere. As Dyson writes, “thinking of atmospheres also returns us to the breath, to the continuous and necessary exchange between subject and environment, a movement that forms

¹¹³ Jim Drobnick, “Trafficking in Air,” *Performance Research: A Journal of the Performing Arts* 8/3 (2003): 29.

¹¹⁴ Some classic examples include German prints by Otto Dix (*Shock Troops Advance under Gas* from The War, 1924) and Georg Grosz (*Shut up and do your duty*, 1927), as well as Surrealist photographs which show bourgeois bodies wearing various uncanny types of facial prosthetics.

¹¹⁵ Goh, 121.

¹¹⁶ *Ibid.*, 116.

multiplicity existing within the space necessary for sound to sound, and for Being, in whatever form, to resonate.”¹¹⁷ So what happens when our natural breath no longer serves as a sign of human biological property, and instead the structuring of human subjectivities and social positions are mediated through mechanical prosthetics?

My further research will examine a deeper dimension of posthumanism which arose as a result of bodies self-generating, re-crafted, encoded and misinterpreted by such technological and biological agencies.¹¹⁸ Embodiment continues to transform along with environmental pressures, particularly through interactions with technology. As we have seen in the evolution of new media art, there remains a tension between the agency of the body to control its own self-movement/navigation, and the agency of the technical apparatus.¹¹⁹ Whereas vision machines transform the activity of perceiving into a computational data, human perception contributes to bodily modalities of tactility, memory and duration.¹²⁰

In my case studies, the machine is subjected to the human body which is called upon to adapt to and internalize the biological input and output of breath.¹²¹ The multisensoriality of each work, channeled through breathing, inserts a reflexive quality to the experience. The variety of properties, energies and rhythms marks a delineation from the personal to the social and prompts a rethinking of breathing as an universal act that is also a form of expression, communication, and subject of affective consideration. Performing in the virtual world, breath can be seen, felt and even heard in new and exciting ways. This thesis has argued that The Einstein Brain

¹¹⁷ Dyson, 17.

¹¹⁸ Katherine Hayles explains that the most important characteristic of posthumanism is that it reconfigures the human body, as the original prosthesis we all learn to manipulate, so that it can be seamlessly articulated with intelligent machines. Hayles, *How We Became Posthuman*, 3.

¹¹⁹ A simplified Deleuzian definition of the technical apparatus is as the complex movement or process by which something escapes or departs from a given territory. See Deleuze and Guattari, 508.

¹²⁰ Mark B. Hansen, *New Philosophy For New Media* (Cambridge, Mass.: The MIT Press, 2004), 101.

¹²¹ Kroker, “Digital Inflections – The Einstein's Brain Project: Alan Dunning and Paul Woodrow in conversation with Ted Hiebert,” Accessed 20 August 2015: <http://www.ctheory.net/articles.aspx?id=678>.

Project's *ALIBI*, Christa Sommerer and Laurent Migonneau's *Mobile Feelings* and Rebecca Allen's *Coexistence* attempt to *breathe life into the virtual*: human and machine co-exist in Mixed Reality, a synthesis of computer-generation and visualization of biodata, thus making apparent the emotive and ephemeral workings of the body and machine. I have interpreted these projects as events, contexts, or allegories for our own successes or failures of (inter)subjective processing.

IMAGES



Fig. 1 – Marcel Duchamp, *Air de Paris* [*50cc de Paris*], 1919 / 1964, glass, wood, 14,5 x 8,5 x 8,5 cm, © Artists Rights Society (ARS), New York / ADAGP, Paris / Estate of Marcel Duchamp



Fig. 2 – Piero Manzoni, *Artist's Breath* (*Fiato d'Artista*), 1960, balloon, rope, lead seals and bronze plaque on wooden base, 35 x 180 x 185 mm, Tate Collection.



Fig. 3 – Samuel Beckett, *Breath*, 1969, play, 1 minute, https://www.youtube.com/watch?v=io_scJbhCOY.



Fig. 4 - Maria Abramovic and Frank Uwe Laysiepen (Ulay), *Breathing In, Breathing Out*, 1977, performance, Studenski Kulturni Centar in Belgrade, 19 minutes, <https://www.youtube.com/watch?v=rWixdA2xTSs>.



Fig. 5 - Oscar Muñoz, *Aliento [Breath]*, 1996–2002, Detail Courtesy Daros-Latinamerica Collection, Zurich, <https://canadianart.ca/must-sees/mois-de-la-photo/>.

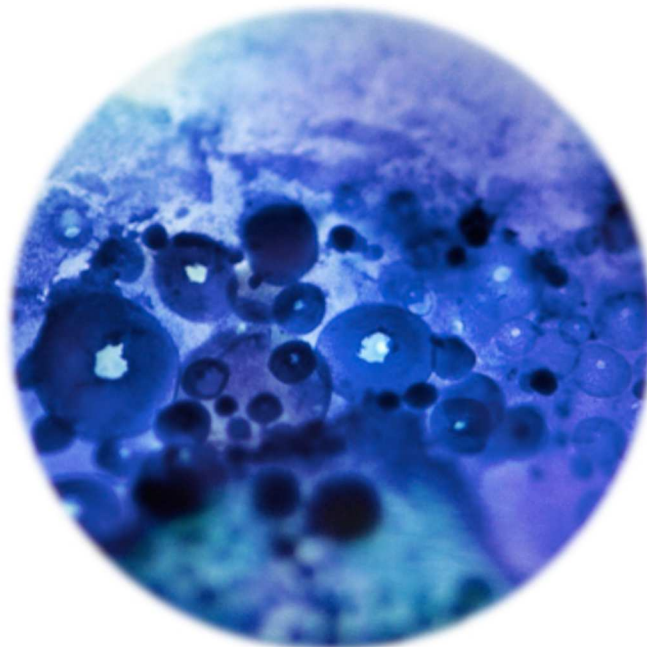


Fig. 6: Sabrina Raaf, *Breath Cultures*, 1999, photograph of petri dish, <http://raaf.org/projects.php?pcat=2&proj=15#>.

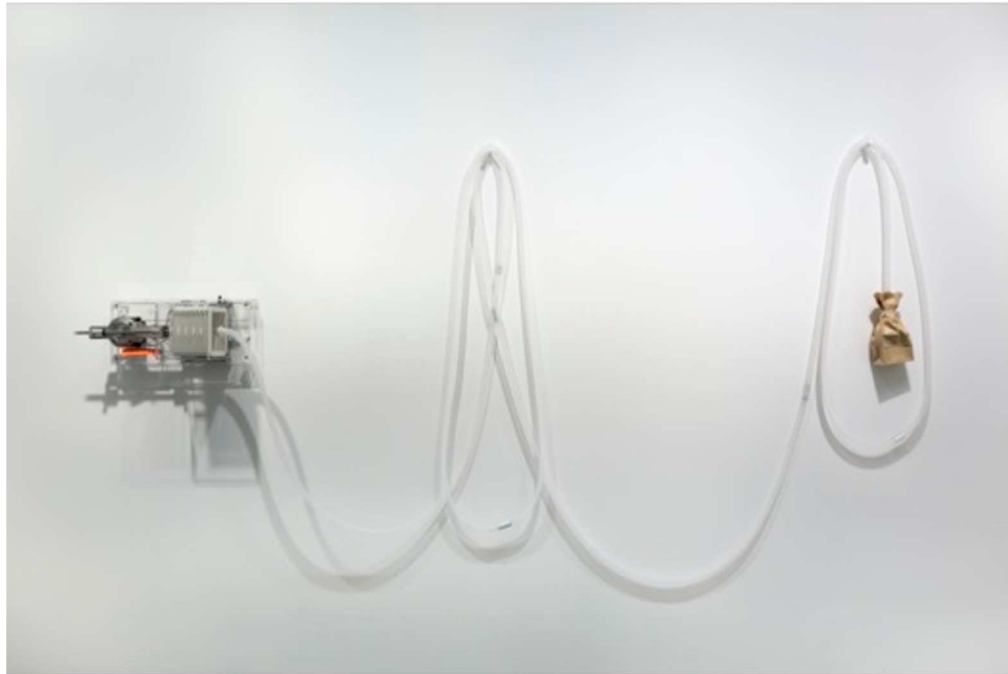


Fig. 7: Rafael Lozano-Hemmer, *Last Breath*, 2012, Obra Sonora, Carroll / Fletcher Gallery, London, United Kingdom, 2014, http://www.lozano-hemmer.com/last_breath.php.



Fig. 8 – Sketch for the design pavilion screen of the University of Quebec in Montreal. Jean Dubois, *Tourmente*, 2015, interactive public video screen, dimension and duration variable, <http://www.jeandubois.info/blog/project/tourmente/>.



Fig. 9 - Jean Dubois et Chloé Lefebvre, *À portée de souffle*, 2008, dimensions and duration variable, Photo from Experimenta — Utopia Now, International Biennial of Media Arts, Federation Square, Melbourne, <http://www.jeandubois.info/blog/project/a-portee-de-souffle/>.

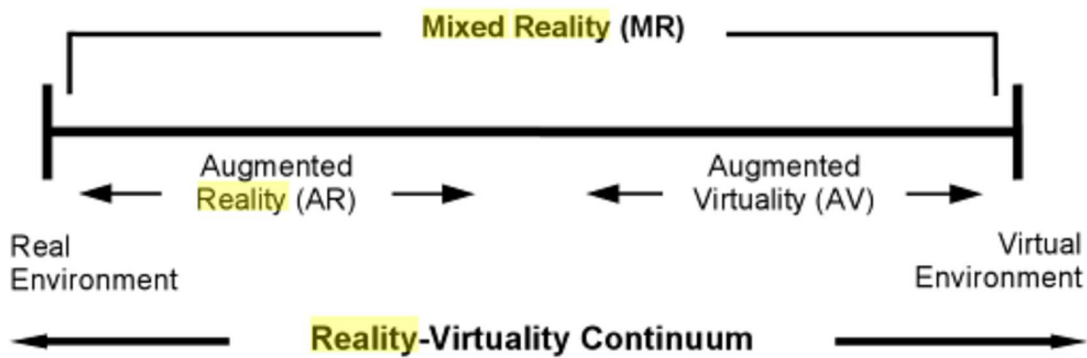


Fig. 10 - Milgram and Colquhoun's Reality-Virtuality Continuum. Xiangyu Wang, Marc Aurel Schnabel, *Mixed Reality In Architecture, Design, And Construction*, Springer Science & Business Media, 2008, 4.



Fig. 11. Ulrike Gabriel, *Breath*, 1992, ARTLAB “Prospect 1”, Tokyo,
<http://www.medienkunstnetz.de/works/breath/>.

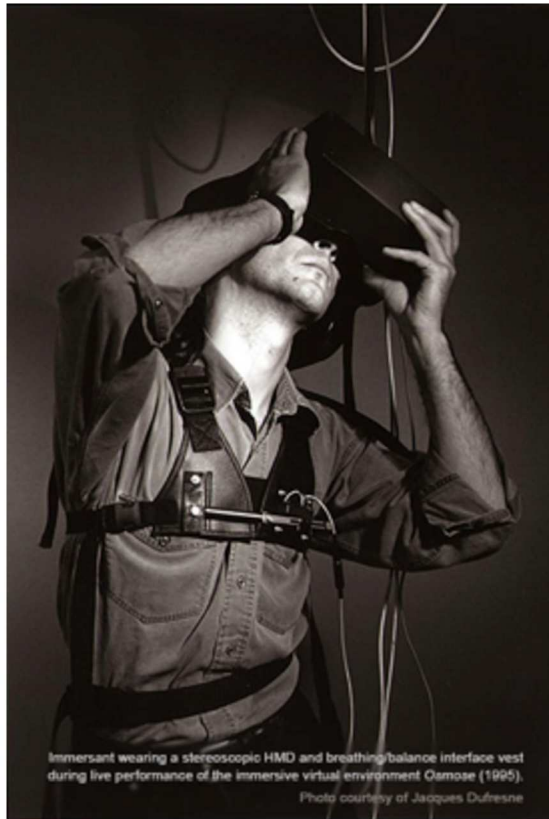


Fig. 12 – Immesant, Char Davies, *Osmose*, 1995, Musée d'art contemporain de Montréal,
<http://www.fondation-langlois.org/html/c/page.php?NumPage=103>.

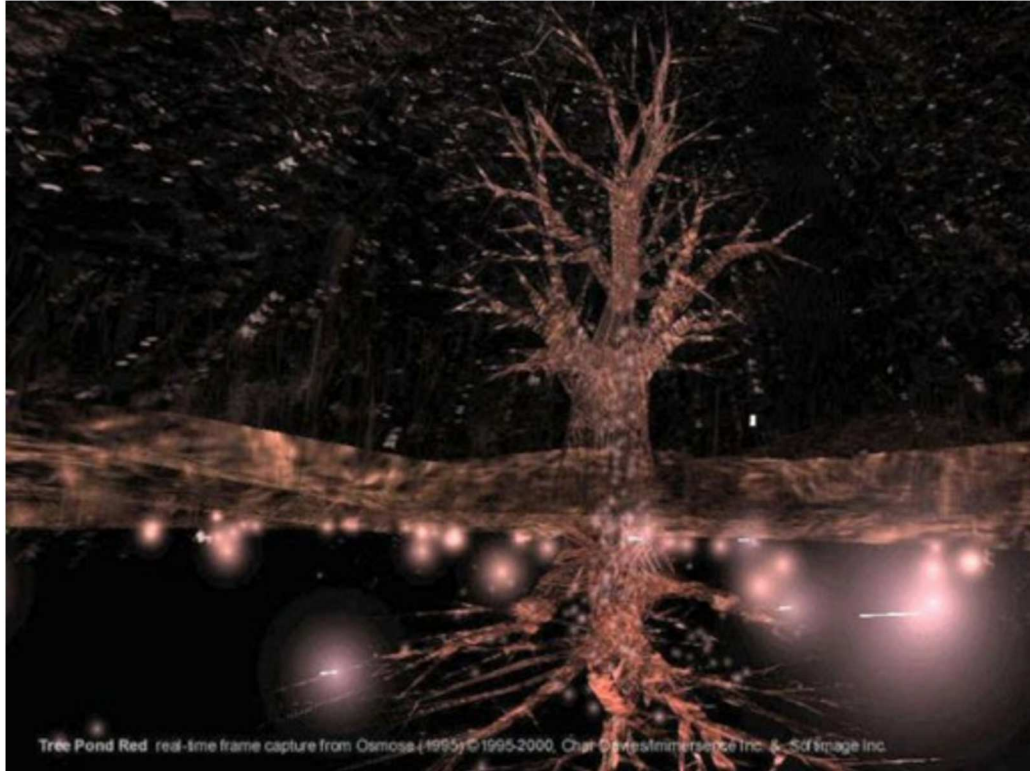


Fig. 13 – Computer-generated nature realm, Char Davies, *Osmose*, 1995, Musée d'art contemporain de Montréal, <http://www.fondation-langlois.org/html/e/page.php?NumPage=103>.

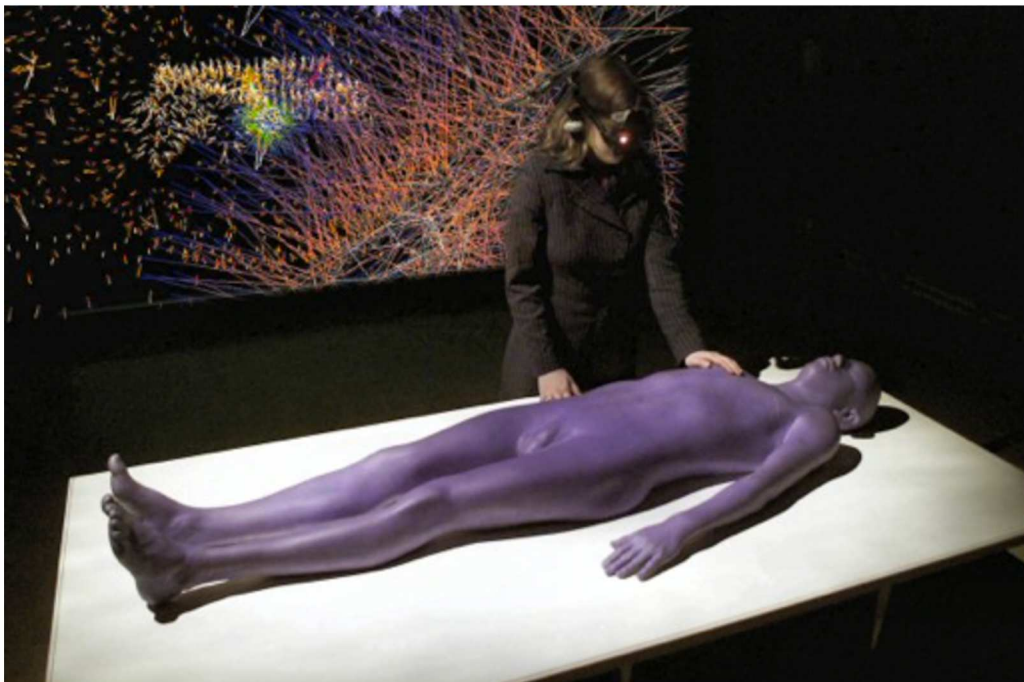


Fig. 14 – Einstein's Brain Project, *ALIBI*, 2000, *Madhouse* cycle at TechnOboro art center in Montréal, Québec, <http://www.ctheory.net/articles.aspx?id=678>.



Fig. 15 – Christa Sommerer and Laurent Mignonneau, *Mobile Feelings I*, 2002, IAMAS Institute of Advanced Media Arts and Sciences in Gifu Japan, in collaboration with France Telecom Studio Creatif, <http://www.asquare.org/networkresearch/2007/christa-sommerer-and-laurent-mignonneau>.



Fig. 16 - Christa Sommerer and Laurent Mignonneau, *Mobile Feelings II*, 2004, IAMAS Institute of Advanced Media Arts and Sciences in Gifu Japan, in collaboration with France Telecom Studio Creatif, <http://www.asquare.org/networkresearch/2007/christa-sommerer-and-laurent-mignonneau>.



Fig. 17 – Rebecca Allen, *Coexistence*, 2001, "Mixed Realities," Interaction Design Institute Ivrea Gallery, <http://www.rebeccaallen.com/projects/coexistence>.



Fig. 18 - Rebecca Allen, *Coexistence*, 2001, "Mixed Realities," Interaction Design Institute Ivrea Gallery, <http://www.rebeccaallen.com/projects/coexistence>.

BIBLIOGRAPHY

- Allen, Rebecca. "Coexistence." Last Updated 2013. Accessed January 1 2015:
<http://rebeccaallen.com/v2/work/work.php?isInstall=1&wNR=11&wLimit=3>.
- Anzieu, Didier. *The Skin Ego*. New Haven and London: Yale University Press, 1989. Translated by Chris Turner.
- Barthes, Roland. *Mythologies*. Paris: Éditions du Seuil, 1957.
- Benford, Steve and Gabriella Giannachi. *Performing Mixed Reality*. Cambridge, Mass.: The MIT Press, 2011.
- Bishop, Claire. *Artificial Hells: Participatory Art and the Politics of Spectatorship*. London; New York: Verso Books, 2012.
- Card, Stuart K., Thomas P. Moran, and Allen Newell. *The Psychology of Human-Computer Interaction*. New Jersey: Lawrence Erlbaum Associates, 1983.
- Cataldi, Sue L. "Chapter 3: Depth and Flesh." In *Emotion, Depth and Flesh: A Study of Sensitive Space*. Albany: State University of New York Press, 1993. 57-79.
- Cecil, Paul. *Inter-subjectivity and process categorization: co-agency in a unitive paradigm*. MA Dissertation: Literature, Religion and Philosophy University of Sussex, August 1999.
- Cecchetto, David. "Chapter 4: *The Trace*: Melancholy and Posthuman Ehtics." In *Humanesis: Sound and Technological Posthumanism*. Minneapolis: University of Minnesota Press, 2013. 93-107.
- Deleuze, Gilles and Félix Guattari. *A Thousand Plateaus*. Translated by Brian Massumi. London: A&C Black, 2004.
- Dery, Mark. *Flame Wars: The Discourse of Cyberculture*. Durham: Duke University Press: 1994.
- Duranti, Alessandro. "Husserl, Intersubjectivity and Anthropology." *Anthropological Theory* 10/1 (2010): 1-20.
- Dunning, Alan and Paul Woodrow. "Electric flesh – the electromagnetic medium: The Einstein Brain Project." *Technoetic Arts: A Journal of Speculative Research* 3/3 (2005): 155-168.
- Drobnick, Jim. "Trafficking in Air." *Performance Research: A Journal of the Performing Arts* 8/3 (2003): 29-43.
- Dyson, Frances. *Sounding New Media: Immersion and Embodiment in the Arts and Culture*. Los Angeles/London: University of California Press, 2009.

- Edwards, Steve. "A Psychology of Breathing Methods." *International Journal of Mental Health Promotion* 7/4 (November 2005): 30-36.
- Esrock, Ellen J. "Embodying Art: The Spectator and the Inner Body." *Poetics Today* 31/2 (Summer 2010): 217-249.
- Esrock, Ellen J. "Touching Art: Intimacy, embodiment and the Somatosensory System." *Consciousness and Emotion* 2/2 (2001): 233-254.
- Farman, Jason. *Mobile Interface Theory: Embodied Space and Locative Media*. New York: Routledge, 2012.
- Feuerbach, Ludwig. *The Essence of Christianity*. London: Trübner, 1881.
- Fried, Robert. *The Psychology and Physiology of Breathing in Behavioral Medicine, Clinical Psychology, and Psychiatry*. New York/London: Plenum Press, 1993.
- Levin, Thomas Y., Frohne, Ursula and Weibel, Peter. *CRTL [SPACE]: Rhetorics of Surveillance from Bentham to Big Brother*. Karlsruhe: ZKM Center for Art and Media, 2002.
- Gallese, Vittorio & Michele Guerra. "Embodying Movies: Embodied Simulation and Film Studies." *Cinema* 3 (2012): 184-195.
- Goh, Irving. "Touch Today: From Subject to Reject," *SubStance* 40/3 (2011): 115-129.
- Hansen, Mark B. N. *New Philosophy For New Media*. Cambridge, Mass.: The MIT Press, 2004.
- Hansen, Mark B. N. "Embodying Virtual Reality." In *Bodies in Code: Interfaces with Digital Media*. New York/London: Routledge, 2006.
- Hayles, Katherine N. *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics*. Chicago/London: The University of Chicago Press, 1999.
- Hayles, Katherine. "Flesh and Metal: Reconfiguring the Mindbody in Virtual Environments." *Configurations* 10/2 (2002): 297-320.
- Hjorth, Larissa. *Games and Gaming: An Introduction to New Media*. Oxford: Berg, 2011.
- Irigaray, Luce. "The Way of Breath." In *Between East and West: From Singularity to Community*. Translated by Stephen Pluhacek. New York: Columbia University Press, 2002.
- Irigaray, Luce. *The Forgetting of Air in Martin Heidegger*. Translated by Mary Beth Mader. Austin: University of Texas Press, 1999.

- Kathleen Forde and Rafael Lozano-Hemmer in conversation. Rafael Lozano-Hemmer: Vicious Circular Breathing. Exhibition catalogue. Sept. 14 2013 - Feb. 16, 2014. Borusan Contemporary, Istanbul, Turkey.
- Kroker, Arthur and Marilouise Kroker, eds. "Digital Inflections – The Einstein's Brain Project: Alan Dunning and Paul Woodrow in conversation with Ted Hiebert." *CTheory* (1/25/2011). Accessed January 1 2015: <http://www.ctheory.net/articles.aspx?id=678>.
- Leys, Ruth. "The Turn to Affect: A Critique." *Critical Inquiry* 37 (Spring 2011): 434-472.
- Manovich, Lev. "The Poetics of Augmented Space." *Visual Communications* 5/2 (2006): 219-240.
- Massumi, Brian. *Parables for the Virtual: Movement, Affect, Sensation*. Durham, N.C., 2002.
- McGlotten, Shaka. *Virtual Intimacies: Media, Affect and Queer Sociality*. Albany: State University of New York Press, 2013.
- McRobert, Laurie. *Char Davies' Immersive Virtual Art and the Essence of Spatiality*. Toronto: University of Toronto Press, 2007.
- Minissale, Gregory. *The Psychology of Contemporary Art*. New York/Cambridge: Cambridge University Press, 2013.
- MIT, "Affective Computing," *Massachusetts Institute of Technology*, Accessed January 1 2015, <http://affect.media.mit.edu/index.php>.
- Munster, Anna. *Materializing New Media: Embodiment in Information Aesthetics*. Dartmouth, NH: Dartmouth College Press, 2006.
- N/A. "The Einstein's Brain Project." University of Calgary. Accessed January 1 2015, <http://people.ucalgary.ca/~einbrain/new/main.html>.
- Noe, Alva. *Action in Perception*. Cambridge, Mass.: The MIT Press, 2006.
- Oliver, Kelly. "The Look of Love." *Hypatia* 16/3 (Summer 2001): 56-78.
- Sommerer, Christa, Laurent Mignonneau and Gerfried Stocker, eds. *Interactive Art Research*. Vienna/London: Springer, 2009.
- Ross, Christine. "Spatial Poetics: The (Non)destinations of Augmented Reality Art." *Afterimage* 38/3 (2010): 16-20.
- Rowlands, Mark. *The New Sciences of the Mind: From Extended Mind to Embodied Phenomenology*. Cambridge, Mass.: The MIT Press, 2010.

- Schiphorst, Thecla. "Breath, Skin and Clothing: Using Wearable Technologies as an Interface into Ourselves." *International Journal of Performance Arts and Digital Media* 2/2 (2006): 171-186.
- Shiff, Richard. "Chapter 7: Breath of Modernism (Metonymic Drift)." In *In Visible Touch: Modernism and Masculinity*, ed. Terry Smith. Sydney: The Power Institute of Fine Arts, 1997. Pg 185-215.
- Skof, Lenart and Emily A. Holmes, eds. *Breathing with Luce Irigaray*. New York/ London: Bloomsbury, 2013.
- Sommerer, Christa and Laurent Migonneau. "Mobile Feelings II." 2002-2003. IAMAS Institute of Advanced Media Arts and Sciences, Gifu, Japan. In collaboration with France Telecom Studio Creatif, Paris. Accessed January 1 2015: <http://www.interface.ufg.ac.at/~christa-laurent/WORKS/CONCEPTS/MobileFeelingsIIConcept.html>.
- Sommerer, Christa, Lakhmi C. Jain and Laurent Migonneau. *The Art and Science of Interface and Interaction Design*. Berlin: Springer, 2008.
- Sturm, Hertha and Marianne Grewe-Partsch. "Television—The Emotional Medium: Results from Three Studies." In *Emotional Effects of Media: The Work of Hertha Sturm*. Ed. Gertrude Joch Robinson. Montreal, 1987. Pp 25-36.
- Sutton, Damian, Susan Brind and Ray McKenzie, eds. *The State of the Real: Aesthetics in the Digital Age*. New York, NY: I.B. Tauris & Co. Ltd., 2007.
- Tarryn Handcock, "Transgressing Boundaries: Skin in the Construction of Bodily Interior," IDEA Symposium 2012 *Interior: A State of Becoming*, Curtin University, September 2012.
- Turkle, Sherry. *Alone Together: Why We Expect More from Technology and Less from Each Other*. New York, NY: Basic Books Group, 2011.
- Waeider, Paul, curator, "Extimacy: The Intimate is Other," from *Extimacy. Art, Intimacy and Technology*, Es Baluard museu d'art modern i contemporani de palma, 29.01.2011 - 01.05.2011, Accessed January 1 2015: <http://www.esbaluard.org/en/exposicions/69/extimacy/>.
- Wang, Xiangyu and Marc Aurel Schnabel. *Mixed Reality In Architecture, Design, And Construction*. New York: Springer Science & Business Media, 2008.