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Touch and Go is published in collaboration with Watermans and Goldsmiths College in occasion of the Watermans' International Festival of Digital Art, 2012, which coincides with the Olympics and Paralympics in London. The issue explores the impact of technology in art as well as the meaning, possibilities and issues around human interaction and engagement. *Touch and Go* investigates interactivity and participation, as well as light art and new media approaches to the public space as tools that foster engagement and shared forms of participation.

TOUCH AND GO

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Editor in Chief
Lanfranco Aceti lanfranco.aceti@leoalmanac.org

Co-Editor
Özden Şahin ozden.sahin@leoalmanac.org

Managing Editor
John Francescutti john.francescutti@leoalmanac.org

Art Director
Deniz Cem Önduygu deniz.onduygu@leoalmanac.org

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Editorial Address
Leonardo Electronic Almanac
Sabanci University, Orhanli – Tuzla, 34956
Istanbul, Turkey

Email
info@leoalmanac.org

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Touch and Go

VOLUME EDITORS
LANFRANCO ACETI, JANIS JEFFERIES, IRINI PAPADIMITRIOU

EDITORS
JONATHAN MUNRO, ÖZDEN ŞAHİN

Watermans International Festival of Digital Art, 2012

***Touch and Go* is a title that I chose together with Irini Papadimitriou for this LEA special issue.** On my part with this title I wanted to stress several aspects that characterize that branch of contemporary art in love with interaction, be it delivered by allowing the audience to touch the art object or by becoming part of a complex electronic sensory experience in which the artwork may somehow respond and touch back in return.

With the above statement, I wanted to deliberately avoid the terminology 'interactive art' in order to not fall in the trap of characterizing art that has an element of interaction as principally defined by the word interactive; as if this were the only way to describe contemporary art that elicits interactions and responses between the artist, the audience and the art objects.

I remember when I was at Central Saint Martins writing a paper on the sub-distinctions within contemporary media arts and tracing the debates that distinguished between electronic art, robotic art, new media art, digital art, computer art, computer based art, internet art, web art... At some point of that analysis and argument I realized that the common thread that characterized all of these sub-genres of aesthetic representations was the word art and it did not matter (at least not that much in my opinion) if the manifestation was material or immaterial, conceptual or physical, electronic or painterly, analogue or digital.

I increasingly felt that this rejection of the technical component would be necessary in order for the electronic-robotic-new-media-digital-computer-based-internet art object to re-gain entry within the field of fine art. Mine was a reaction to an hyper-fragmented and indeed extensive and in-depth taxonomy that seemed to have as its main effect that of pushing these experimental and innovative art forms – through the emphasis of their technological characterization – away from the fine arts and into a ghetto of isolation and self-reference. Steve Dietz's question – *Why Have There Been No Great Net Artists?* [1] – remains unanswered, but I believe that there are changes that are happening – albeit slowly – that will see the sensorial and technical elements become important parts of the aesthetic aspects of the art object as much as the brush technique of Vincent Willem van Gogh or the sculptural fluidity of Henry Moore.

Hence the substitution in the title of this special issue of the word interactivity with the word touch, with the desire of looking at the artwork as something that can be touched in material and immaterial ways, interfered with, interacted with and 'touched and reprocessed' with the help of media tools but that can also 'touch' us back in return, both individually and collectively. I also wanted to stress the fast interrelation between the art object and the consumer in a commodified relationship that is based on immediate engagement and fast disengagement, touch and go. But a fast food approach is perhaps incorrect if we consider as part of the interactivity equation the viewers' mediated processes of consumption and memorization of both the image and the public experience.

Nevertheless, the problems and issues that interactivity and its multiple definitions and interpretations in the 20th and 21st century raise cannot be overlooked, as much as cannot be dismissed the complex set of emotive and digital interactions that can be set in motion by artworks that reach and engage large groups of people within the public space. These interactions generate public shows in which the space of the city becomes the background to an experiential event that is characterized by impermanence and memorization. It is a process in which thousands of people engage, capture data, memorize and at times memorialize the event and re-process, mash-up, re-disseminate and re-contextualize the images within multiple media contexts.

The possibility of capturing, viewing and understanding the entire mass of data produced by these aesthetic sensory experiences becomes an impossible task due to easy access to an unprecedented amount of media and an unprecedented multiplication of data, as Lev Manovich argues. [2]

In *Digital Baroque: New Media Art and Cinematic Folds* Timothy Murray writes that "the retrospective nature of repetition and digital coding—how initial images, forms, and narratives are refigured through their contemplative re-citation and re-presentation—consistently inscribes the new media in the memory and memorization of its antecedents, cinema and video." [3]

The difference between memorization and memorialization may be one of the further aspects in which the interaction evolves – beyond the artwork but still linked to it. The memory of the event with its happening and performative elements, its traces and records both official and unofficial, the re-processing and mash-ups; all of these elements become part of and contribute to a collective narrative and pattern of engagement and interaction.

These are issues and problems that the artists and writers of this LEA special issue have analyzed from a variety of perspectives and backgrounds, offering to the reader the opportunity of a glimpse into the complexity of today's art interactions within the contemporary social and cultural media landscapes.

Touch and Go is one of those issues that are truly born from a collaborative effort and in which all editors have contributed and worked hard in order to deliver a documentation of contemporary art research, thought and aesthetic able to stand on the international scene.

For this reason I wish to thank Prof. Janis Jefferies and Irini Papadimitriou together with Jonathan Munro and Özden Şahin for their efforts. The design is by Deniz Cem Önduygu who as LEA's Art Director continues to deliver brilliantly designed issues.

Lanfranco Aceti
Editor in Chief, Leonardo Electronic Almanac
Director, Kasa Gallery

1. "Nevertheless, there is this constant apparently inherent need to try and categorize and classify. In Beyond Interface, an exhibition I organized in 1998, I 'datamined' ten categories: net.art, storytelling, socio-cultural, biographical, tools, performance, analog-hybrid, interactive art, interfacers + artificers. David Ross, in his lecture here at the CADRE Laboratory for New Media, suggested 21 characteristics of net art. Stephen Wilson, a pioneering practitioner, has a virtual – albeit well-ordered – jungle of categories. Rhizome has developed a list of dozens of keyword categories for its ArtBase. Lev Manovich, in his Computing Culture: Defining New Media Genres symposium focused on the categories of database, interface, spatialization, and navigation. To my mind, there is no question that such categorization is useful, especially in a distributed system like the Internet. But, in truth, to paraphrase Barnett Newman, "ornithology is for the birds what categorization is for the artist." Perhaps especially at a time of rapid change and explosive growth of the underlying infrastructure and toolsets, it is critical that description follow practice and not vice versa." Steve Dietz, *Why Have There Been No Great Net Artists? Web Walker Daily* 28, April 4, 2000, http://bit.ly/QjEWlY (accessed July 1, 2012).
2. This link to a Google+ conversation is an example of this argument on massive data and multiple media engagements across diverse platforms: http://bit.ly/pGgDsS (accessed July 1, 2012).
3. Timothy Murray, *Digital Baroque: New Media Art and Cinematic Folds* (Minneapolis: University of Minnesota Press, 2008), 138.

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Touch and Go: The Magic Touch Of Contemporary Art

It is with some excitement that I write this preface to Watermans International Festival of Digital Art, 2012. It has been a monumental achievement by the curator Irini Papadimitriou to pull together 6 groundbreaking installations exploring interactivity, viewer participation, collaboration and the use or importance of new and emerging technologies in Media and Digital Art.

From an initial call in December 2010 over 500 submissions arrived in our inboxes in March 2011. It was rather an overwhelming and daunting task to review, look and encounter a diverse range of submissions that were additionally asked to reflect on the London 2012 Olympic and Paralympic Games. Submissions came from all over the world, from Africa and Korea, Austria and Australia, China and the UK, Latvia and Canada and ranged from the spectacularly complicated to the imaginatively humorous. Of course each selector, me, onedotzero, London's leading digital media innovation organization, the curatorial team at Athens Video Art Festival and Irini herself, had particular favorites and attachments but the final grouping I believe does reflect a sense of the challenges and opportunities that such an open competition offers. It is though a significant move on behalf of the curator that each work is given the Watermans space for 6 weeks which enables people to take part in the cultural activities surrounding each installation, fulfilling, promoting and incorporating the Cultural Olympiad themes and values 'inspiration, participation and creativity.'

Some, like Gail Pearce's ***Going with the Flow*** was made because rowing at the 2012 Olympics will be held near Egham and it was an opportunity to respond and create an installation offering the public a more interactive way of rowing, while remaining on dry land, not only watching but also participating and having an effect on the images by their actions. On the other hand, Michele Barker and Anna Munster's collaborative ***Hocus Pocus*** will be a 3-screen interactive artwork that uses illusionistic and performative aspects of magical tricks to explore human perception, senses and movement. As they have suggested, "Magic – like interactivity – relies on shifting the perceptual relations between vision and movement, focusing and diverting attention at key moments. Participants will become aware of this relation as their perception catches up with the audiovisual illusion(s)" (artists statement, February 2011). Ugochukwu-Smooth Nzewi and Emeka Ogboh are artists who also work collaboratively and working under name of One-Room Shack. ***UNITY*** is built like a navigable labyrinth to reflect the idea of unity in diversity that the Games signify. In an increasingly globalized world they are interested in the ways in which the discourse of globalization opens up and closes off discursive space whereas Suguru Goto is a musician who creates real spaces that are both metaphysical and spiritual. ***Cymatics*** is a kinetic sculpture and sound installation. Wave patterns are created on liquid as a result of sound vibrations generated by visitors. Another sound work is Phoebe Hui's ***Granular Graph*, a** sound instrument about musical gesture and its notation.

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Audiences are invited to become a living pendulum. The apparatus itself can create geometric images to represent harmonies and intervals in musical scales. Finally, Joseph Farbrook's ***Strata-caster*** explores the topography of power, prestige, and position through an art installation, which exists in the virtual world of Second Life, a place populated by over 50,000 people at any given moment.

Goldsmiths, as the leading academic partner, has been working closely with Watermans in developing a series of seminars and events to coincide with the 2012 Festival. I am the artistic director of Goldsmiths Digital Studios (GDS), which is dedicated to multi-disciplinary research and practice across arts, technologies and cultural studies. GDS engages in a number of research projects and provides its own postgraduate teaching through the PhD in Arts and Computational Technology, the MFA in Computational Studio Arts and the MA in Computational Art. Irini is also an alumni of the MFA in *Curating* (Goldsmiths, University of London) and it has been an exceptional pleasure working with her generating ideas and platforms that can form an artistic legacy long after the Games and the Festival have ended. The catalogue and detailed blogging/documentation and social networking will be one of our responsibilities but another of mine is to is to ensure that the next generation of practitioners test the conventions of the white cube gallery, reconsider and revaluate artistic productions, their information structure and significance; engage in the museum sector whilst at the same time challenging the spaces for the reception of 'public' art. In addition those who wish to increase an audience's interaction and enjoyment of their work have a firm grounding in artistic practice and computing skills.

Consequently, I am particularly excited that the 2012 Festival Watermans will introduce a mentoring scheme for students interested in participatory interactive digital / new media work. The mentoring scheme involves video interviews with the 6 selected artists and their work, briefly introduced earlier in this preface, and discussions initiated by the student. As so often debated in our seminars at Goldsmiths and elsewhere, what are the expectations of the audience, the viewer, the spectator, and the engager? How do exhibitions and festival celebrations revisit the traditional roles of performer/artist and audiences? Can they facilitate collaborative approaches to creativity? How do sound works get curated in exhibitions that include interactive objects, physical performances and screens? What are the issues around technical support? How are the ways of working online and off, including collaboration and social networking, affecting physical forms of display and publishing?

As I write this in Wollongong during the wettest New South Wales summer for 50 years, I want to end with a quote used by the Australia, Sydney based conjurers Michele Barker and Anna Munster

> *Illusions occur when the physical reality does not match the perception.* [1]

The world is upside down in so many alarming ways but perhaps 2012 at Watermans will offer some momentary ideas of unity in diversity that the Games signify and ***UNITY*** proposes. Such anticipation and such promise!

Janis Jefferies
Professor of Visual Arts
Goldsmiths
University of London, UK

23rd Dec 2011, University of Wollongong, NSW, Australia

1. Stephen L. Malnik and Susana Martinez-Conde, *Sleights of Mind: What the Neuroscience of Magic Reveals about our Everyday Deceptions* (New York: Henry Holt and Company, 2010), 8.

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Interaction's Role as Catalyst of Synthesized Intelligence in Art

by

Judson Wright

artist/programmer
Pump Orgin
http://pump.org.in

ABSTRACT

The psychological role of interactivity was studied as the first computing machines were being built in the 1950's. However, attention was quickly detoured to other aspects of the exciting new technology. A subtle shift occurred from JCR Licklider's psychology-based "Man-Machine Symbiosis" perspective to Doug Engelbart's "wow factor"-based interface design a few years later. In the former paradigm, interactivity is employed, by the programmer(s)/engineer(s), in the service of integrating meaning, by the user, with the necessarily chaotic data of the computer. Meaningful output is therefore a result of the combination of human behavior and that of the computer. In the latter, interactivity is a means by which the computer can be employed intuitively, originally as an alternative to explicit command-line-type instructions, assumes the software will supply the desired meaningfulness. The underlying strategy of this scheme is that the computer be as inconspicuous as say, a hearing aid or contact lenses, and not detract attention from the output (as an object).

While meaning is often essential to the goal in both cases, the underlying assumption of a Platonist view, that there exists an object – a concrete yet physically inaccessible entity – is plainly dualistic. Dualism states the mind and body are distinct in that, while the body is subject to physical laws and directly detectible in physical ways, the mind is not. Yet somehow, the mind appears to exert some control over the body, by sending object-messages. This perspective is taken further to describe a model where computer output is seen as a final product (an object) of the program, the interaction being a means to this end. Though dualism has long been shunned by hard science, it has hardly been evicted from the deeper roots of scientific thought.

The Lickliderian approach takes more of a constructivist view of conceptualization, which we will address further. Constructivism is mainly entertained in educational theory and has never been discussed much at all in computer science. However, it is extremely relevant to issues such as Artificial Intelligence, and certainly the role of interactivity in computation. While these philosophies may be enlightening, we do not favor either abstraction, but do believe that both yield important concrete results, within appropriate tasks, each being useful in very distinct fields. However, in this essay we will focus on the Lickliderian approach. By engaged involvement in exploration of the physical environment, one also undergoes engagement in the neural processes of synaptic construction. Interactivity can and often does play an integral role in 'discovering' meaning. Better understanding of this role is essential to efficient and more effective use of computation.

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1. INTERFACE

While clicking on friendly graphic icons in Facebook *may* enhance the way members feel the software, it has indirect influence on how we *understand* the software, how we conceptualize the mechanics of what the computer is really doing, even in an abstract way. In many cases, that conceptualization remains hazy, with no pressing need to be improved. Without a sturdy concept, experiences can be intimidating. Friendly icons are one means of reassurance, though have no effect on the underlying conceptualizations.

Interaction, to varying degrees, creates that pressing need for us to conceptualize, to understand how and why a system behaves as it does. Deeper interaction is a catalyst of deeper understandings. Given minimal interactive options, such as a button that allows us only to pause or play a linear recording, we are generally only prompted to create minimal concepts. This is not a criticism however. In most cases it is even useful, so we are not cluttering our minds with detailed, robust models for everything we encounter. Some things just aren't that important to our individual lives. Nonetheless, in many specific cases, this 'user-friendly' approach does not suffice for *employing* computers to address computational problems. This fundamental issue, due to fundamental misconceptions about meaning and noise, thwarts tasks such as facial recognition or language generation and where they come from. Even far advanced researchers in computer science, lack these deeper conceptualizations, not because they are ignorant, but because they lack that 'pressing need.'

Art employing interactivity (regardless of the medium, technology or lack thereof, eg. gospel call-and-response singing) can supply this need, which somewhat

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explains why it is often lacking in hard science. Often scientists just aren't interested in art. Though there are no strict or universal rules about how we each learn, this constructive learning process is crucial in ways that many artists, and even many scientists, do not consider. A field that often *does* consider this aspect is cognitive science, however there is generally very little mention of interactivity. While cognitive scientists do certainly often discuss computers, they often (unknowingly) apply a Platonist perspective. Interaction is viewed as part of interface, something occurring on the surface, not part of the inner computational process *in the machine*. The error is in only considering the machine output as a final product, independent of the human who must interpret that meaningless configuration of pixels or ink as non-random. The Platonist assumption is that there is some real object, which has meaning as an intrinsic feature, a meaning which is inert (un-interactive, static) and only imperfectly ascertainable to others.

Obviously, next we should discuss this learning process and how it relates so fundamentally to art. But in order to proceed, we must first clear up some initial assumptions. While interactivity is hardly isolated to computer technology, technology does make interaction far more convenient. However, concepts about human learning and computer learning are often indiscriminately intertwined, such that less obvious issues of interaction are often obscured.

2. HUMAN LEARNING

There is a fairly consistent schedule of *pruning* in the brain. [1] We are born with potential neural networks for a wide variety of un-honed skills. Around two weeks the vast majority of unused (un-strengthened) are abandoned. Less extensive pruning occurs around age two, again around age six, to lesser degrees at longer intervals throughout life. We might set our crucial learning time according to the Piagetian [2] [3] pre-operative stage, which is estimated during those same years, from about two to seven. Nonetheless, there is a time period where the *specific* lessons learned by a child are not remotely as important as is the process by which the child learns to form concepts (for themselves) in general. Memorization of say multiplication tables are easily forgotten and often only understood insofar as they can be correctly (according to the teacher) regurgitated on tests. But, for instance, a child may discover a more fundamental notion in determining how much tea to make for all of the dolls to get a full cup. But there is no universal way to learn. Each child merely follows interests to perform activities. Hopefully, the larger application of one of these games is understood. "Ah, the math problem 3×6=18 is like if you had 6 dolls with 3 cups!" Obviously, this example is far too complex, and more accurately, realizations would build very gradually from much smaller steps. However, these steps are not always complete sentences. And they absolutely must be taken in the child's own terms, exploiting the strengths and weaknesses, of that child's unique idiosyncratic *learning styles*. [4]

Though a common psychological illusion would make it seem that correct answers indicate the child has learned multiplication from a dictating math teacher, further testing often reveals the child has not actually grasped the underlying concepts. The child has not abstracted the words and symbols in such a way that the concepts can be re-applied as needed. The child may have no idea that multiplication is even useful for things outside of school math tests. [5] [6] While the child can easily be discouraged by failure to appease the teacher, and, as a protective strategy, shut themselves off from further mathematical discourse, encouragement for successes on these tests, often does not apply further than the personality of the adult the child wishes to please. We do not need to dwell on the tragic results of our education system. The point here is merely that interaction, in the broadest sense, is fundamental to Child Development.

> *Though there are no strict or universal rules about how we each learn, this constructive learning process is crucial in ways that many artists, and even many scientists, do not consider.*

3. VARIATIONS OF PROJECTED INTELLIGENCE

For over a decade now, most of my artwork is related to three key investigations. One is the work of Richard Gregory on the eye and brain. [7] [8] The eye is not an isolated system, but plays a smaller role in instigating thoughts. Of particular note is his short film of a Dalmatian walking through snow patches. [9] [10] From a still image, it is difficult to identify the scene. However, in motion, the scene becomes clear. So long as the dog is moving, the brain draws imaginary outlines of it. It uses Gestalt rules to do so. What is peculiar about this phenomenon is that Gestalt rules apply not just to visual organization, but rather well to audio scene analysis. [11] I would further hypothesize that these Gestalt rules function well beyond modality and sensory analysis to conceptual analysis at a more fundamental level.

Another experiment is ELIZA, the AI program by Weizenbaum. [12] The program appears as a simple text editor. It claims to be a computer therapist and begins by asking (in text) how you feel today. Let's say we answer with "Fine, but my tooth is bothering me." (again, in text). ELIZA might reply, "Why is your tooth bothering you?" It utilizes a well-known trick from psychology, repeating back part of something just said. We have already given meaning to the words, so when we hear them again, assume the question is meaningful as well. ELIZA appears intelligent, primarily to the person *actively* typing answers concocted in response, though this meaning is entirely projected.

For a simple example, I might include an image of the program ELIZA. However, depicting the program rendered would be misleading. The essence of ELIZA lies in the interaction, not an object. To understand the program, a *visual* by-product is simply a distraction. Having first discovered this fairly popular program in about 2000, I have probably never actually seen the original. But so long as the algorithm remains fairly unchanged, this remains trivial. To teach someone to ride a bike, as an object, we absolutely do need a physical bike, but the bike is a superfluous cog in a greater system. Most any bike will do, and certainly features

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like the color or the taste of it are not relevant. The object only deserves enough attention to get to the interaction.

Also of note is the "man-computer symbiosis" [13] of JCR Licklider. He predicts that AI will succeed at things like voice recognition, possibly by 1980 (which it clearly did not), but until that time, proposes a way for the strengths of human intelligence and machine's computational abilities to work *together*. His team developed an example of this for the US Air Force. [14] Their challenge was to integrate data from multiple radar stations around the word to create a complete monitor of the skies above the US. This included developing the computer hardware, then accomplished with vacuum tubes offering very little speed or memory. One problem was that a display of this information yielded chaos of points. No machine (at any speed with limitless memory) could distinguish the useful information from the inevitable noise. But that noise could not be eliminated without taking away critical data. The solution was the 'light pen,' which allowed the human watching the screen to track particular interesting dots displayed and perform further calculations. [15]

In all three examples, the machine makes no effort at all to behave intelligently. It merely performs 'dumb presentation' of the meaningless data. The audience *interactively*, if only at a mental level and not with gross motor impulses, imbues the presentation with meaning. These examples are presented as a bridge between scientific efforts to collect chaotic data, which is computable, and artistic efforts to understand expression, which is not purely chaotic. It is not enough to merely reveal a bridge between these camps. We must *actively* cross that bridge.

3.1. Projecting Organization

The perceptual magnet effect (PME), as studied in spoken and musical sounds [16] is an essential difference between the organic and mechanical notions of detection. The conceptual categorizations of chaotic audio are prone to be interpreted as a particular iconic expected notes or phonemes. When the source is fairly similar to the exemplar, this would be expected. But there is a grey area, where the source is perceived as being closer than it actually is. This magnet-like tendency recurs, not just in perception, but general comprehension. It is one indication that conception is not a result of a passive process, where stimuli reflect the experience as a mirror would. Rather imagine a sculptor creating a likeness of a model in the studio, that will eventually be displayed elsewhere. The sculptor may aim for realism in highly specific details, but rarely expects that the entire sculpture will be mistaken for the model. Attention is not general. One does not pay attention to every aspect at once. Thus the sculptor in our minds is continually revising – interactively. Our ability to shift attention to a specific detail, is maintained like a muscle that can become as precise as a violinist's fingers, but, just as a child's handwriting is a product of fine-motor dexterity, so too our mental toolbox of conceptualizations is a product of engagement. A (motor) skill, like virtuosity playing the violin, need not be conscious or expressible in words, but a 'feeling for it' is recognized.

"Although today's culture is very mediated by current standards, it is actually characterized by a relatively low level of practical information from which the average person can benefit in their daily lives… The brute force arithmetic techniques that have recently been used by computers such as Deep Blue to defeat human chess champions, along with techniques for solving classical mathematical problems such as the factoring of large integers, do not illuminate us in any way regarding how the human central nervous system and brain function. While working at Bell Labs in the late 1960s and early 70s [just after Licklider], physicist Edward Arthurs was part of a pure research division that included people working with computer science, mathematics, and acoustic and visual research. Among other things, the scientist in Division 10 developed games that require moving in 4-dimensional space. In order to be successful while interacting with these 2-dimensional projections of 4-dimensional space, it was necessary to build up an intuition of this [sic] other dimension. Arthurs reported that after playing these games for a while, the researchers developed a good kinesthetic feeling of 4-dimensional space through using all of their senses." [17]

This is much the same thing that Paul Bach-y-Rita describes of when people, first introduced to his apparatus, begin learning to 'see' with the tongue, and the neuroplastic changes within the somatosensory map in the brain. [18] [19] [20] The upshot is that while Marshall McLuhan might propose that "The Medium Is the Message," [21] and Claude Shannon might propose that content is irrelevant, [22] both conceptualizations are (necessarily) severely limited in modeling communication. Both insist that consideration of communication be isolated to a single-dimensional dynamic. This view of communication has proven crucial for certain purely theoretical, mechanistic, empirical problems, and ultimately leads to an Inglebartian perspective. But it does not describe the learning as it takes place in human brains, in real-life situations, for that we require a Lickliderian approach to interactivity.

3.2. Experiments

Here are three examples of pieces I created that exemplify the role of interaction in cognition. We begin with *ASCII Ink Blot* (2004). The user is shown a random configuration of characters. These characters form what is termed ASCII art, which was particularly popular in the early days of the Internet, when file size was more of an issue. Since ASCII characters used very few bytes, whereas pictures used quite a few, often in emails people drew figurative and abstract graphics, using text symbols. The user then describes, in text, what they see in the 'ink blot,' and presses the submit button. The characters submitted by the user are then reconfigured to draw the subsequent 'ink blot' test. In this case, the interaction and the resulting computer output are inextricable.

Figure 3.1. ASCII Ink Blot.

William James made the famous analogy that the brain develops habits of though similarly to the way ruts are created in a road. When a small rut is driven over, the car will tend to fall directly into that rut, even slightly adjusting the position of the automobile in doing so. Furthermore, wheels repeatedly falling into that rut will erode the rut such that the odds increase that it will be fallen into next time. In *Ruts in the Road* (2010), users are shown random letters, falling like rain. Employing a very basic form of interactivity, they are instructed to click on letters that occur in their name. Faintly, paths are drawn between points of clicking. One will tends to notice letters in patterned areas and not simply randomly across the screen. At first, these faint paths are difficult to detect, though gradually they accumulate and the paths define a very visible space.

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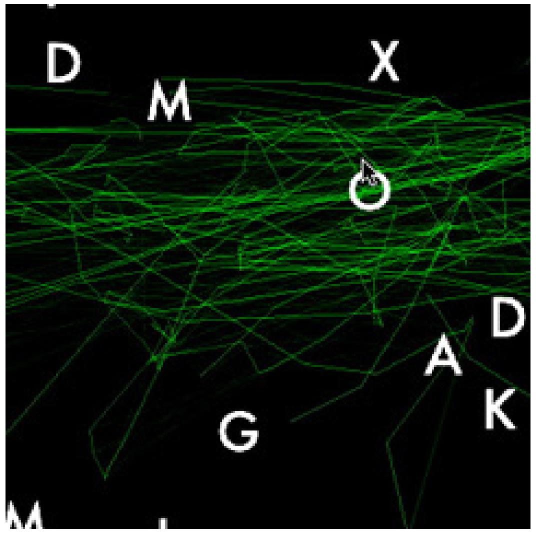

Figure 3.2. Ruts in the Road.

It is important to stress the extremely subtle ways in which interactivity can be incorporated, not for its own sake, nor the sake of usability. Interaction is engagement that bridges the human and the machine. It is a means of creating meaning-making structures, further causing shifts in the mental rules of perception, gradually adapting to interpret the computer's noise and ground as message and fore. Literally, *Sonic Displacement* (2009, 2012) displaces what we see, with what we hear. This piece encourages audience members to behave uncharacteristically, in concert with other individuals, to 'learn' new perceptive relationships, causing them to reinterpret their environs. Importantly for this piece, we experience the world *by integrating other sensations* and employing our muscles to explore, test, push, pull, and observe how our world reacts to us. This piece is meant to manipulate the relationship between perceptive relationships and the environment so that the connection between our 'perceptions' and our 'behavior,' rendered concrete and physical via technology, can be recognized, re-explored and reconstructed by a physically engaged audience. Simply put, the observer who passively waits for something to happen, will wait forever. The user, who engages, will begin the process of altering perceptions, constructed by that very process. Interaction jump-starts this cyclical process.

Technically speaking, displacement uses microphones to monitor ambient sounds and sends them to a computer. The computer analyzes the sounds and produces a list of variables. Meanwhile, a camera, pointed at the crowd, similarly creates lists of visual variables. These numbers constitute an abstracted, animated view of the people in the space. If the room is silent, the projection looks rather like an ordinary view on a security monitor. But gallery space is noisy, crowded and chaotic, thus distorting the image in logical, but unsuspected ways. As people respond, attempting to understand that logic, the images react to their activity and the surrounding environment, revealing the integration.

What is fascinating is that the participants, who are given none of the above explicit explanation, spontaneously begin to actively experiment within it. They strive to make change, to be affective, to interact with each other within this unexpected ambiance. They experiment with the sound and images, and with each other. They wave their arms; they dance; they make high pitched sounds; they stomp and jump and fling themselves about; they shout and sing and hold each other – in order to understand what they are experiencing. The goal of the piece is not to create anything visual, though that is clearly the computer output. The goal is to create this artificial situation, specifically in an art gallery context, that radically alters how people behave, in what is usually a familiar space, with familiar rules. As perceptions warp, behavior changes for each individual participant from their own 'usual.' Moreover, the resulting responses symbiotically alter how that perception is presented to them. The audience is given a concrete illustration of how the environment, the self and others are inextricably linked, only distinguished by this cyclical, highly personal process of 'reality' construction, that we call perception.

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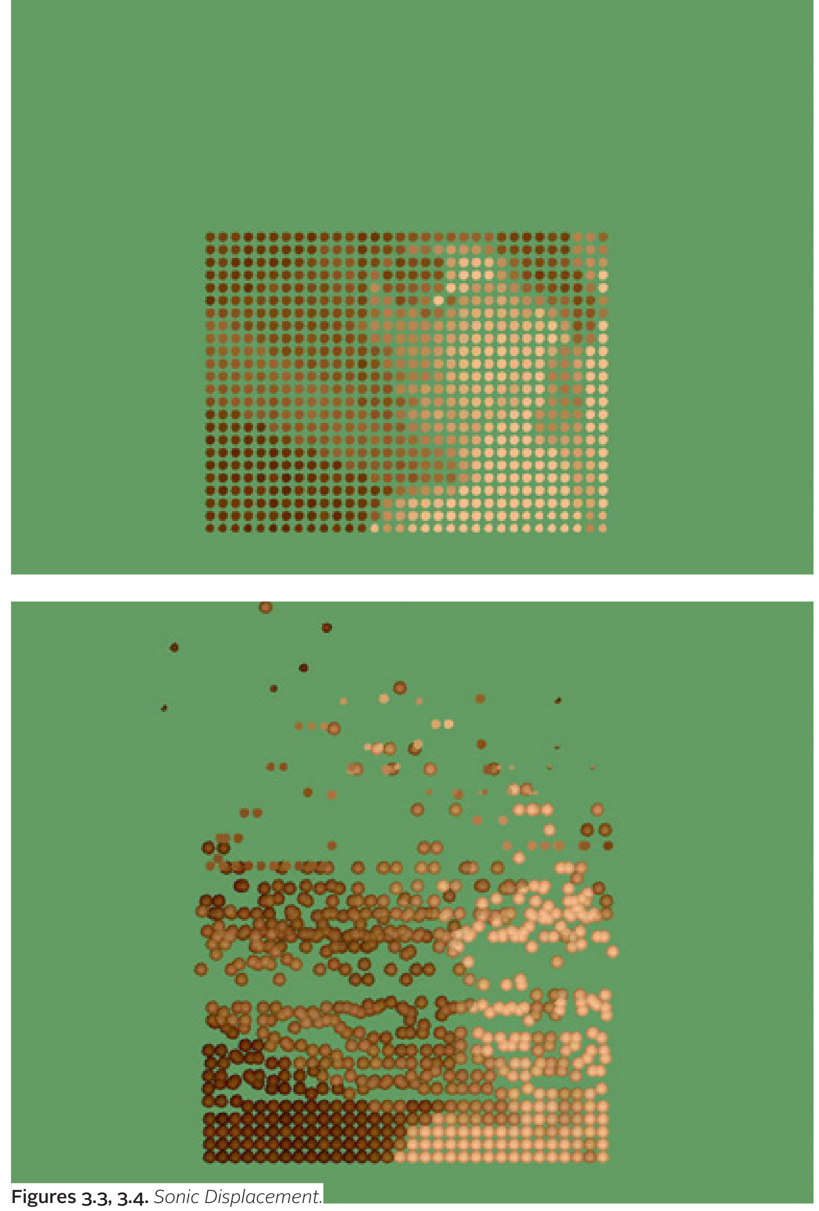

Figures 3.3, 3.4. *Sonic Displacement.*
These screen shots illustrate the pieces reaction to silence versus (medium volume, high pitched) noise.

4. CONCLUSION

In much of computer art, including pieces of my own, often the 'input' is random behavior (technically pseudorandom, but unpredictable enough) or may as well be (for instance data from bio-sensors). The 'output' is assumed to imbue that chaotic data with a meaning, applying a cookie-cutter-esque filter, in such a way as the data is contextualized – or rather contextualization is something that can be added, as Hobbes believed, *on top* of an a priori object. [23] However, any output is subject to context, which *must* be established independently of the computer. In fact, computer users quite regularly confuse errant information, such as a system crash, with as 'message' from the software, which they are currently attending to, even if many other programs are currently running idly in other windows. Causality in computer interfaces is very rarely as detailed and generalize-able as the causality we casually apply, with fair success, to experiences in the world with which we are familiar. Causality can be applied in computer behavior, but by and large, un-intuitively and at a very technical level most do not consider, though conclusions other than "I don't know why" are drawn anyway. [24] In short, computers do require very precise organizing protocols for the storage

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of data. However, they then tend to obscure context. Thus, one effective strategy for re-establishing context is with interactivity. The more deeply integrated it is with the problem as a whole, the more likely the computer output will be interpreted as meaningful. This is a powerful technique that is easily and regularly misused. If the audience member engages only at a very initial sensory level via *interface*, the computer plays no real role at all in constructing that meaning, yet often receives full credit. [25] Again, the meaning must be explicitly articulated by some non-computational means.

In cases where the randomized 'input' is not really random, but arbitrary (still unpredictable yet still following intentional 'decisions'), such as biosensors, fish tanks, and social software, this may have more significance to the author, or those familiar with the system, but it remains chaotic data. In such cases, presented with a choice of buttons, no option actually can possibly link the input source and the output, except via explicit dictation. This is fine, but there is no likely architectural work at the neural level. [26]

Feedback and interactivity are not guarantees of meaning, but open a door to allow access to it. For example, often museums consider displays interactive, that provide a button which when pressed, begins a narration. The narration is not understood by the button-pushing act. The narration remains internally unaffected by it. When potential source of intelligence is then subject to feedback (interactivity), it becomes possible to design a process by which the behavior of the system can be detected by the user, and the users response, positive/negative or more complex, can be applied to the subsequent behavior of the system. This process is termed, in Cognitive Science, by Gerald Edelman as *reentrance.* [27] What we might hope to do, with the aid of art, regardless whether we consider ourselves artists, is to encourage the observer to create meaning for things that are not inherently intelligently organized. We aim to demonstrate how meaning might be a result of a synthetic system.
While I am proposing a model that is *cybernetic*, even as Norbert Weiner would describe the term, we are taking the opposite perspective. Weiner states "[T]he performance of a piece of apparatus should be fed back to it as information on which to operate...In other words, the automatic substrate must listen, and it must speak." [28] But we might *also* look at this dynamic such that the tool-user must speak, in order for that substrate to be told what to do, including the terms in which it might be 'spoken,' so that the tool-user will appropriately identify the tool's presentation of a solution -- in other words, for that substrate to be *heard*. It so happens that, thanks to computers, interactive components can be made part of a given substrate. ■

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