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Record of Creative Work

A comprehensive exam report submitted
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By
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UNIVERSITY OF CALIFORNIA, LOS ANGELES
Department of Design | Media Arts

STATEMENT OF COMPLETION FOR THE DEGREE OF

MASTER OF FINE ARTS

This is to certify that

Jihyun Kim

has completed the requirements for the M.F.A degree in

DESIGN | MEDIA ARTS

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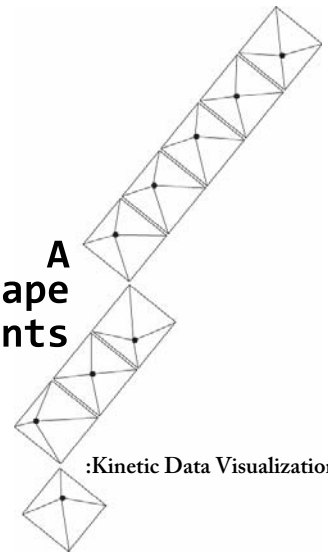
DATE: Nov. 26. 2008

A Landscape of Events



:Kinetic Data Visualization of Natural Phenomena

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A Landscape of Events, Installation View, May.2008
New Wight Gallery, Los Angeles, USA

Abstract

A Landscape of Events

The acceleration of data collection and geographic technologies has changed the physical and virtual boundaries of nature, perceptions of geometry, geopolitical paradigms, and ecological issues. Perception now extends beyond our immediate physical and phenomenological experiences of space. Historically, in many cultures around the world, the concept of landscape implied a process of distancing nature from a perceiving human subject, and has been conflated with countless predetermined cultural, social, and political meanings. What, then, does such a notion of distancing mean within a contemporary urban context and new technologies? This project explores landscapes within a contemporary art/urban context and interrogates the physical and emotional aspects of our current engagement with technologies.

A Landscape of Events is a kinetic data visualization that simultaneously objectifies nature, subjectivizes landscape, and visualizes natural phenomena. This project employs (near) real-time data from natural events that resist visual recognition and cannot be experienced in everyday spaces. This project investigates different interpretations of ocean wind and suggests the evocation of interaction with this indeterminate space. This project utilizes data, physical objects, and space to visualize the experience of natural phenomena and experiment in creating a subjective scene. *A Landscape of Events* is moments that exist somewhere in the physical realm and encourage viewers to question their sense of their surroundings in order to counter the pervasive atmosphere of passivity in contemporary urban life.

"Nature is an enigmatic object, an object that is not absolutely object; it is not absolutely in front of us. It is our ground, not what is in front of us, but what bears us."

[Maurice Merleau-Ponty]

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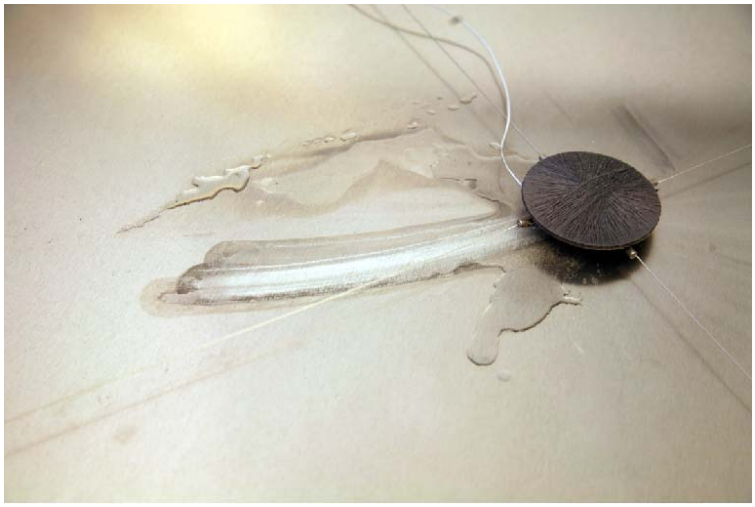

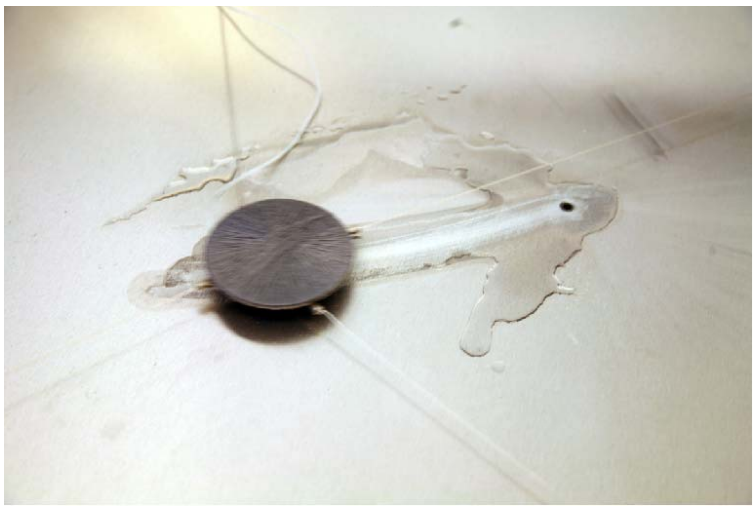

A Landscape of Events
Salt Water, Movements, and Corrosion
NOAA station 46026, Nov. 2008
Los Angeles, USA

1. Introduction

1.1. Background

New technologies, particularly data collection and geographic mapping technologies such as global positioning systems (GPS), geographic information systems (GIS), and remote sensing, have produced complex concepts of place/space and blurred the physical and virtual boundaries of nature, the perceptions of geometry, ecological issues, and geopolitical paradigms. Place/space now exists as a mobile sphere where physical and virtual realms cross each other and create different perspectives. Within such an infinite and abstruse context, the fixed boundaries of time/space do not exist and nature is not limited solely to traditional ecological environment frameworks concerning issues of global warming, overpopulation, and vanishing species. Space/place is no longer a fixed physical scene. Rather, within this conceptualization, space is more about the landscape made, created, and recreated by humans and their social, economical, and cultural activities.

Figure 1. Hans Haacke, Wind and Water Sculpture, Tri-Quarterly Supplement, 1967

According to Paul Virilio, "Landscape has no fixed meaning, no privileged vantage point. It is oriented only by the itinerary of the passerby."[1] Landscape is a complex experience constituted not by one's cultural, economic, political and technological environment that is differently distributed and conceived in different parts of the world but by individuals themselves. So there can be various ways to interpret the meaning of landscape. The traditional landscape art genre was radically transformed in the 1960s, when many artists stopped merely representing the land, and new technologies, such as video, spread out to public.

[1] Virilio, Paul, Translated by Julie Rose. A Landscape of Events. MIT Press, 2000, p xi
* The title, *A Landscape of Event*s, is from this book.

Landscape is meditative moments that are connected to life, art, nature, and humankind through everyday life; these are the ways in which we articulate and enact individual experiences, or re-order our responses, in the space we live now.

The concept of landscape implies a process of distancing nature from the perceiving human subject. Historically, in many cultures around the world, this concept of landscape has been conflated with countless predetermined cultural meanings. Such socio-culturally defined distancing often privileges the visual/verbal objectification of landscape while marginalizing all of the non-visual/verbal forces, such as human subjectivity and individual imagination. What, then, does such a notion of distancing mean within a contemporary urban context–i.e. a rendered world? Mark Hansen explores this concept in a *rendered* world using the following worlds:

> [A]lmost every aspect of our daily lives is "rendered" in data. New data collection technologies have made it easy to record continuous, high-resolution measurements of our physical environment (weather patterns, seismic events, and the human genome). We are also constantly monitoring our movements through and interactions with our physical surroundings (automobile and air traffic, large-scale land use, and advanced manufacturing facilities). In computer-mediated settings, our activities either depend crucially on or consist entirely of complex digital data (networked games, peer-to-peer technologies, and Internet usage). As a result, the flow of data has become an important force in contemporary life.[2]

Figure 2. Carl Andre, 2 (1H x 12S), Aluminum Double Twelver, 1999

We are living in an age increasingly overloaded with information in a *rendered* world which consists of a variety of realities. Whenever we encounter digital data and representations in everyday life, there is always some 'distancing' that results from reducing our images to bits and pixels. In that way, perception can extend beyond our immediate physical and phenomenological experience of space. My project attempts to not only visualize a landscape of events that employs real time data from natural phenomena but also explore landscapes within contemporary urban/art context. This project interrogates the physical and emotional aspects of

[2] Mark Hansen, 2007

our current engagements with technologies. This project also provokes curiosity, leading to a critical exploration of the boundaries between the real and the virtual, land and non-land, natural and artificial, and the material and the abstract through data recomposed natural events.

1.2. Objectives

A Landscape of Events simultaneously objectifies nature, subjectivizes landscapes, and visualizes the liminal and invisible scene of natural phenomena. This project employs real-time data from natural events that resist visual recognition and cannot be experienced in everyday spaces such as ocean wind, tide, ground water flow, and ground movement. Unremarkable, customary yet noticeable movements are the constituent materials of this project. Just as artists have been exploring nature through the actions of traveling, walking, mapping, excavating, and building, I study the incidental planetary rhythms of wind, water, and ground through near real-time data measurements. I then manipulate the data through the processes of reconstitution, arrangement, and distortion. This thesis is to explore landscapes within contemporary urban/art context and interrogate the virtual, physical, and emotional aspects of our current engagements with technology.

Figure 3. James Turrell, Roden Crater, near Flagstaff, Arizona, in progress since 1980

Chapter 2 of this thesis, titled A*bsence of Landscapes*, investigates the foundational theories of modern nature and new urban experiences. I will investigate the effects of those new phenomena found in our contemporary urban life. This chapter discusses their changing meanings of nature and urban experiences – not only how they influence our everyday lives, but also how we view them. As a cultural, historical, theoretical, philosophical and/or aesthetic background for this thesis, I describe ideas of Félix Guattari and Estern thoughts in this chapter. Another focus of this chapter is to investigate how new technologies are inspiring a new sense of landscape and the impact of these technologies on contemporary digital urban life. Following this, I introduce wind as the topic of focus in this thesis and accompanying project.

Chapter 3, *framing to mapping*, covers geo-related technologies, particularly GIS as a new media, map and visualization, and multitudinous realities. After discussing GIS, I explore how the fields of cartography and mapping are changing due to these new technologies. The analysis then investigates current information visualization flow and introduces some of my previous experiments as examples. The analysis then explores multitude realities, and I suggest a different way of visualization through a hybrid reality.

Chapter 4 describes how methodologies can be used to address kinetic information visualization of natural phenomena, in particular, ocean wind. In terms of process, the project is divided into three main parts: (a) a virtual process – analysis of data and methodology for investigation, which is part of the traditional process of information visualization, (b) a physical process – developing mechanical systems for representing near real-time data movements of natural events, and (c) a hybrid process – combining the aesthetic components that connect virtual and physical processes. The project intertwines not only the fields of technology and art, but also the virtual and the real.

Finally, my *Conclusion* rearticulates my central concept and provides an overview of the project's exhibition including my own observation and viewers' reactions.

Figure 4. Walter De Maria, *The Equal Area Series*, 1976-77

1.3. Project Overview

A Landscape of Events presents a kinetic data visualization beyond screen-based representations. The project employs (near) real-time data from natural phenomena, in particular, ocean wind from the west coastline of US. The wind exists neither in heaven nor on earth, neither in west nor east, and neither in presence nor history. It exists as invisible space *between* everything, in the middle, amid considerations as a potential territory. This project utilizes data, physical objects, and space to visualize natural phenomena as a physical form. It experiments in creating

a subjective scene that allows a full range of possibilities from data, material, form, and scale.

The project presents real-time natural productive movements based on ocean wind data that is updated every 10 minutes. Performatory movements of wind data create traces of corrosion as time passes. Wind traces are overlaid again and again, and the aluminum sheet is deeply corroded. Movements represent the presence of the wind and corrosion traces represent the history of the wind. The salt water coagulated after being pumped out from underneath the aluminum sheet, and there were some visible secretions. The physical form of the work consists of construction materials from our surroundings such as metal, concrete, and machinery.

The project examines our experience of the spatial and perceptual conditions through objects/installations and visualizes environmental events. The project invites different interpretations of natural phenomena as those events interact with the indeterminate space created by my project. In my work, the viewer shares our subjective experiences, and moments of instantaneous communication with the natural events. *A Landscape of Events* is moments that exist somewhere in the physical realm and encourage viewers to question their sense of their surroundings.

Figure 5. A Landscape of Events, Los Angeles, 2008

A Landscape of Events
Salt Water, Movements, Corrosion and
Secretions after one week
NOAA station 46028, Nov. 2008
Los Angeles, USA

2. Absence of Landscapes

HAMM: Nature has forgotten us.
CLOV: There's no more nature.
Samuel Beckett – Endgame

2.1. Modern Nature

Now in the age of new media, we often experience nature indirectly and mediated with man-made images and perspectives, but we still constantly receive messages from the environment. Nature is a subject of permanent interest and relevance as seen in landscape paintings, art and photography everywhere. Nature might always be the most popular subject of art; it is also arguably the most open-ended.

The web survey project by Komar and Melamid in 1995 concerning the 'Most Wanted and Least Wanted Paintings'[3] reflects "the artists' interpretation of a professional market research survey about aesthetic preferences and taste in painting."[4] As the result of the survey, the most popular pictures were landscape paintings for almost every country in the world, and this says landscape be the most popular subject of everyday life. However, at the same time, we can see how the representation and imagination is limited. Such culturally defined distancing often privileges the visual objectification of landscape while marginalizing all of the non-visual forces at work in nature.

Figure 6. Ned Kahn. Technorama Façade,The Swiss Science Center, Switzerland. 2002

[3] form Golan Levin's keynote presentation at Infovis07, 'Visualization without computer'
[4] http://www.diacenter.org/km/index.html(accessed May, 29,2008) In 1994, they began the process which resulted in *America's Most Wanted* and *America's Least Wanted* paintings, which were exhibited in New York at the Alternative Museum under the title "People's Choice."

Figure 7. Komar & Melamid, Most Wanted and Least Wanted Paintings, 1995

Images present us, simultaneously, in terms of culture, power, symbolism, and politics with the same redundancies of behavior. Within this image-oriented environment/landscape, there are no more individual experiences of absolute time and space in our ordinary life. In consideration of these ideas, there are several theoretical and philosophical views about image in modern society. For example, in Regis Debray's book *Vie et mort de l'image[1992]*, a survey of the metamorphosis of the image, the author criticizes the equality of the visual organ – 'visuality = real = truth' and the disappearance of invisible and subjective things. He states that if everything can be seen, then nothing is valuable. Singularity is decreasing with the progressive debasement of objects and spaces, and discreditable and banal visuality is increasing.

I often think that there is potential for creating singularities focusing on invisible communication and human subjectivity. I propose mental ecologies as an act for creating stylistic si ngularities within the otherwise closed world of continuously recycled and redundant mass-media imagery in everyday life. In short, Félix Guattari's ideas and Eastern views of nature are two influential theories behind this thesis.

Ecosophy Guattari wrote about our ordinary life in the new media society, "At best there is the creation or innovation of new Universes of references; at the worst there as deadening influence of the mass media to which millions of individuals are currently condemned." Guattari explores *ecosophy* as one of the foundational theories of nature as mental and invisible. It consists of three intrinsic and inseparable spheres of ecology: the environment, social relations and human subjectivity. He writes that mental ecology's "ways of operating will be more like those of an artist, rather than of professional psychiatrists who are always haunted

by an automated ideal of scientificity."[5] His perspective involves shifting "the human and social sciences from scientific paradigms towards ethico-aesthetic paradigms."[6] Guattari states:

> [G]eopolitical configurations are changing at a great pace whilst the Universes of technoscience, biology, computer technology, telemetrics and the media further destabilizes out mental coordinates on a daily basis. The suffering of the Third World, demographic cancer, the monstrous growth and degradation of the urban fabric, the insidious destruction of the biosphere by pollution and the incapacity of the system to reconstruct a social economy adapted to the new technologies – all of this ought to lead to the mobilization of minds, sensibilities and wills.

Openness Eastern thought presents a complementary idea of nature that emphasizes mental ecology, invisible energy, imagination and openness such as Qi, I Ching and Buddism. In Eastern culture, ecology in art is using both natural and man-generated forces, the materials and human energy of a given environment, in order to enhance life in a given environment and possibly beyond those geographic borders. In this context, art is considered part of people's ordinary life and the mediation-based communications which communicate between humans and nature. In other words, instead of creating simulative images and objects, arts are considered to create things that help people to communicate with nature more easily. For example, there is a traditional architectural structure in Korea in the past called 'Jung-Ja', which is a kind of arbor. This is different from the European and Western arbor, located inside manmade gardens; Jung-Ja was usually located and constructed in nature itself. The frame of Jung-Ja becomes the real screen of nature, and people inside the space could move into and experience the real scene surrounding them.

Figure 8. Roni Horn, The library of water, 2007

Again, in Eastern thought, the domination of nature is closely linked to other systems of domination like our everyday life. For instance, in the preface to the book, *Buddha Mind in Contemporary Art*, the editors Jacquelyn Bass and Mary Jane Jacob state the importance of Buddhism and nature in art. "The influence and resonance of Buddhism is

[5] Guattari, Felix. The three ecologies. Athlone Press, 2001, p49
[6] Ibid.,, p10

important, not as a prescriptive religious doctrine, but as a perspective that has achieved a state of synthesis with some important element of art practice."[7] Bass and Jacob also mention:

> [A]nother intent was to cultivate the potential for satisfying aesthetic experience engendered by an open, aware state of mind. We hope to address, within a field rethinking its own practice, bow the audience can best access and have a rich experience with art.[8] ... is realization that art resides not in the mind of the artist or in the art object, but in the mind of the viewer. This realization parallels the Buddha's insight that suffering resides not in events or objects but in our mind[9]

In my opinion, there are some connections between the contemporary West and the East of the past, and the most significant idea that makes a connection between both is openness and mind in nature. In this context, Umberto Eco's *Open Work* provides an influential idea: "A work of art is a complete and closed form in its uniqueness as a balanced organic whole, while at the same time constituting an open product on account of its susceptibility to countless different interpretations."[10] Brass described Marcel Duchamp as an artist who changed not only "how we experience art, but how we experience life."[11] "If you wish" Duchamp said at the end of his life, "my art would be that of meaning: each second, each breath is a work which is inscribed nowhere, which in neither visual nor cerebral. It's a sort of constant euphoria."[12]

My project questions the modern landscape which means not only the absence of traditional concept of nature, but also the absence of individual imagination and human subjectivity in the complex and passive urban life. In terms of the concept, personally, my project consists of the following purposes: (a) the individual's possibility of sensing and being themselves without external pressures and preconceptions and (b) the idea of representing and transforming nature in different forms and contents that

Figure 9. Marcel Duchamp, Rotoreliefs, 1935

[7] Baas, Jacquelynn and Mary Jane Jacob., Ed., Buddha mind in contemporary art. University of California Press, 2004, p11
[8] Ibid., p11
[9] Ibid., p20
[10] Eco, Umberto. Open Work. Harvard University Press, 1989, p49
[11] Baas and Jacob. Buddha mind in contemporary art. p20
[12] Tompkins, Calvin. Duchamp: A Biography. Henry Holt, 1996, p408

can be applied in a new space/place – a hybrid reality or a utopia under the concept of a new urbanism. To describe these concepts more effectively, I will provide appropriate examples from Olafure Eliasson's solo exhibition *Take Your Time* and Norman Foster's *Crystal Island.*

Figure 10. Olafur Eliasson, The weather project, Tate Modern, 2003-4

Take your time Olafure Eliasson's recent exhibition, *Take Your Time*, in SF MOMA, is an interesting reference because his works are about "seeing yourself sensing." He proposed the concept, *being alter*, "progression constantly in dialog with the viewer (Eliasson, 2003 in his interview)" The important points in his proposal are the individual's idea of space, duration, and the view of him or herself. In contemporary society, it is easy to lose individuals' sense with cultural mass media imagery. I think, like Guattari mentioned, individuality is an important aspect can be used to recreate a valuable urban life. In her review on ARTFORUM, Anne M. Wager says;

> [W]hereas for Eliasson, "seeing yourself sensing"– being alter, that is, to your self and surroundings - has long been the goal.... In "take your time", "your" perception is the theme. For Eliasson the topic is not new. Yet it seems to have taken a while for him to realize who exactly who you might be, and how they should deposing of their time.

Figure 11.Norman Foster, Crystal Island, 2007

*A new mixed-use destination for Moscow

Crystal Island For the future, I can imagine other types of places where we can live, like those we see in Science Fiction movies: for example a hybrid space where we actually live now, the outer space, and a new form of space, such as the one proposed by Norman Foster, who is a London-based architect, and contributed to the design of Crystal Island. How are physical space and nature reconceptualised by the new technologies built within new/hybrid environments? What kinds of interaction will be possible in the new/hybrid space? In this regard, Norman Foster's *Crystal Island* project is remarkable. Forster sees *Crystal Island* as a paradigm of compact, mixed-use, sustainable city planning, with an innovative energy strategy and 'smart' skin, which buffers against climate extremes.

2.2. Urban Experiences

Figure 12. View of cities from Google Earth, 2008
(FromTop: Los Angeles, New York, and Seoul)

A city is a space where people's lives and deaths, their presence and history, their wealth and poverty, and the holy and secular parts of their lives are compressed together. People live together in cities and their lives can not be described without cities, which are an aggregate of human activities. How many people live in cities? "According to the UN, the number of urban dwellers is expected to increase from roughly 3.2 billion today to more than 4.9 billion by 2030."[13] New York, Los Angeles, London, Tokyo, and Seoul are gigantic industrialized and media-oriented cities, and convey icons of high-rise concrete buildings, automobiles, freeways and so forth.

Regarding Virilio's concept of landscape from Virilio, which, as I wrote above, is "oriented only by the experiences and the itinerary of the passerby," most landscape now is closer to urban scape than the traditional natural scape. Then what about life in the city? To maintain the system of the city, people just pursue their everyday actions without an aim and they are becoming consumer-driven. In contemporary cities, individual subjects are disappearing along with personal style. I believe new technologies can make it possible to develop more active and creative ways of communication in the urban lifestyle thus encouraging diverse styles.

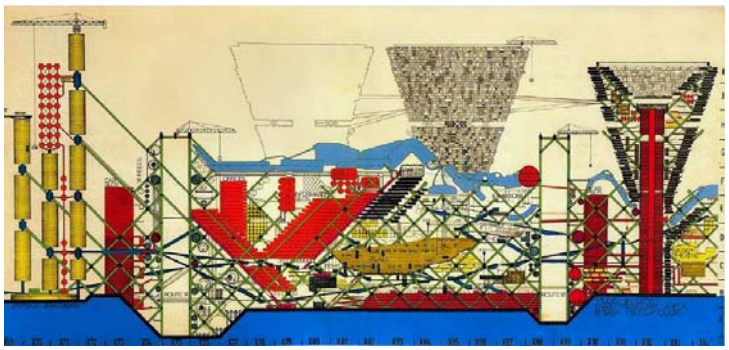

Figure 13. Archigram, Plug-in City, 1964

[13] Potere, David and Annemarie Schneider. "A critical look at representations of urban areas in global maps", GeoJournal, 2007, p 55

Figure 14. Blast Theory, Can You See Me Now?, UK, 2001

*A game that happens simultaneously online and on the streets. (down) An urban gamer running while playing the game.

Tehnological Living In the 1960s, Archigram proposed new forms of cities with new environments where new technologies are possible everywhere; for example, a media city, a plug-in city, and an instant city, and those cities of imagination. These cities that were represented as graphic based works now became a reality in these days. Pedestrians are not just people who are passing by, but they are also people who can interact with multi-user environments such as mobile apparatus and locative media in urban spaces. These also can be defined as social and cultural spaces that allow telecommunication between people with different purposes.

The apparatus is merged with physical space and recreates a different urban context. For instance, in one new media art genre there are locative games which use mobile devices such as the project *Can you see me now?*.[14] Another example is happening now in Seoul, Korea. When people in Korea want to protest against the government's policies, these days, they use mobile devices and media to communicate with other individuals, not only as a planning tool for arranging meetings, but also to report on situations in real-time through another media, such as internet communities. The following is a quote by Van Loon, explaining a multiplicity of rhythms in ordinary life:

> [E]veryday life consists of a multiplicity of rhythms. Everyday life thus entails a range of flows, each with their own 'proper time' (e.g, duration, pace, frequency). Likewise, we could argue that everyday life consist of multiplicity of spatialization, including forms of embodiment. If we were to use 'space of places', we would have to bear in mind the inherently dynamic, volatile, contested, unstable, and *multiplicitous* (rather than duplicitous) nature of 'place'.[15]

With embedded ubiquitous computing technologies, urban life is now becoming a hybrid reality, i.e. a networked entity. New technologies such as mobile devices and locative media are making urban life more active and creative with nomadic and playful

[14] http://www.blasttheory.co.uk/bt/work_cysmn.html (accessed June.10.2008)
[15] Loon, Van J. "Social spatialization and everyday life." Space and Culture, vol.5, no.2, p.88-95, 2002

movements. I believe that the new interfaces from those technologies can provide the potential for creating individual singularities**.** Stated by N. Katherine Hayles in Adriana de Souza e Silva's article, "there is no longer a homogeneous context for a given spatial art, but rather pockets of different contexts in it."[16]

New Experience There is a sense in which physical experience can be more interesting in comparison with the simulated imagery, which is focused on images viewed in limited space, especially, in front or inside of media screens. Although some art works and projects have used physical objects such as gloves and goggles to make people feel physically involved and take steps to individualized responses, I think these projects still limit the body to the space inside a room or near multimedia equipment; movement of the human body limits in how their experiences its environment. The new experience should be more open and invisible.

In conclusion, with a ubiquitous computing environment with mobile devices and locative media, the meaning of private and public space is becoming important and expanded as a space which has convergent and divergent possibilities. No one can live without public space and media technologies now. The street can be used for a creative canvas and new technology can be the tool for artists, and pedestrians can participate, enjoy, and recreate those events from them. The new experience can be blurred not only the gap between image and reality, but also the gap between the virtual and the real.

Figure 15. Rafael Lozano-Hemmer, Under Scan, 2005

* Featuring over 1,000 interactive portraits in public urban space.

[16] Adriana de Souza e Silva, "From Cyber to Hybrid: Mobile Technologies as Interfaces of Hybrid Spaces", Space and Culture, Vol. 9, No. 3. Aug, 2006, p. 269

2.3. Air and wind

In this thesis project, I use ocean wind data from the NOAA (National Oceanic and Atmospheric Administration)'s buoy center[17] to visualize and create phenomena of natural circumstances as a new art form. Many people think about, write about, and describe wind from various fields, such as science, industry, military, and government. In the nineteenth century, meteorological technologies became an increasingly valid and popular branch of science. The field of meteorology now uses advanced technologies and almost every country has advanced systems for observing, measuring, anticipating and managing meteorological data. Just as the French sociologist of science, Bruno Latour said, "air had become public; gas had become a branch of military; a whole science of atmospheric manipulation had been declared."

In addition, wind/air has become an open-ended subject in culture and art fields. For example, Latour describes, "Air first we feel nothing, we are insensitive, we are naturalized. And then suddenly we feel not something, but the absence of something we did not know before could possibly be lacking."[18] *In his book, Air and Dreams: An Essay on the Imagination of Movement,"* Gaston Bachelard wrote "all immanence is joined a transcendence, and describes air as a solitary, imageless, iconoclastic representation of the imagination, a form of poetic meditation that replaces predetermined and socialized recognitions."

Nature
Weathering
Biological
dispersal
...

Speed
Propeller
Fans
...

Urban
Wind power
Ventilation
...

Eastern thoughts and perspective is another influential view for my project which is the notion of the wind. In an Eastern context, wind is considered as the first step for creating energy in the world. In his thesis, Hong-key Yoon describes wind as a key starting point of the environmental cycle:

> [T]he energy of Yin-Yang belches and becomes wind; ascends and becomes cloud; descends and becomes rain; flows underground and becomes vital

[17] http://www.ndbc.noaa.gov/ (accessed Febrary.03.2008)
[18] Jones, Caroline A., Ed. Sensorium: Embodied Experience, Technology, and Contemporary Art .The MIT Press, 2006, p105

energy" Here we see that the transformation of Yin-Yang energy is explained only up to the point of its becoming vital energy...subsequent paragraph of the text expounds "the canon states that as the vital energy emerges to the wind, it disperses " The implication is that the vital energy becomes wind when it slips out of the earth.[19]

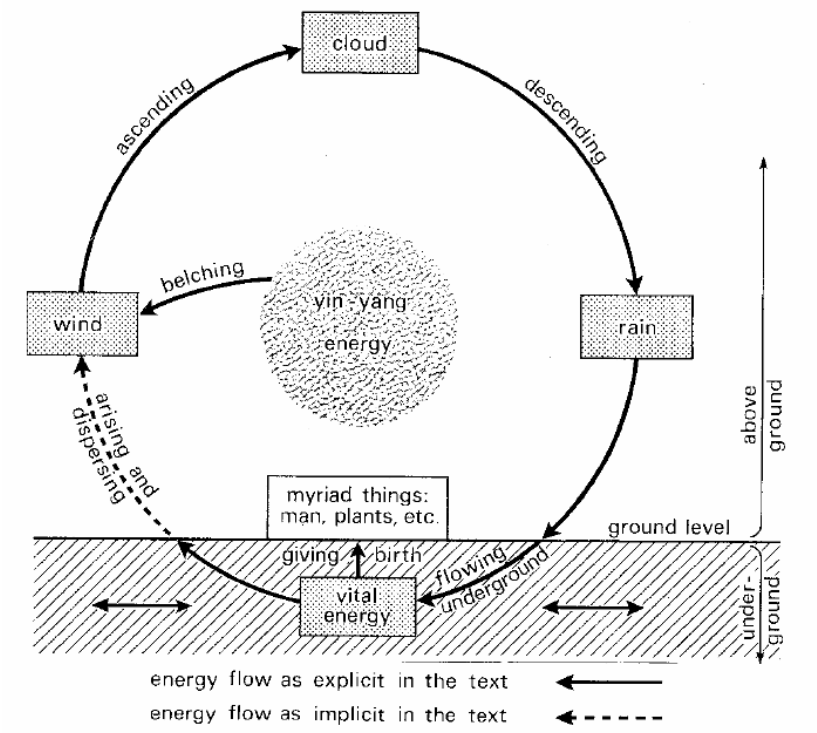

Figure 16. Diagrammatic interpretation of the early Chinese idea of an environmental cycle [20]

Wind exists in a far-flung and minute place that is out of the reach of time. On the other hand, it is the place of an enormous 'gap' – a 'gap' that allows individual imagination.

[19] Yoon, Hong-key. "An early Chinese Idea of a Dynamic Environmental Cycle". GeoJournal 10.2 , 1985, p211
[20] Ibid., p211

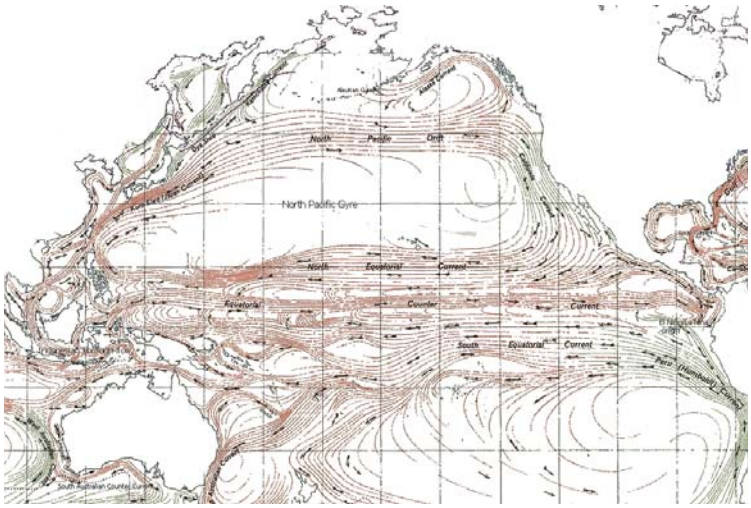

Figure 17. Wind Flow (between West and East)

In summary, from these examples, there are potentials for individual subjective imaginary exploration through natural phenomena, especially wind. Wind is important topic among the other natural phenomena, and that is why I chose this data for my project. I would like to explore wind and interrogate the physical and emotional aspects of our current engagements with technologies. The wind exists neither in heaven nor on earth, neither in west nor east, and neither in presence nor history. It exists as invisible space between everything, in the middle, amid considerations as a potential territory at the beginning of all crystallization.

A Landscape of Events
Results from the installation
(up) NOAA Station CARO3, One day, May.2008
(down) NOAA Station 46042, 3 days, Nov.2008
Los Angeles, USA

3. Framing to Mapping

The greatest value of a picture is when it forces us
to notice what we never expected to see.
JOHN TUKEY

3.1. GIS as New Media

A necessary component of this thesis is the investigation and discussion of the geographic information system (GIS) which are spatially referenced to the Earth. GIS associated attributes and mapping tools are increasingly available on the World Wide Web (WWW) and a growing number of Web sites offer advanced GIS services such as route finding and geocoding system. GIS technologies are becoming part of our daily lives, and linked with multimedia and various virtual, mixed, and hyper realities.

> [G]IS integrates hardware, software, and data for capturing, managing, analyzing, and displaying all forms of geographically referenced information."[21] Using GIS, a system for capturing, storing, analyzing and managing data, the cartography of a map can be supplemented with textual information, digital images, sound, diagrams, and other miscellaneous graphical information.[22]

Figure 18. Yves Klein, RP5, Globe Terrestre Bleu, 37.5 * 24.5 * 21.5cm.1962

In general, the meaning of GIS can be understood in the following ways. First, "GIS has increasingly become an important means to communicate certain aspects of the real world to the general public."[23] For example, organizations such as NASA(National Aeronautics and Space Administration), USGS (U.S. Geological Survey), and NOAA (National

[21] http://www.gis.com/ (GIS allows us to view, understand, question, interpret, and visualize data in many ways that reveal relationships, patterns, and trends in the form of maps, globes, reports, and charts.)
[22] Tor Bernhardsen. Geographic Information System. Wiley; 3 edition , 2002 , p313
[23] Sui, Daniel Z and Michael F. Goodchild. "GIS as media?" International Journal of Geographical Information Science, 2001, p388

Oceanic and Atmospheric Administration) provide geographic data to public as 'a common language' and ways of observing and 'discovering' the world.[24] We can easily access these webpage and get various data from there. For example, web sites such as Map Quest and Google Map serve millions of users every day, and they have changed conceptions of what constitutes an ordinary life, and have produced new art forms as well. In these aspects, the primary goal of all GIS operations in the end is "to communicate information to an audience in society."[25] Second, significant changes have occurred in the past decade in the part played by digital geographical information in people's lives.

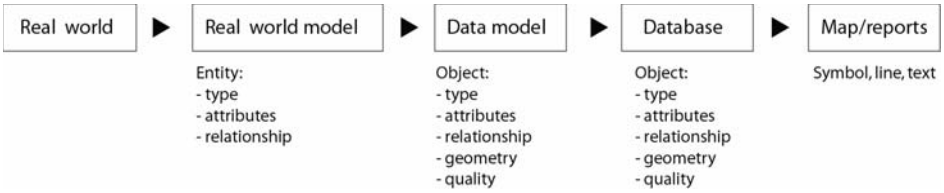

Figure 19. "To bring the real world into GIS, one has to make of simplified models of the real world. Uniform phenomena can be classified and described in the real-world model, which is converted into a data model by applying elements of geometry and quality. The data model is transferred to a database that can handle digital data, from which the data can be presented."[26]

GIS technologies expand the possibilities of visualization of nature and earth beyond flatland. By examining GIS, instead of focusing on visualizing geographical data as the representation of a graphical image on the screen, I should emphasize the different ways of recognizing, investigating, and documenting GIS-based data as phenomenological methodology. Like Haque mentioned in his essay, "Technology is used to provoke interactions between people, and between people and their spaces."[27] The concept of GIS, one of new media, has many possibilities for new interactions between people, and between people and their spaces and nature beyond the traditional interaction through images on the media screen.

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[24] Sui, Daniel Z and Michael F. Goodchild. "GIS as media?", P388
[25] Ibid., p388
[26] Tor Bernhardsen. Geographic Information System. Wiley; 3 edition , 2002 , p37
[27] Haque, "Hardspace, softspace and the possibilities of open source architecture", www.haque.co.uk, 2002 (accessed Mar 24, 2008)

History of GIS
*GIS class notes, 2007, spring

- Map-making started
(1200 B.C.,)

- Pioneer research
(late 1950's to early 1970's)

- Major research and
development
(1970's to early '80's)

- Commercial development
(1980's to present)

- Currently, GIS is booming
everywhere.

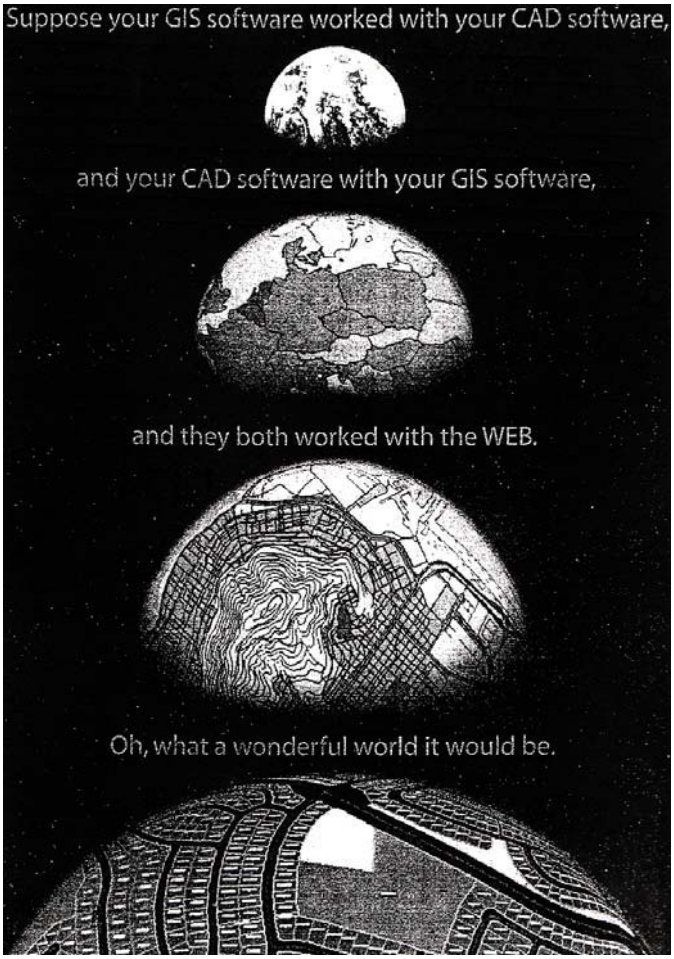


Figure 20. "What a wonderful world it would be"[28]

[28] Pickles, John. A History of Spaces: Cartographic Reason, Mapping, and the Geo-Codes World. London and New York: Routledge, 2003 , p147

3.2. Map and Visualization

Map and Worlds Maps are the representation of reality but they also have the potential of imagination. There is a belief that maps are true and "the 'real' is always produced on terms of a particular economy of capacities created through social, economies, political and technical assemblages."[29] Maps are not simulacra, such as some images that do not have relationships to an outside; they are real. When people look at maps, there may be an assumption that maps represent a reality, which exists somewhere on the earth. At the same time, maps can prompt imagination and stories. For example, seeing the world map in my room helped me not only to gain knowledge about other areas of world where others live, but also to imagine my own stories. These are one of important aspects of visualization.

Maps are one of primary and most common way to visualize the world, "Maps and mapping have always been theoretical and practical importance to geographer and cartographers, and they have had long standing technical and metaphorical importance for the theory and practice of fields such as geology, surveying, astronomy, anthropology, art history and literature."[30] It has a long history and has many ways to visualize the scientific research to artistic practice. It also has a meaning of observing the world beyond the space where people are living right now. In the book, *A History of Spaces*, there is a good summary by the author, Pickles, about the meaning of map and cartographic practices.

> [M]aps no longer are scene to simply represent territory, but are understood as producing it; in important ways 'maps precede territory', they inscribe boundaries and construct objects that in turn become our realities. ...Geomorphological mappings do not so much mirror the physical world, but create textual abstractions that name and give structural form to the myriad fluxes and flows; they inscribe form and process through graphical representation and circulate these in ways that render them real...[31]

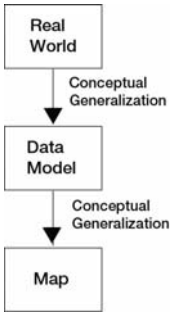


Figure 21. Several levels of generalization have to be carried out in order to represent the real world on a map.(Geographic Information System. Wiley, p44)

[29]Pickles, John. A History of Spaces: Cartographic Reason, Mapping, and the Geo-Codes World, 2003 , p91
[30] Ibid., p27
[31] Ibid., p145

With new digital technologies for mapping, now, there is a lot of maps we can see though internet as almost real-time. As the new digital technologies spread out, like Pickles mentions in his book, “Perhaps we should place emphasizes on the worlds that are being produced in the digital transition, the conceptions of history with which they work, and the forms of socio-political life to which they contribute."[32] New technologies for maps and mapping have an impact on contemporary urban society and public practices.[33] The following is a quote by Board, explaining about represented and generalized maps and models:

> [I]t is comparatively easy to visualize maps as representational; models of real world, but it is important to realize that they are also conceptual models containing the essence of some generalization about reality. In that role, maps are useful analytical tools which help investigators to see the real world in a new light, or even to allow them an entirely new view of reality.[34]

Data Visualization The democratization of information has important implications for how we understand space, culture, economy, society, and nature. As we know, data visualization is a powerful tool for representing, understanding and sharing information. In many fields, the goal of visualization is to provide the viewer with a better understanding of data or solving an isolated part of the specific problems for the scientific and social achievements. Visualization also can offer a method for seeing the unseen. It also enriches the process of scientific discovery and fosters profound and unexpected insights. Ben Fry mentions “one goal of information design is to show comparisons between elements.”[35] Conceivably, contrast, hierarchy, and grouping are other elements to show differences.[36] One aspect of visualization is that it becomes different according to size, weight, color, and so on.

Figure 22. Mark Hansen/ Ben Rubin, Listening Post, 2004

[32] Pickles, John. A History of Spaces: Cartographic Reason, Mapping, and the Geo-Codes World, 2003 , p146
[33] Ibid., p146
[34] Ibid., p27 (Board, C. “Maps as models." Edited by R.J. Chorley and P. Haggett, models in Geography, London: Methuen, 1967, p671-726)
[35] Ben Fry, “Computational Information design.”, 2004, p110
[36] Ibid., p113

Figure 23. Golan Levin and RSG, JJ (Empathic Network Visualization), 2002

In terms of visualization itself as a representation of reality, there have been issues such as omissions of original data, range, and scale. Interaction, the new way of communication by new technologies, can be helpful to solve these problems effectively with functions of zooming in/out, selecting/clicking, etc. Ben Fry also stated that the elements of interaction for the last step of visualization are to amplify and emphasize information visualization. In addition, there are also different directions of information visualization; data visualization is a more creative form than static elements. Golan Levin's JJ is a good example that uses peoples' "facial expressions to visualize the emotional content of network traffic."[37]

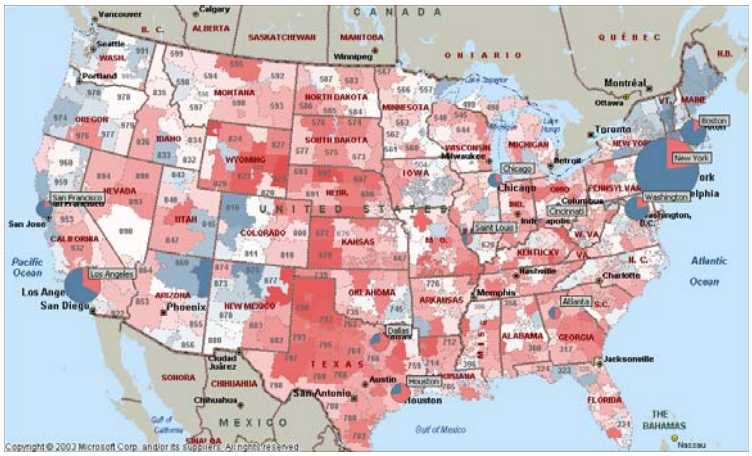


Figure 24. FundRace.org, an online tool. Users can seek information on local donations

> [W]hen you hear the term "information overloaded," you probably know exactly what it means because it's something you deal with daily. In Richard Saul Wurman's book information Anxiety(doubleday), he describes how the *New York times* on an average Sunday contains more information than a Renaissance-era person had access to in his entire lifetime. [38]

Since we are living in an age increasingly 'overloaded' with information, the role of visualization will become more and more important. There is likely to be a positive trend towards data visualization – the collection and sharing of such data with the public. In this way, I think the boundary of

[37] http://www.flong.com/projects/jj/
[38] Ben Fry, Visualizing data, p2

data collection and visualization can be unlimited, and there are many possibilities to recall individual subjectivity. I had an opportunity to visit both InfoVis07 and InfoVis08 and found certain differences across the two conferences. At InfoVis08, there was more research about social-related information visualizations than scientific visualizations, as well as more information on perception, design, and interaction issues. Beyond scientific visualization, information visualization, particularly social related data sets, has begun to draw attention.

The democratization of information gives the public access to more data. For example, during and after the U.S. election, people could track the amount of donations to the candidates and the voting rate at almost real time. In addition, the public can generate information themselves and share it. Many Eyes, a public web site "where users may upload data, create interactive visualizations, and carry on discussion"[39] is an example to explain data collecting/sharing platform operated by the public. Following is a description about the webpage:

> [T]he goal of the site is to support collaboration around visualizations at a large scale by fostering a social style of data analysis in which visualizations not only serve as a discovery tool for individuals but also as a medium to spur discussion among users.[40]

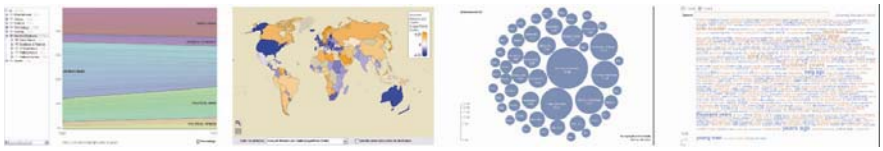


Figure 25. Many Eyes: " a cleverly used stacked graph that shows relative differences in the type of postings on two online link aggregators, a world map showing the average account balance per capita, a bubble chart showing the size of the endowments of different US universities, and a tag cloud showing two word occurrences in the work of Yeats"[41]

[39] Viégas, Fernanda and B. Martin Wattenberg., al.,"*Many Eyes*: A Site for Visualization at Internet Scale', 2007, p1121
[40] Ibid. , p1121
[41] Ibid. , p1124

Experiments I have been exploring data as a new material that can be a different way of observing and representing ordinary life and realities. With a deep interest in data and data visualization, last year (2007) I took classes on basic GIS, Database Aesthetics, Computer Programming and Statistical Computing to learn and understand more about data visualization and associated techniques. Here are three experiments that I conducted during the past year.

Lovecity[42] was a simple group experiment with the main purpose of finding the physical locations of people registered on the website www.lovecity.com. We explored the website and were able to get information about the age, sex, interests and location of users. Various programs were used to obtain and manage this data, such as Python for scraping and parsing data from the web, Stata for the statistical analysis of the data, Filemaker for cleaning up the data, and ArcGIS [43] to map the data.

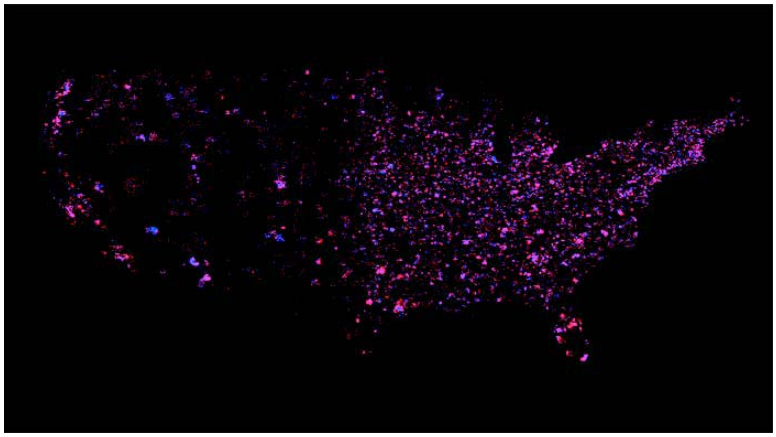


Figure 26. Red/Blue colors represent Female/Male's numbers and locations in the website

This was a good practice, but when I thought about data visualization as a creative practice, there should be more interesting ways of visualizing these data. After this experiment, I started to look at creating more

[42] During DMA Database Aesthetics class (2007, Spring Pro. Mark Hansen)
[43] http://www.esri.com/software/arcgis/index.html (ArcGIS is an integrated collection of software products for all your GIS needs. It provides a standards-based platform for your work on the Web, mobile devices, and desktop applications.) (accessed Mar 24, 2008)

innovative ways of visualizing data with other content, rather than simply directly representing data, and using computer screens as the dominant form.

Weekly YouTube[44] was created as a group project during the Statistical Computing class with Statistics Department students at UCLA. Interesting starting points for this project included using text-based data instead of numeric data, and representing it as an old media form (a paper), although the data is from a new media platform, the YouTube.com website. We stored data from the website for one week, and were able to analyze a portion of each of the main categories, the most viewed, and people's comments about particular videos during the period. We mainly used Python Beautiful Soup[45] software for this project to store as well as other tools such as MySQL and R to analyze the stored data. Possible tools that can be used for this kind of projects will be discussed in the next chapter.

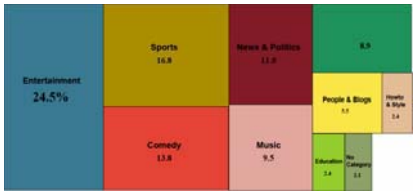


Figure 27. Analyzed categories from the YouTube website during one week period

Figure 28. The portions of pages depend on the relevant percentages of the categories

[44] Fall, 2007 (Pro. Mark Hansen)

[45] http://www.crummy.com/software/BeautifulSoup/ (accessed March.12.2008) Beautiful Soup is a Python HTML/XML parser designed for quick turnaround projects like screen-scraping

Figure 29. Case Study of Terrain Analysis based on DEM: Mt.St.Helens, 2007, Spring

Isles Blossom[46] was the next experiment I conducted is a landscape visualization that uses geographic data obtained by remote sensing. Each screen of this work represents various perspectives and subjective distortions of islands. After thinking about the process of generation of the data, I thought about trying to blur the data and adding noises to the already filtered data. This work was especially inspired by Asian traditional landscape paintings which have various perspectives in one painting using a vertical format. I downloaded numeric Digital Elevation Models (DEM)[47] data from the USGS (U.S. Geological Survey)[48], and produced a 3D model with a program called ArsGIS. The processes are set out below:

> DEM(Digital elevation model) contains an array of elevation measurements, usually organized as a square or rectangular grid. This process of creating a DEM in the ArcGIS environment can be divided into three phases:
> 1) acquisition of the DEM data from a secondary source
> 2) converting the DEM into a format ArcGIS can work with
> 3) the creation of shadedrelief models, slope and aspect maps and isolines for topographic maps.[49]

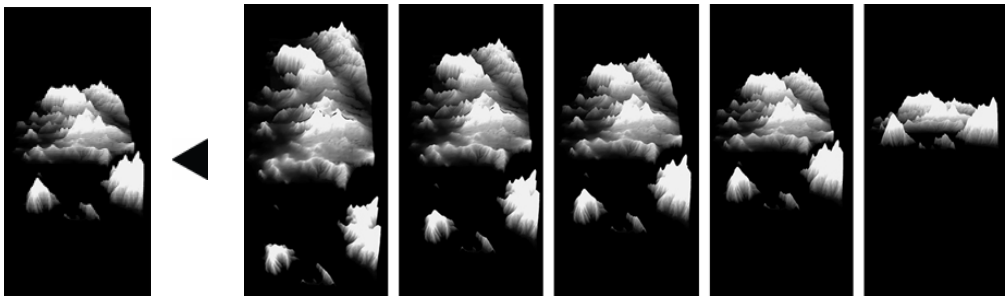


Figure 30. Case Study: Combined view from five different perspectives (San Francisco Bay Area)

[46] During DMA Design|Media Art Studio class (2007, Spring, Pro. Rebeca Méndez)
[47] A digital elevation model (DEM) is a digital representation of ground surface topography or terrain. DEMs are commonly built using remote sensing techniques, however, they may also be built from land surveying. [Wiki] The USGS Digital Elevation Model (DEM) data files are digital representations of cartographic information.
[48] http://www.usgs.gov/(accessed Mar 24, 2008)
[49] GIS class notes, 2007, spring

Figure 32. Isles Blossom, 2007, Details

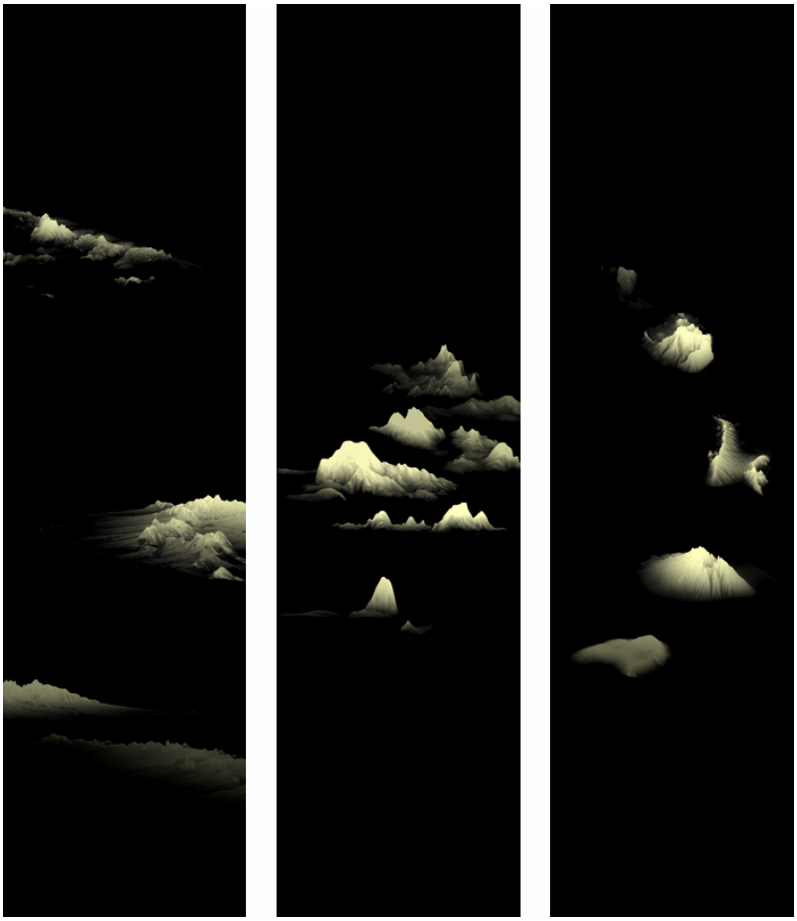


Figure 31. Isles Blossom, 2007, Inkjet Print, 24*90 inch (Each), Islands in US (From Left: Long Island, San Juan, Hawaii)

Figure 33. Q.S. Serafijn / NOX, D-Tower, Netherlands, 2003

*A coherent hybrid of different media where architecture is part of a larger interactive system of relationships.

Figure 34. Casey Reas, Trundle, 2001

Visualization without screens Data is invisible and there are many visualization methods that can make it visible. As a result, collected data from our real world is transformed to the virtual world. Data becomes trapped in the virtual world. People can only interact with it through a computer. Given the importance of data in our ordinary lives, the ways in which we visualize data is too limited. Why not try to bring out the data in the real world again, representing it in pure space through real movement in the form of nature? Such represnetations begin to perform a natural behavior and/or natural production. 'D-tower' conceived by artist Q.S. Serafijn and architect Lars Spuybroek/NOX-Architekten in Netherlands is one good example that shows not only data generated by the public (e.g., people's everyday emotions) but also consequently changes in color state of the sculpture everyday.

Kinetic Information Sculpture Interestingly, at the end of his PhD dissertation, Ben Fry mentions a different form of information visualization called kinetic information sculpture. "A step further would look at how to make the visualization of data more like a kind of 'kinetic information sculpture'."[50] In his book, Virilio also states that sculpture and new land art are important esthetic subjects in this media-oriented society. Also, in his master's thesis, Casey Reas proposed *behavioral kinetic sculpture* as a new method of interaction in this digital world:

> [A]s the decade's progress, we will find ourselves interacting with machines more and more frequently, but what will be the qualities of these interactions? Through integrating information processing technologies into kinetic sculpture we are able to explore new methods and properties of interaction....[51]

To avoid using privileged visual methods such as media screens and/or ink on paper and to provide a more reliable representation of nature, in my project, I tried to use a new method to visualize data–a physical system

[51] Reas, Casey. "Behavioral Kinetic Sculpture" MS diss., Massachusetts Institute of Technology, Program in Media Arts & Sciences, 2001

which has real time kinetic movement. In this thesis, I am proposing this kinetic information visualization as a new form of data visualization that can reveal and transfer data in the physical form and in real space.

3.2. New Realities

In contemporary society, we have to adjust to new realities (i.e. virtual, hyper, mixed, and hybrid realities) of the plethora of the mass media in contemporary urban life. With life in various realities, like Jean Baudrillard said, "the surrounding universe and our very bodies are becoming monitoring screens," the landscape around us now unfolds as a screen. In his book, *The Ecstasy of Communication*, Baudrillard stated, "The landscape, the immense geographical landscape seems a vast, barren body whose very expanse is unnecessary (even off the highway it is boring to cross), from the moment that all events are concentrated in the cities, which are also being reduced to several extremely miniaturized high places."[52]

In cities, people are becoming consumer-driven, and our bodies have to deal with various media screens, from the screens of TVs to those of mobile phones. However, it is impossible to judge such a media evaluation either positively or negatively. Baudrillard proposed an interesting idea about the image and screen in our modern life, which he referred to as 'hyper-reality.' In the book *Continental Philosophy,* editors McNeill and Feldman describe this concept:

> [B]audrillard argued that technological existence unfolds as the presentation of simulacra, that is, of images that correspond to no underlying reality or truth, but operate as a play of signification in which it becomes increasingly impossible to identify any original or uncontaminated reality. Where reality becomes virtualized in this manner, there the virtual and the real became fused, existence has been transformed into what Baudrillard called "hyperreality".[53]

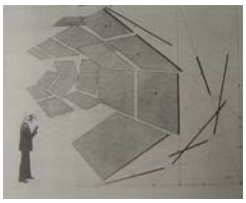


Figure 35. Herbert Bayer, Diagram of the Field of Vision, 1930

[52] Baudrillard, Jean, The Ecstasy of Communication. Translated by Bernard and Caroline Schutze, Semiotext(e), 1988, p19

[53] McNeill, William and Karen S. Feldman., ed., Continental Philosophy: an anthology. Blackwell, 1998. p443

In addition, with his concept of hyperreality, the development of locative media, such as mobile devices, navigation systems with global positioning systems, and ubiquitous computing environments, has in recent times blurred not only the gap between image and reality, but also the gap between virtual and real. Adriana de Souza e Silva provides a good summary of the social transitions caused by these technologies in his article, "From Cyber to Hybrid: Mobile Technologies as Interfaces of Hybrid Spaces"

> [T]he internet undeniably opened our consciousness to the possibility of large-scale communities known as multiuse environment, which were not confined to the same physical place. The cell phone has been frequently studied as a means of two-way communication, whereby private spaces are created inside public spaces [Gergen, 2002; Plant, 2001; Puro, 2002].[54].

Again, in my thesis project, instead of visualizing data as a graphical representation in the virtual world, the goal is to explore the different ways of observing, documenting, and visualizing not only those phenomena but also the processes themselves in the hybrid world. Within the discourse of materiality, how physical material characteristics are perceived through human senses is an important subject for my research.

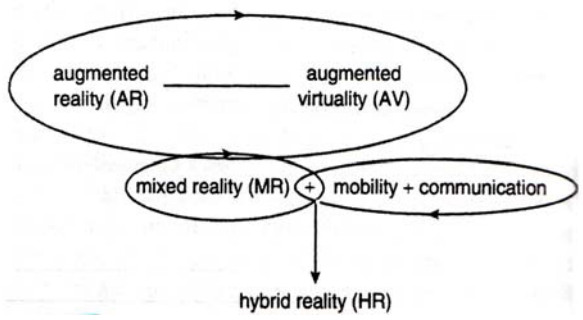


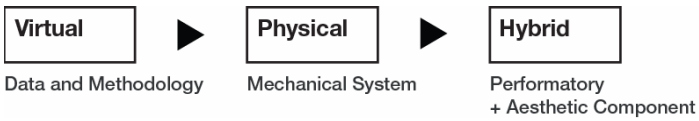
Figure 36. Diagrams of Hyper reality within the Contest of the Real-Virtual Continuum [55]

[54] Adriana de Souza e Silva, "From Cyber to Hybrid: Mobile Technologies as Interfaces of Hybrid Spaces", Space and Culture, Vol. 9, No. 3. 2006, p272
[55] Ibid. , p266

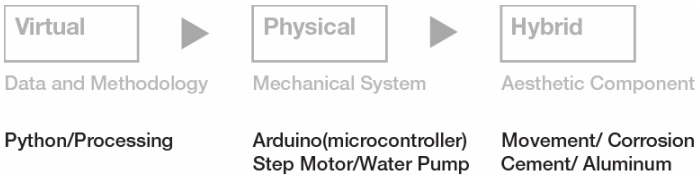
A Landscape of Events
Details, May/Nov.2008
Los Angeles, USA

4. A Landscape of Events

The complex urban life makes people look for something else
- an event, escape, and the world of utopia.
JOSEPH CORNELL



Process The project is divided into three main parts: (a) a virtual process – analysis of data and methodology for investigation, which is part of the traditional process of information visualization, (b) a physical process – developing mechanical systems for representing near -time data movements of natural events, and (c) a hybrid process – combining the aesthetic components that connect virtual and physical processes. The project combines and intertwines not only the fields of technology and art, but also the virtual and the real.



4.1. Virtual Process: Data and Tools

Data In his PhD dissertation, *Computational Information Design,* Ben Fry proposed seven stages of information visualization in order to make his process accessible to a wider audience; "a tool is introduced to simplify the computational process for beginners and can be used as a sketching platform by more advanced users."[56] For my thesis project, the first influential idea concerning this process is the possibility and flexibility to visualize data as on my own; this led me to the topic I chose for my thesis project. However, as I stated above, my project is not visualizing data as a screen-based representation, but as a physical kinetic information visualization/installation.

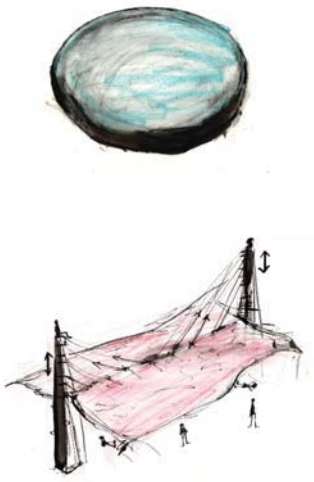


Figure 37. Initial idea sketches for rainfall and tide dataset.

For this project, I started with Fry's stages to explore and manage my dataset, and the stages that he proposed are as follows:

[A]cquire–Parse–Filter–Mine–Represent–Refine–Interact [57]

1. *acquire*: the matter of obtaining the data, whether from a file on a disk or from a source over a network.
2. *parse*: providing some structure around what the data means, ordering it into categories.
3. *filter*: removing all but the data of interest.
4. *mine*: the application of methods from statistics or data mining, as a way to discern patterns or place the data in mathematical context.
5. *represent*: determination of a simple representation, whether the data takes one of many shapes such as a bar graph, list, or tree.
6. *refine*: improvements to the basic representation to make it clearer and more visually engaging.
7. *interact*: the addition of methods for manipulating the data or controlling what features are visible.

In my project, I followed 6 stages from 'acquire' to 'refine'. Before starting the first step, I took an additional step – analyzing datasets to check the suitability of my project. I needed a dataset that is updating in real time and is generally from a location. Although my project is not

[56] Fry, Ben. "Computational Information design." PhD diss., Massachusetts Institute of Technology, Program in Media Arts & Sciences, 2004
[57] Fry, "Computational Information design.", 2004

about using data for a scientific purpose, this stage was important for me to prepare and understand structures and characters of the data prior to starting the next steps. First, I analyzed a dataset from the NOAA Ocean Wind Buoy Center.[58] Their website provides data acquired from buoys form all over the world and is updated in near real time. As a result of this stage, I found that there are twelve types of data structures in the NOAA website. Among them, four types of data structures provide wind data, which are wind speed and direction. The website currently provides updated data from over 700 stations, and 465 stations provide wind data (data fields: cwind, drift, supl, and txt). I used some programming languages for this step and I will briefly describe the many tools used for this stage in the next paragraph.

type	description
adcp	Acoustic Doppler Current Profiler Data
adcp2	Acoustic Doppler Current Profiler Data
cwind	Continuous Winds Data
data_spec	Raw Spectral Wave Data
dart	Water Column Height (DART) Data
drift	Standard Meteorological Data for Drifting Buoys
supl	Supplemental Measurements Data(wind)
swdir	Spectral Wave Data (alpha1)
swdir2	Spectral Wave Data (alpha1)
swr1	Spectral Wave Data (r1)
swr2	Spectral Wave Data (r2)
txt	Standard Meteorological Data(wind)

Figure 38. Twelve types of data structures form NOAA's website

Wind Unit

A standard unit
1 km/h = 0.278 m/sec
= 0.621 mph(mile/h)
= 0.540 kn(knot)=0.911 ft/sec

1 m/sec ≒ 2 kn,
1 kn ≒ 1852 m/h
1 m/s = 3,6 km/h
= 1,944 knots
= 2,237 miles per hour

TXT

#YY	MM	DD	hh	mm	WDIR	WSPD	GST	WVHT	DPD	APD	MWD	PRES	ATMP
#yr	mo	dy	hr	mn	degT	m/s	m/s	m	sec	sec	degT	hPa	degC
2007	4	15	13	50	120	4	0	6	0	0	4	3	MM
2007	4	15	12	50	140	4	0	5	0	0	4	4	MM
2007	4	15	11	50	120	5	0	6	0	0	4	3	MM

CWIND Continuous Winds Data

#YY	MM	DD	hh	mm	WDIR	WSPD	GDR	GST	GTIME			
#yr	mo	dy	hr	mn	degT	m/s	degT	m/s	hhmm			
2007	3	5	6	20	314	8	0	320	10	0	604	
2007	3	5	6	10	315	7	8	999	99	0	9999	
2007	3	5	6	0	314	7	8	999	99	0	9999	

DRIFT Standard Meteorolog Data for Drifting Buoys

#YY	MM	DD	hhmm	LAT	LON	WDIR	WSPD	GST	PRES	PTDY	ATMP	WTMP	
#yr	mo	dy	hrmn	deg	deg	degT	m/s	m/s	hPa	hPa	degC	degC	
2007	3	6	1700	11	50	-36	1	40	9	3	MM	MM	MM
2007	3	6	1600	11	50	-36	2	40	9	3	MM	MM	MM
2007	3	6	1400	11	50	-36	3	50	8	8	MM	MM	MM

SUP1 Supplemental Measurements Data

#YY	MM	DD	hh	mm	PRES	PTIME	WSPD	WDIR	WTIME		
#yr	mo	dy	hr	mn	hPa	hhmm	m/s	degT	hhmm		
2007	3	6	12	0	MM	MM	10	0	44	1145	
2007	3	6	11	0	MM	MM	10	0	33	1037	
2007	3	6	10	0	MM	MM	10	5	40	945	

Figure 39. Four types of data structures with wind speed (WSPD) and direction (WSPD)

[58] http://www.ndbc.noaa.gov/ (accessed Febrary.03.2008)

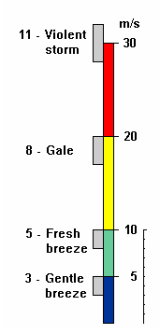


Figure 40. Beaufort wind scale is an empirical measure for describing wind speed based mainly on observed sea conditions. [Wiki]

Tools In fall 2007, I took a course called Statistical Computing from Mark Hansen in the UCLA Statistics Department. During this class, he introduced tools that could be used in different ways for different purposes and explore the artifacts of communication. An outline of these tools is given below:

[E]macs, Unix tools, Python
Regular expressions, manipulating text
R, data types, basic computations, writing functions, objects and methods
Code distribution, R packages, software licenses
Scripting visualization via Processing
Databases, SQL, R interface to MySQL, XML
Statistical computation in real-time systems

For my data analysis stage, I mainly used Python urllib,[59] which is scripting language, to acquire and parse the large sample data from the website. R[60], an integrated suite of software facilities was used for data manipulation, calculation and graphical display of samples. Next, like Ben Fry, I used Processing[61] as a necessary supplementary component.

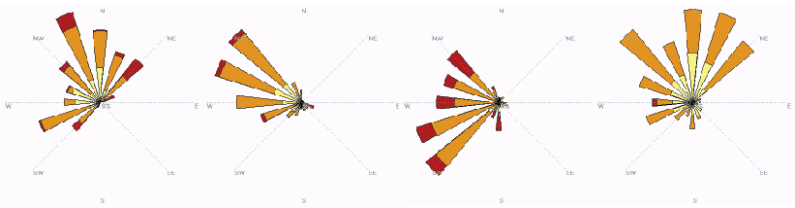


Figure 41. Examples of wind data analysis for 4weeks: station 40007

In my project, I used Python to get and update data continuously (in this project, every 10min). The Python module saves each station's updated data files in the proceeding data folder. Processing was used to get data and phase it and send signals to Arduino[62] and simulate data on the computer screen.

[59] http://www.python.org/ (accessed March.12.2008)
[60] http://www.r-project.org/ (accessed March.12.2008)
[61] http://processing.org/ (accessed March.12.2008) Processing is a simple programming environment that was created to make it easier to develop visually oriented applications.
[62] http://www.arduino.cc/ (accessed March.20.2008)

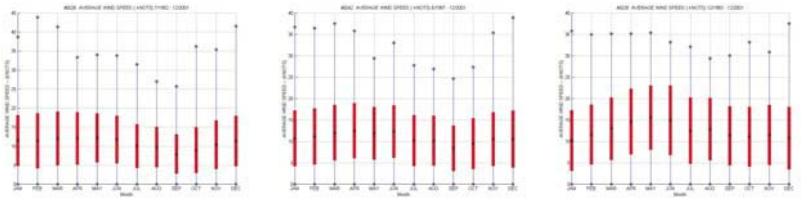


Figure 42. Historical wind data analysis from NOAA:
From this, I can set the maximum and minimum values of wind speed in my program.

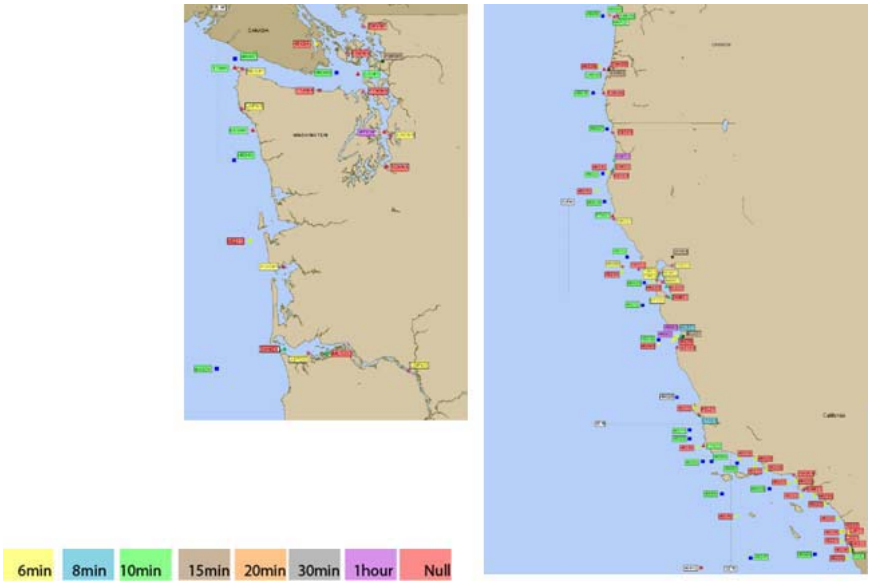


Figure 43. Possible data stations near west coastline:
Different color s show different timelines (updating timelines are form 6min to one hour).

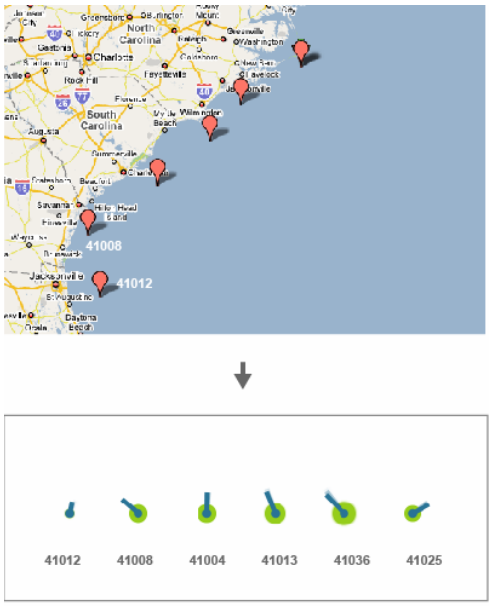


Figure 44. Wind Observation and Visualization: 6 Stations from South Carolina Coastline
NOAA Station: 41012, 41008, 41004, 41013, 41036, 41025
Data Acquired: Dec.16. 2007

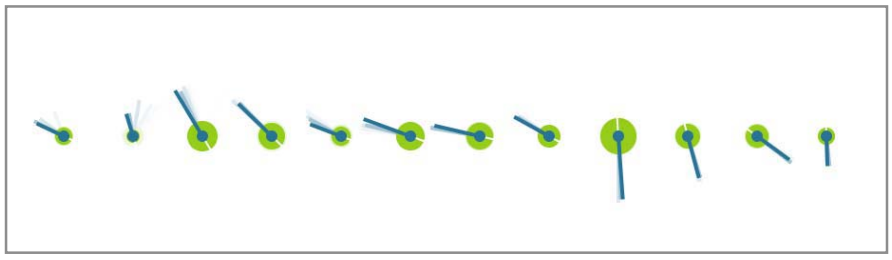


Figure 45. Wind Observation and Visualization: 12 Stations from South Carolina Coastline
NOAA Station: 41012, 41008, 41004, 41013, 41036, 41025, 44014, 44009, 44017, 44013, 44007, 44027
Data Acquired : Dec.16. 2007

4.2. Physical Process: Mechanical System

After the data analysis stage, I started looking for a specific system that I could apply to my concept – a kinetic information sculpture that can create physical motion out of data. For data, I would input values for real-time wind speed and direction. The values would be naturally derived input controlling the device. It would have the realistic coordination, location, and movement of natural phenomena. First, I thought of a system that could mark X and Y coordinates on a plate, like CNC machines and old plotters.

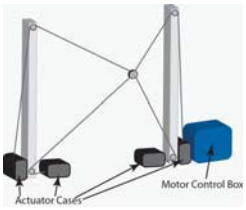


Figure 46. NIMS(Networked InfoMechanical System), Per Henrik Borgstrom, UCLA (sourse: NIMS paper)

*Advanced system with tension controllers.

Plotter System Uli Franke and Jürg Lehni's Hektor[63] and NIMS-PL from the Department of Electrical Engineering at UCLA are inspirational projects that use a similar system. I had a chance to visit NIMS-PL lab and see the cabled robotic system, "which has been used for a diverse amount of applications such as environmental sensing, search and rescue, sports and entertainment, and air vehicle simulators."[64] I also talked to a developer of the machine, who gave me information and idea about making the kind of plotter system I wanted. After I had visited the lab, I immediately started to construct my little robot. During the process, I had dozens of decisions to make and many problems to solve.

Figure 47. Uli Franke and Jürg Lehni's, Hektor, 2002
*Hektor is light and fragile installation consists of two motors, toothed belts and a can holder that handles regular spray cans.

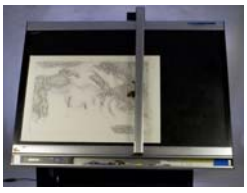


Figure 48. Karlsruhe, You Don't Matter, 2008

*A plotting machine into an output device, that can draw, scratch or cut

Basically, I used two stepper motors to control the length of the cables, and two keychain retractors to function in place of gravity. Of course, using four motors is more accurate for controlling positions, but I had to be conservative with my budget at that time. Fortunately, I had a chance to develop a machine with the four stepper motors after the exhibition. Stepper motors were mounted onto the aluminum sheet along two edges of the rectangle. They move cables to control position by pulling and

[63] http://www.hektor.ch/ (accessed May.22.2008)
[64] Energy Based Path Planning for a Novel Cabled Robotic System. http://research.cens.ucla.edu/areas/2005/NIMS/ (accessed May.22.2008)

releasing. I used a coated stainless cable for its flexibility and corrosion resistance.

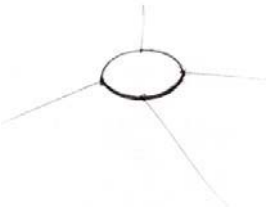
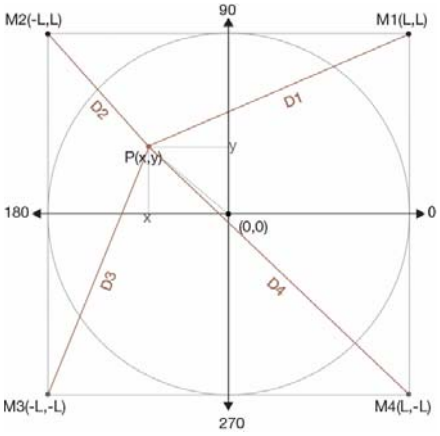


Figure 49.
A moving device sketch



$$D1 = \sqrt{(L-x)^2 + (L-y)^2}$$
$$D2 = \sqrt{(-L-x)^2 + (L-y)^2}$$
$$D3 = \sqrt{(-L-x)^2 + (-L-y)^2}$$
$$D4 = \sqrt{(L-x)^2 + (-L-y)^2}$$

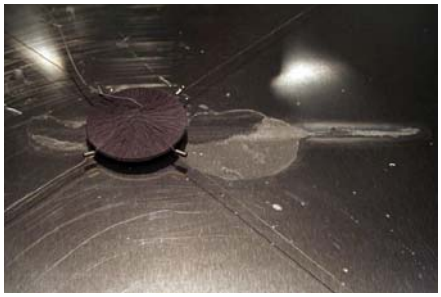


Figure 51. Equations were used to get step numbers to run motors and transform them to the real world situation.

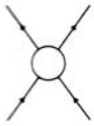


Figure 50.
Ideas for movements

[Example Code]

Distances

```
distance_1[i] = sqrt (2 * sq(L) - 2 * L * (map(s,0, MAXsp, 0, L)) *
(cos(radians(d)) + sin(radians(d))) + sq(map(s,0, MAXsp, 0, L)));
// i=station, l= a radius of a aluminum sheet, MAXsp= a maximum wind speed
```

Step Numbers

```
int motor_1 = (int) (200 * (dis_1 - (sqrt(2) * L)) / PI * D);
// for a 200step motor
```

Module System My intent was to make the piece a modular system – able to be rearranged, modified, expanded or reduced like the media itself (aluminum size, length of cable, etc.). The modules also could be joined together to produce a map of data collection locations.

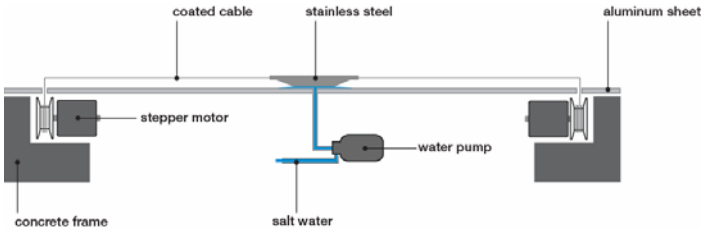


Figure 52. Module Diagram


Figure 53.
First module prototype

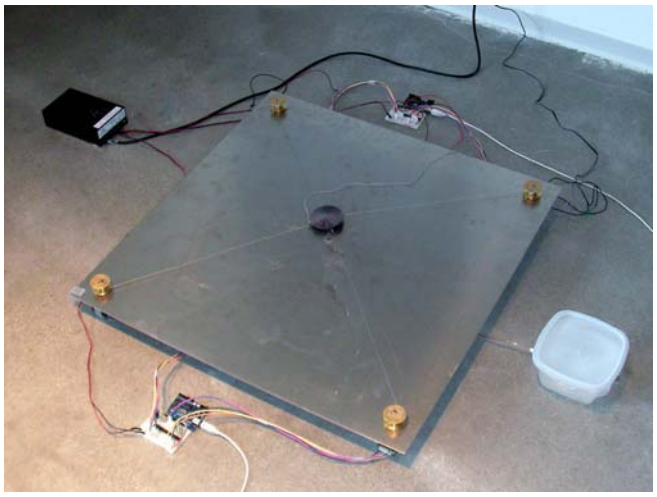


Figure 54. Module Prototype
(Power Supplies, 2 sets of arduino+2stepper Motors, Water Pump)

Controlling Stepper Motor Motors are simple and useful for making realistic animation and motion in the physical environment. There are various types of motors, such as DC motors, servos motors, gearedhead motors, and stepper motors – each motor has different characteristics and

applications. These motors basically create rotary motion, and it is possible to convert it to run mechanical devices such as levers, pulleys, and gears. Stepper motors are used for my project to control precisely X-Y coordination on the aluminum sheet.

Figure 55. Japan Servo Stepper Motor KH56KM2-901

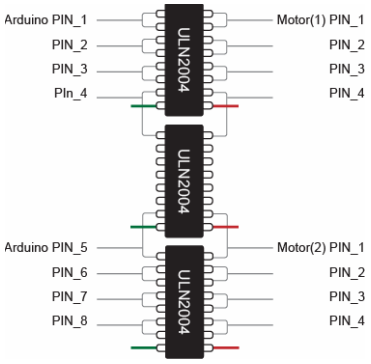


Figure 56. ULN2004 transistor

With a microcontroller – arduino[65] board – I was able to control the steps per degrees of the stepper motors, and they can translate the steps into linear distances. They can very useful for moving a precise distance or a specific number of rotations.[66] The general concepts of stepper motors are below.

[T]he stepper motor combines both precise positioning and a full 360-degree range of motion. Stepper motors move in discrete steps around a circle. For example a 200step motor moves 360 degrees in 200 steps (1.8 degrees per backward. They have reasonably good torque, as well. However, they are more complex to connect than other motors.[67]

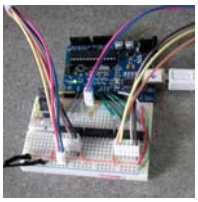
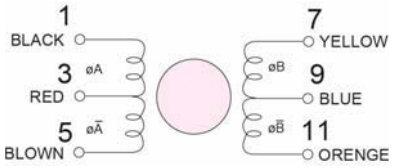


Figure 57. Assembled circuit



STEP	1	2	3	4
BLACK	–			–
YELLOW	–	–		
BLOWN		–	–	
ORENGE			–	–
RED	+	+	+	+
BLUE	+	+	+	+

Figure 58. Unipolar connection diagram (KH56KM2-901)

[65] http://www.arduino.cc/ (accessed May.22.2008)
[66] O'Sullivan, Dan. and Tom Igoe. Physical Computing: Sensing and Controlling the Physical World with Computers. Course Technology PTR, 2004, p260
[67] O'Sullivan, Dan., Physical Computing, p250

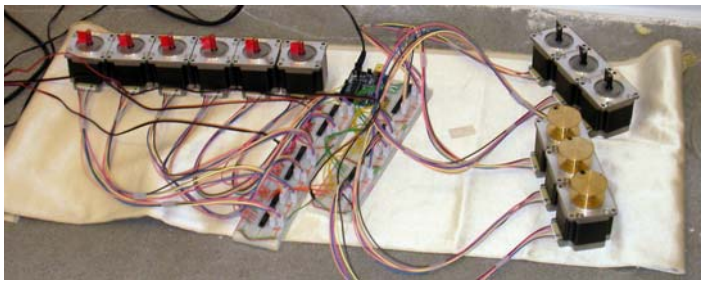


Figure 59. Two weeks running test
12 motors (KH56KM2) with 3arduinos and 1 power supply (3V/40AMP)

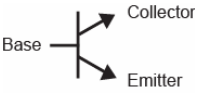


Figure 60. NPN transistor

Washer Pump To control salt water, windshield washer pumps for cars are used. They usually require 12V of electricity to function, but 5V of power was enough to pump water up to 4 inches from underneath of an aluminum sheet.

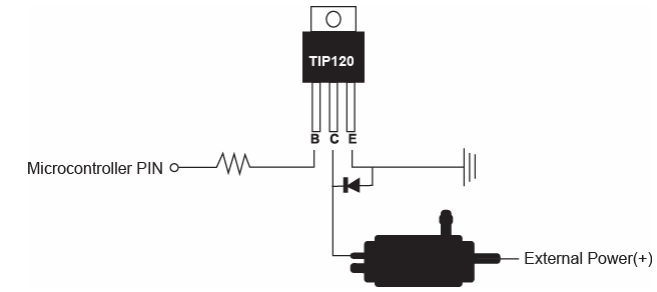


Figure 61. Tip 120, an NPN transistor, with diode (1N5399) was used to control the amount of water and time for the pump.

Figure 62. Windshield washer pump manufactured by CRP-Contitech/Meyle.

Special Electrical Needs of Motors (power supply) Like other motors, stepper motors need more power than the arduino type of microcontroller. Because motors draw so much current when they start up, they affect the current going to the circuit that controls them. To avoid this problem, I used bigger power supply than required because the efficiency of power supplies may be lower than the labeled description. Some tips I learned during the creation of my installations are (1) use regulated supplies, which ensures that the voltage will not drop as the current increases (2) use switching supplies which are more efficient than linear ones; however, depending on the product, SMPS's (Switching Mode Power Supplies') efficiencies vary, and (3) use decoupling capacitors.

4.3. Aesthetic Process: Forms and Materials

Kinetic Information System In terms of visualizing the data in my project, there are two main ways of data visualization – the kinetic movements of the present which occur as a real time movement by means of a plotter system, and the tracing of past movements which corrode sheets of aluminum. In his MS thesis, *Behavioral Kinetic Sculpture,* Casey Reas explains the word *Kinematics* "as the study of motion unattached to forces or objects" and *Kinetics* "as motions resulting from forces directly connected with physical systems."[68]

In my work, the motions represent the presence and the trace visualizes the history of the presence. I can call the system as being a real-time kinetic information system. As a final form, the project is like a space, environment and nature. The movement is transformed from ocean wind data (virtual, but from real data) to the real world. When the wind breeze is light, the device moves slowly, and the water pump spouts out a small amount of water, while the behavior is fast and strong when the wind breezes strongly.

Corrosion Despite the degree of control that the system will have, I was willing to let the system produce some unpredictable effects, so that the results of visualizing the natural data in this way will be unexpected, like nature itself. What I hope to do is represent natural phenomena using nature itself – not by using unnatural graphical patterns or paint. I am looking for something from nature itself, particularly related wind, in this project. During wind data research, I was looking for phenomena with wind which is my first series of data. After research, I found one interest method which is galvanic corrosion, one common form of corrosion in marine environments.

Figure 63. Andy Warhol, Copper Oxidation

Galvanic corrosion is an electrochemical process, in which one metal corrodes preferentially with another, when the two (or more) dissimilar metals come in contact with an electrolyte solution such as slat water. I

[68] Reas, Casey. "Behavioral Kinetic Sculpture" MS diss., Massachusetts Institute of Technology, Program in Media Arts & Sciences, 2001, p.20

felt that the corrosion on the artificial materials resembled the connection between the artificial human and nature.

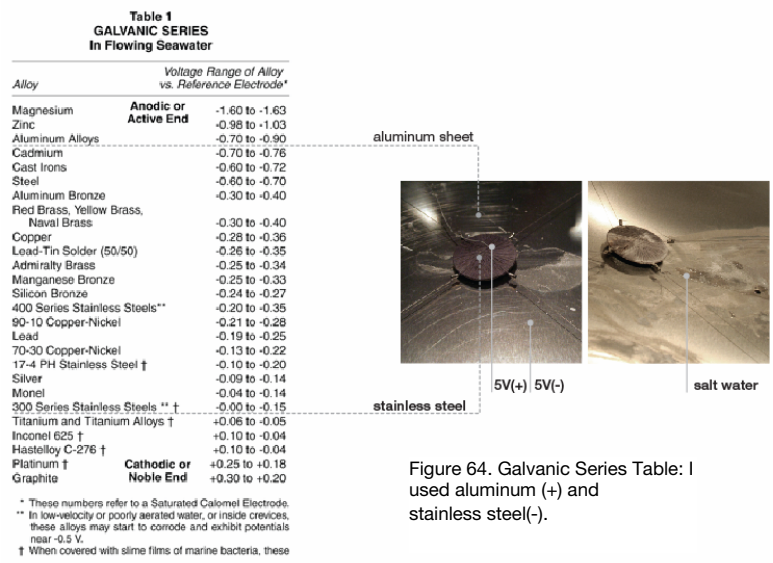


Table 1
GALVANIC SERIES
In Flowing Seawater

Alloy		*Voltage Range of Alloy vs. Reference Electrode**
Magnesium	**Anodic or Active End**	-1.60 to -1.63
Zinc		-0.98 to -1.03
Aluminum Alloys		-0.70 to -0.90
Cadmium		-0.70 to -0.76
Cast Irons		-0.60 to -0.72
Steel		-0.60 to -0.70
Aluminum Bronze		-0.30 to -0.40
Red Brass, Yellow Brass, Naval Brass		-0.30 to -0.40
Copper		-0.28 to -0.36
Lead-Tin Solder (50/50)		-0.26 to -0.35
Admiralty Brass		-0.25 to -0.34
Manganese Bronze		-0.25 to -0.33
Silicon Bronze		-0.24 to -0.27
400 Series Stainless Steels**		-0.20 to -0.35
90-10 Copper-Nickel		-0.21 to -0.28
Lead		-0.19 to -0.25
70-30 Copper-Nickel		-0.13 to -0.22
17-4 PH Stainless Steel †		-0.10 to -0.20
Silver		-0.09 to -0.14
Monel		-0.04 to -0.14
300 Series Stainless Steels ** †		-0.00 to -0.15
Titanium and Titanium Alloys †		+0.06 to -0.05
Inconel 625 †		+0.10 to -0.04
Hastelloy C-276 †		+0.10 to -0.04
Platinum †	**Cathodic or Noble End**	+0.25 to +0.18
Graphite		+0.30 to +0.20

* These numbers refer to a Saturated Calomel Electrode.
** In low-velocity or poorly aerated water, or inside crevices, these alloys may start to corrode and exhibit potentials near -0.5 V.
† When covered with slime films of marine bacteria, these

Figure 64. Galvanic Series Table: I used aluminum (+) and stainless steel(-).

I experimented with the distance between the positive and negative poles (the aluminum and the stainless steel) in the salt/baking powder water. I also applied many different power supplies, from 3V to 6V. Higher voltage/current produced more gases (oxygen and hydrogen), created more oxidation and heat – it is almost like a short circuit. For this project, I used 5V DC and 350 milliamps power supplies and it was fine for a week [based on personal communication with Eric Graham (Center for Embedded Networked Sensing)].

Figure 65. Setting for the first corrosion test (aluminum + steel wool) in March 2008

Figure 66. Setting for the corrosion test

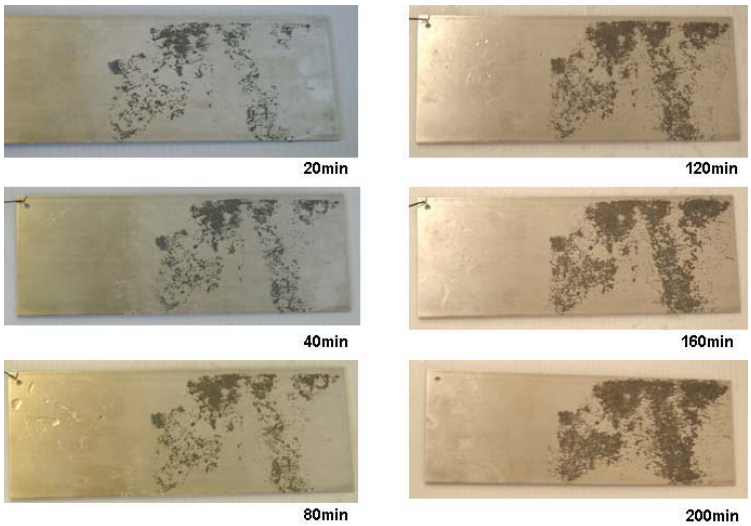


Figure 67. Results form the second corrosion test as time passes

After the exhibition, I had the opportunity to develop the system further. I was able to run modules for more than a week; wind traces were overlaid again and again, and the aluminum sheet was deeply corroded. The salt water coagulated after being pumped out from underneath the aluminum sheet, and the combination of salt water, an electrolyte, and the thread of the moving device led to some visible secretions. I did not expect the exact results when I started, but the experiment was interesting enough. When I looked at the system for a while, I surprisingly had a similar feeling to when I saw a seascape on a boat. It feels like being in nature itself, and in a kind of minimized space.

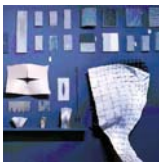


Figure 69.
Immaterial | Ultramaterial,
Toshiro Mori

Materials My project replaces this 'virtual' information with the 'hybrid' world. I think dealing with physical materials is getting important because we are losing a sense for the real materials as screen-based media make us involved the virtual world. For this project, I have used raw materials of everyday life instead of commercial materials/products and they maybe all in the daily object not only for me but also other people who live in cities. Materials such as aluminum, stainless, concrete, wood, plastic, and cable were used which are materials that we see and touch everyday, like nature.

Figure 70. 3D CNC
Milting Test (During
Tech-Seminar 2008,
Winter)

Fabrication Fabrication, is one of my current interests, by which I mean producing something that is not a commercial product to sell and buy in this capital society. In ordinary life, especially in an urban setting, we sometimes need to buy these products to survive. It is easy to forget what they are made from and the only see the finished products. Thus, for this project, I used raw materials from our surroundings and fabrication technologies.

In winter 2008, I took Tech Seminar course in the UCLA Architecture Department, and had access to their fabrication equipments such as a laser cutter, a 3D printer, and 2D/3D milling machines that "enable the production of physical objects directly from digital models, allowing for new forms and aesthetics of space."[69] For this project, I used a laser cutter for labeling wind buoy stations of each concrete frame that I molded. Assembled Modules visualize selected stations of real-time data.

Figure 71. Laser cutting for labeling

[69] http://www.generatorx.no/category/digital-fabrication/ (accessed November 10. 2008)

Figure72. Initial Mapping plans

Installation Again, the wind just exists as things 'between' everything, in the middle, amid considerations as a potential territory. To present this concept effectively, it took me a long time to decide things such as the size of the module, the thickness of the aluminum sheet, the height of the cement frame and so on. These were decided both according to my personal aesthetic sense, and for functional reasons. If possible, I have a concept of applying this work to physical public spaces in the future, for example to the exterior facades of buildings. Imagine living in outer space, or in a new type of living space such as in Foster's Crystal Island; there should be other types of nature in the ordinary environment rather than landscape paintings and photographs.

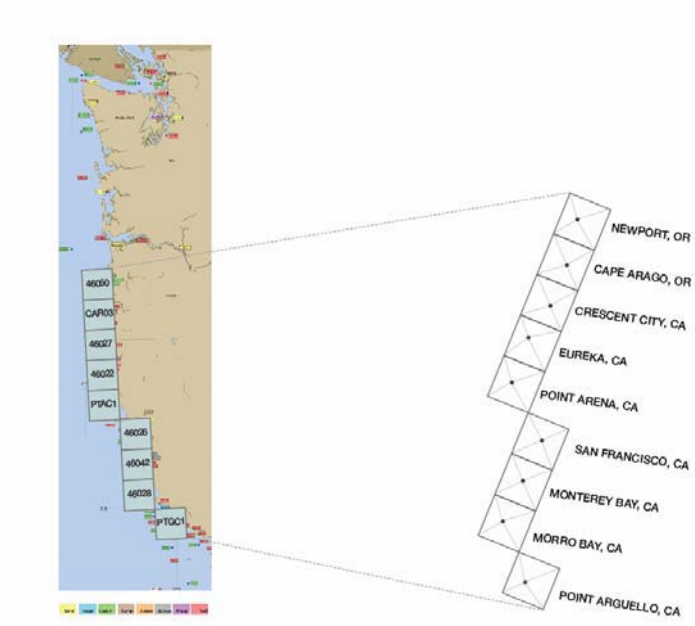
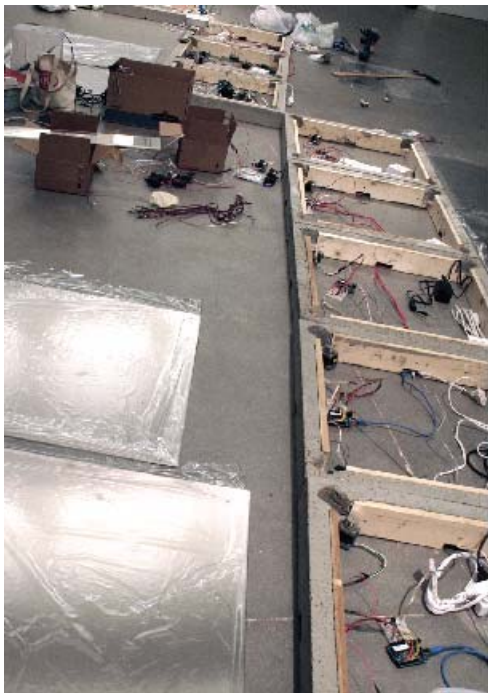


Figure 73. Final Mapping diagram with 10 stations



Molding concrete frames and preparing installation, April-May.2008
Installation room, DMA at UCLA, Los Angeles, USA

A Landscape of Events, Installation View, May.2008
Opening Reception (up), Critic (down), New Wight Gallery, Los Angeles, USA
Photography by Rebeca Méndez

5. Conclusion

A Landscape of Events

Before the exhibition, I had a tight schedule to develop the robot, build the installation, and solve the problems involved in doing so. I have not yet had the chance to think about the shape of results and how people will react. Exhibiting this project in the gallery was a good opportunity to observe peoples' reactions as well as the results of corrosion. Both hearing from people and watching traces of corrosion were delightful experiences. One Canadian woman, Dawn, said that she would like to sit for a while near the installation, and take a rest while thinking, imaging, reading and whatever. That was one of the best comments I received, and exactly what I had been looking for.

James Turrell said in his statement in *Mapping Space*, "I am interested in posing questions than in answering them." One purposes of the project is to explore natural scapes that can pose questions as opposed to answering and explaining them, like nature itself. Likewise, I encourage viewers to question their sense of the surroundings, I am questioning it myself - how can there be *virtual* without *real*, *human* without *nature*, *here* without *there*, *today* without *tomorrow* and *yesterday*, and *always* without *never*? How can we recognize them? This project is to explore landscapes within contemporary urban and art context and interrogate

the physical and emotional aspects of our current engagements with technologies.

This thesis and its accompanying project is an attempt to explore visualizing (near) real-time data as a physical form beyond media screens. To avoid using privileged visual method and to provide a more reliable representation of nature, I used real time kinetic movements and corrosion instead of drawing with ink on papers or screens. My work is the place of an enormous 'gap'. The 'gap' allows imagination and it belongs to a dimension of *reality*, *nature* or a *city* in a strict sense.

My belief is that this project can be applied to physical public spaces in the future. For example, it could be installed inside/outside of Foster's building as a different approach to nature. It also could be used as a public sculpture, a façade/skin of building, or even a form of mobile device that people can bring everywhere. People experience nature indirectly and their everyday physical experience is usually in the space of cities. When the project is embedded in cities in a different form from media screens, I believe that the project can create the gap that recreates a different urban context.

A Landscape of Events New Wight Gallery, Los Angeles, USA

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Figures

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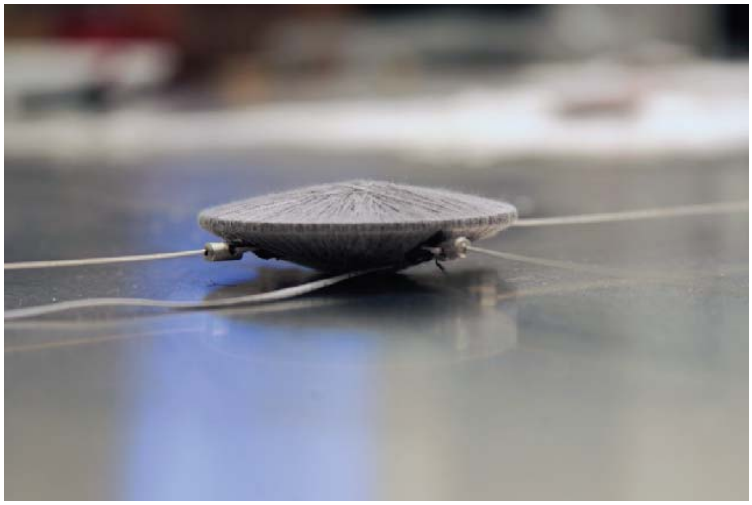

The moving device, after 7days, Oct, 2008