

SENSING AT THE PERIPHERY

MINGXI LI

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HUMAN EXPERIENCE IN THE AGE OF DYNAMIC MEDIA

This thesis is submitted in partial fulfillment of requirements for the degree of Master of Arts in Design and approved by MFA Design Review Board of Massachusetts College of Art and Design in Boston.

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The more you can do by intuition the smarter you are; the computer should extend your unconscious. —Mark D. Weiser

The more you can do by intuition the smarter you are; the design should extend your unconscious. —Mingxi Li
(paraphrasing Mark D. Weiser)

ABSTRACT


My thesis research focuses on exploring the possibilities of dynamic media design to facilitate more human and multi-sensory, and therefore, a more natural way to access information and to communicate.

In my thesis, I researched the historical, theoretical and psychological aspects of communication and technology and developed six case studies to determine how dynamic media design can incorporate the human senses in modern communication.

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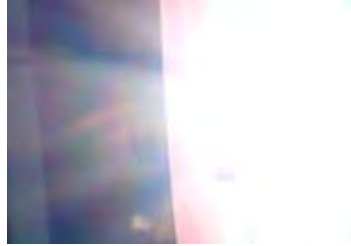
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INTRODUCTION

Experience as Multi-dimensional Feeling

During the first semester in DMI, there is a class called “Design as Experience” taught by Gunta Kaza. On the first night of class, she brought each of us a small bottle of a brown liquid that smelled like children’s cough medicine. The assignment was to respond in any way to, with or about the bottle of liquid. I had no idea what was inside the bottle and I was confused. The only effort I could imagine was to bring it with me everyday, hoping to get inspired. But as the week went on I remained confused, and was annoyed every time the bottle reminded me that I had not finished my homework. I was not inspired; no bright idea came to me until the night right before the assignment was due. Actually it was 2 am; I decided to take the risk of tasting it. I opened the bottle, put a drop of the unknown liquid on my tongue. A strong flavor stimulated my tongue. Even after several hours, I was in bed and could still feel the sore spot. The sore felt familiar. It reminded me of the way sunshine hurt my eyes. It was August in Boston with lots of sunshine everyday, a new experience to me. Before, when I was at home, sunglasses were only for matching clothes and styles. But here, in my first week in Boston, I realized that good sunglasses are a must. Remembering this experience of sunshine inspired me. The next morning I took photographs of many things, which reflect sunshine. I collected and shot picture of metal, glass, water and bright colored objects to record and express my feeling of pain and pleasure. I found a way to express those feelings of stimulation on different sense organs. Looking back today, I think that day might be my first time clearly experiencing that all the senses are connected and being pushed to express that synthesis.



After the class, I found out that what was in the bottle was vanilla. A nice flavor for ice cream! When I realized what it was, it evoked other feelings and reminded me of another story.

In my first semester, I lived in a MassArt dorm. At 5pm every day, there came a truck with loud bright music. The truck would circle there for a half-hour every time. The loud bright music was just noise to me and it bothers me. At that time, I thought that the noise was from some trash truck. The idea of that being a trash truck really disturbed me; it caused a bad mood at every 5pm. One day, I finally opened up to my roommate.

“What is that noise coming from? Is that from a trash truck?”

“No, I don’t think so, I think that is from an ice cream truck.”

“Really? Uh...ice cream is my favorite! You mean a whole truck of ice cream is circling right under my window? That’s great!”

After that, my emotional response to the sound of that loud, bright sound changed. Then just hearing music or thinking about the ice cream truck makes me visually related to happy experience. Sensory synthesis—that might be the first time I experienced it by myself and realized that combining different senses could be part of design.

People pick up information with their whole body. Information enters through integrated sensory perception channels, such as sight, touching, hearing, smelling, tasting and other senses to wake up internal memory to form a comprehensible circle. I, as an interactive visual communication designer, believe dynamic media design should allow people to acquire information intuitively and naturally. In the history of technology, the development of Human-Computer Interaction is the process of making the computing more human and less a tool. Currently, in the age of dynamic media, ubiquitous computing and current interactive technologies

(calm technology) offer the interactive designer a chance to create new and enhanced possibilities of interface, participatory systems and environments in the context of culture.

My thesis has developed through six case studies. “Pointing Sound” focuses on exploring the combination of visual, audio and body movement. “DrawerScan” explores the use of technology in everyday life and at home. “Map of Sound” discovers interaction on a timeline and drawing as a way of mapping emotion. “Complaints-in-a-Container” explores dynamic media design as a method to heal traumatic experience and proves visual perception can influence human interaction. “Ambient Widget” investigates mapping another person’s ambient information to enhance the communication. The whole thesis researches the potential ways through which humans are able to receive and access information in a more natural mode. It investigates multi-sensory perception at the periphery—sensing and understanding the relationship of space, and objects, and people, and more comprehensively.



NATURE OF SENSORY EXPERIENCE

As a designer, one needs to consider how information can be communicated more naturally between humans involved in transmitting information. Therefore, one must understand the needs and abilities of prospective users. Looking at how humans acquire information can be a guide to designing the interactive system to help people transmit and experience shared information.

SENSORY INTEGRATION AND MEMORY

I. SENSORY INTEGRATION

There are seven senses—five classic senses: of vision (sight), auditory (hearing), tactile stimulation (touch), olfaction (smell), and gustation (taste). Other sensory modalities exist, internal sensory source, vestibular sense (balance and the sense of movement) and proprioception (the sense of knowing one's position in space, body awareness), which provides the feeling of movement and of gravity.

Sensory integration is the basis for all the behavior. According to Jean Ayres sensory integration is “the ability to synthesize, organize, and process incoming sensory information received from the body and the environment to produce purposeful goal-directed responses”. Input from tactile, movement, position, auditory and visual senses are critical to the development of mature motor planning, coordinated use of both sides of the body, balance, eye-hand coordination, body awareness, language, visual perception, and emotional stability. Through sensory integration, the brain can relate all of these different sensory modality inputs into coherent outputs that better prepare us to fully comprehend our environment.

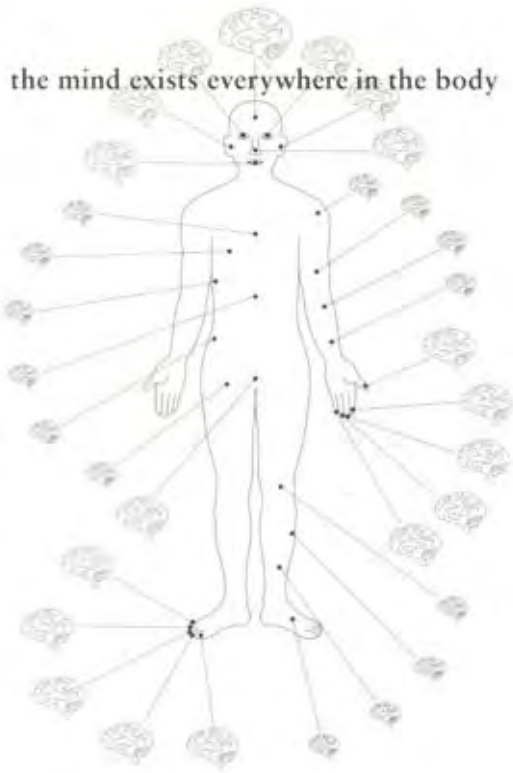
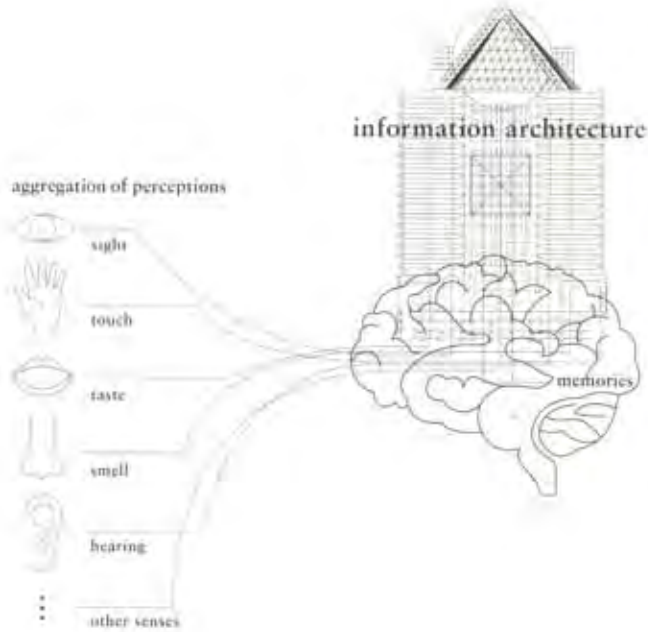
What is the most natural way for all humans to express themselves, to get information, to communicate? When we were children, we learn about the world around us and ourselves by exploring, experiencing and playing. With the use of all of our senses, and through daily routines and interaction with others, children continuously gather, organize, and respond to information.

II. MEMORY

In psychology, memory is a person's mental ability to store, retain and recall. Memory in the comprehensive sense is that "connective structure, inherent in every culture". In Elena Esposito's view, "memory is not merely a container for remembrances, not an adherence to the past, but rather a prerequisite for communication." So when design uses common memories for one generation of people or one society people can easily establish knowledge foundation before the communication. We also use recall (recognition) as the precondition for communication and interaction. Recognition (re+cognition) is a process that occurs in thinking when some event, process, pattern, or object recurs, and is used for the process of awareness or thought. This takes place as we process the new stimuli along with previous memories and experiences and find relationships between the current stimuli and our memories.

The next step of memory is predication; "prediction of future patterns is the desired output."(Jeff Hawkin) Successful predication is understanding of prior experience and communication, and using that to raise the level of efficiency and quality of communication.

The natural way of gathering information is that the information through external stimuli, including five basic senses and assorted sensory perception, to internal sensory organ—memory.



Kenya Hara's vision about the brain is existing everywhere in the body.

III. PERIPHERY

A periphery is the outer limits or edge of an area or object (Compact Oxford English Dictionary of Current English). Based on Mark D. Weiser's concept, periphery is anything but on the fringe or unimportant. What is in the periphery at one moment may in the next moment come to be at the center of our attention and so be crucial. For example, the sound of the projector during the presentation, when the presenter pays more attention to the response of audience, and the content of the lecture, the "wu~wu~" sound in the background assures that the projector works fine. If the sound has changed, we could easily pick up the information that something is wrong. This information fluently transfers from the background to foreground and successfully catches our full attention.



HISTORY OF INTERACTIVE TECHNOLOGY

From an historical point of view, we can see that designers are always working to improve the way of Human-Computer Interaction by aiming to approximate more natural, more human-like, ways of interacting. And in the evolution of technology history, “now” is the time to make HCI more natural and intuitive.

I. THE HISTORY OF HUMAN-COMPUTER INTERACTION

The design of interactive computer systems since the end of World War II has been influenced by a series of scientific theories and ideas about the typical computer user. The whole series of theories has been suggested in an attempt to explain the relationship between technical and social change, technical determinism and social determinism. The people who believe in technical determinism argue that the new technologies predetermine the direction of changes and set the conditions for social change. The people who represent the social deterministic direction have formulated the idea that the influence of technology can only be understood in terms of the importance or meaning that humans attribute to it. No matter what, the two theories continue to remain the most popular and influential theories for describing the relationship between technology and society.

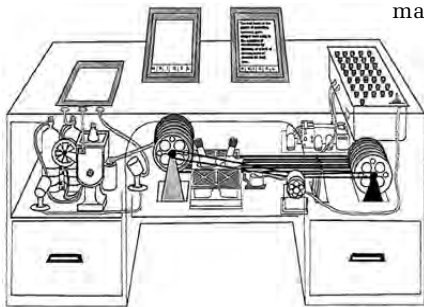
As Anne-Jorunn Berg and Merte Lie stated, “Several of our studies concluded that changing technologies initiate a period of instability and provide possibilities for social change, but we also saw that desirable changes had to be initiated by human action.”

THE MEMEX

As far back as 1939, Vannevar Bush in his essay “As We May Think” recognized that we need new methods of organizing the growing amount of information. Bush answered to the problem of increasing lots of information to create a memory extender call “Memex”.

“A Memex is a device in which an individual stores all his books, records and communications, and which is mechanized so that it may be consulted with exceeding speed and flexibility. It is an enlarged intimate supplement to his memory.”

Bush envisioned Memex as a tool to support intellectual activity by the use of an automatic procedure for indexing, saving and recalling information, and did not plan to imitate cognitive processes. However, his Memex represents a major conceptual step in the development of computers. Bush proposed Memex as an information administration tool that would allow data to be stored on microfilm and made easily accessible, linkable with hyperlinks and programmable.



THE AUGMENTATION OF HUMAN INTELLECT

Engelbart developed the concept of a computer-based system for the augmentation of human intellect. He directed a research group that was assigned the task of developing aids for efficient communication between humans and the computer during the 1960s.

“The term ‘man-machine interface’ has been used for some years to represent the boundary across which energy is exchanged between the two domains. Exchange across the “interface” occurs when an explicit-human process is coupled to an explicit-artifact process.”

According to Engelbart, an appropriate interface for enabling a smooth combination of human and mechanical process could contribute to the augmentation of the cognitive abilities of humans. The human and technical components of socio-technical system were thus equally important, whereby the functionality of the computer tool and the human ability to use this tool come together at the Human-Computer interface. (Engelbart’s concept of human-computer interface) Engelbart also described what his system for augmenting human intellect might look like:

“Symbols with which the human represents the concepts he is manipulating can be arranged before his eyes, moved, stored, recalled, operated upon according to extremely complex rules...”

COGNITIVE PSYCHOLOGY AND GRAPHICAL USER INTERFACE

Alan Kay described a fictive computer, which he named “Dynabook” at the end of 1960s’. The Dynabook was to be a personal, dynamic medium for the masses, on which users should be able to save all their personal documents, texts, sounds, pictures and animations. Alan Kay claimed that computer, like every other medium, would trigger changes on an individual as well as a social level. In quoting Marshall McLuhan, Kay tells us:

“What McLuhan was saying is that if the personal computer is a truly new medium then the very use of it would actually change the thought patterns of an entire civilization. He had certainly been right about the effects of the electronic stained-glass window that was...The intensely interactive and involving nature of the personal computer seemed an antiparticle that could annihilate the passive boredom invoked by television. But it also promised to surpass the book to bring about a new kind of renaissance...What kind of a thinker would you become if you grew up with an active simulator connected, not just to one point of view of the ages represented so they could be dynamically tried out and compared.”

Kay spoke only of the Dynabook and no longer of the computer, but to capture the spirit of a medium and a similar effect on culture as the “Gutenberg technology”. So Dynabook not only should be operated or programmed on the symbolic level, but also had to support the sensorimotor and iconic abilities of the human user. Alan Kay’s methodology of interface design based on cognitive, constructivist educational psychology.

GRAPHICAL USER INTERFACE

A graphical user interface (GUI) is a way for humans to interact using windows, icons and menus and which can be manipulated by a mouse, and often, to a limited extent, by a keyboard as well.

A major advantage of GUIs is that they make computer operation more intuitive, and thus easier to learn and use. For example, it is much easier for a new user to move a file from one directory to another by dragging its icon with the mouse than by having to remember and type seemingly arcane commands to accomplish the same task. Adding to this intuitiveness of operation is the fact that GUIs generally provide users with immediate, visual feedback about the effect of each action.

In addition, GUIs allow users to take full advantage of the powerful multitasking capabilities of modern operating systems by allowing such multiple programs and instances to be displayed simultaneously. The result is a large increase in the flexibility of computer use and a consequent rise in user productivity. GUI has become much more than a mere convenience. It has also become the standard in Human-Computer Interaction, and it has influenced the work of a generation of computer users. Moreover, it has led to the development of new types of applications and entire new industries. (The Linux Information Project)

BEYOND THE GRAPHICAL INTERFACE

A young generation of designers like Brenda Laurel began to develop new concepts of Human-Computer Interaction, which apply theater or agent metaphor. Agents are programs, which are able to formulate and define goals, to initiate processes, and to interact with other software agents and the user in the sense of reacting to events appropriately. The idea of learning through cooperative work and experience, interactive learning, has thus become a central element in the design of human computer interfaces.

SUMMARY

Improving the Human-Computer Interface is a process of:

1. Lessening the time of knowing computer functionality, experience and memory is important in order to convert old knowledge to new.
2. Understanding the user (human) as a center issue, and their need and ability to absorb the information.
3. The computer becoming more human and as media become less of a tool.

Designers must understand the capabilities and limitations of technologies in order to know the possibilities they offer for design. The development of technology offers a fundamental possibility of utilizing human sense integration to pick up information existing at the periphery.

II. FOUR MAJOR TRENDS IN COMPUTING

“The important waves of technological change are those that fundamentally alter the place of technology in our lives. What matters is not technology itself, but its relationship to us.” (Mark D. Weiser, the father of ubiquitous computing) There are four eras of computing according to Weiser.

The Major Trends in Computing—The development of computing technology based on the relationship with people.

- Mainframe - many people share a computer
- Personal Computer - one computer, one person
- Internet Widespread Distributed Computing . . . transition to . . .
- Ubiquitous Computing (The age of calm technology) - many computers share each of us

III. CALM TECHNOLOGY

The age of calm technology is when technology recedes into the background of our lives. We are almost there.

Currently, computers are everywhere, we want to compute while doing something else and have more time to be more fully human, we must radically rethink the goals, context and technology of the computer and all the other technology crowding into our lives. Calm technology engages both the center and the periphery of our attention, and in fact moves back and forth between the two. That is the fundamentally encalming statement. Calm technologies empower our periphery. This happens in two ways. First, a calming technology engages both the center and periphery of our attention, which easily moves back and forth between both. Second, a technology may enhance our peripheral reach by bringing more details into the periphery. This is encalming when the enhanced peripheral reach increases our knowledge and so our ability to act, without increasing information overload. This is possible because things existing at the periphery attended by large portions of our brains, which is devoted to peripheral (sensory) processing. (*The coming age of calm technology*)

Based on Weiser “Calmness is a fundamental challenge for all technological design.” Because we are live in the era of the calm technology era, designers are given the chance to design for calm, using both the center and the periphery of our perception. So we need to design for periphery, people can complete control without feeling overwhelmed. “We must learn to design for the periphery so that we can most fully command technology without being dominated by it.” (Weiser)

The result of calm technology is the enhancement of human awareness of both time dimensionality and place dimensionality; the supplement of utilizing assorted human senses.

“When our periphery is functioning well, we are tuned into what is happening around us, and also to what is going to happen, and what has just happened. Also periphery connects us easily to a myriad of familiar details. This connection to the world be called ‘locatedness’, and it is the fundamental gift that the periphery gives us.” (Weiser)



SENSORY INTERACTION DESIGN: SIX CASE STUDIES

A. THEORETICAL PRINCIPLES OF INTERACTION

Interaction design is a fundamental synthesis of design in general.—Norbert M. Schmitz

Large parts of current media use people's vision as the main input channel, for example: cinema, television and computer. Many also used the tactile sense as with a keyboard and a multi-touch screen. But our senses are not limited to only two. A human is a sophisticated machine; all the senses are integrated and work together. When there is sensory integration, the human brain can relate all of these different sensory modality inputs into coherent outputs that better prepare us to fully comprehend our information and environment. So how can dynamic media design help to combine all the senses in order to access information and comprehend environment?

Either theory of affordance or theory of ambient communication can be referenced depending on which sense organ is sensing information at the periphery.

I. AFFORDANCE

a. GIBSON'S AFFORDANCE THEORY

Perceptual psychologist James J. Gibson originally introduced the term in his 1977 article “The Theory of Affordances” and explored it more fully in his book *The Ecological Approach to Visual Perception* in 1979. He brought about radical changes in the ways we think about perception with his theories of ecological optics, affordances and direct perception. He defined affordances as all “action possibilities” latent in the environment, objectively measurable and independent of the individual’s ability to recognize them, but always in relation to the actor and therefore dependent on their capabilities. For instance, a set of steps, which rises four feet high, does not afford the act of climbing if the actor is a crawling infant. Gibson’s is the prevalent definition in cognitive psychology.

Gibson assumed that we perceive in order to operate on the environment. Perception is designed for action. Gibson called the perceivable possibilities for action affordances. He refers to the actionable properties between the world and an actor (a person or animal). Affordances are relationships. They exist naturally: they do not have to be visible, known, or desirable, i.e. surfaces for walking, handles for pulling, space for navigation, tools for manipulating, etc. In general, our whole evolution has been geared toward perceiving useful possibilities for action.

b. NORMAN'S PERCEIVED AFFORDANCE THEORY

Donald Norman's theory of "perceived affordance" makes the concept dependent not only on the physical capabilities of the actor, but also their goals, plans, values, beliefs and past experience. (*The Design of Everyday Things*)

Norman claimed that "the designer cares about what action user perceives to be possible than what is true." You are approaching a door through which you eventually want to pass. The door, and the manner in which it is secured to the wall, permit opening by pushing it from its 'closed' position. We say that the door affords (or allows, or is for) opening by pushing. On approaching that door you observe a flat plate fixed to it at waist height on the 'non-hinge' side, and possibly some sticky finger marks on its otherwise polished surface. You deduce that the door is meant to be pushed open: you therefore push on the plate, whereupon the door opens and you pass through. Here, there is a perceived affordance, triggered by the sight of the plate and the finger marks that is identical with the actual affordance. Note that the affordance we discuss is neither the door nor the plate: it is a property of the door (the door affords opening by pushing). (Affordance example, Norman, 1988)

COMPARISON OF GIBSON AND NORMAN

Gibson's original definition of affordances allows that the actor may throw the recliner and sit on the softball, because that is objectively possible. Norman's definition of (perceived) affordances captures the likelihood that the actor will sit on the recliner and throw the softball. Effectively, Norman's affordances "suggest" how an object may be interacted with. For example, the size and shape of a softball obviously fits nicely in the average human hand, and its density and texture make it perfect for throwing. The user may also bring past experience with similar objects (baseballs, perhaps) to bear when evaluating a new affordance.

Norman later explained that this adaptation of the term had been unintended. However, the definition from his book has become established enough in HCI that both uses have to be accepted as convention in this field.

c. GAVER'S AFFORDANCE

Bill Gaver talks about something have an affordance, need to think more about the biophysics of a situation and combining with low-level perceptual information—in other words, information that can be conveyed though light or sound about physics of a situation. Once a user thinks about a physical environment being an interface, they start to attend to the information being conveyed by physical object that give them hints about what they might be able to do with those objects.

In general, the affordances of objects are often grouped by the continuity of information about activities they reveal. This notion is implemented in my case studies. I consider carefully each attribute of design from concept, from metaphor chosen, to every design decision including shape, size, materials and all the other periphery of the physical object. More description will follow in subsequent case studies.

II. AMBIENT COMMUNICATION

AMBIENCE

According to Oxford English Dictionary, ambience includes the idea of surrounding, encircling, encompassing and environing.

AWARENESS

Computer Supported Cooperative Work (CSCW) researchers have identified a number of core dimensions of cooperative work. A non-exhaustive list includes: Awareness: individuals working together need to be able to gain some level of shared knowledge about each other's activities. Examples would include: being aware of someone in the next office typing, a light on in the office indicating that someone is still there, and the sound of footsteps suggesting that someone is coming and the distance is closing.

AMBIENT AWARENESS

Ambient Awareness is the state of knowing about the environment in which you exist; about your surroundings and the activities of others in the same place. Awareness is essential in collaboration in order to coordinate the activities in a shared environment. During face-to-face interpersonal communication, people share the same environment. It may be, for example, background noise or a sense of the sky darkening. From those ambient clues, we become more aware of more information and understand each other better than we do when we engage in verbal communication only. Computer-mediated communication, like on-line chatting, loses those ambient clues.

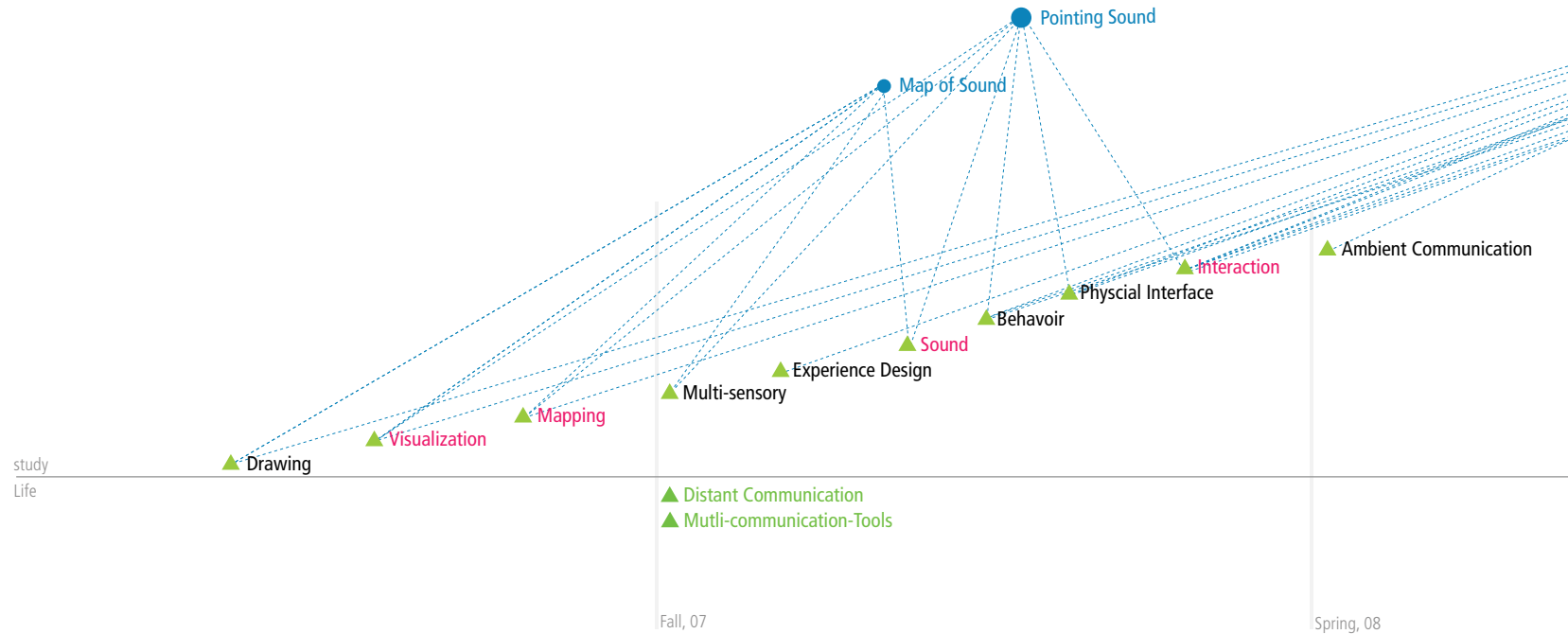
HUMAN ACTIVITY AWARENESS

People have a need to feel connected to others, especially, people they care about, and from whom they are separated by great distances. People bridge that gap by using computer-mediated communication. Yet, some people argue that personal computing isolates people. So the challenge is: How can ambient media be used to create a persistent, yet non-intrusive connection between loved ones, bringing people a sense of community through shared awareness of human activity?

I will quote my personal project to continue the story of “Sensing at the Periphery”.

MAP OF PERSONAL DEVELOPMENT AT DMI

- Research related ■
- Common thread ■
- Case studies ●
- Influence ▲





Fall, 08

Spring, 09

Now

CASE STUDY

POINTING SOUND

I. INTRODUCTION

“Pointing Sound” represents my efforts to design and build physical interface for people that incorporates creating, playing sound and whole-body interaction. In the system, people can experience the interaction process by seeing musical notes (map), hearing the sequence of sound and by creating sound through their body movement.

Traditional musical instruments, such as pianos, are designed for precise interaction; performers require a certain level of professional skill with their instruments before playing well. “Pointing Sound” is a prototype seeking to explore natural body movement to create and play sound.

II. PROJECT ANALYSIS

“Pointing Sound” is a project I did during the first semester in Professor Jan Kubasiewicz’s design studio. There are two main parts of the assignment: one is to design or compose a sequence of sounds; the other one is to design a musical score.

In the first part of the assignment, the requirement is: The sounds will be generated by using any object or objects, either found and appropriated for this purpose or created specifically for the project. When I started the project, my initial idea was quite simple and came from a single spark: Could I only use body movement as way of generating sound? How about considering the human body as an instrument when people naturally move their bodies and play sound? So, the concept is: the use of play to create sound with whole-body interaction.

INPUT PART SETUP

At the implementation level, the system I set up uses a video sensor as an input device, tracking people’s position through the video camera. The grid of the video camera screen is by default divided into twelve rectangles by twelve rectangles. The process of design is tedious, considering the system might be too sensitive, if set up by

default twelve by twelve, a person body takes more than one grid each time, then sounds can easily overlap. So I changed both the grid of system and the position of the video camera to avoid that. I put the video camera nearly on the floor; so that people could jump then to trigger sound. Or I put the video camera on top of a cabinet, so that people were only allowed to interact using one finger. I tried many variations, until I found that the system was least likely to be disturbed when working in a dark environment. So, for the first prototype, people would move in front of the video camera with a luminous object to trigger sound in a dark environment.

How to set up the system in a way that would be more comfortable and natural for people to interact with? I tried several different and unsuccessful ways of setting up the system. When I tied the video camera on the ceiling, I could draw a map on the floor right under the camera. People held luminous objects to beam on the floor map. However, the shadows of people would block out the illuminated object. I also tried shooting with the video camera, held very low only focusing on peoples’ lower legs. I drew a longer map on the floor in front of camera, people had to jump to interact with system. However the speed of jumping was too slow and would accidentally trigger other sounds. At final version, I drew the map on the wall with people pointing with a laser pen to follow

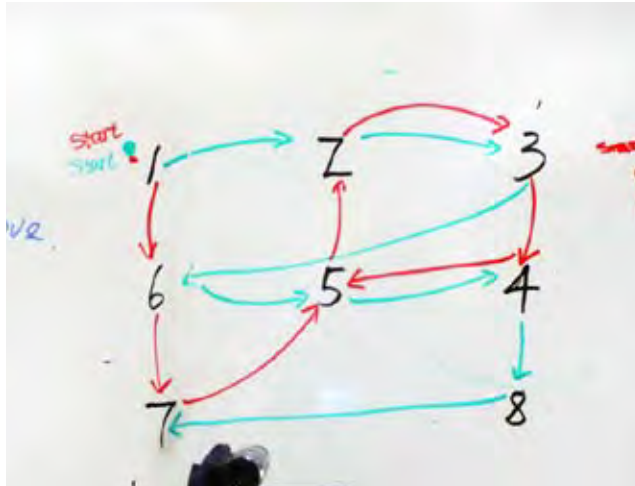


When tied the video camera on the ceiling I drew a map on the floor right under the camera. People held luminous objects to beam on interact floor map.

the map and at the same time trigger the sound.

The second part of this project was to design a score; not a traditional musical notation, but using visual language to design the score. The purpose of the score is to instruct the performer about the procedures and the details involved in interpretation of the original sequence of sounds.

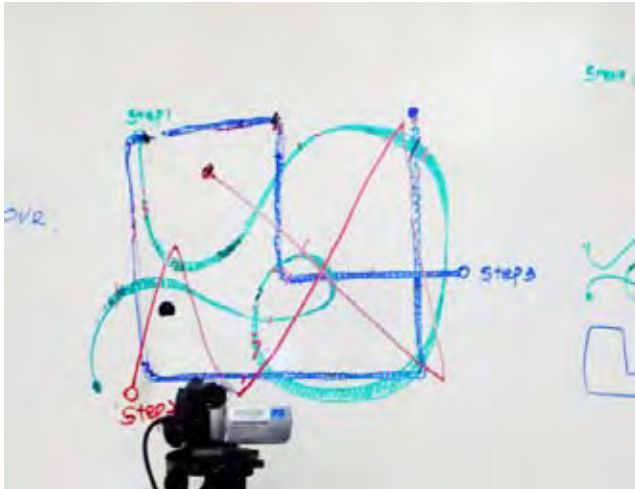
Design question: How can I map a system in such a way that would easily help people grasp the idea in a moment and follow the visual notes successfully? In designing the musical score aspect, I also tried several different ways to visualize sound. The various styles of mapping sound indicate both sound and rhythm. One was assigning a number inside each grid. The performer had to point to numbers in sequence to trigger sound. Another was linking numbers to lines. This resulted in a version of multiple lines on the wall based on each point in the line moving from one position to another to create a series of points. This generated sounds, and the style of each line is based on each sound effect.



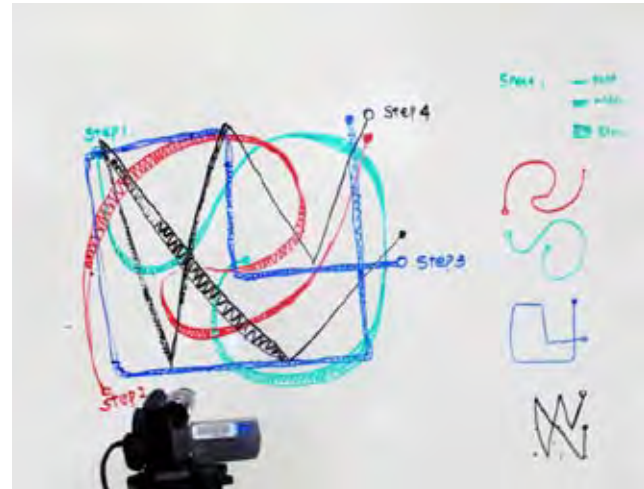
The first draft of mapping sound, pointing by number.



The second draft of mapping sound, red dot is point of sound.



First version considering the speed of pointing

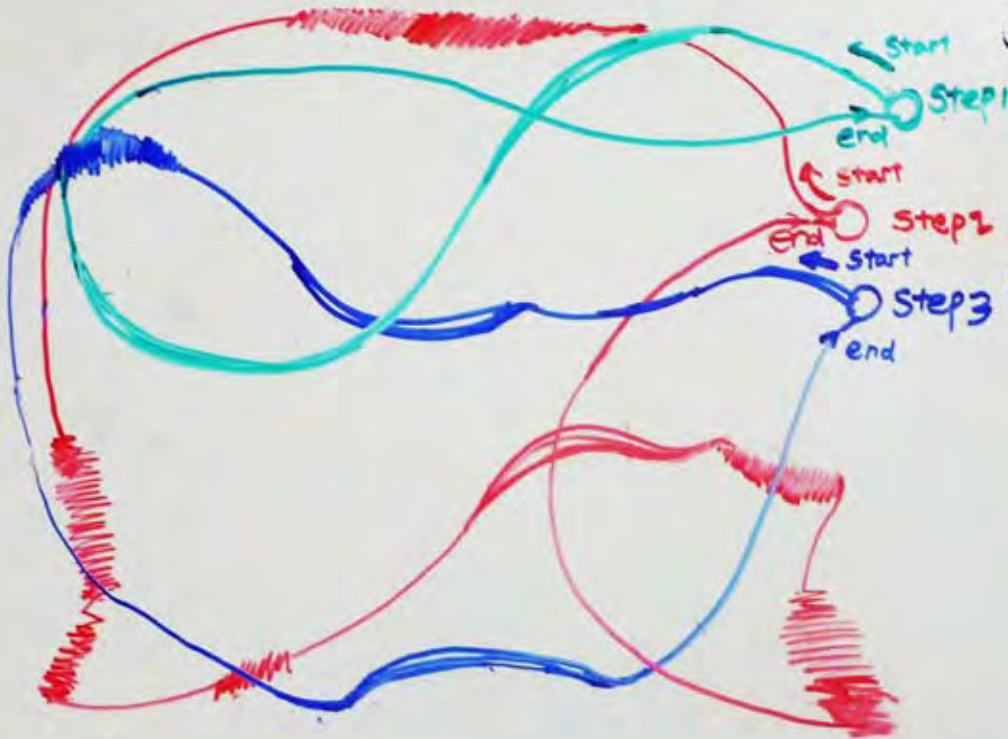


First version considering harmonious of sound

① Choose your want use red dot to follow lines or blue dot to follow lines first.

② if you choose blue dot stand on "stand here" if you choose red. stand anywhere in the room

③ use the red/blue dot follow lines



THE OUTPUT PART

When I chose the sounds to put into the system, one design problem was how to harmoniously connect many sounds together, more specifically, how to harmoniously connect the multiple sounds produced by the gesture of dragging the laser pen. In both cases, sound is supposed to harmonize with the gesture.

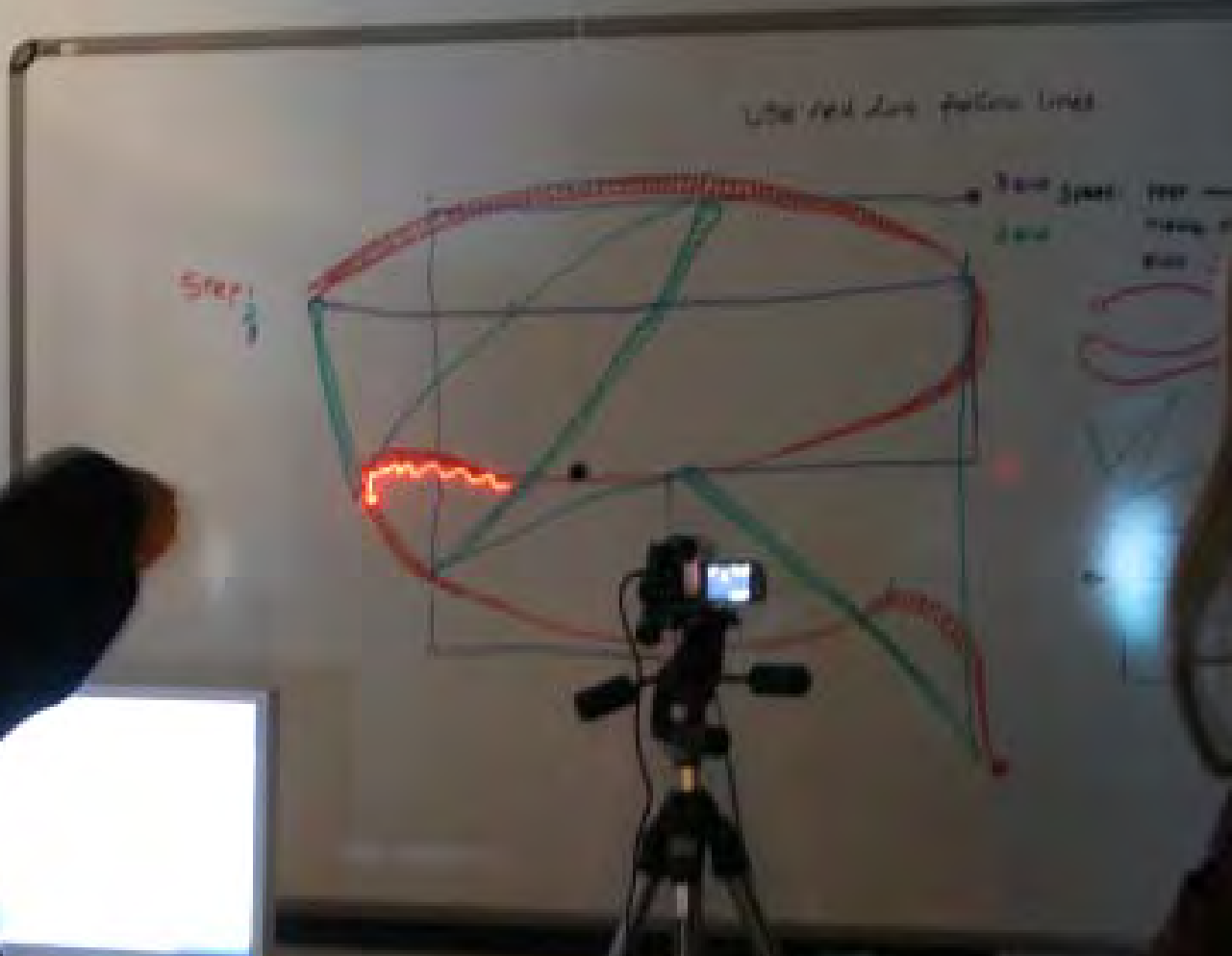
I set key cluster sounds to match the small shaking gesture; the sound of bagpipe to match the slipping gesture; the sound of violin to match the circling gesture; the sound of metal to match the snapping gesture. A difficulty was to figure out how to use life sounds in the process of re-arranging their sequence to create a new “music”.

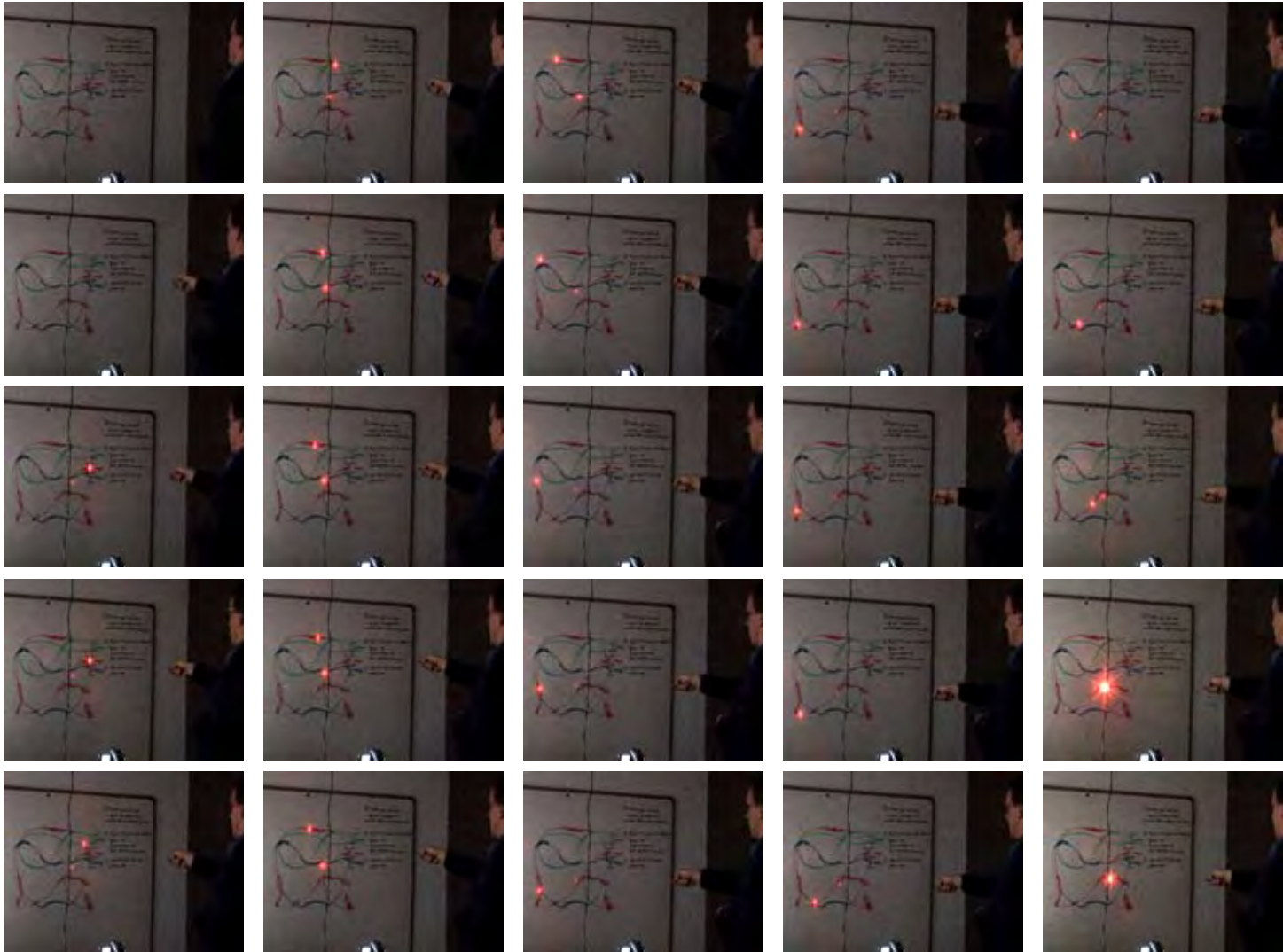


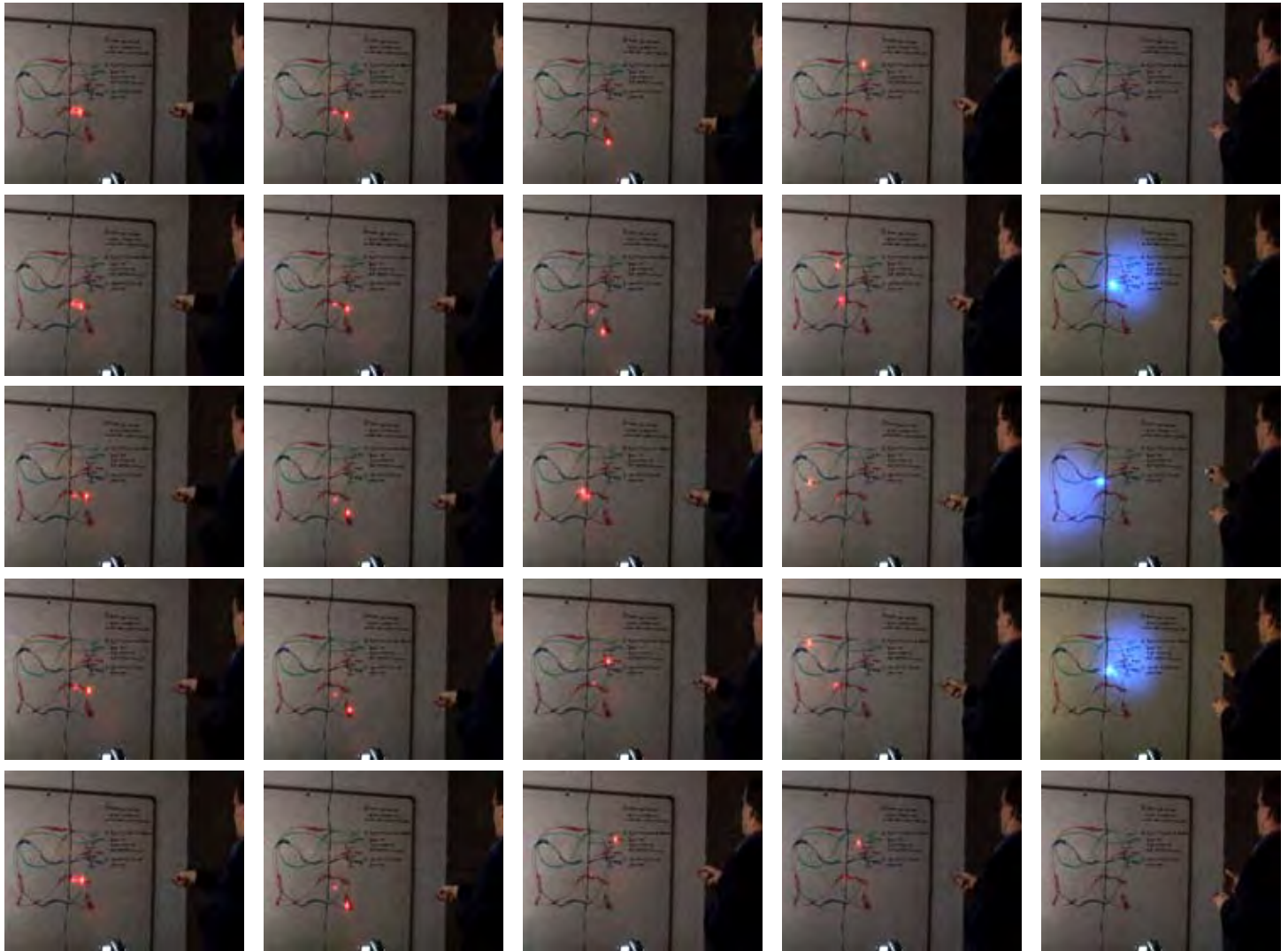
Use red dot follow

Step 1
2
3









The “Pointing Sound” project could nearly count as the first interactive project I did in the DMI program. I designed that without many theories. I worked mostly from intuition. Now, analyzing each step of the “Pointing Sound” project, I realize many common threads I later used in all of my projects that followed.

III. COMMON THREADS

I could not see in isolation any common item on the list below without linking them to my personal history.

DRAWING

Drawing is a way of recording, communicating and expressing. Drawing is an efficient method for expressing emotion. I have a long relationship with drawing; my mother sent me to drawing class when I was four or five years old. Eventually, I got into professional art high school. There, we spent five hours every day seven days a week drawing still life and people. We went to the countryside for two weeks to draw nature each semester. That was a wonderful experience; I often think that if I could go back to the past, I would definitely choose to return to my high school days.

If we widen the definition of “drawing”, to include the gestures of “tracing, dragging, following, mark-making”, the possibilities are without endless.

VISUALIZATION

I did not know there was a career called “designer” until my second year at high school. I accidentally found a book on the best advertisements in the world. That was the first time I realized that there exists a group of people who make their living by being humorous, critical and emotional and by telling stories in a visual way. Even a picture can tell touching stories. I knew immediately that I wanted to be one of them myself. Choosing to be a visual designer was quite deliberate. Rather than saying I like visual communication design, I prefer to say I like myself more as a visual designer. Being a visual designer, I can use my sense of humor, my ability to come up with new concepts and my sensitivity to details to create projects.

MAPPING (INFORMATION VISUALIZATION)

Mapping is a way of thinking; it combines the meaningful and the beautiful in order to enable people to gain knowledge and understanding of data. I first experienced mapping as a junior in college. I felt joy and found meaning in the process—it just seems natural to me. I asked myself: How could I design a project that not only visualized information allowing people to get information and knowledge, but also one that gives people a chance to communicate and experience emotion?

SOUND

I never thought of myself as a person who would deal with sound, until I actually worked with it. I am not a musician. Back when I was little, Mom tried to send me to piano class, hoping I could have some fun there. She bought a small keyboard and even sewed a nice cover for it. Most of my childhood memories are happy, but those lessons are not. I still cannot read musical notes. I just felt all my peers and my teacher criticize me. I still can vaguely remember the feeling of embarrassment and that summer’s bright white sunshine. I believe I had no talent for any type of work involving music, including sound. During Professor Kubasiewicz’s Design Studio, I realized that sound is a big part of communication, equally important with visual communication. At the same time, I became aware that “Sound is not necessarily music”. This theory made me comfortable. After that, I began to appreciate tiny sounds as when it is raining softly or heavily hitting an umbrella. I have become very sensitive to sound.

PEOPLE

When I am designing, people are the principal factor I need to take into account. During my undergraduate years, besides being trained to have a precise eye, I also had it drilled into my brain “Design serves people”; a slogan often used by my adviser Min Wang. At DMI, people became an even more important element in design. The issue at hand is: I need to consider every possible aspect of human behavior, and plan every step of the interaction process.

CASE STUDY

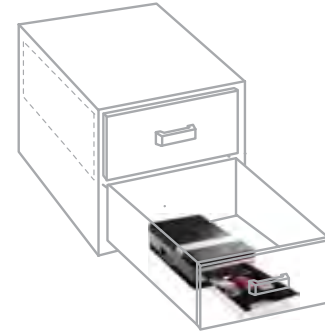
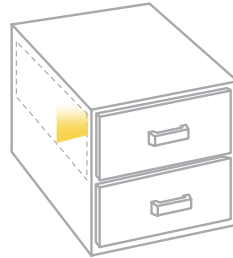
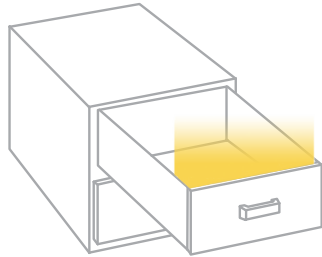
DRAWERSCAN

PROJECT DESCRIPTION

What can contents of our drawers tell us about our daily routines? How many times each day do we open and close drawers to remove or deposit objects? If we could observe these patterns of use, how would they look?

In my conceptual project, a drawer's contents are scanned two times for each use: First, as the user pulls open the drawer, and then again after the drawer is closed. The result is to capture both the active process of removal/adjustment/deposit, as well as the final state of rest. The scans are compiled in sequence and the print output is rendered on an external display.

THE SYSTEM SET UP



1. A flatbed scanner is mounted into the drawer's bottom surface.

2. The scanning element moves away from the user, staying "In place" as the drawer is opened.

3. Another scan is done once the drawer is closed.

4. Printing output as display.

CASE STUDY OF GAVER'S HISTORY TABLECLOTH

An electronically enhanced tablecloth designed to cover a kitchen or dining room table that glows beneath objects, creating a visual halo that expands very slowly. When items are removed, the glow fades quickly. In addition, the size of the glow increase too. By signal how long things have been left on the table. The tablecloth highlights the 'flow' of objects over a period of time on surfaces in the home.



COMPARISON OF DRAWERSCAN AND HISTORY TABLECLOTH

SIMILARITY

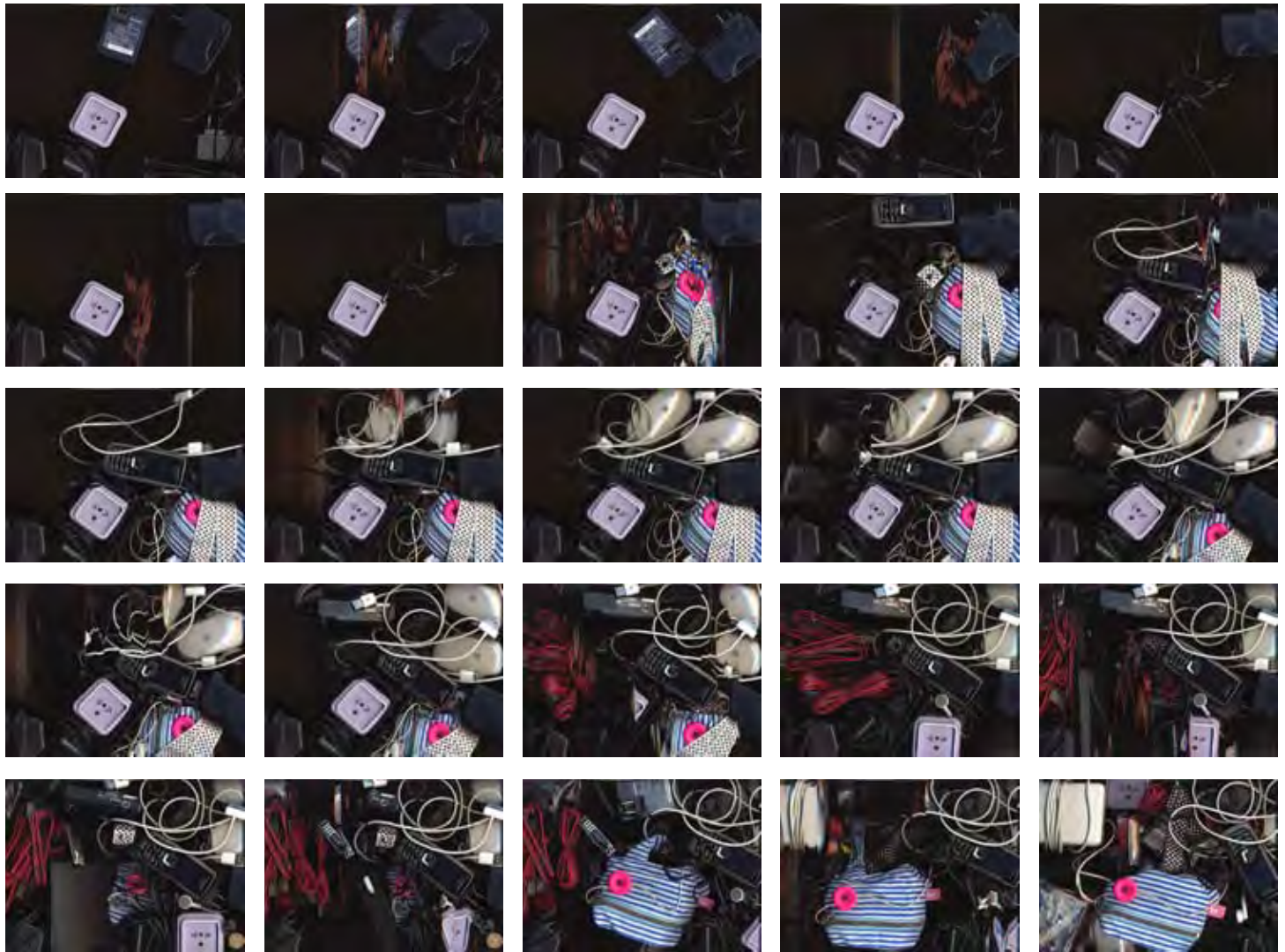
Both projects DrawerScan and History Tablecloth are sneaking technology and design that impact everyday routine life. They harmoniously combine normal human action in their design. They exist almost invisibly, and can be ignored, until we notice that they bring a nice surprise and are even useful.

DIFFERENCE

DrawerScan presents clearly visual result, telling the whole story, the history of objects at home; what we moved and how we moved them.







CASE STUDY

FEARLESS SPEAKING—COMPLAINTS-IN-A-CONTAINER

ABSTRACT

Luckily, most human do not go through huge traumas of war or disaster, but we still deal with small traumas every day. Fearless Speaking—Complaints-in-a-Container is a project to help people to open up and communicate small displeasure in semi-public places and release their emotions without fear of being recognized.

PROJECT ANALYSIS

MOTIVATION

In October 2008, I spent two hours on Skype with my best high friend school Lynn. During our conversation, she told me that she was seriously depressed recently, because of moving to Germany, changing her major from art to math and breaking up with her boyfriend. I worried about her when I put myself in her shoes. I wanted to really help her out of her depression and not just be comforting.

When taking a class in the Visual Art Program at MIT titled “Interrogative Design”. I read several articles about trauma and particularly “Trauma and Recovery”. This article explains how people suffer from horrible events and terrible trauma and how to help them recover. Another article, “Woman’s War” is about many women who served in the military and who suffered from post-traumatic stress disorder, a highly debilitating condition brought on by an abnormal amount of stress.

Depression is common, affecting about 121 million people worldwide. More than 32 million people in the United States will experience a major depressive episode in their lifetime. This happens regardless of

gender, race, ethnicity, or income. Everyone occasionally feels blue or sad, but these feelings are usually fleeting and pass within a couple of days. When a person has a depressive disorder, it interferes with daily life, normal functioning, and causes pain for both the person with the disorder and those who care about him. Those experience depression need treatment to get better. (National Institute of Mental Health)

Currently, prosthetic design is well developed for disabled community in a physical way. All of those products are well made of high quality material and mimic the actual human body parts. But in the project “Complaints-in-a-Container”, I seek to demonstrate that prosthetic design is not limited to only the physical but may, influence the emotional as well. Design question: Can design be powerful enough to help people heal from trauma? How can design help media become more natural in its function as an extension of the human body? How can design be made transparent enough to help people release or communicate human emotion?

Communication is defined as a process by which we assign and convey meaning in an attempt to create shared understanding. The ways of communication are both verbal and non-verbal. As I see the process of verbal communication, the first step is not sending a message but “in being open”. In an ideal society or in a transparent

relationship, people are free to totally open up and express themselves. However, for many reasons in both public speaking and in interpersonal conversation, people hardly feel free to express themselves because of “post-traumatic silence”, “the subtle relationship between people” and “cultural difference”, and so forth.

“I missed the bus!”, “My car was scratched by the stupid car next to me!”, “I broken up with my boyfriend”... All of these “traumas” make up normal peoples’ daily life. We struggle with them; they keep us alive. Since there is a hierarchy in displeasure and complaints, we feel more free to speak out about large issue as climate or politics. But in a semi-public environment, in an office or a classroom, we hardly to speak out the things they are bothering us. It is socially unacceptable to share our traumas and complaints, with people who are not our closest friends.

THE PROCESS OF DESIGN



The shape and size of box is squeezable and stretchable by the amount of complaints.



One box, one side is for “speaking”, the other is for “listening”. The gesture of “opening” from middle before the real communication imply “opening up is first step during communication”.



Separate to two box by function. Two boxes are not necessarily stay in the same spot that increase the possibility of interaction. Two person can use and interact it at the same time.





“Speaking Container”, microphone put in.



“Listening Container”, light sensor and speaker put in.



COMPLAINTS

IN A CONTAINER.

Feeling in an Act of Stress



Speedy Cleaning
www.SpeedyCleaning.com

Address of Violation: 156 Alford St

The following Refuse & Litter violation(s) was observed at your property:



- Trash/recycling out before 6pm the day before collection
- Trash in plastic bags out the night before collection
- Trash bags used are not heavy-duty
- Trash barrel(s) has no tight-fitting lid
- Trash in plastic bags or barrels are over 50 pounds
- Trash in plastic bags or barrels are out past 6pm

THE WORKS
LET HomeServices (1-800-877-8777)
Somerville, MA 02149
TEL 343-4833
FAX 617-349-4005

WARNING
VIOLATION OF REFUSE & LITTER
Chapter 21A of the Code

Property Owner



Urbión Expolión

Ingredientes / Ingredientes:
 Only Extra Virgin Olive Oil
 (Purified variety)
 Huelva de Oliva Virgen Extra
 (Varietal Purified)

Nutrition Facts
Valeur nutritive

Serving Size: 100ml (3.38 fl. oz.)
 Amount Per Serving
 Total Fat 100%
 Sodium 0%
 Total Carbohydrate 0%
 Protein 0%

PRODUCED AND PACKED IN SPAIN BY:
 PRODUCT ET ABRIÉ EN BOULGRIE EN ESPACE PAR:
 SOC. COOP. AND. UNIÓN DE URBION
 C/ Córdoba, 9
 URBION, (Jaén)
 Tel. 953.750.840, Fax 953.758.123
 e-mail: almacen@urbion.com
 www.urbion.com
 P.O. Box 10.546 J
 Best before: see lid
 A consommation de préférence agréée: voir le couvercle
 (CE)-E39-179

shaus

CLASSIC ROAST



COMPLAINTS
 IN A CONTAINER

Labeling is an Act of Love

shaus

Nutrition Facts

Serving Size: 100ml (3.38 fl. oz.)
 Amount Per Serving
 Total Fat 100%
 Sodium 0%
 Total Carbohydrate 0%
 Protein 0%

WAG
Pepper Sauce





COMPLAINTS MEGAPHONE









Design is not to make comfort but meaning.—Krzysztof Wodiczko

COMPARISON OF CONTAINER AND MEGAPHONE

From the coffee can to the megaphone, how the physical object—the container, is supposed to look was a serious design problem. More importantly and specifically, people already have a stable concept for each existing shape, form, size, weight, etc. Everything means something in the human brain. Every detail of a physical object can communicate to people.

1. Metaphor: when I adopt a coffee can, the most common objects, as the complaints container. It can indicate that suffering is normal, is part of every day life. When I adopt a megaphone, as a way of voicing information, it can indicate that there is hope when pain is heard by people.

2. Size: when the size of the “speaking container” is as small as a fist, it suggests that we are supposed to talk in a lower voice compared with the loudness suggested by a larger container.

Therefore, the issue is, that people’s visual perception will influence people’s behavior and action. Furthermore, the human gesture (how to use, how to grasp an object) will transmit a meaning to the human brain. Even a tiny difference in gesture will create a big difference in meaning. Like a long, powerful handshake compared with a short soft one, even two seconds shaking hands will leave a different impression and meaning.

FINDINGS AND CONCLUSION

The design process took a long time. At first, I chose a coffee can as the container for the “complaints” project. I preferred the idea of putting the design into a supermarket to be sold as part of everyone’s’ daily routine. Then I had to consider further how the object was supposed to look. Should it be a whole? Should it be separated into two parts? What size should it be? Not until I designed—the cover of the box, so it could flap to open or close, did I have an option to silence people. It made me realize how much the visual perception together with the human gesture would enhance meaning.

I concluded that when we, interactive and dynamic media designers, plan the process of interaction, we need to pay attention to the visual details of the physical object. Designers must understand the meaning of metaphors of the chosen objects and all aspects of communication in the process of making meaning. Other elements required careful selection as well. Size, shape, materials, all of these is visual hints that encode meaning. At the same time, all the elements influence the way of human interaction. There is a thread that weaves together perception and gesture with the metaphor and all the details ultimately form a Gestalt.

CASE STUDY

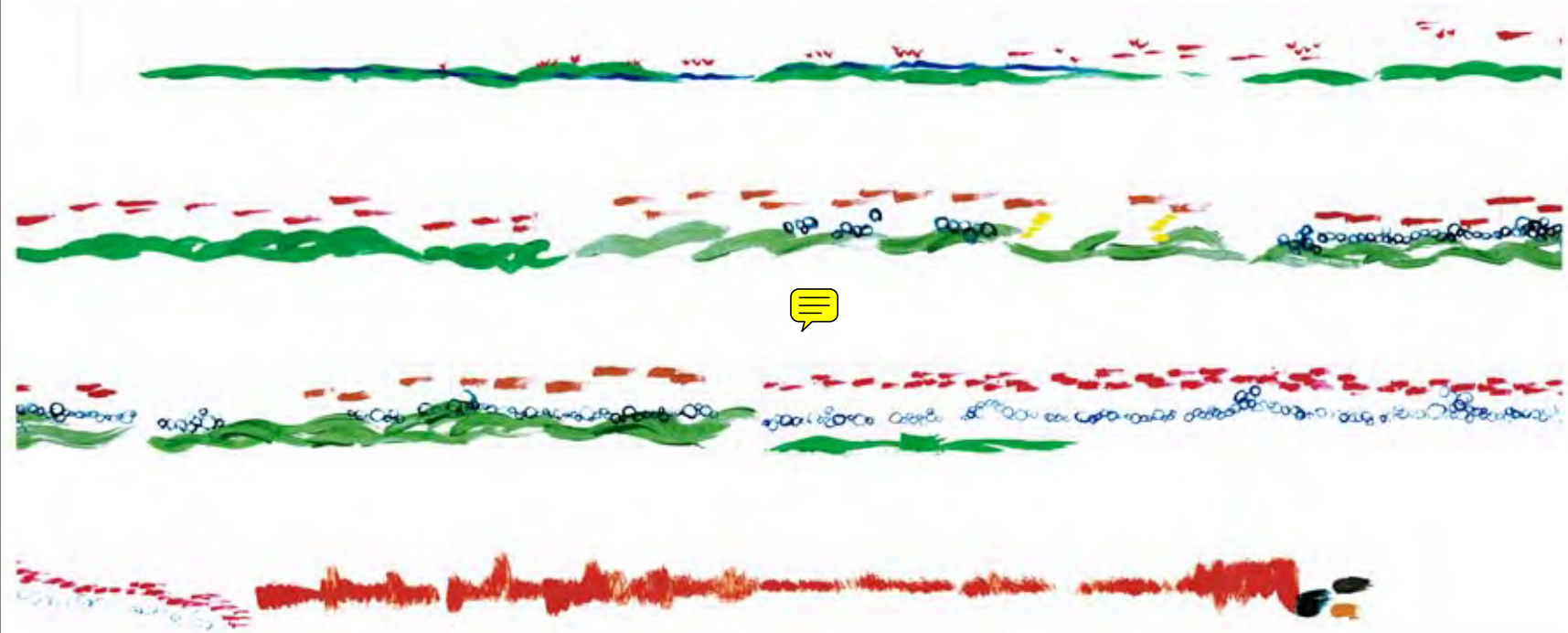
MAP OF SOUND

Project task: visualization sound—Vox 5.

There are three main elements existing in the project: information, mood and time. The information is sound itself including volume, pitch and multiple levels, the mood is relatively happy and the time is one minute and thirty five seconds. Design exists on two levels. On one level, visualizing sound, drawing is used as a method for expressing emotion or mood. The sound piece, Vox 5, expresses a lively and bustling mood. In mapping sound, I not only visualize the sound itself but I also express that lively mood, drawing by using brushes and bright colors moving to the rhythm on the timeline result in a signal visual representation of sound, mood and time.

On the other level, the user is able to “read” the narrative, by unfolding each second of sound, page-by-page, fold-by-fold. The final form, is a ninety-five pages long accordion-fold book. Each page is equal to one second of sound on the timeline. The flipping of each fold or page is one second of time and one second of sound. The human interaction enables the user to experience both visualization and the narrative of sound simultaneously.









CASE STUDY

DRAWING BY EMOTION

I. INTRODUCTION

“Drawing by Emotion” is a system that recognizes human emotions generated by vocal cues, and then uses that data as input to operate and activate a drawing machine.

“Drawing by Emotion” aims to express human emotion from the whole set which includes object metaphor, motion and visualization statement. Five machines are based on five selected basic emotions: Anger, Happiness, Neutrality, Sadness and Boredom. The object metaphors chosen are respectively, a hammer, a spinning top, a weaving loom, an IV set, and a pendulum. Each machine transforms a vocal emotional statement into a visual expression of that emotion.

The project has two basic parts: one is to develop a system that can accurately detect a person’s psychological state by analyzing the output of vocal cues. The other is to process this information in real time (as it happens) and convert it into visual evidence

According to Hiroshi Ishii, head of the Tangible Media Lab, Interaction requires two key components. One is control, through which people can manipulate access to digital information and computation. In this project, “control” is the human voice (speaking

naturally), which may or may not encode emotion. Also, it's very important to have external representations that people can perceive, to understand the result of the computation. And in my project, the drawing result is the decoding of the emotion.

The research begins with several questions: whether or not human speech encodes emotional cues? What is emotion? What is the standard determining emotion? What is the function of emotion expression? The following sections review the research that has been used to address these questions.

II. THEORETICAL CONTEXT

a. THEORIES OF EMOTION

What is emotion?

“Everyone knows what an emotion is, until asked to give a definition. Then, it seems, no one knows” (Fehr & Russel, 1984) Emotion is a notoriously hard concept to define, and there are no generally agreed upon criteria for what should count as an emotion and what should not.

b. EMOTION CLASSIFICATION

There are many different emotion classifications. Andrew Ortony and Terence J. Turner (1990) collated a wide range of research on identification of basic emotions.

Basic emotions:

According to Robert Plutchik (1980):

Acceptance, anger, anticipation, disgust, joy, fear, sadness, surprise

According to Arnold M. B. (1960):

Anger, aversion, courage, dejection, desire, despair, fear, hate, hope, love, sadness

According to Ekman, P. Friesen E. W and Fllsworth W. B:

Anger, disgust, fear, joy, sadness, surprise

According to Nico H. Frijda (1986):

Desire, happiness, interest, surprise, wonder, sorrow

According to Gray J. A. (1982):

Rage and terror, anxiety, joy

According to Carroll E. Izard (1971):

Anger, contempt, disgust, distress, fear, guilt, interest, joy, shame, surprise

According to William James (1884):

Fear, grief, love, rage

According to McDougall, W (1926):

Anger, disgust, elation, fear, subjection, tender-emotion, wonder

According to Mowrer O. H (1960):

Pain, pleasure

According to Oatley, K and Johnson-Laird, Philip. N(1987):

Anger, disgust, anxiety, happiness, sadness

According to Panksepp, J (1982):

Expectancy, fear, rage, panic

According to Tomkins S. S (1984):

Anger, interest, contempt, disgust, distress, fear, joy, shame, surprise

According to 339-353. Watson J. B (1930):

Fear, love, rage

According to Weiner, B and Graham, S (1984):

Happiness, sadness

Secondary emotions include feelings such as affection, admiration, pride, conceit, nostalgia, remorse and rancor.

c. THE FUNCTIONS OF EMOTIONAL EXPRESSION

The communication of emotion is often viewed as crucial to social relationship and survival, and many of the most important adaptive problems faced by our ancestors are assumed to have been social by nature. Emotional expressions can serve as shapers of social behavior through two interrelated mechanisms. First, by expressing emotions we can communicate important information to others, thereby influencing their behaviors, and by recognizing others' expressions we can make quick inferences about their probable behaviors. (Darwin, 1872) Secondly, expressions can regulate social behavior by evoking emotional responses in the decoder.

There are many cues to enable accurate recognition of emotions including vocal intonation, facial expression, posture, behavior, skin color and temperature. Facial expression is thought to be one of the most important elements in the expression of emotion. Ekman, P. and Oster, H. claim, "In humans the face seems to be a richer and more dependable source of information about emotion than any other expressive modality". In fact, many of the

studies involving the perception of emotion from vocal cues present high levels of recognition, in some cases higher than those obtained from (at least static) visual stimuli. (Julie Robson and Janet MackenzieBeck) In “The Expression of Emotion in Man and Animals”, Darwin states that:

“With many kinds of animals, man included, the vocal organs are efficient in the highest degree as a means of expression”

d. PROSODIC EMOTION RECOGNITION

Hypothesis: Different emotions have varying effects on the properties of the different speech sounds.

Most studies have considered vocal expression as a means to communication. Hence, fundamental issues include

- A. the content (what is communicated?)
- B. the accuracy (how accurately is it communicated?)
- C. code (how is it communicated?)

METHODS OF COLLECTING VOCAL EXPRESSIONS

Most studies of vocal expression to date have used some variant of the “standard content paradigm”. That is, someone (an actor) is instructed to read some verbal material aloud, while simultaneously portraying particular emotions chosen by the investigator. The emotion portrayals are first recorded, and then evaluated in listening experiments to see whether listeners are able to decode the intended emotions. The same verbal material is used in portrayals of different emotions, and most typically has consisted of single words or short phrases. (Laukka 2004)

Other common methods include the use of emotional speech from real conversations, induction of emotions in the speaker using various methods, and the use of speech synthesis to create emotional speech stimuli.

VOCAL CUE ON EMOTION RECOGNITION

A fundamental question is what aspects of the voice signal should be measured? The most obvious answer to this question is: “As many as possible.” So current research on emotion recognition based on vocal cue test on:

Prosodic features: (the patterns of stress and intonation in speech): pitch, voice intensity, duration, frequency, pauses (Fairbanks & Hoaglin, 1941)

Quality features: phonation type, precision of articulation manner (Davitz, 1964), voice timber, micro-structural regularity(Davitz, 1964)

Spectral features: bandwidth energy

K. R. SCHERER'S THEORY OF VOCAL EXPRESSION

The general principle of Scherer's theory is that physiological variables, to a large extent, determine the nature of phonation and resonance in vocal expression. Scherer offers predictions for acoustic cues associated with anger, disgust, fear, happiness and sadness; these are the "five major types of emotional states that can be expected to occur frequently in the daily life of many organisms, both animal and human."

My data and method of research, based on the work "Emotional Space Improves Emotion Recognition" by Raquel Tato, Rocio Santos, Ralf Kompe, J.M.Pardo, has helped to answer the two key questions: whether speaking (vocal cues) encodes emotions and which emotion statements currently can be decoded and what methods are used to decode?

In that paper, they the authors aimed to recognize five emotional states: anger, happiness, sadness, boredom and neutrality. They used two classifiers looking at prosodic features and giving as output three levels in the activation dimension (high=anger-happy, medium=neutral. Low=sad-bored), and a second classifier, looking at quality features, and making the final decision concerning an emotional state. In their first study, speaker-dependent experiment: an experiment was carried out taking the whole set of 37 prosodic features as input to the neural network classifier (NN), with no hidden layer, to assess the confusability among the five emotional states.

	Angry	Bored	Happy	Neutral	Sad
Angry	0.46	0.09	0.24	0.19	0.1
Bored	0.1	0.39	0.09	0.2	0.34
Happy	0.25	0.09	0.59	0.14	0.06
Neutral	0.2	0.19	0.14	0.3	0.2
Sad	0.12	0.34	0.08	0.22	0.39

“Emotional Space Improves Emotion Recognition” by Raquel Tato, Rocio Santos, Ralf Kompe, J.M.Pardo

Although the recognition rate is not particularly high, the output values clearly differentiate the position of the emotional state on the arousal axis. Another thing to be read clearly from above the table is that emotion is a relative quantity.

“Drawing by Emotion”, five machines simultaneously coordinated to draw together based on the fact.

III. PROJECT ANALYSIS

“Drawing by Emotion” uses the whole set, including the machine itself, the motion of the machine and the visual result as a process to transform vocal emotion cues to visual emotion expression.

The entire process combines human senses and a system installation to create a visual expression of emotion. Overall, in “Drawing by Emotion”, the interaction between human and machine, can be treated as part of Human-Robot Interaction or Human-Computer Interaction. Usually, the function of robots is to extend the range of the physical capacity of humans, especially in dangerous or extreme conditions. The basic goal of Human-Robot Interaction is to develop principles and algorithms to allow more natural and effective communication and interaction between humans and robots. “Drawing by Emotion” seeks to elevate the process of interactivity. It envisions a way of manipulating a robotic machine that is capable of reacting to human voice that carries emotional cues—a human way—rather than a command-line interface. Its function would expand and integrate human senses.

There are several layers to the main elements of the project “Drawing by Emotion”:

OBJECT METAPHOR

When I designed each component of the project, the central question was: How could the machine express emotion? And how can that expression be accepted by people as an emotional?

Past experience of a meaningful object can easily wake up memory and then connect a person to a new meaning. Metaphor: The term of “metaphor” describes an expression of speech “in which a word or a group of words is transferred out of its actual context of meaning into another, without there being a direct simile between the descriptive term and that which it describes”(Duden)

“The process of metaphor-creation mirrors the cognitive development of humanity. With the aid of metaphors, people are able to find connection in thought processes and bring areas of experience into relationship with each other.”
(Jurgen Fritz)

Metaphor connected with memory. It connected the past experience and new experience to become a brand new unit and convert unfamiliar, unaccustomed to familiar and accustomed. The use of metaphor is a process of transferring and connecting from the past to the

present toward the future.

“Drawing by Emotion” selects five object metaphors to represent five basic emotions: Anger—a hammer; happiness—a spinning top, sadness—a IV set; neutrality—a weaving loom; boredom—a pendulum.

The reason for selecting those metaphors is based on my own and to common experience. The image of hammer crushing things, reminds me of the emotional statement of anger. The pleasant memories of spending hours playing with a spinning top as a child influenced my choosing a spinning top for a happiness machine metaphor. When I was in the hospital with a fever, I experienced how infusion is a long, painful process. That is the reason an IV set was chosen as the sadness machine metaphor. The motion of a clock pendulum always remains at the same speed and rhythm, which leaves a person feeling very bored. The mode and pattern of a moving loom leaves a neutral impression.

When I wake up my own memories for selecting metaphors, there are design questions: when we design what is the balance between “new” and “old”? How to keep people feeling the ideas are fresh, but not overwhelm them? In his book, *On Intelligence*, Jeff Hawkins observes:

“Brains like familiarity, but they get bored. They are genetically programmed to want to discover new patterns; you don’t want it too new because that seems dangerous. You want it somewhat familiar and somewhat new. Somehow new and old at the same time gives the best design. If a design is so new that people can’t relate to it, then they reject it.... you want it to be just slightly different, enough that people say, Oh, that’s cool”.

DRAWING

How does drawing specifically express emotion? Which drawing, which visual element, could represent which emotion?

Not only does what I draw matter, but how I draw it matters too. So two parts need to be taken into consideration: the drawing process and the visual result.

THE DRAWING PROCESS

What matters in the process of drawing are both motion and the tool used in making the mark. The speed, the force, the rhythm, the fluency and the loudness; each aspects of the movement all matter in communicating the

meaning and expression of an emotion.

The “Drawing by Emotion”, system sets up the variables of motion in each of the five machine of the fives machines.

The expression, *anger* is based on other related words, for example, *choler*, *conniption*, *infuriation*, *quick short temper*, all of which help me to visualize the image. The basic movement of the anger machine is hitting. The variables are the height from which hitting begins, the speed of hitting, the rhythm of hitting and the force (intensity) of hitting.

The expression, *happiness*, is based on other related words, like *delight* and *cheer*. The basic movement of the happiness machine is circling. The variables are the size of the circling, the speed of circling, the rhythm of circling and its fluency, plus the width of the brush and the number of brushes.

The expression, *neutrality*, is based on other related words, such as *disengaged* and *inactive*. The basic movement of the neutrality machine is making straight lines. The variables are the number of strokes.

The expression, *sadness*, is based on other related words, such as *dejection*, *dismal* and *blue*. The basic movement of the sadness machine is dripping. The variables are the starting height of the dripping and the frequency of the dripping.

The expression, *boredom*, is based on other related words, such as *lethargy* and *monotony*. The basic movement of the boredom machine is short repetitive stroking. The variables are the speed of stroking.

THE VISUAL RESULT

Color

Perception of color is the single most strongly emotional part of the visual process. Color has strong affinity to emotion. Color also carries symbolic meaning and associative meaning.

There are many color theories. Relevant to my project is according to Donis A. Dondis who states that color has three dimensions which can be defined and measured: hue, saturation and brightness. In “Design by Emotion”, I chose colors based on the general knowledge that bright colors often express excitement, while duller or darker ones can express relaxation, depression, sleepiness, or other low-key emotions. In the system, red, yellow, black, blue grey and grey represent respectively anger, happiness, neutrality, sadness and boredom. Each of the colors, except grey, which express boredom, has five different levels of hue, saturation and brightness to express different degrees of each emotion.

Shape

Each shape has its own unique character and characteristics and meaning, a great deal of meaning is attached to each one. We get meaning in several ways, some through association, some though arbitrary attached meaning and some through our own psychological and physiological perceptions.

A splash shape, has qualities in irregularity, scalability, can express an intense emotion. Therefore this shape is used for representing anger in the system.

Curved lines are lively and suggest energy, they can express a pleasant emotion, so curved lines easily represent happiness in the system.

Straight lines convey neutral feelings, so useful for representing neutrality in the system.

Dots are delicate, tiny, like rain drops. They can express a “down” feeling, represent sadness in the system.

Strokes are monotonous and represent boredom in the system.

Pattern

Pattern conveys multiple levels of information. One level combines the tools and the force of drawing. For example, in work with sharp, percussive strokes, like a Vincent Van Gogh painting, the brush strokes always give the painting an anxious tone.

The neutrality machine in “Drawing by Emotion”, uses sharp pencils and consistent force.

The anger machine uses a block of wood, a hammer and powerful pounding.

The happiness machine uses soft brushes and rapid light circular motions.

The sadness machine uses gentle dripping water.

Another level of pattern is connected with movement. Pattern is a representation of motion on the timeline. The layer of patterns reveals the movement and its attached meaning.

Movement

Movement in a visual representation, is described as the compositional tensions and rhythms in visual data, even when what is being seen is actually fixed and unmoving. The layers of meaning in the drawing (pattern) are indicated by the intensity, the size, the speed and the length of time expended by the person making the drawing. From that, a great deal of emotional information is conveyed by the visual itself, the self-recorded visualization. The degree of emotion is conveyed in patterns related to movement.

MAP OF "DRAW BY EMOTION"

Five types of machine
Five emotion

Description

Variable in motion and drawing

Visual Parameter

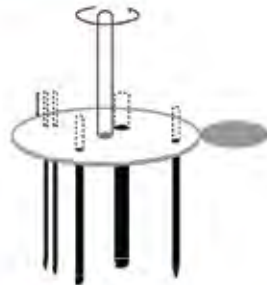
Color

Shape

Happy Happiness/Happy

Delight
Cheer
Ecstasy

Size of circle
Speed of circling
Rhythm of circling
Fluency of circling
Whole circling- a quarter
Width of bush
Number of bush



Angry Anger/ Angry

Choler-jump
Connption-no rythm
Infuriation-huge sound
Quick, short temper

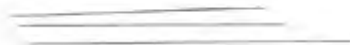
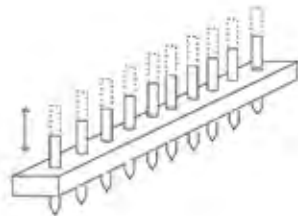
Height of start hitting
Speed of hitting
Rhythm of hitting
Intension of hitting



Netural
Netural

Disengaged
Inactive

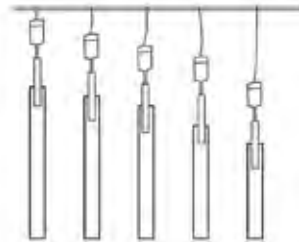
Number of stroke



Sad
Sadness/Sad

Dejection
Dismal
Blue

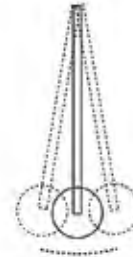
Height of dripping
Frequency of dripping



Bored
Boredom/Bored

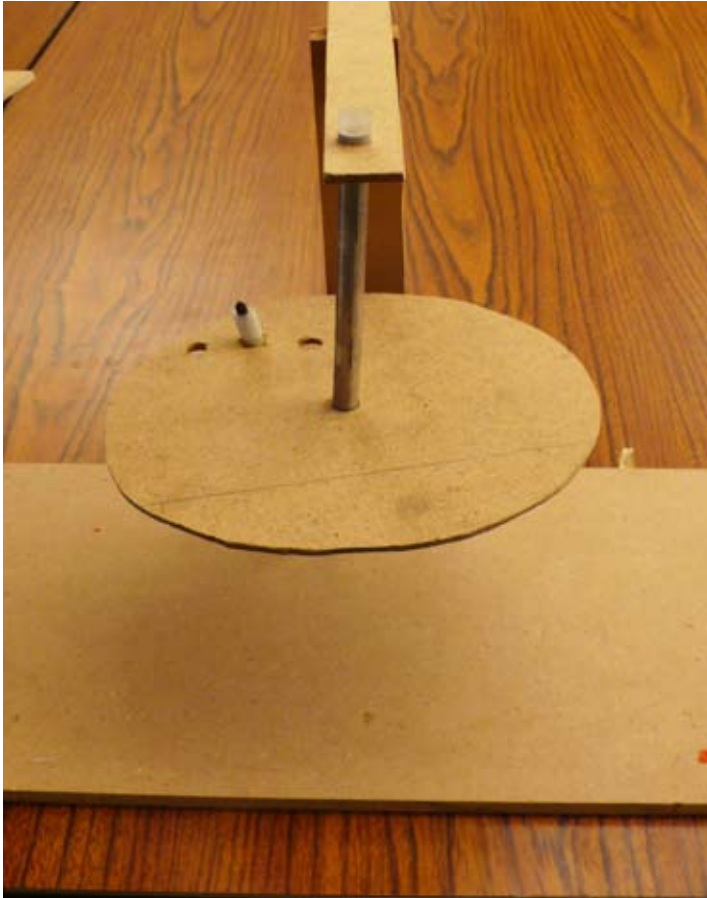
Lethargy(a sleep state)
Monotony

Speed

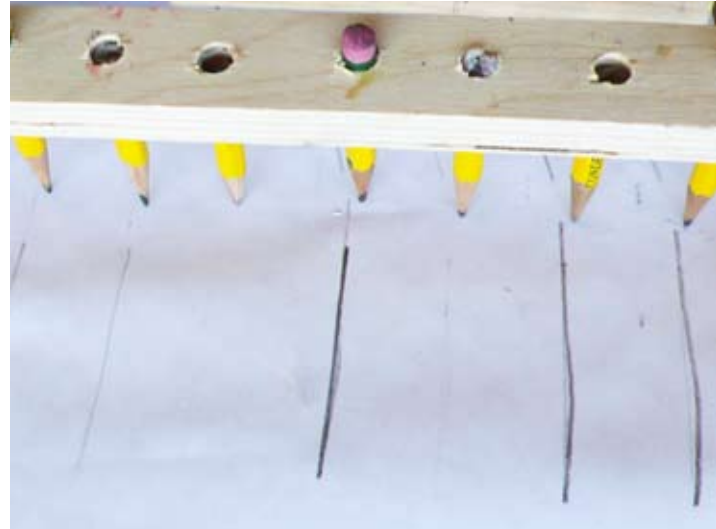


THE FRIST PROTOTYPE

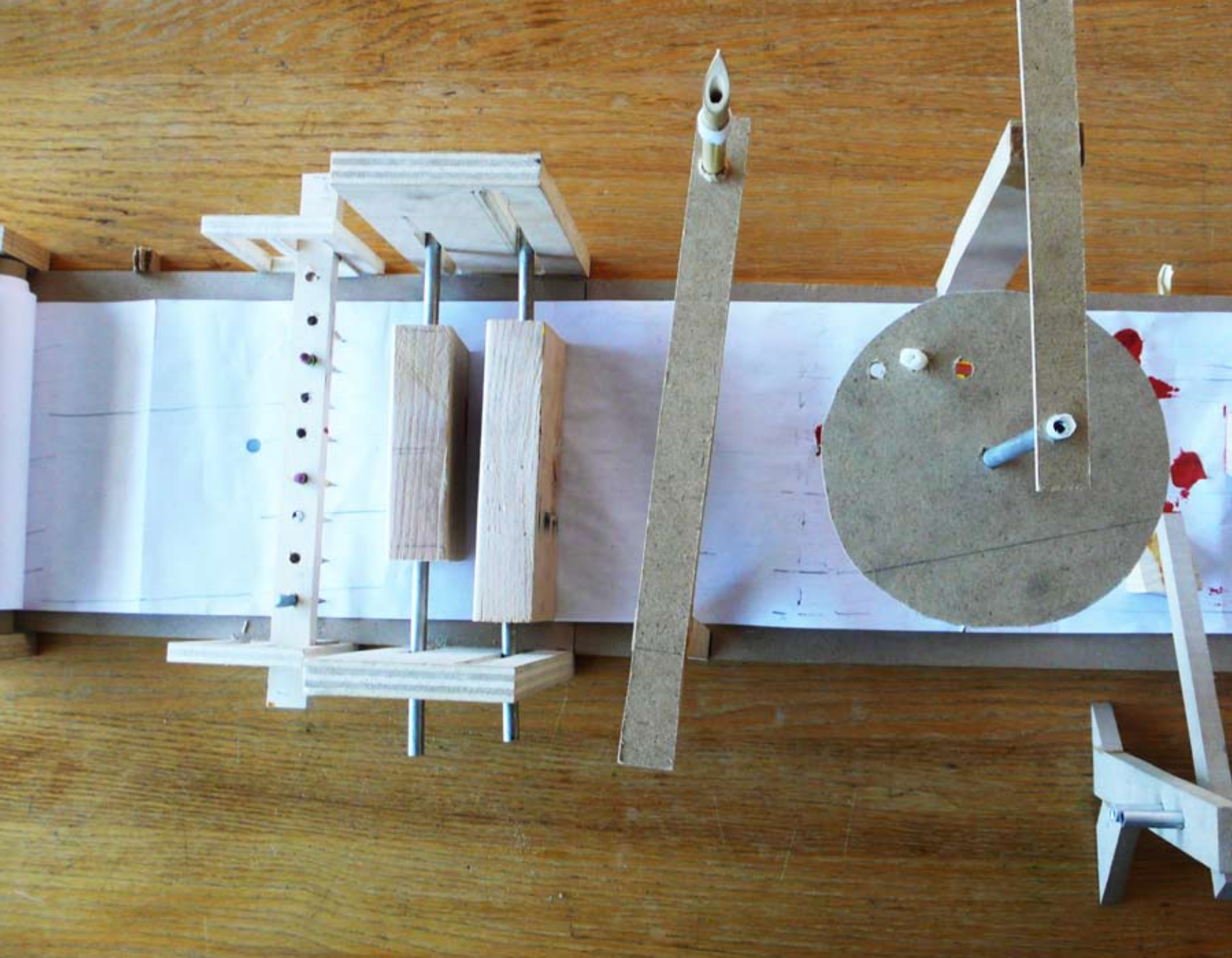




THE FRIST PROTOTYPE

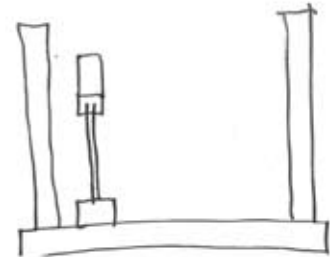
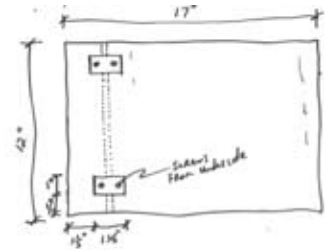
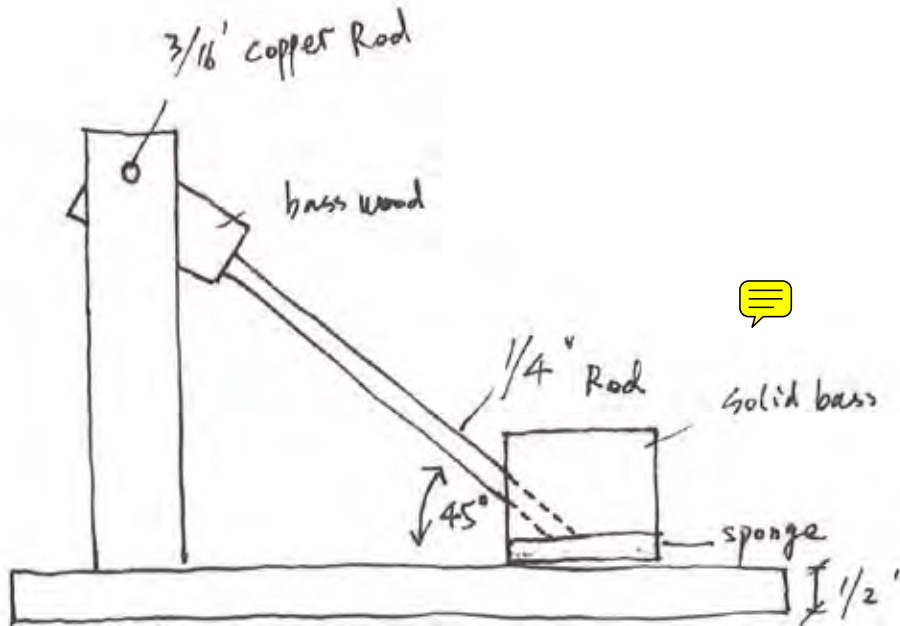


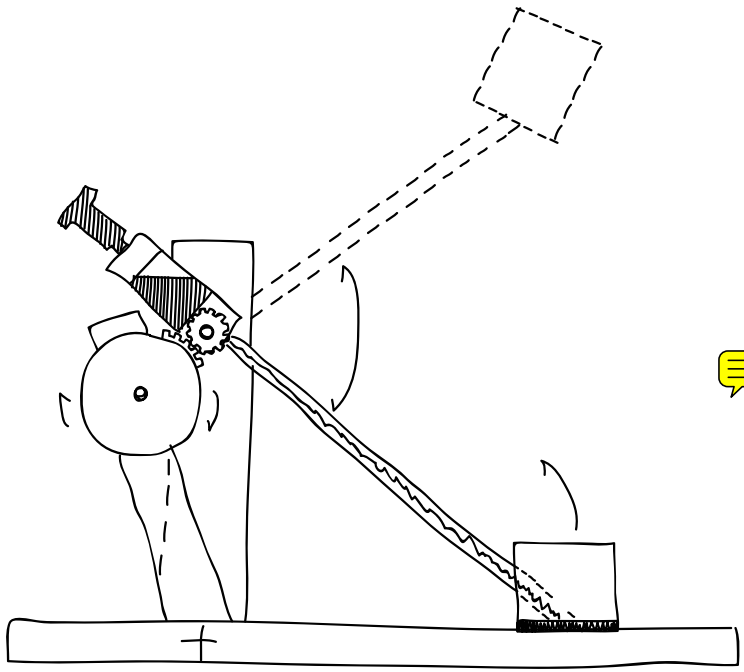




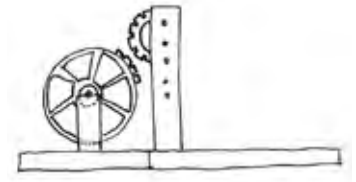
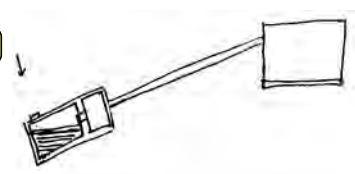


SKETCH FOR WORKING PROTOTYPE

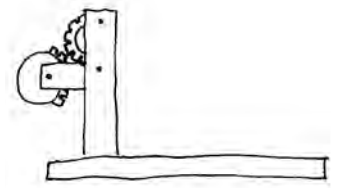




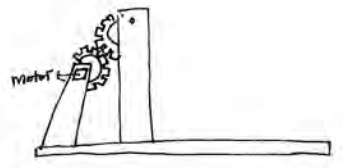
hammer Motion.

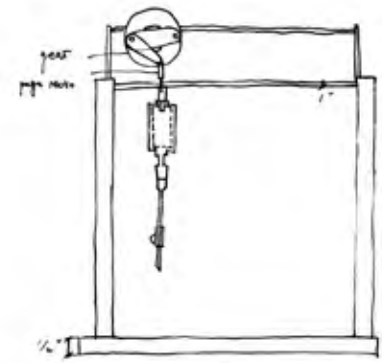
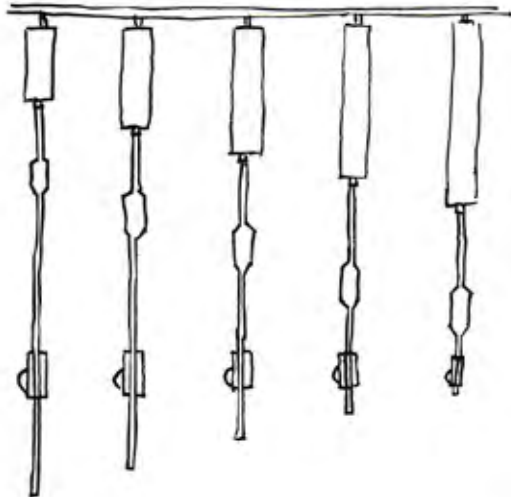


gear setup 1

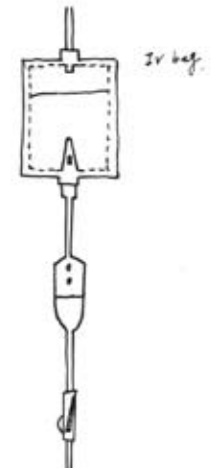


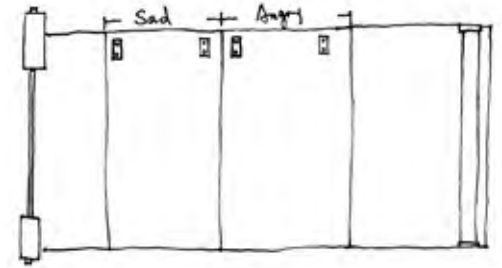
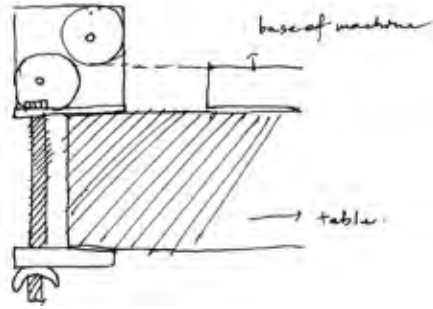
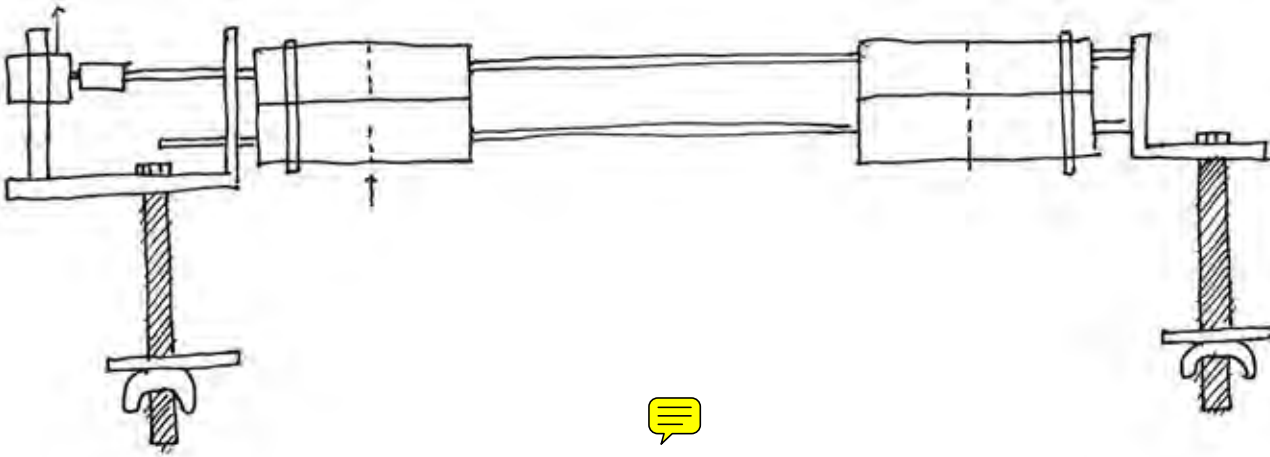
gear setup 2

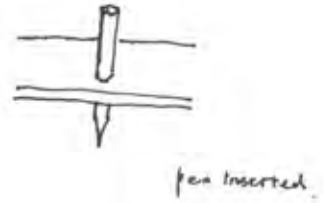
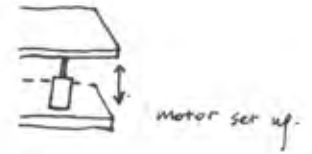
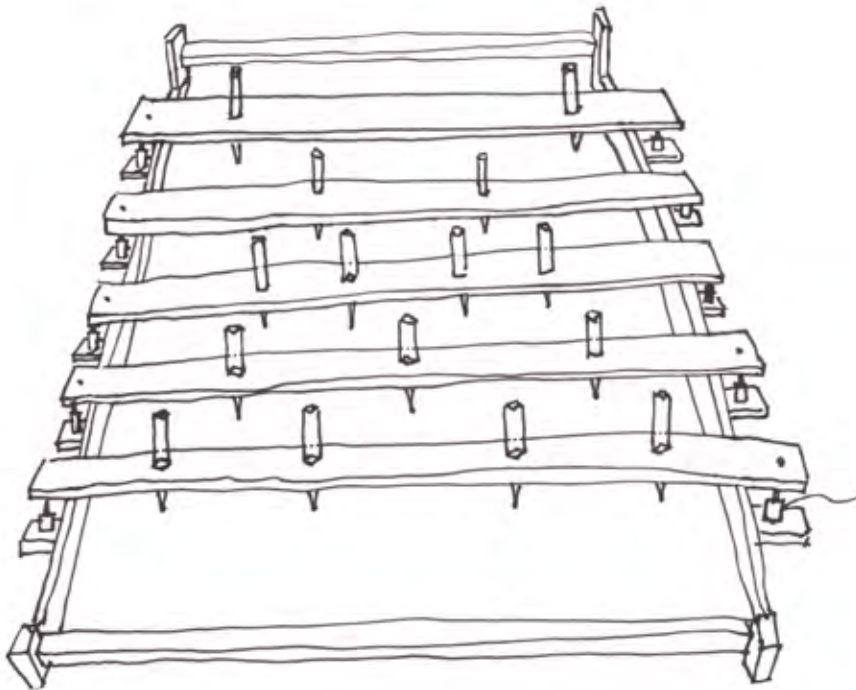




- bag position
- size of Lv bag

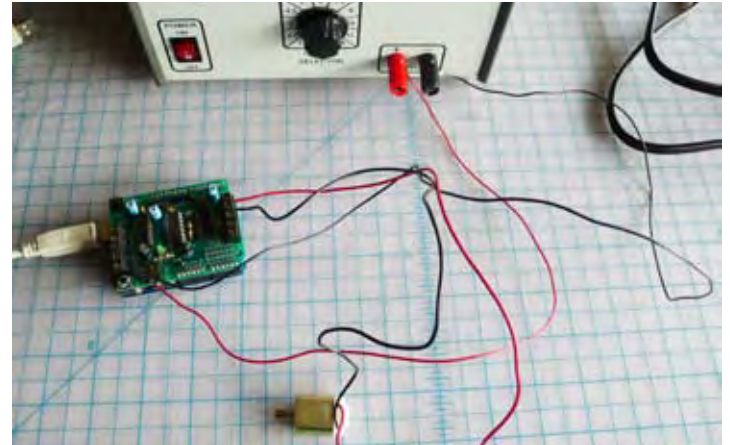






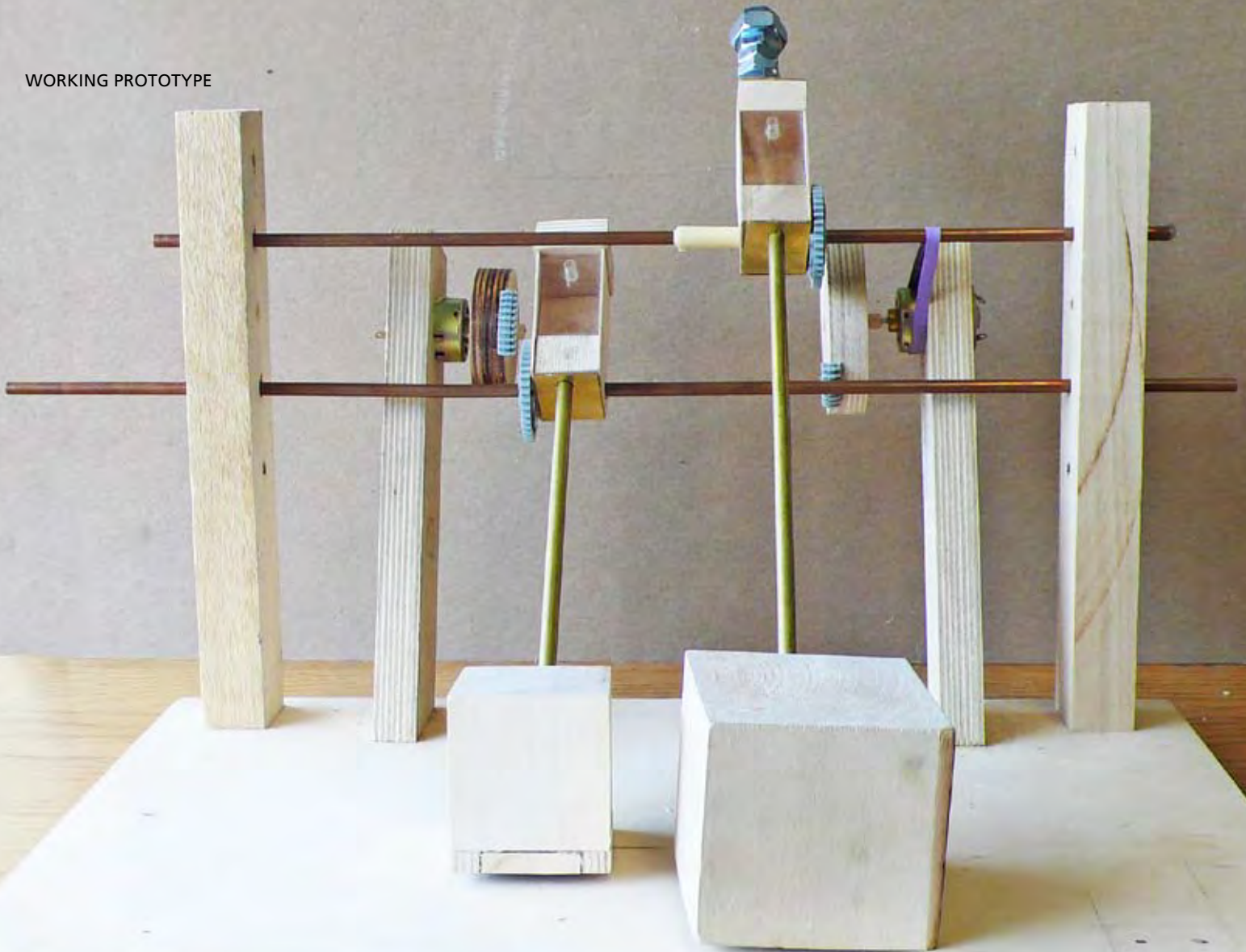


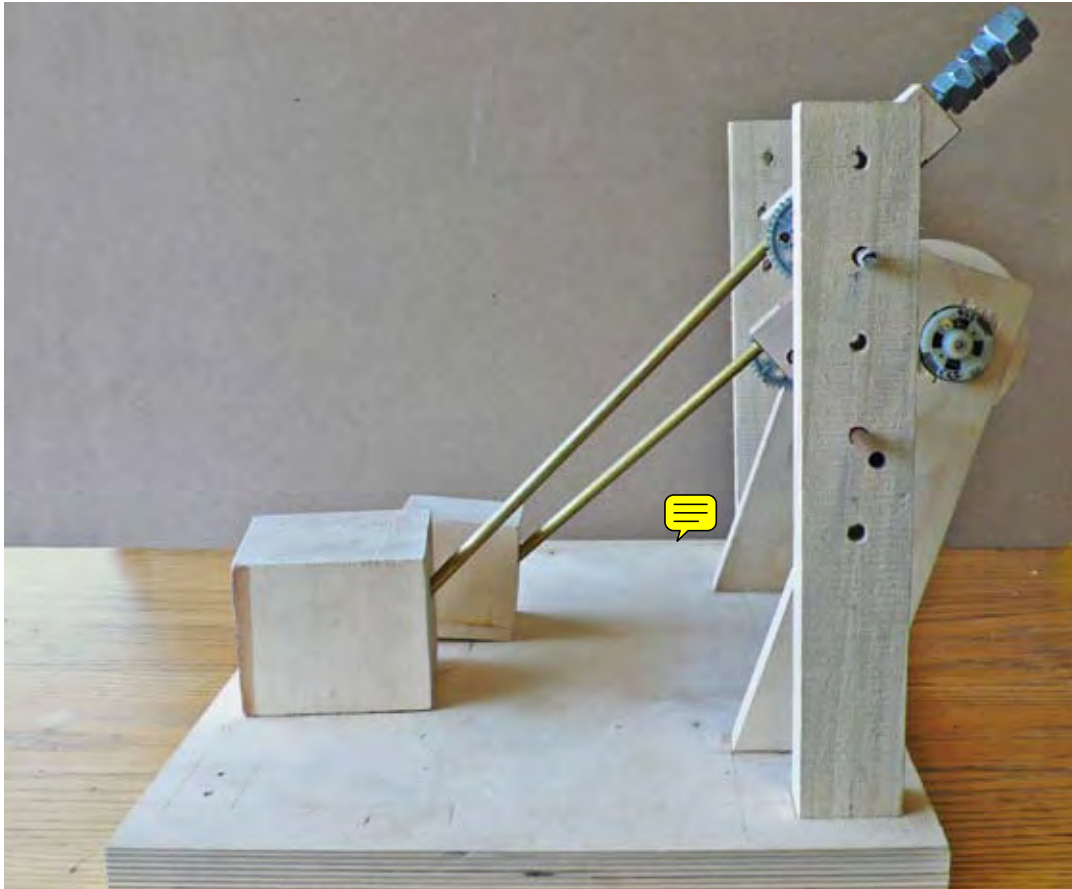
Arduino and Processing code



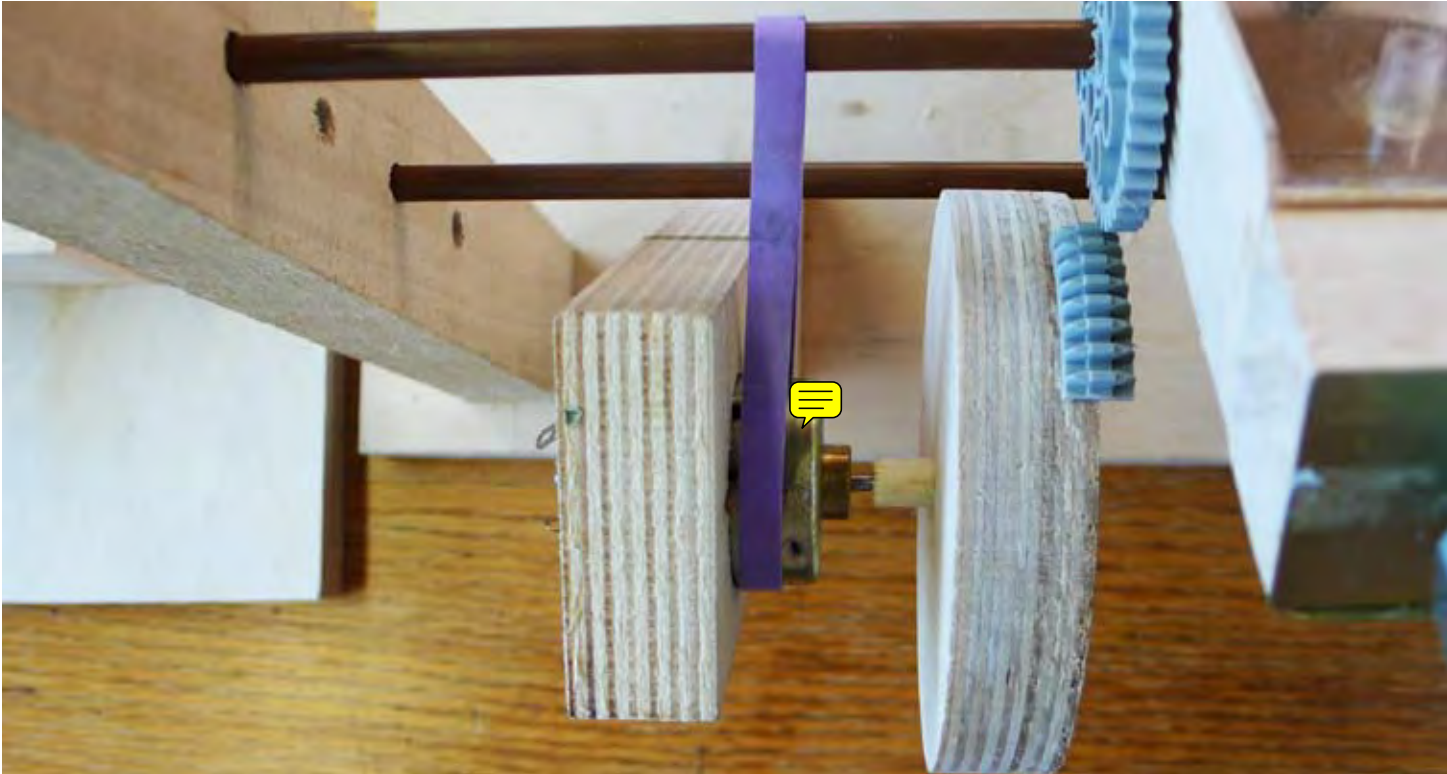
Motor connect with motor shield

WORKING PROTOTYPE

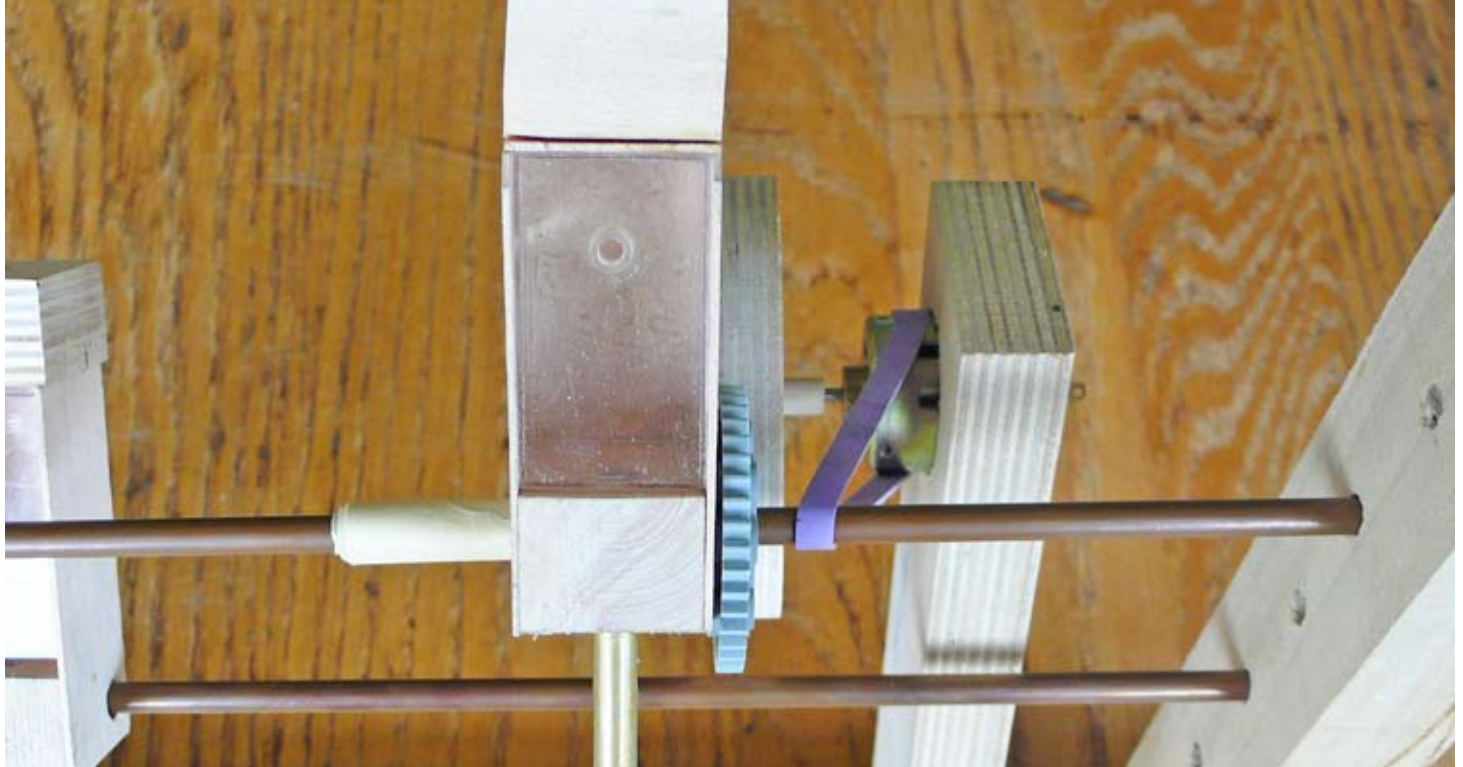




MOTORS AND GEARS' SETUP



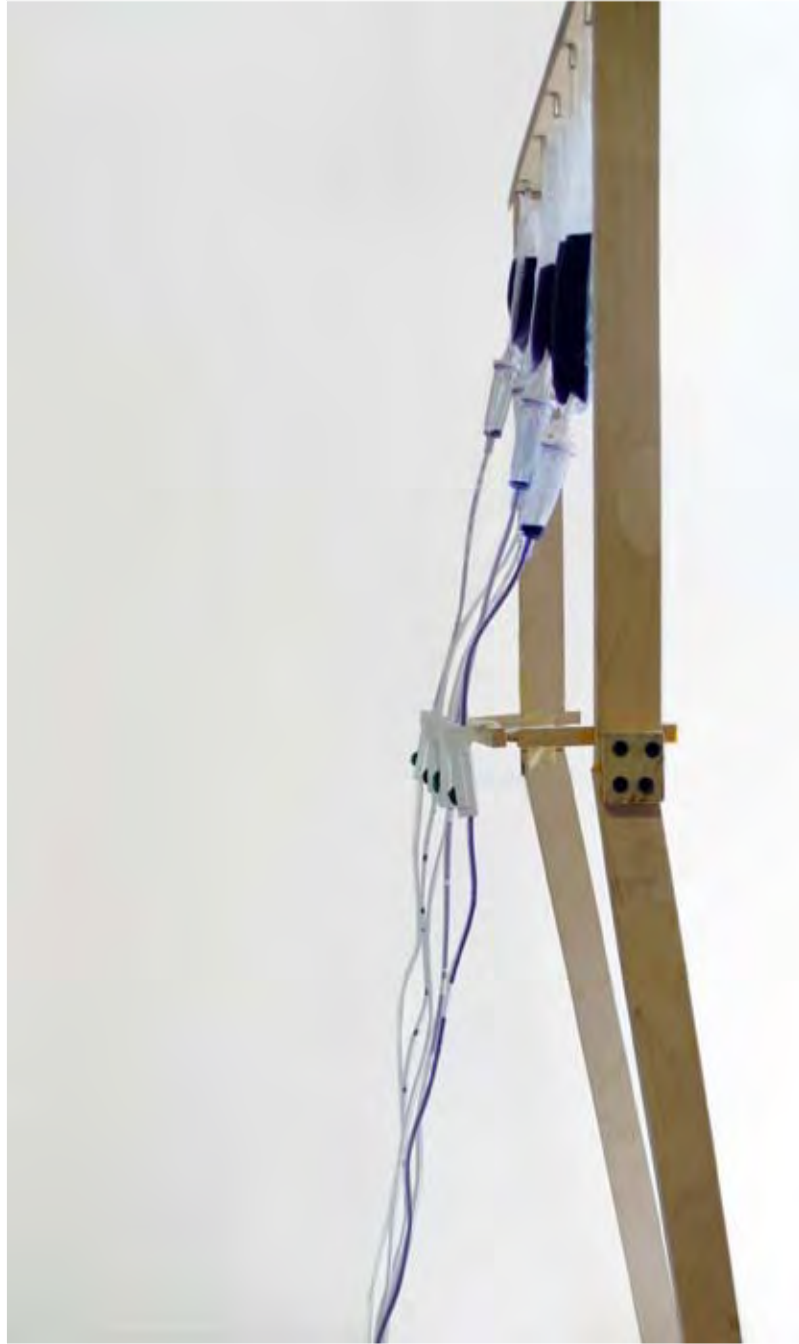
INK CONTAINER



ANGER MACHINE—VISUAL RESULT





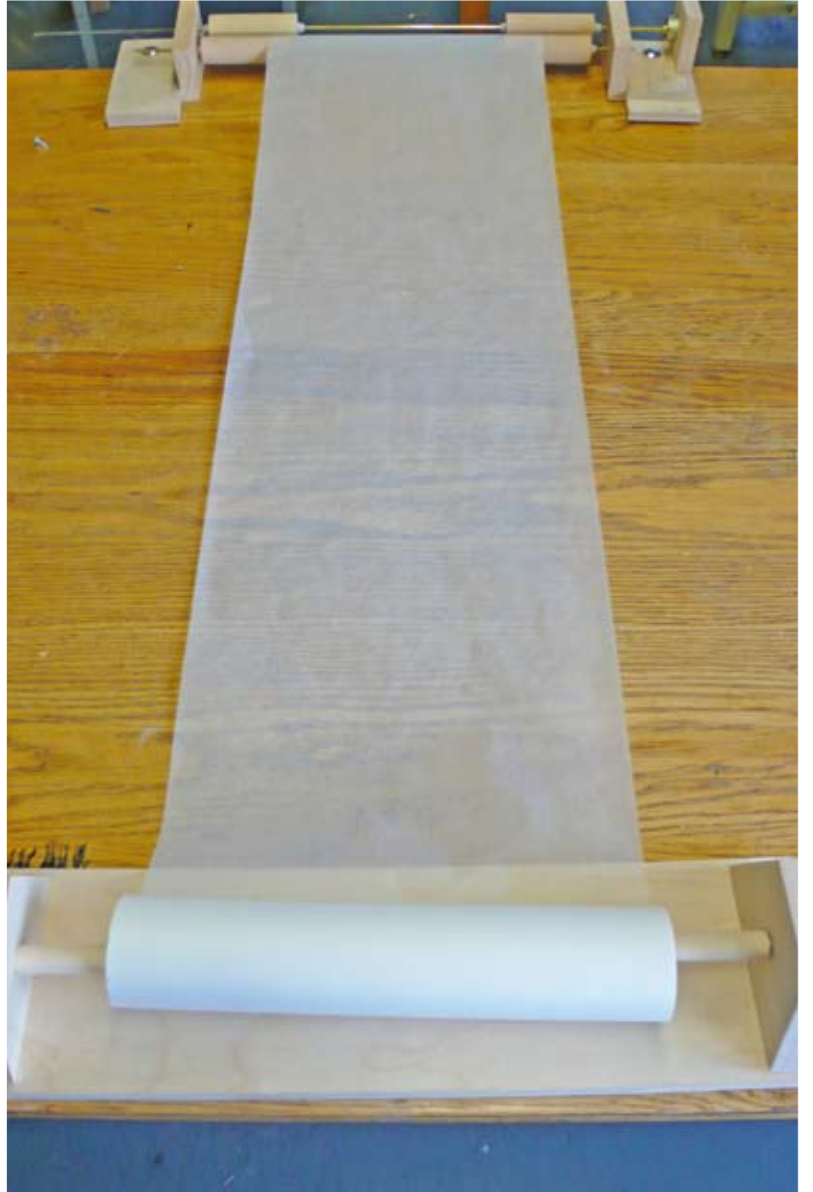




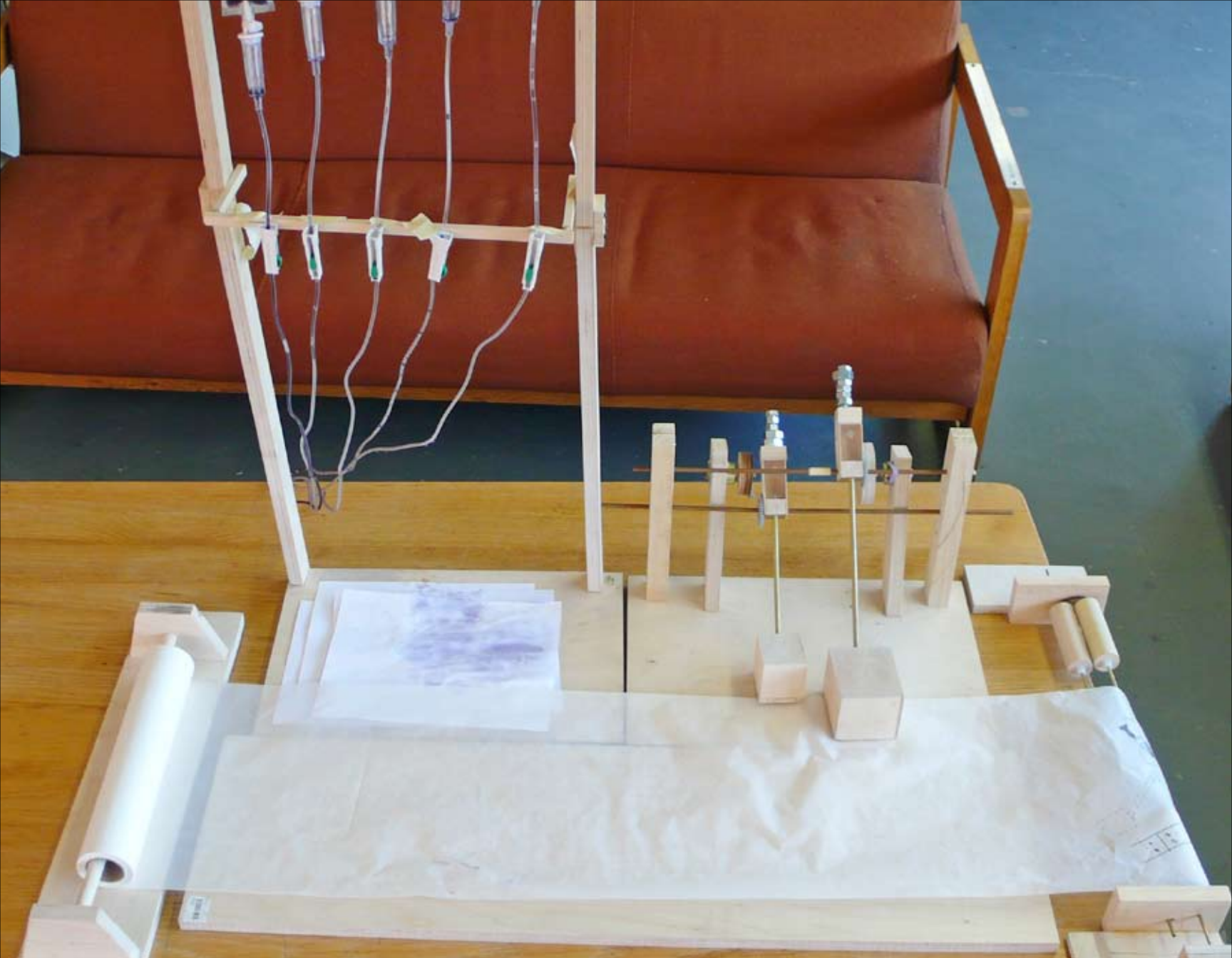
SADNESS MACHINE—VISUAL RESULT













IV. PROJECT CONCLUSIONS AND FINDINGS

In “Drawing by Emotion”, I have researched emotion recognition and especially focused on prosodic emotion recognition. I also have analyzed each step from formalizing of the concept through every step to the final interaction. Each design decision in “Drawing by Emotion” is aimed to ensure that the project works well to express emotional statements.

Emotion is a notoriously hard concept to define. Even more difficult is to design for emotion. But that is crucial for designer to sense the right signal of emotional expression. Among many cues that can be treated as emotion recognition, vocal cues present high level of recognition. I selected widely accepted the classification of emotions based on known research refer to paper “Emotional Space Improves Emotion Recognition”.

“Drawing by Emotion” is a three steps process of representing five basic emotional states: anger, happiness, sadness, boredom and neutrality. The first step is object metaphor—the right metaphor will reach a place of common knowledge that will help people “get” the emotion. The second step is the mechanics of the metaphor—the variables of motion, including the speed, the rhythm, the movement trends, the sound, etc—all these can imply that emotion. The third step is visual result—

from color, shape, pattern and self-record movement—all these aspects represent emotion as well.

“Drawing by Emotion” is an on-going project. As soon as the prototype is fully functional, I plan to do user testing, particularly the input of users emotional expression vis-a-vis an output in the form the machine’s “emotional” behavior.

PERSONAL INSIGHTS

AMBIENCE AS EVENT EVIDENCE

I live in shared town house; all my roommates are busy bees. I barely get a chance see them during the semester. But there is plenty of ambient evidence that suggests they are around. The sound of a slapping door at 7:15 am is Scott in a hurry to catch bus. The smell of bitter coffee is Alan boiling coffee. Phillip's coffee smells different from Alan's. A hot mist in the bathroom is Amy just finishing a shower. From the ambient information I get a sense of who is around and what they are doing, even though I may not actually see them.

AMBIENCE AS CONNECTION

In the fall of 2007, I arrived in Boston to begin school. I did not feel any connection with the city, until one night. I had just returned from China after the winter break in January of 2009. It was a freezing night; I could hardly hold onto my luggage. I walked from Central Square to my Cambridge town house. Darkness, the cold, piles of old snow and some the smell of burning wood floating in the air, all combined to stimulate my senses. Suddenly, all of that ambient information reminded me of my grandpa's home where it was also cold, snowy, and smelled of burning wood.

From my own experience, I realized how important the ambient information can be.

CASE STUDY

AMBIENT WIDGET

I. PROJECT DESCRIPTION

“Ambient Widget” is a software system which is mapping ambient information in online communication. It is a tool that could all online communication channels and a system that could share ambience information.

MOTIVATION

I am a person who lives on the Internet. When I first began to know the Internet, I considered it mostly a game and used it for online-chatting. From then on, on-line chatting was a serious part of my life. Then I left Beijing and came to Boston. It was the first time I left home, everything was so different, the environment, the culture, the people, the language and the academics. All of these things were the content of my communication with my parents and friends in China, Europe, Australia and Africa. At the same time, I experienced great feelings of “lost connection” with all the people I cared about the most. I really wanted to keep the thread of connection with them. These two reasons motive me to become a master of on-line chatting using five different instant messaging software programs. I became involved in many online communities and spent a long time “on line”.

The history of networked computing shows that, given a chance, people will adapt technology for social interaction. Recently, online service providers have discovered that chatting, email and other communicative activities are the key services that people want. Computer-mediated communication systems today bring huge advantages to people in terms of convenience, speed and efficiency. No matter where I am physically,

as long as I can get connected to the Internet, I can send messages to people all over the world. And thanks to video cameras, people can even see me; see how I am and what I am wearing, etc. Compared to the past when people communicated over great distant by writing letters, then waiting two weeks or more for a response, online instant messaging has made amazing progress in long distance communication.

Even though, there exists so many advantages in computer-mediated communication and despite the fact that it has proved to be extraordinarily popular, significant problems remain. Compared to face-to-face conversation, on-line chatting has its limits. It is difficult to convey many basic social cues, such as shared ambient environments, physical space, gestures, emotions and individual uniqueness.

The project “Ambient Widget” particularly deals with “the lack of shared ambient environment”. The central idea behind this project is adding ambient information to enhance the online communication environments. “Ambient Widget” is a software device that can transmit information often lost in the distant background, or in the distant periphery, of a person’s attention. A related question here is: If we know more ambience information during an online-communication, can we feel more connected with the other person?

When I decide to blend ambience information displays into the current online-chatting environment, certain factors needed to be taken into careful consideration: What kind of information is to be displayed? The question is related to the next one: What kind of ambience information will enhance this on-line communication?

During face-to-face conversation, two people share the same moment, location, amount of light, noise and so forth. People, through their awareness of those factors, will better understand each other. Considering this, while designing project “Ambient Widget”, I embedded six pieces of ambient information including: distance, geo-location, conversation history, proximity time zone, emotion and personal relationship, hoping to achieve this aim—enhanced online communication.

THE DESIGN PROCESS

In the final design, I used a dashboard as a platform to hold all the selective categories of ambient information. Inside the application, there are several functional items: message receiving friend list; geo-location; emotion state; history and “other”, six parts to be applied by users.

I used the bee cell as a metaphor for the basic design form. Since the beehive is a social center, it contains much bee communication activity and a social hierarchy. In this respect, it resembles human communication and society. According to Colin Ware “For purpose of data display, we can treat motion as an attribute of a visual object, much as we consider size, color and position to be object attributes”. I used motion as a main visualization method to map information. The speed of motion identifies the volume of content. The fastest speed means instant message; a middle speed means an online community message; a slow speed means email. The shape of motion identifies emotion (positive, neutral and negative). The size of the motion shape identifies the degree of emotion. The position of motion indicates the distance between the message receiver and sender. The color of the trace indicates the relationship between people.

Two aspects of the interface design need to be considered: one motion and immobility. Regarding motion, I considered: how the movement will be shown and how the motion will look. Then I borrowed the “bee dance” as a metaphor for the communication mode of the system. The shape and the speed of bee dance are dependent on the distance between the hive and the food and the sun’s position. At first, I directly applied the circle in

a zigzag or wobble pattern as a motion pattern to convey both “distance” and the “volume of content”.

But I found it was too complex for users to understand, especially in a short period of time. Although that result is not the one I expected, it raised another issue for me: what is the balance between “awareness” and “distraction”? How much information is appropriate for people to be aware of? Too much will distract users and too little will bore them?

In the “Ambient Widget”, the ambient information is mapped as motion, or as activities. However, motion is not the center of the communication, the content is the center. So, the mapping needs to be represented as periphery, until the user wants to know more of the peripheral information. Then, naturally the information will be transformed from the periphery to the center. Later, in the final design, I simplified the motion to “various lengths of line” and “different sizes of dots” as traces to imply “distance” and “volume of content”.

How can “Ambient Widget” be integrated within the computer window yet not to be “another burden” for a user? I designed the application panel to be transparent, so it is superimposed over all other applications. That resulted in my discovery that the periphery has its own hierarchy and it is a relative concept when compared with the center. Therefore, even with many levels of peripheral

information existing in the “foreground”—in the computer window—users will treat the content of conversation as the center of attention. The mapping of ambient information and other applications in the window remain in the “periphery”. The mapping through motion becomes the relative “center” more than any other available application.

MAPPING RULES

RELATIONSHIP

Family



Friend



Classmate



Co-worker



Acquaintance



PROMXIMITY TIME ZONE



DISTANCE



Far

Middle

Near

VOLUME OF CONTENT

Motion of moving

Fast Instant messgae


Middle Online community message

Slow Email


EMOTIONAL CONTENT


Type of emotion

Degree of emotion

Postive 

Neutral 

Negative 

Degree of emotion 







Receive message

Friend list

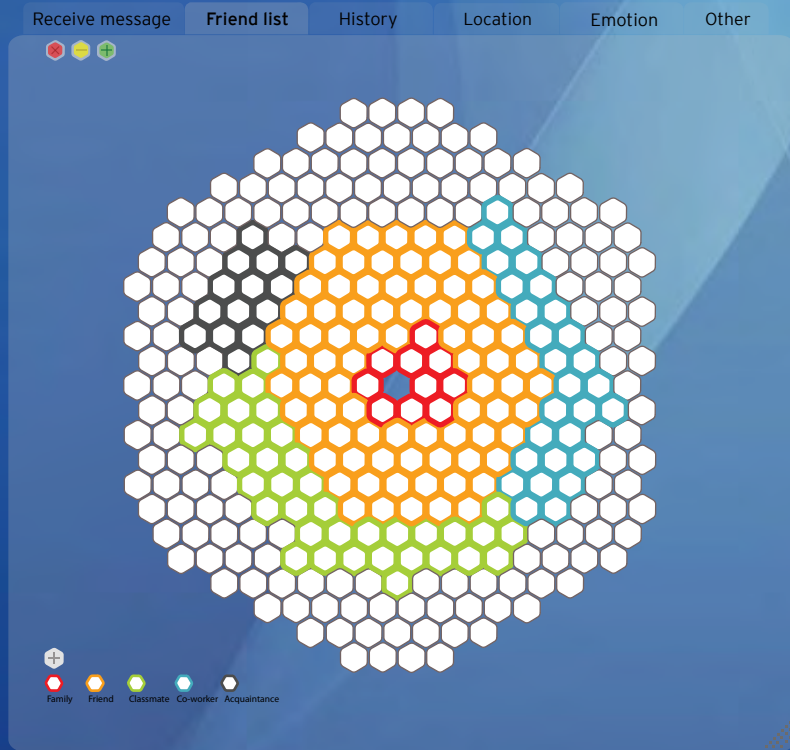
History

Location

Emotion

Other

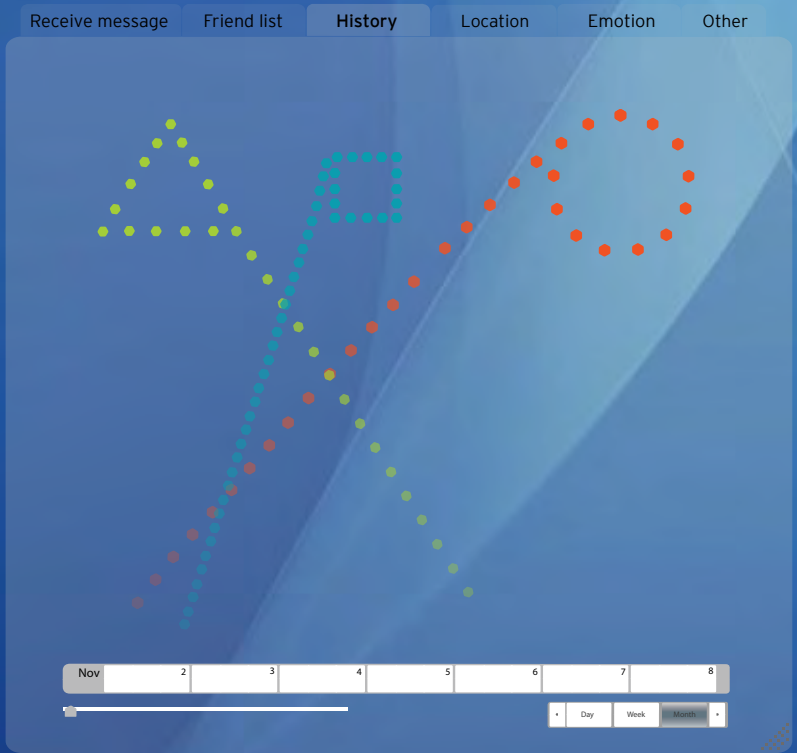




Receive message Friend list History Location Emotion Other



- Family
- Friend
- Classmate
- Co-worker
- Acquaintance
- Not-available



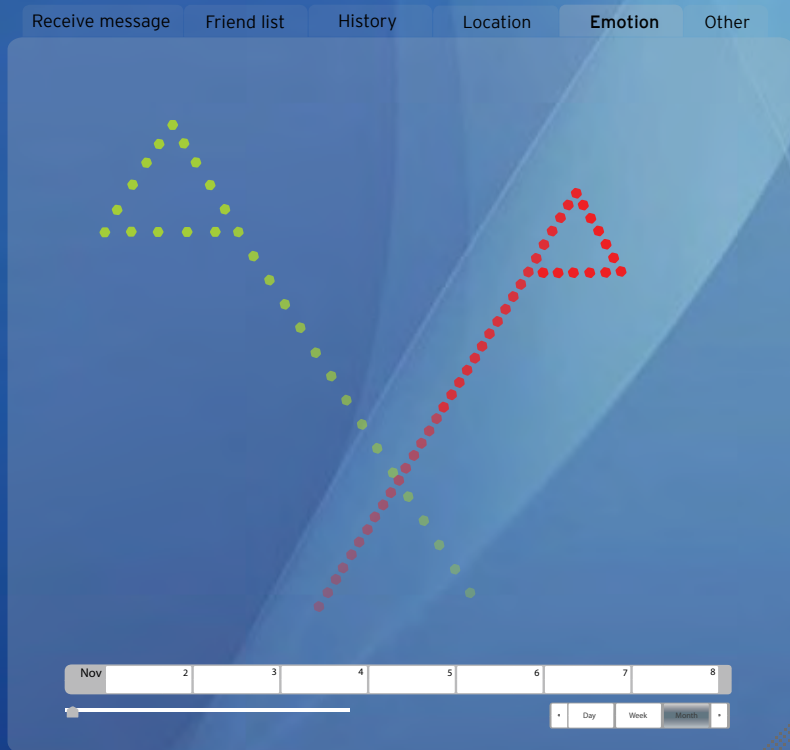
Receive message Friend list History **Location** Emotion Other



Nov 1 2 3 4 5 6 7



- Day Week Month -



Receive message

Friend list

History

Location

Emotion

Other



Message



Friend list



History










Location




Emotion



Receive message Friend list History Location Emotion **Other**

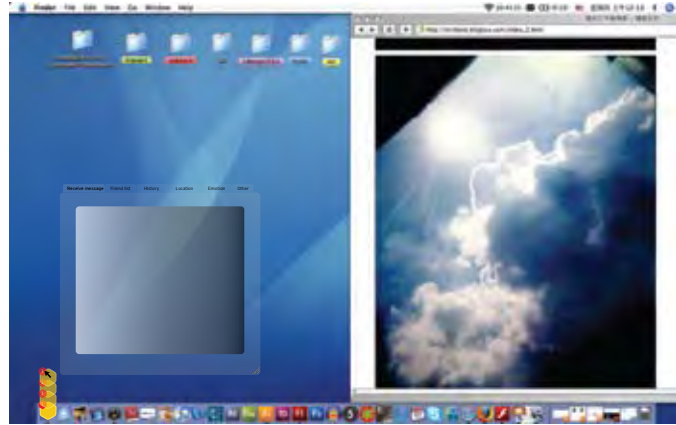
 Friend list	Family		
 Message	Friend		
 History	Classmate		
 Location	Co-worker		
 Emotion	Acquaintance		



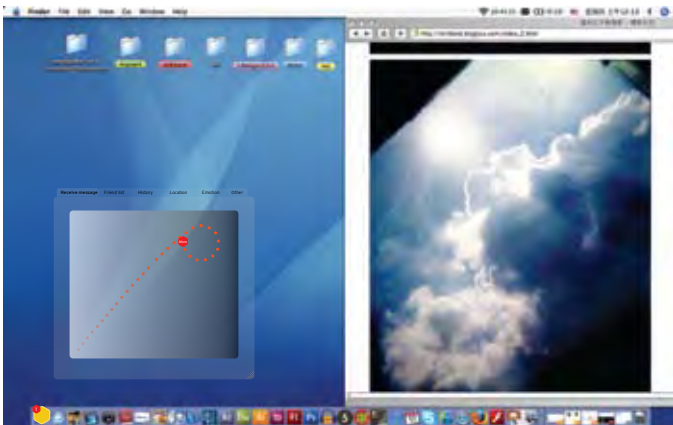
THE PROCESS OF RECEIVING MESSAGES



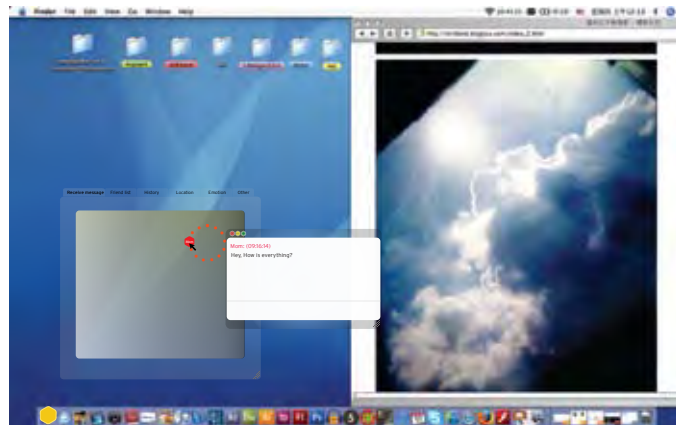
1 When one message coming: Dock icon jump with number icon.



2 User double click to get message



3 Icon move and left trace based on distant person's ambient information



4 Double click people's name to get message

III. PROJECT CONCLUSIONS AND FINDINGS

“Ambient Widget” as a software prototype combines current online chatting tools with ambient information and brings “shared awareness” into current online chatting to enhance computer-mediated communication. “Ambient Widget” differs from other ambient projects, which normally transfer one distant person’s ambience to another person’s ambience and still keeps it as background. “Ambient Widget” visualizes a distant person’s ambient information and converts background information to foreground accessibility. The point is, that ambient design is not moving information off the screen as a matter of extending the notion of what should be displayed. Ambient displays imply a different kind of use with a different kind of attention on the part of the user. According to Jennifer Mankoff: “An ambient display normally communicates on the periphery of human perception, requiring minimal attention and cognitive load.”

In “Ambient Widget”, I utilize mapping as a method of converting ambient information to simple motion activities. At the same time, the transparent application panel can be superimposed over the other applications. That leads the users to easily transfer their “periphery attention” back and forth to the center attention.



CONCLUSION

Interaction design, dynamic media design, is a process of creating ways to build a connection between humans and information. That is not limited by media—digital or analog. Design extend the meaning of the media. Any medium, a book, a wood object, can be treated as dynamic media design, as long as it explores existing possibilities involving human interaction.

As designers, we design for human beings, using human abilities. According to Kenya Hara: “a human being is a bundle of very delicate receptor organs and at the same time an image-generating organ equipped with a vigorous memory—playback system.” How people naturally get information is through multi-sensory perception and memory integration. A designer, planning the process of human interaction, should consider all of the external stimuli to human senses of sight, touch, hearing, smell, taste and the other sensory modalities of space and time. More importantly, as information goes through the five basic senses—as well modalities, it may invoke the internal sense—memories. The integration of all of these elements result in the “Gestalt moment.” All the parts form an aggregate of perception. The sensory integration picks up information, while memory refers to past experience, and together they greatly enhance comprehension and

communication.

Periphery, indicates both which part of human perception is caught and the mode in which the information exist. The task of the designer is to figure out how to design both for the periphery and for the center and how to transfer back and forth naturally from “foreground” to “background.”

Using dynamic media design, we can use multiple methods to establish the connection between humans and information, based on human multi-sense ability. In my thesis, I explored the visual display including: visual connection (mapping) and visual hints, audio display—sound. Those two parts are also the cues to moving between the periphery and the center.

Vision is one of the main sources for human information reception. Mapping establishes the direct visual connection between humans and information. And offers a chance to access a the “big picture” of information. The visual hints, such as the size and material, influence the location, the nature, the way and forces of human interactions, which indicate what is about to happen. Sound is an essential element for communication and interaction as the evidence of events currently happening. Sound, also conveys as much information as visual cues

do about affordances. Therefore sound is related to the internal structure of objects. (William W. Gaver).

The notion of affordances and the notion of ambient communication demonstrate both the relationship between the information or objects and the sensory perception of a person. In my thesis, I seek to explore how to build a connection for people to naturally and intuitively sense information through sensory integration and the periphery of human perception at the physical periphery (space, object). I have researched the historical, technologic and psychological aspects to support my design. I also discussed the motivation, implementation and applications behind my case studies and attempted to identify lessons I have learned through the process. Many more studies need to be done before a solid design theory emerges. Hopefully, my work will help guide others and myself in this pursuit.

During the past two years, I kept questioning myself why I was here and what I was learning. Until one day, I realized that I can use the way of dynamic media design thinking to design for the real life and create brand new experiences for myself and others. The wonderful things that happened during the past two years are not only the projects what I presented in this dissertation,

but the process of exploration as well. Indeed this new thinking process, new ways of exploration—focusing on multisensory human experience—made me realized that I have changed my understanding of design. Dynamic media design is a way of thinking that involves all human experience, you just need to have an eye to find it.

For me, this moment is not “an end.” It means “a start”.



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