

Memex and Beyond  
: A Design Trajectory from Vannevar Bush's Memex

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A thesis  
submitted in partial fulfillment of the  
requirements for the degree of

Master of Design

University of Washington  
2014

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Program Authorized to Offer Degree:  
School of Art,  
Interaction Design

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**Abstract**

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This project revisits memex, a hypothetical knowledge-storage device that Vannevar Bush proposed in 1945 and traces its trajectory in the perspective of interaction design. While the pursuit of memex from a technological perspective shows its benefits now, it is still questionable whether today's digital artifacts truly realize Bush's insights into the human thinking process of association.

As a response to Vannevar Bush's memex, this thesis suggests mmx, a conceptual system that supports cognition and interaction using a non-intrusive augmented vision. Visualizing cognitive activities as the linkages between knowledge nodes, mmx enables tracking, linking, rearranging, and sharing of information sources according to how humans think, amplifying personal and collective knowledge. A video prototype of mmx was created with this text as a final outcome.

The processes of multi-dimensional studies derived from Vannevar Bush's memex, a design research for understanding association, and the final execution to create the video prototype for mmx ultimately reflect the relationship of today's information technology and design, and their ideal development to support human intelligence.

# Memex and Beyond

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A Design Trajectory from Vannevar Bush's Memex

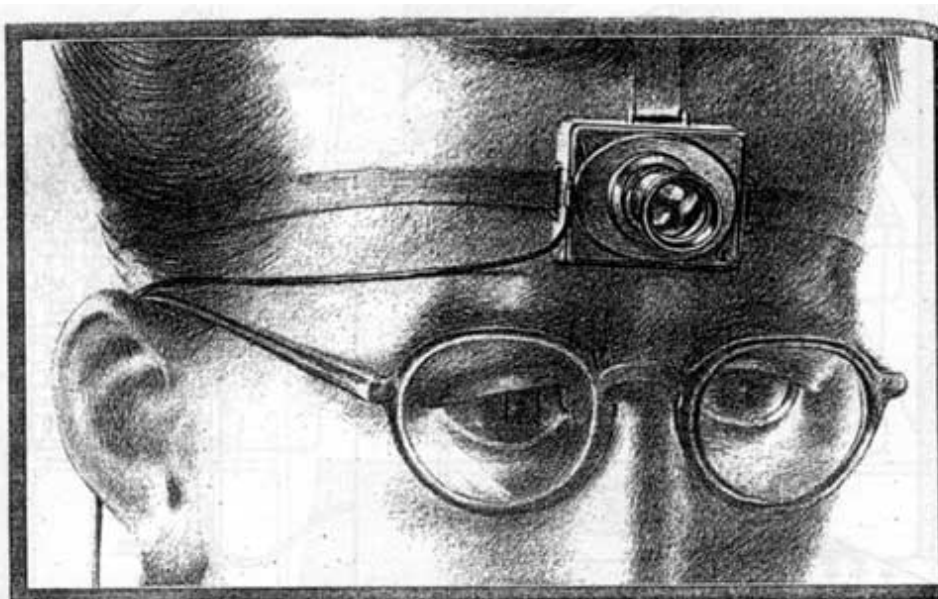
Haeree Park



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A SCIENTIST OF THE FUTURE RECORDS EXPERIMENTS WITH A TINY CAMERA FITTED WITH UNIVERSAL-FOCUS LENS. THE SMALL SQUARE IN THE EYEBROW AT THE LEFT SIGHTS THE GEAR

# AS WE MAY THINK

A TOP U. S. SCIENTIST FORESEES A POSSIBLE FUTURE WORLD  
IN WHICH MAN-MADE MACHINES WILL START TO THINK

by VANNEVAR BUSH

DIRECTOR OF THE OFFICE OF SCIENTIFIC RESEARCH AND DEVELOPMENT

Condensed from the *Atlantic Monthly*, July 1945

**T**his has not been a scientists' war; it has been a war in which all have had a part. The scientists, burying their old professional competition in the demand of a common cause, have shared greatly and learned much. It has been exhilarating to work in effective partnership. What are the scientists to do next?

For the biologists, and particularly for the medical scientists, there can be little indecision, for their war work has hardly required them to leave the old paths. Many indeed have been able to carry on their war research in their familiar peacetime laboratories. Their objectives remain much the same.

It is the physician who have been thrown most violently off stride, who have left academic pursuits for the making of strange destructive gadgets, who have had to devise new methods for their unanticipated assignments. They have done their part on the devices that made it possible to turn back the enemy. They have worked in combined effort with the physicians of our allies. They have felt within themselves the stir of achievement. They have been part of a great team. Now one asks where they will find objectives worthy of their best.

• • •

There is a growing mountain of research. But there is increased evidence that we are being bogged down today as specialization extends. The investigator is staggered by the findings and conclusions of thousands of other workers—conclusions which he cannot find time to grasp, much less to remember, as they appear. Yet specialization becomes increasingly necessary for prog-

ress, and the effort to bridge between disciplines is correspondingly superficial.

Professionally our methods of transmitting and reviewing the results of research are generations old and by now are totally inadequate for their purpose. If the aggregate time spent in writing scholarly works and in reading them could be evaluated, the ratio between these amounts of time may well be startling. Those who conscientiously attempt to keep abreast of current thought, even in restricted fields, by close and continuous reading may well shy away from an examination calculated to show how much of the previous month's efforts could be produced on call.

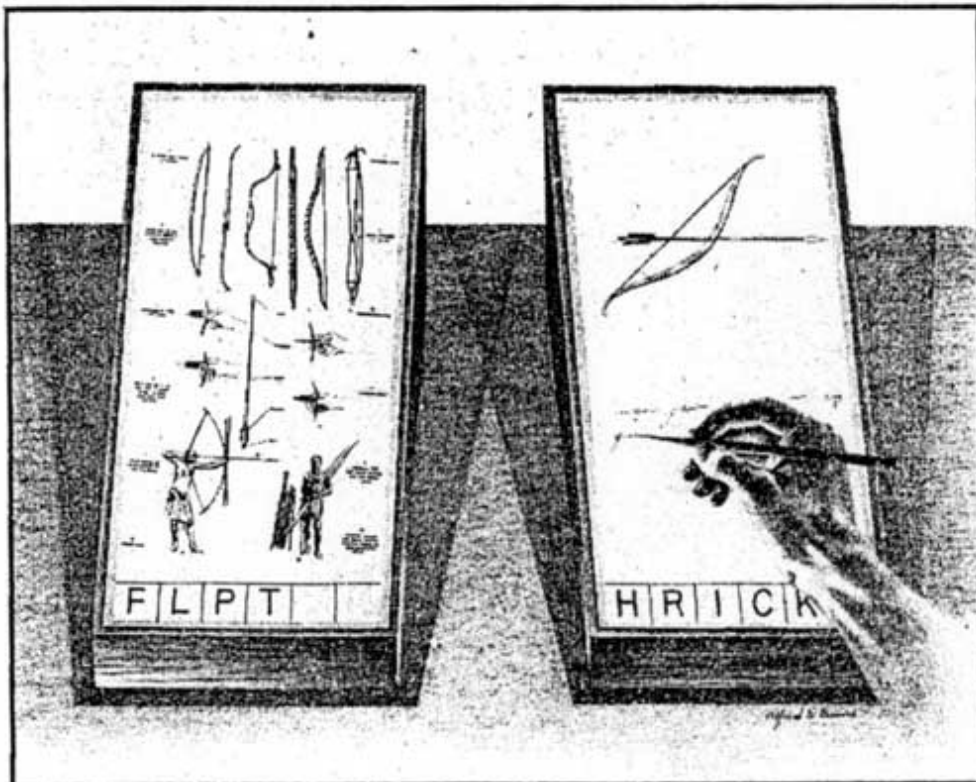
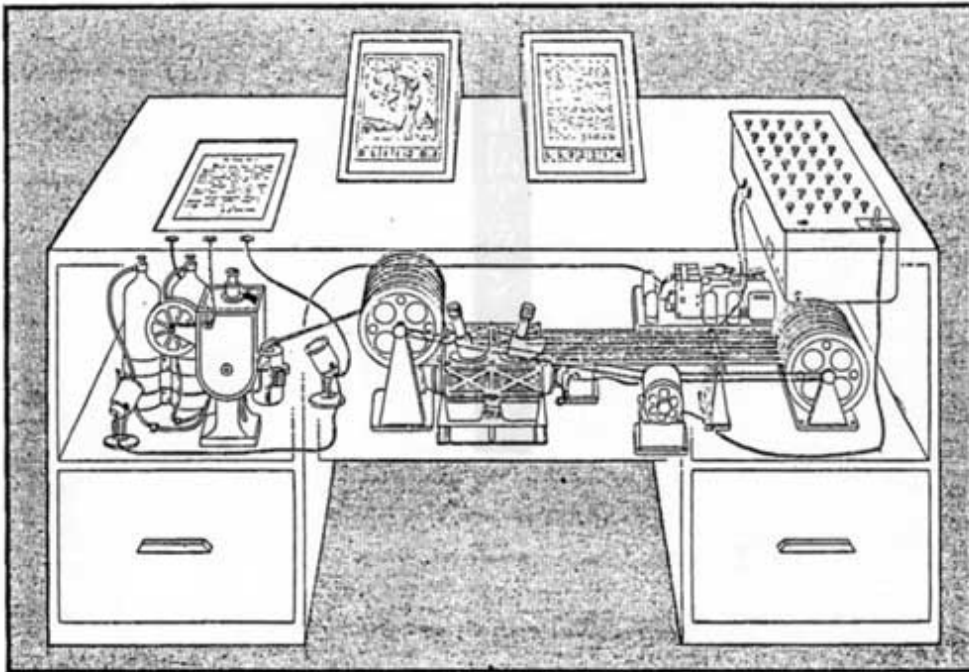
Mendel's concept of the laws of genetics was lost to the world for a generation because his publication did not reach the few who were capable of grasping and extending it. This sort of catastrophe is undoubtedly repeated all about us as truly significant attainments become lost in the shuffle of the inconsequential.

Publication has been extended far beyond our present ability to make use of the record. The summation of human experience is being expanded at a prodigious rate, and the means we use for threading through the colossal mass to the momentarily important item is the same as was used the days of square-rigged ships.

But there are signs of a change as new and powerful instrumentalities come into use. Photocells capable of seeing things in a physical sense, advanced photography which can record what is seen or even what is felt, thermionic tubes capable of controlling potent forces under the guidance

Figure 0.0.

"As we may think" and memex illustrations in *LIFE* magazine (Bush, 1945)



# MEMEX 2014 - DESIRABLE TECHNOLOGY OF THE PAST, PRESENT AND FUTURE

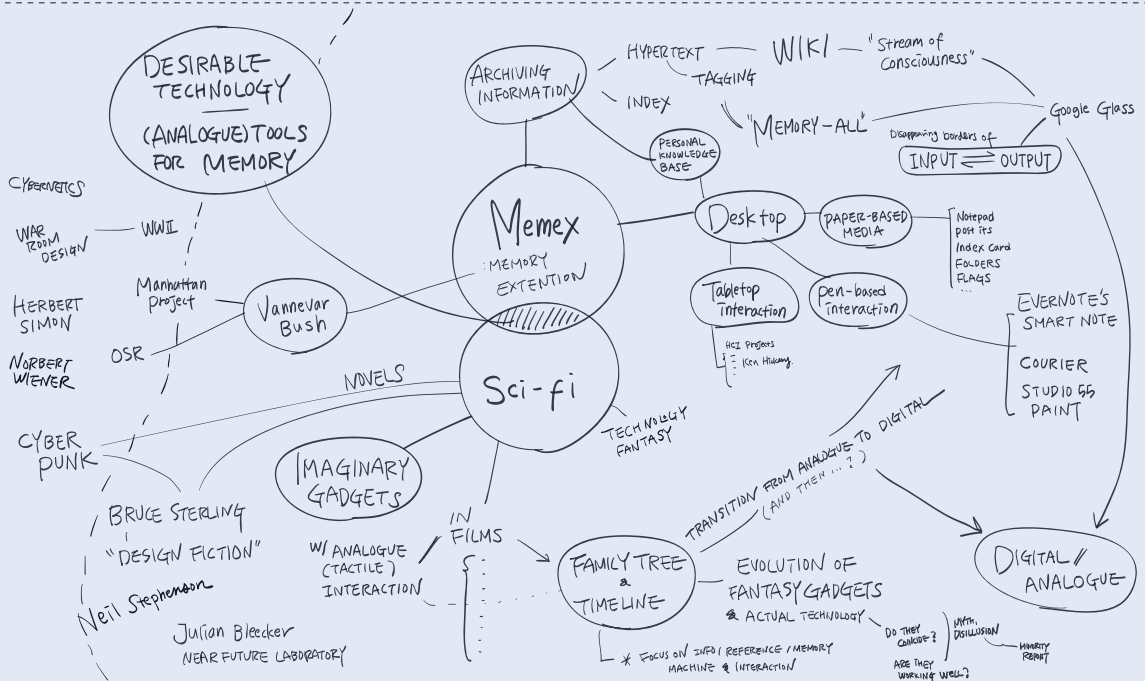


Figure. 1.a.

An early brainstorming for fixing the thesis subject.  
(Spring 2013)

# 01. Introduction

This project is about a future vision contained in an imaginary device, memex, and how design technology can support the original thinking processes of humans. Memex first interested me as an influential idea incorporated in an old-fashioned mechanism; later, I came to recognize that its vision could also be a blueprint for the direction of current and future digital technology. This motivation allowed me to explore the relationship between the technology and the visions of the future.

Digital technologies have influenced our everyday lives, and even how we think, by changing their forms more intimate. The surfaces and frames for containing digital artifacts are disappearing, and so are the physical gaps between digital artifacts and the human body. With the development of recent technologies such as biometric sensors, the “terminator vision” will probably be enabled soon. However, even though these potential technologies are fascinating, our lives will not become sci-fi movies. I believe that a new role of interaction designer is emerging: designing our experiences of new digital technologies with thoughtful consideration of our everyday lives.

Countless subtopics can evolve from memex. Truly, Vannevar Bush’s original article engages today’s readers and encourages them to study media,

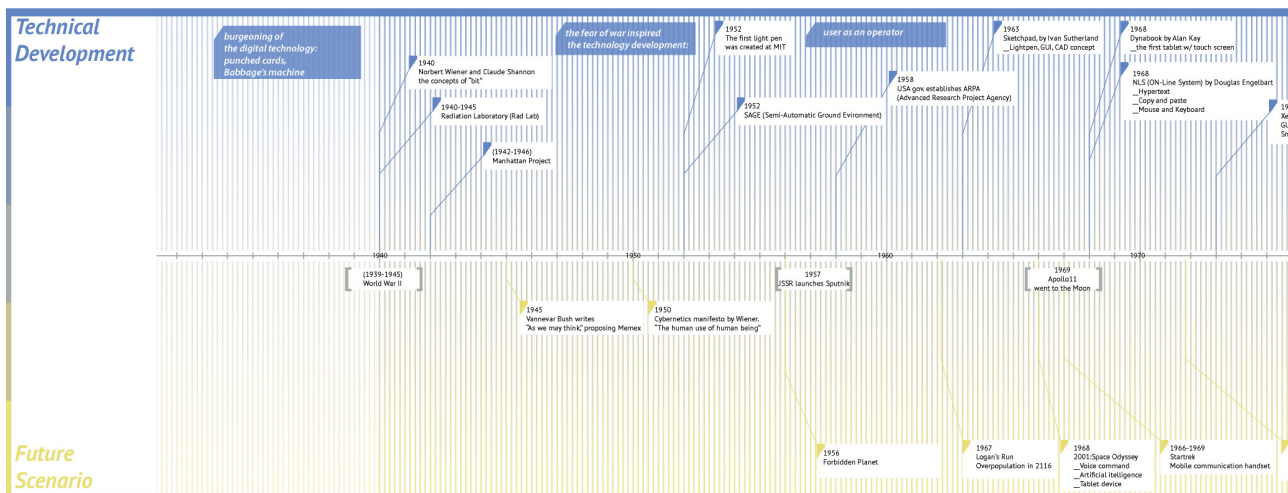


Figure. 1.b.

Early exploring in memex and the computer pioneers encouraged me to create a timeline of technical development and future scenario. It aimed to trace the inter-influencing between technological developments and imaginative vision. (Spring, 2013)

human–computer interaction (HCI), cognitive science, visual perception theory, artificial intelligence, cybernetics, and the culture of the Western world following two World Wars (Figure 1.a.). I was very excited by these opportunities but certainly not able to address all of them. This project ultimately aims to propose a designed artifact, *mmx*—a system that achieves memex vision, and its first task was to explore what form this potential system could take. This text will take on the role of documenting the journey and communicate its legitimacy and feasibility. Therefore, I want to note that this document is not meant to be a deep discussion in each subtopic that can be derived from memex.

As an overview of this thesis document in that sense, first I introduce memex and Vannevar Bush, and the vision he sought to accomplish through memex. With this background on the significance of memex, I question whether today's digital tools support our cognitive activities in ideal ways that resemble our thinking process of association.

In the next part, the process and findings of my design research on present-day intellectual research are discussed. I report how observation research focusing on engineering researchers' activities plays a role in the thesis project, and how it influenced my design decisions.

After that, I introduce the process of designing the *mmx* system, the factors that influenced my design decisions, and the technological and contextual foundation behind them. Then I introduce basic *mmx* interaction employing the gaze-interaction technique, and what design criteria shaped the visual elements of the interface. I also explain the process of video prototyping production from the scenario creation to video shooting practice.







*“Consider a future device for individual use, which is a sort of mechanized private file and library ... 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.”*

Vannevar Bush, “As we may think” *The Atlantic* (1945)

## 02. Background

### **2.1. The beginning**

I began my research by attempting to understand exactly what Bush was trying to demonstrate when he presented his memex device in 1945. I then studied his initial article, “As We May Think,” as well as the subsequent interpretations by Bush’s followers. However, before examining these works, it will be useful to discuss just who Vannevar Bush was.

#### **2.1.1. Vannevar Bush, a pioneer**

Born in 1890, Vannevar Bush lived to become an influential scientist, electrical engineer and administrator of World War II-era America. He inherited the American engineer’s optimism with regard to the burgeoning scientific research of the twentieth century, and later established the groundwork for the advent of the digital computer and the information revolution. As a result of his significant contributions during the war, he is best known as a director of the Office of Scientific Research and Development (OSRD) (Renear, Mylonas & Dam, 1996).



Figure 2.1.1.

Vannevar Bush (1890-1974)

Based on his expertise in engineering and his experiences studying developing technology's effects on modern warfare, Bush realized that the rebuilding of post-war America required a technological base. After his wartime administrative role, he presented his technological vision in several significant public essays. The most stimulating element of this vision was the creation of a hypothetical personal knowledge base device called the memex, which he presented in [The Atlantic Monthly](#) article “As We May Think” in July of 1945.

### 2.1.2. Memex: the memory index that works “as we may think”

In “As We May Think,” Bush first recalls World War II and the various possibilities for new technologies that he witnessed during the war. He recognized the explosion of scientific information, and how a device or system that contained this information would contribute to the building of a robust post-war society. Thus, Bush then calls for such a system that would allow professional workers—scientists, lawyers, physicians, businessmen and historians are those he explicitly mentions—to manage large amounts of [data](#) from different sources. Bush then introduces the memex, his ambitious conceptual device for this sort of information management. Because he possessed a radical imagination for his time, this design was on the boundaries of available technology. According to Bush, the memex—short for “memory index”—is a desk with display screens, keyboards, memex’s mechanical selector (Zachary, 1999).

The inspiring achievement of the memex is not, however, the analogue technology utilized, but rather the vision for its eventual function. In his article, Bush describes how the memex will store and retrieve data in a manner suited to the patterns of human thinking. In so doing, Bush argues that the memex has the potential to enhance human cognition and understanding.

### 2.1.3. Information and knowledge—association

Then how does the human mind work? Bush responds to this question by suggesting that the mind links information by [association](#):

*“... The human mind does not work that way. [It operates by association.](#) With one item in its grasp, it snaps instantly to the next that is suggested by the association of thoughts, in accordance with some intricate web of trails carried by the cells of the brain. It has other characteristics, of course; trails that are not frequently followed are prone to fade, items are not fully permanent, memory is transitory. Yet the speed of action, the intricacy of trails, the detail of mental pictures, is awe-inspiring beyond all else in nature.”* (Bush, 1945)

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Later that same year LIFE magazine published an illustrated and version of “As we may think.” (Figure o.o)

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Bush writes, “all his books, records, and communications.”

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The term ‘association’ refers a connection formed by relating two or more conceptual entities or mental states in psychology. As regards memory, it describes a mental activity of recalling information that one previously learned or experienced based on their similarities.



As Bush states, we link and rearrange information sources according to our experiences and interpret this information according to our knowledge (Harper, 2010). Amazingly, his comparison between the human mind and a library is similar to how computers are conceptualized today (Figure 2.1.3.). For instance, if someone enters the novel title *Slaughterhouse Five* on an Internet search engine, the results will present information items about *Slaughterhouse Five* in a list form: a Wikipedia article, an Amazon link for the book, some quotes from the book, etc. We can skim through text of the book, and even copy and paste a passage into a personal note. However, all these inputs from the computer are separated and discontinuous. The computer merely presents the information items; the choosing and comprehension of these items happens in our own minds.

On the contrary, if we hear the title *Slaughterhouse Five* in a conversation, we may first recall the story of the novel, the book cover we saw on Amazon, or a particular cigarette in the novel, which then causes us to think of our friend who smokes the same cigarettes. Or, alternatively, we might recall the movie based on the novel and then remember scenes from this movie, which then lead to other associated ideas and experiences. This series of associations consists of our knowledge about *Slaughterhouse Five*. We retrieve our knowledge about *Slaughterhouse Five* in the form of linkages of associated information, which Bush terms “trails.”

Bush also describes how the memex can support our understanding of information and even expand our knowledge by recording and retrieving these trails:

*“The owner of the memex, let us say, is interested in the origin and properties of the bow and arrow ... He has dozens of possibly pertinent books and articles in his memex. First he runs through an encyclopedia, finds an interesting but sketchy article ... Next, in the history, he finds another pertinent item, and ties the two together ... he branches off on a side trail ... Thus he builds a trail of his interest through the maze of materials available to him.*

...

*Several years later, his talk with a friend turns to ... In fact he has a trail on it. A touch brings up the code book. Tapping a few keys projects the head of the trail ... So he sets a reproducer in action, photographs the whole trail out, and passes it to his friend for insertion in his own memex, there to be linked into the more general trail.” (Bush, 1945)*

Indeed, in his article Bush attempts to convince readers that his new device could radically change the nature of intellectual work. This vision has, in fact, significantly influenced today’s information technology.

### 2.1.4. Technology development and future scenarios

The technological explosions of early computer pioneers intrigue today's public. The memex directly influenced many of the digital technologies developed in the 1950s and 1960s. Hypertext, computer-supported cooperative work and input devices were all pioneered during this period (Renear, Mylonas & Dam, 1996). The next generation of researchers continued such developments and eventually fostered today's fruitful digital artifacts. Indeed, as is evident from recent history, new technologies continue to inspire other visionary plans, and similarly, the envisioning of a future can stimulate the development of another tool to realize that vision (Figure 1.b.). This co-evolution of technology and futuristic vision has re-situated the user from the one who controls to the one who interacts. However, this raises a question: do today's digital devices work better than the memex? Do they work "as we may think?"

### 2.2. A call for a new memex

*"Software tools abound for managing documents and other information sources, but are rarely used for managing the personal, subjective knowledge an individual gleans from them." (Davies, Morales & King, 2005)*

Today, nearly seventy years since the envisioning of the memex, most individuals own multiple digital devices that operate almost identically to each other and are able to access vast amounts of information. These digital aids merely support the display or curation of information, as exemplified by my example of the discontinuous flow of browsing information regarding *Slaughterhouse Five*.

We live now in an age of information abundance. Out of this vast amount of information, we must still recall memories from contextual cues and consolidate them in order to make semantic associations that are personally significant. Today's occupations increasingly require the utilization of information and the production of creative solutions, but the information overload and all the diverse digital tools have made it difficult to locate and utilize this information. Moreover, these tools have caused us to rely on them in order to locate information (Thompson, 2013), rather than relying on more traditional modes of thinking, namely, association. Association and knowledge are not a concern of computer processing, and the instant access of information does not make us smart or creative.

Thus, a new memex that fully realizes Bush's original intention—to make a device that works like we think—may be especially significant today, when all our various tools are scattered in virtual and analogue space. It is now critical

for interaction designers, whose role is the shaping of the future, to place “technological ideas in relation to the development of society and culture, and more general philosophical considerations.” (Stolterman & Löwgren, 2007)





## 03. Design Research

### 3.0. The role of design research

In order to design a digital system that works like the human mind, it is essential to understand how the human mind works. However, it is difficult, and rather unnecessary, for a design thesis to examine human perception and cognition according to the scientific method. Although designers must possess an understanding of their design area, they need not be more than competently knowledgeable. According to Bruce Archer (1981), the goal of design research is “the knowledge of, or in, the embodiment of configuration, composition, structure, purpose, value, and meaning in man-made things and systems.” For a designer, research thus presents a kind of “foraging” for the knowledge—the qualitative or quantitative data—needed to define the problem situation and address it throughout his or her design process.

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In the same article, Archer also mentions that the activity of design research is closer to that of the lexicographer than to that of the mathematician.

### 3.1. Defining the research objective

While the relevance of a new memex design extends to general intellectual activities, I limited the target of this particular study to engineering researchers and their paper writing activities because it is nearly impossible to generalize or attain critical findings from a selection of random intellectual

He's making and evaluating a device that can test blood without optical lens, aiming giving a clear image to recognize a disease in it. He's evaluating the device and tuning it by comparing simulation result and experiment result in different design.



In the meeting with his advisor in her office he reports the test results and shares his opinion about it.

He tells that his plan is to change the voltage on the CMOS chip. She reminds him that the device should let them find a certain pattern in the image.

He takes a note but cannot get everything she says. He sketches and make note as she describes about the image that they need to get from experiments.



He goes back in the lab and keeps making notes of test results on his lab note, quickly puts down the condition given. He pin ups his sketch from the meeting. He tries doing it a couple of time, by adjusting the parameter. He takes notes about what to try for the simulation with the lab computer after experiments



He keeps experiments results on his computer too. He finds the memo on his lab note and types it into the chart. He has to see the monitor and the note back and forth, having a vague picture of the numbers he has to input.



After checking and doing routine works, he starts making the presentation slides. He pulls up his previous slide thinking that he can use it as a template. He copies a couple of pages from that slides and retypes on them, puts updates graphs and pictures. He finds some papers and brings them on his extra monitor to use in his slides. To apply some updates, he also sees his lab note, recent experiment data and memos, let them beside his laptop.

- Dialogue + Careful listening
- Recalling recent event and data
- Note taking
- Remembering the goal – an image of blood cell

"What should I do after this meeting?"

- Checking and recording data
- Remembering the goal of the task
- Reminding the image of blood cell

"What is / How much clear the image I have to get?"  
"What do I need to change to get a better result?"

- Copying information from one to a different media

"How was the experiment?"  
"What can I try changing the conditions to get a better result?"  
"How and why is it different from the simulation?"

- Finding relevant information
- Reviewing and reading related papers
- Changing features of the slide document
- Putting together data from different sources

"What was the paper about it I saw last time?"  
"Where are the figures located I used for my paper?"  
"What do I have to put and skip from my paper (to make slides)?"

- Notebook (planner, journal)

- Layout of the advisor's desk and room

- Optical device for experiments,
- Lab computer: - Simulation program
- Designed chip,
- Lab note
- Sticky note

- Sound, touch and visual of lab equipment

- Lab note
- Personal computer
- Lab computer: Simulation program

- Sound, touch and visual of lab equipment

- Personal computer
- Presentation SW, document viewer etc.
- Extra monitor
- Lab note
- Papers (electrical, printed)

f

How can we communicate better in a situation requiring knowledge exchange?

How can we keep a clear image of the goal in mind?

How can we transform information from an non-digital media to digital media?

How do we synthesize different information on different media?

How can we record and remember information from a conversation?

Figure 3.3.a.

The annotated storyboard of a researcher's day

activities, and I needed to define the intellectual activity in a more tangible and accessible manner. The activities of engineering researchers require the synthesizing of information and paper writing is a particular visible manifestation of this activity as it includes the externalization of their research. Thus, I defined my design research question as follows: How do engineering researchers recall and utilize relevant information from their knowledge and experience in their research process?

### 3.2. Purpose and method of research

With the research questions, I outlined the research purpose to maintain the focus on my thesis as below:

1. To attain a vision of work process in thinking-oriented jobs.
2. To identify problems in the storing and retrieving of information.
3. To outline how and when interaction design can intervene to support better research processes.

I determined that it would be useful to visit a researcher's workplace and observe the researcher working so as to attain nonverbal information that the researcher perhaps does not recognize or cannot articulate. As a result, in the

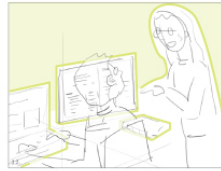


While doing that, he receives a text from his friend. He stops working and replies her to have lunch together. He leaves his stuff as they are and leaves the lab.

Everything he's been working on fades out behind his phone display he's gazing.



While they are talking, his friend asks about his research. He shows her some pictures of blood cell he's got from experiments, explains what is missing in there and what's he's trying now. She tells it's interesting and it can be used for people in where health care condition is poor like Africa, where she went to an internship in summer. They talk further about her internship.



After coming back to his office, he starts working on the slides. His advisor approaches. She suggests a couple of voltage option they can try for the experiment. He stops slide-making and goes to the lab to check the result from the previous test and applies what she said.



In the lab, he checks the test results. He checks the blood sample image under the microscope, briefly notes and sketches how it looks like.

- Processing visual and verbal input

"How much time do I have?"  
"Do I need to finish this before leaving?"

- Smartphone: text message  
- Dialogue in text

/

How do we deal with interruptions while processing information?

What happens when we switch state of mind from working to idle?

- Recalling the project and explaining about it  
- Finding relevant information from another topic

"How can I utilize this information for my research?"  
"How can I apply this new input to my research?"

/

- The ambience of the cafeteria: sound, people, smell, etc.

How do we know whether the information is useful or not from a dialogue? How do we remember it?

How do we continue the work after interruption?

- Continuing a work in progress  
- Processing verbal input  
- Thinking and remembering the verbal input  
- Switching tasks – from testing with equipment to slide making

"What was I doing before leaving here?"

- Verbal input  
- Lab note,  
- Personal computer:

- The status of this desk, the way how his stuff arranged on the desk  
- Sound (music, ambience)

How do we deal with interruptions while processing information?

How do we remember an unexpected input?

- Seeing and evaluating images under the microscope  
- Copying the image under the microscope to the notebook

"Does this look like what I'm looking for?"  
"What should I change the condition for the next test?"

- Microscope  
- Lab note

- Sound, touch and visual of lab equipment

How do we evaluate, compare and store a new finding?

field observation and **semi-structured interview** format, I interviewed and observed eight University of Washington engineering Ph.D. students whose current research phases require frequent information storage, retrieval, and utilization. The interviews were conducted casually, in that I observed the researchers during their normal routine and only posed questions occasionally when I identified a point of research interest, such as the current tools they used for memory, their skills in organizing resources and optimizing their research routine, and the shift in how they used their workspaces. In order to analyze the observation, with the participants' consent I recorded a video of the observations and interview.

### 3.3. Research findings

After coding and analyzing the research, I was able to draw up design challenges for the design of the new memex:

- How might we simplify the process of extracting action items and copying them to another medium?
- Can we capture what is happening on the screen naturally, like we would with a digital camera?

Semi-structured interview is an inquiry method that consists of a pre-designed set of questions and open two-way communication during interview. Compared to a structured interview in which all questions are designed ahead of time, it allows interviewer to explore new ideas and themes that are brought up during the interview. (Wood, 1997)

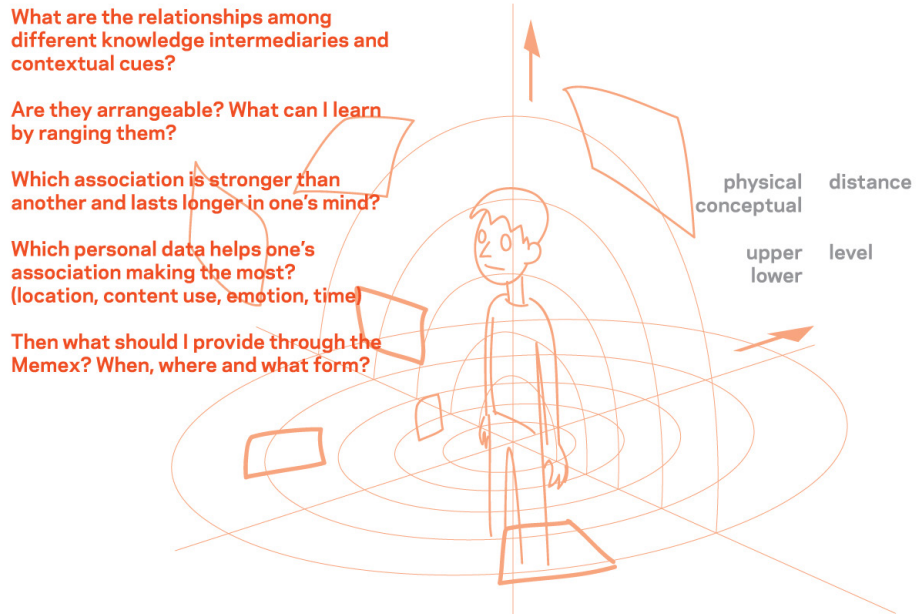


Figure 3.3.a.

A conceptual model of a researcher and his information sources in the field, and derived design challenges.

- How can the desktop provide better visual aid and interactivity for the organization of items?
- What else can help researchers keep in mind a clear image of the goal?
- What can a memo board do to support one's memory?
- How can we help researchers use multiple devices simultaneously?

Based on this research, I also extracted a model scenario and a storyboard (Figure. 3.3.a.) that I could reference throughout the research process. This scenario and storyboard represent the information sources in the workspace, the various interactions with these information sources, and the patterns of the researcher's attention during tasks, and in so doing, crucially provides a spatial conceptualization and represents the transitions of human perception according to different information media. In addition to this scenario, I also created a conceptual model (Figure. 3.3.b.) that indicates the user (researcher) and information sources in the field where his or her perception stretches. All these findings later became significant seeds for the design of my memex.





## 5. AUTOMATIC LINKING

AFTER HE MADE AN INITIATING NODE, AND MOVE ON TO HIS LAPTOP, THE NODE ON HIS SCREEN CHANGES TO ♦ (• → ♦) WHICH MEANS "RELATED" "ASSOCIATED" KNOWLEDGE NODE.

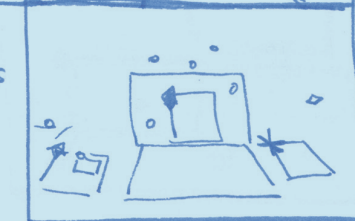
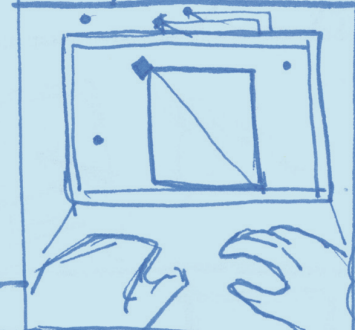
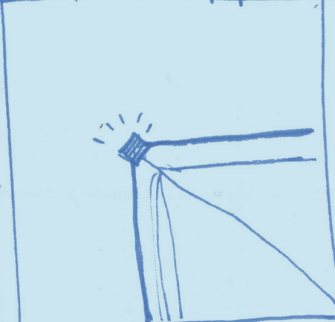
(MMX RECOGNIZED THE SEQUENCE BTW THE NOTE & LAPTOP.)

ON HIS COMPUTER, HE'S READING AN AIRPLANE ACCIDENT. HE FINDS A GRAPH AND DRAWS A BRACKET W/ THE CURSOR.

THE BRACKET DISAPPEARS AND MAKES A ♦ NODE

<sup>SOME</sup> AFTER MAKING NODES IN THIS WAY,

WHEN HE LOOKS AT HIS DESK, HE SEES THE NODES ON EACH ITEM



←  
PANNING

## GENERAL INTERACTION

WHAT HAPPENS WHEN IT IS RECOGNIZED AS A KNOWLEDGE NODE?

→ PUT A NODE (• OR ♦ OR \*)  
→ TRACE AND DRAW BORDER OF THE MEDIA

→ ADD A DIAGONAL LINE TO SHOW IT AS A SIMPLIFIED SURFACE.



HOW TO CANCEL THE FINGERTIP TRACKING:



SHAKE THE HAND LIKE DUSTING

HOW DOES IT LOOK LIKE WHEN HE SEES HIS PC?

→ HE CAN SEE THE LAYERS OF WINDOWS OF HIS PC USES. (HISTORY) EVEN OUT OF HIS PHYSICAL PC SCREEN. (CF. APPLE'S TIMEMACHINE)



— BUT AS LONG AS THEY ARE LINKED OR RELATED W/ CURRENT TASK

## 04. Design Process

### 4.0. Design process overview

After completing the base design research, I began to design the new memex system for [knowledge workers](#). Like other interaction design processes, this was not a linear or clearly segmented design process. Multiple sketches, video sketches, conceptual model creation and reflections accompanied the final execution as an iteration cycle. This chapter will describe why and how I selected the form for *mmx*—a system for the future wearable device—as well as the actual prototyping process of the final interaction system.

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Peter Drucker coined the term “knowledge worker” around 1950s. He argued that knowledge workers use their knowledge for a living and their skills cannot be easily replicated or automated. A software engineers, a doctor, a chemist, and a lawyer are examples of knowledge workers.

### 4.1. Defining the form for *mmx* (Phase 1.)

#### 4.1.1. Early concept of *mmx*

Though I derived my initial inspiration from Vannevar Bush’s memex, my own interpretation of the memex has developed throughout the project process. At the project’s beginning, I pursued a product design that used natural materials. When I had first read about the memex, I was fascinated by its mechanical structure and its limited 1940s technology. Bush’s description of an “almighty desk” that contained myriads of microfilm and functioned

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Throughout the time, I wrote memex as “*mmx*” on my personal notes or writings for my convenience. During a meeting with my advisor Dr. Axel Roesler, we found that the abbreviation had typographic attraction and represents futuristic theme, so we named the final design artifact *mmx*.



“A new memex will work as a physically existing hub where you work on and make your memories significant by re-associating them.”

—At my “Brown bag presentation” in autumn quarter 2013 where MDes candidates presented their initial theses plans.

like an old-fashioned robot reminded me of steampunk aesthetics and retro sci-fi movies. The captivating theme of digital vs. analogue materials seemed plausible for this thesis, and I planned to advocate for the superiority of paper-based media and the need for a desk as a hub for all paper and digital knowledge media. The suggested potential prototype of my first thesis proposal illustrates the initial concept of the new memex I wanted to design:

- It will help users to restore their ideas, scrap information and make information accessible when it is needed.
- It will provide natural interaction with paper-based media and desktop.
- It will enhance the individual user’s productivity and creativity, and is not aimed at collaboration.
- It will exploit digital technologies like wireless communication, optical devices, cloud computing, touch screens, etc., but will not exhibit them too obviously.
- It will not be a laptop or a surface computer, but rather an individual system that interacts with users’ computers and digital devices.
- It will not have to take the form of a physical desk. It can be any analogue form, including that of a wooden plane, a rolled sheet, or a bookshelf.

There were two mistakes in this early conceptualization. Firstly, a furniture-like product, e.g. a desk, is not the correct form for Bush’s idea. In his article, Bush forecasts a future according to his insights into the engineering paradigm. When revisiting his memex, one should not simply repeat or praise his original idea, but rather design the future, as he did. Even if the form he imagined in his own time remains aesthetically interesting, there is no point in reviving it, as it is not defensible with respect to today’s interaction designs. Secondly, though the “digital vs. analogue” theme is attractive, it is difficult to prove that one is superior to the other, as such an argument would involve personal and emotional factors.

Multiple reviews of Bush’s original text and the following process caused me to change my perspective and choose a head-mounted display (HMD) as the interaction design medium.



Figure 4.1.2.a

Motion tracking activation  
on Adobe After Effects

#### 4.1.2. The change of perspective on knowledge base

The design research conducted in the previous phase helped me to understand the dynamics between researchers, their information sources, and their workspaces. My main point of interest was their working spaces, which were limited to a certain range of space around the researcher's desk. During this process, I also, however, identified a critical finding that altered my knowledge base and my perspective on the memex.

While shooting the videos for the observation record, I followed the researchers around their workspace and focused the camera on the objects of their attention. When I analyzed these videos afterward, I realized that such a perspective made me think and act in the researchers' shoes. Moreover, replaying the videos suggested to me the concept of tracing one's information sources in a spatial field.

This finding was extraordinarily stimulating. I wondered to myself, what if we could "see" our workspace with a sort of index or visual aid that indicated



Figure 4.2.1.b.

Time-lapses video sketch

Motion tracking is a computer vision technique that locates and tracks a moving object over consecutive video frames. It has been used in a wide variety of domains including human-computer interaction, surveillance, video compression, video editing, and medical imaging.

Time lapse is a cinematography technique where the frequency of frames captured is much lower than that used to play the film. Because its frame in time-lapse captures much longer time intervals it allows viewer to capture events in larger patterns and longer time scale.

These experiments were also part of an independent study that fellow MDes students Jonathan Cook (1xD) and Bradley Trinnaman (VCD) and I organized. Each of our theses required these small exercises and we critiqued each other's work throughout the quarter (Winter 2013/2014).

what we are currently focusing on. In order to test this idea, I created exercise sketches of some personal workspaces and illustrated how one's information sources are laid out on the space. These exercises included me recording still images and videos of my own workspaces, attempting some [motion tracking](#) in Adobe After Effect (Figure 4.1.2.a.), and creating a [time-lapse](#) video (Figure 4.1.2.b.) on my desk and workspace.

Adobe After Effects revealed the possibility of an interface that would help researchers track and recognize the priority of knowledge mediums, without any intermediary layer or frame. When we record a video, we put the camera lens to our eye's view. As I learned from the video recording of researcher activity, the camera movement represents the transition of attention. Moreover, the possibility of annotating the view in real time offered by video editing tools revealed the potential of design mediation within the user's first-person view.

### 4.1.3. *mmx*, wearable device and augmented reality

Realization of the design potential of the first-person view interface led me to select for the *mmx* the medium of a wearable device, namely, an optical head-mounted display (OHMD.) The recent development of Google Glass and Oculus offered serendipitous interaction with the user's attention. Indeed, this meant that a computer can be embodied to human and help us perceive as the way we think.



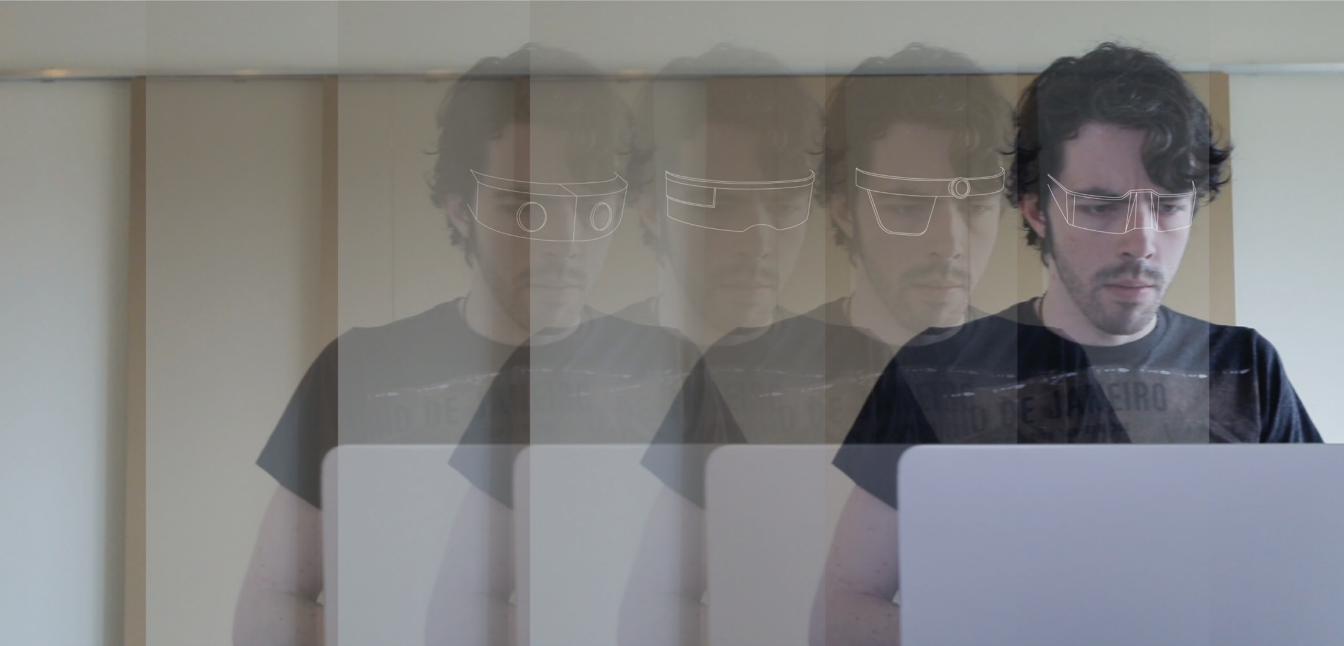


Figure 4.1.3.

Possible forms of *mmx* OHMD. Video stills from the final video prototype.

It is important to note, however, that I do not specify the form of the wearable device for *mmx* in this document or any other design outcome. This is because *mmx* is not a system designed for one specific wearable device; there is room for exploration with regard to its form. Wearable digital devices will expand their domain in the near future, just as the smartphone has done recently, and so arguments as to the product's appearance are of no interest to this thesis. Instead, as an interaction designer, I thought it would be worthwhile to demonstrate how our lives might be altered by *mmx*, and how to use those technologies that are soon to be prevalent. Consequently, my next task was to decide how the interface would function for the OHMD.

## 4.2. Designing interaction (Phase 2.)

### 4.2.1. Gaze interaction as control

Current OHMD technology operates either by touch or voice gesture, or simply as an output display and not as a controller. Hand gesture and voice are not an ideal input interaction for supporting the thinking process. Talking aloud or pointing at something is another externalization of thinking, and its manipulability is **limited** to controlling features.

By contrast, gaze interaction that uses eye tracking is promising, as it is a rapid, natural and intuitive method of control. Facial and eye movements provide natural indicators of how the user processes and experiences information (Figure 4.2.1.). Our eyes naturally focus on the object we are thinking about or manipulating, and changes in pupil size or ocular muscle coordi-

These limitations owe to the fact that OHMD devices are currently only in their early stages of development.



Figure 4.2.1.

Eye movement and facial expressions such as gazing, squinting, and scanning mirror how we perceive what we see.

nate with our perceptions. Human-Computer Interaction (HCI) studies have established the taxonomy of eye movement and techniques for coding it. The mechanism of gaze interaction is optimal for the *mmx* system because it operates naturally by human cognition, and the hardware medium, OHMD, is ideal for detecting eye movement. By employing gaze interaction technique, the *mmx* system can detect and track the user's viewing of information sources and, moreover, prioritize these sources by analyzing eye movements and gaze patterns. Non-intrusive visual elements like nodes and planes are displayed to allow the user to trace his real-time interaction with the information sources.

#### 4.2.2. Visual elements for the *mmx* interface

After I defined the medium of interaction and the system's interaction technique, my design process was fairly smooth. I believed that my memex would visualize and trace user's information sources in real time like motion trackers (Figure 4.2.2.). My next question was what the visual elements of this wearable system should look like. By identifying some basic requirements like, for example, simplicity, I would be able to draw up a list of qualifications for visual elements for the *mmx* from the examples of widespread information organization. Based on these considerations, I created the following design criteria for the interface's basic visual elements:

1. Visual elements should be simple and easily recognizable by both humans and computers.
2. Visual elements should utilize the “[branching out](#)” metaphor.
3. Visual elements should be non-intrusive and use minimal colors.
4. Visual elements should be able to generate as a network.

The notion of the “branching out” metaphor—the linking of ideas and the radial arrangement of ideas around a more central idea—is supported by the mind map, a widely applied method for brainstorming. (Buzan, 1996)

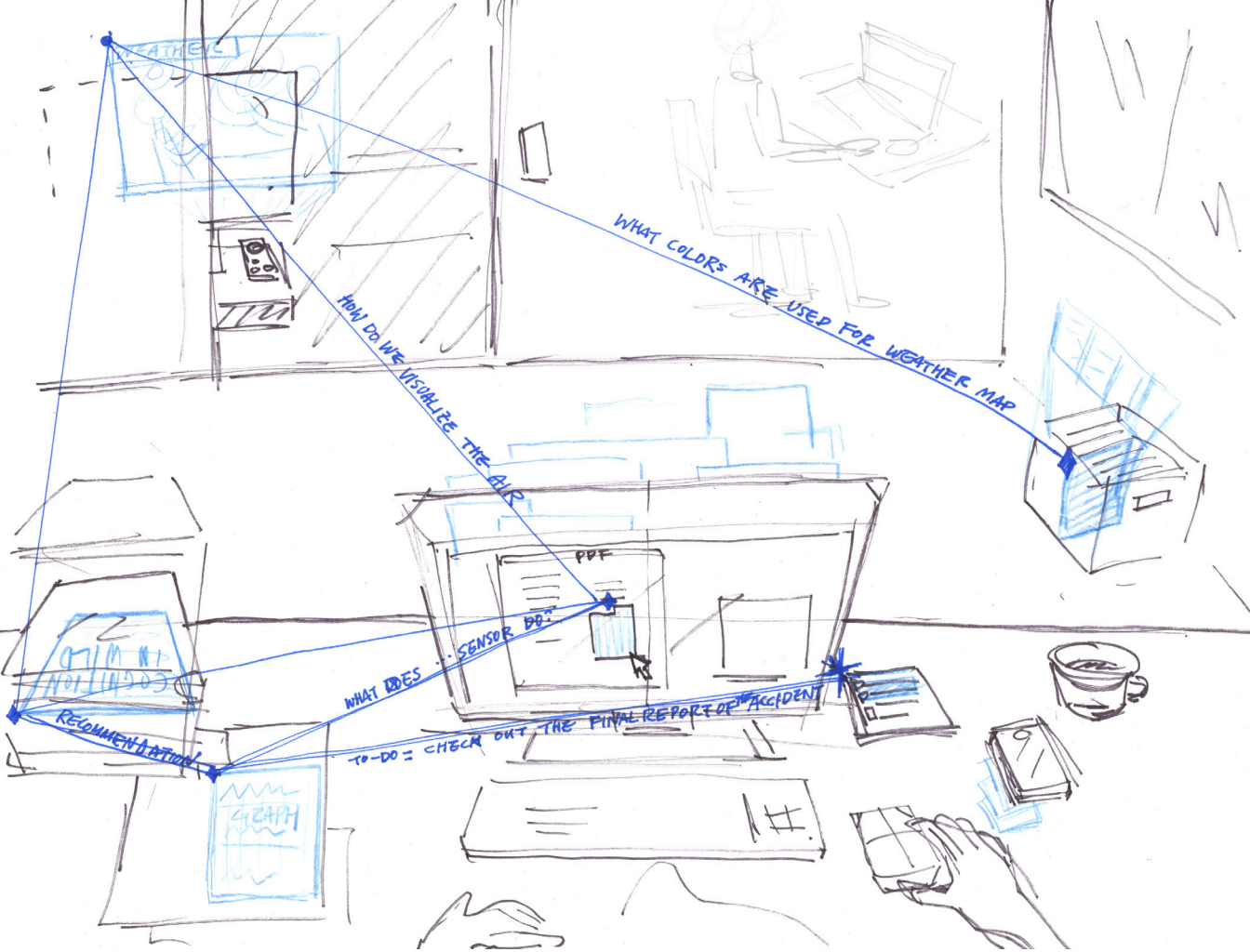


Figure 4.2.2.

A sketch of how to put non-intrusive visual elements as a person's first-person view.

The detailed role and function of the visual interface will be discussed in Chapter 5, “*mmx* - memex and beyond.”

### 4.3. Video production (Phase 3.)

#### 4.3.0. Overview—video prototyping in interaction design

Today’s favored medium for demonstrating interaction design is **video prototyping**. Because its nature is to deal closely with time, video is a suitable form with which to illustrate transitions, space and narrative in the domain of interaction design. Moreover, as the concept and technique of *mmx* is founded upon the video technique and image processing, the visualization of interaction coincides with video production, especially in the editing process.

The significance and various techniques of video prototyping in interaction design are well-covered in MDes alumnus Dan Ostrowski’s (2012, IxD) thesis, “Prototyping Interactions.”

### Camera View

- C** Front (dolly)
- Side
- Behind Jesse (dolly)
- D** Overhead (dolly, timelapse)
- B** Close-up (head)
- Extreme close-up (eyes)
- Noticing
- E** First-person \_ desk front
- First-person \_ note on desk
- First-person \_ laptop
- First-person \_ ceiling
- First-person \_ front - over the air
- First-person \_ seeing over (TV)

Kinect view

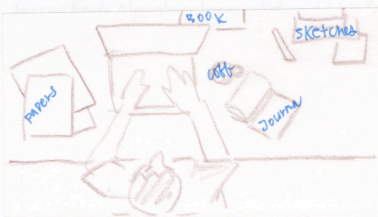
Another user's desk

### Location -

a designer's room with a big desk and a TV  
someone else's work place (studio)

### Actor

- a designer-look person (male)
- Glasses (only few scenes in the intro)
- Short sleeve T shirt
- Designer-like look



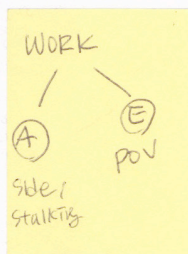
### Check list: equipments.

- ✓ Dolly
- ✓ Stabilizer
- ✓ POV - backpack, pillow, belt, weigh
- ✓ Lights
- ✓ Tripod
- ✓ Memory
- ✓ Lenses - default, wide, pancake(?)
- ✓ Big white board
- ✓ Time lapse remote
- ✓ Laptop
- ✓ knowledge media - note, files on laptop,
- ✓ some books - cog in wild, 787 book
- ✓ memo on desk & wall
- ✓ desk
- ✓ chair
- ✓ chair without back (for first person video)
- ✓ TV
- ✓ masking tapes
- ✓ post its
- ✓ a circle tape on index finger for tracking?

→ Laptop COVER

### laptop preset

- ✓ white jpg - for annotation
- ✓ Adobe s/w
- ✓ Chrome
- ✓ PDFs



DOLLY / NO DOLLY  
WIDE / 13S  
A 1 S (AFTIMING)  
3,5 16 1/3sec  
30FPS 60FPS  
Rubber band panning

Figure 4.3.1.a.

An excerpt from the video  
production note



### **4.3.1. Production planning**

#### ***Creating the Scenario***

Although my design research had already supplied me with a model scenario, I decided to create another scenario, this time of a designer's working process. The scenario was derived from my own experience designing a primary flight deck display in the class "Fundamentals of Interaction Design" with Dr. Axel Roesler. I designed a unique flight deck display that visualizes aerodynamic data as visual patterns like those on a heat map. The design process was an intense cognitive activity that required various kinds of information and the processes of exploring these information sources led to instances of creativity. Thus, I thought it represented an excellent example of association and that I could communicate well the internal process of thinking, as it was my own personal experience.

#### ***Designing scenes, lightings and camera work***

It was fortunate that I already gained a fair amount of experience designing and planning video shooting as part of my involvement in the Boeing Flight Deck design project in the autumn of 2013. For that project I created a video prototype demonstrating a new concept for commercial flight decks. Also, on-line video tutorials found on YouTube and Lynda.com helped me learn how to use natural and additional light for indoor video shooting.

Multiple test shots in the actual shooting location allowed me to acquire a sense of how to design scenes and use lights. Still photos taken during the test recording were useful for the creation of a video production note. On this production note (Figure 4.3.1.a.) (Appendix) I put every detail that could potentially be useful for the shooting, including equipment checklists, props and requirements for the actor. Also, the color coding and labeling of scenes and camera work made the flow of video shooting more efficient.

Additionally, in the location setting I masked unnecessary distractions on the walls and products, and created, to the extent that I could, an environment of neutral colors. This detailed effort contributed to the video a futuristic mood and the easier application of after effects.

#### ***Equipment***

Digital SLR cameras with video recording features are well received today by the general public and professionals as well because of their better manageability and affordable cost. I own a Canon 70D digital SLR camera, which has a powerful autofocus and focus-tracking feature that is ideal for shooting video. Additionally, I created a track slider (Figure 4.3.1.b.) for smooth panning shots, which quite satisfyingly enhanced the overall quality of my final video. More than any other piece of equipment, I needed a first-person view cam-





Figure 4.3.1.b.  
DIY track slider



Figure 4.3.1.c.  
The actor with the first-person  
view camera rig

era rig. Commercial action cameras like GoPro are well known for creating first-person video, but they cost more and lack the manual features of digital SLR cameras. I found a YouTube tutorial on how to build a first-person view camera rig using a backpack and a tripod (Figure 4.3.1.c.). When shooting with a wide-angle lens, it represented the user's view quite naturally.

### ***Casting the Actor***

It was important to cast an experienced actor, as the interaction in the video required demonstrating gaze interactions and externalization of the user's deliberation. I asked the University of Washington School of Drama for a student mailing list and contacted a junior student, Colton Sullivan. Without Colton's professional acting, the conceptual interactions of *mmx* would not have been properly presented.

### **4.3.2. Post Production—editing and adding after effects**

It is critical to edit soon after completion of the first shooting, as it can help one decide whether additional shooting is required. While finalizing the initial rough edit and testing the flow of the narrative, I began to add visual effects. For editing and effects, I used Adobe Premiere Pro and After Effects because of the synchronized workflow between the software.

mmx

*Memex and beyond*



## 05. *mmx*, Memex and Beyond

### 5.1. Visual elements of *mmx* - nodes, planes and scape

#### ***Nodes***

Knowledge nodes are the basic elements that visualize and trace the user's information source.

The *initiating node* indicates a seed of the information under exploration that is the topic or the objective of the exploring. *mmx* begins tracking the user's exploration of information when the users make the initiating node. The user can create the initiating node by giving a preset signal, such as tapping on the to-do list item on the user's notebook.

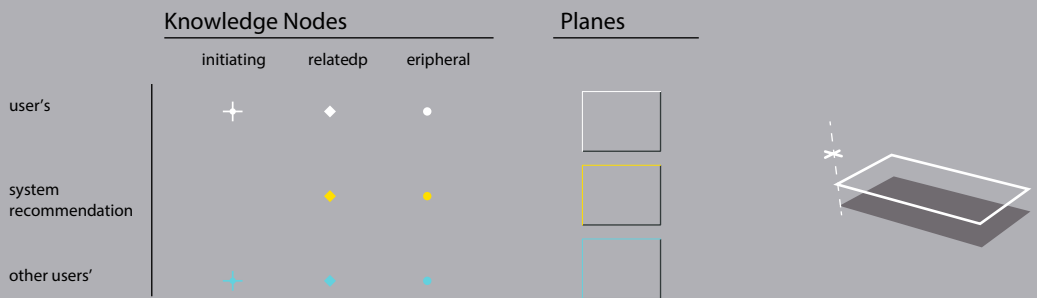
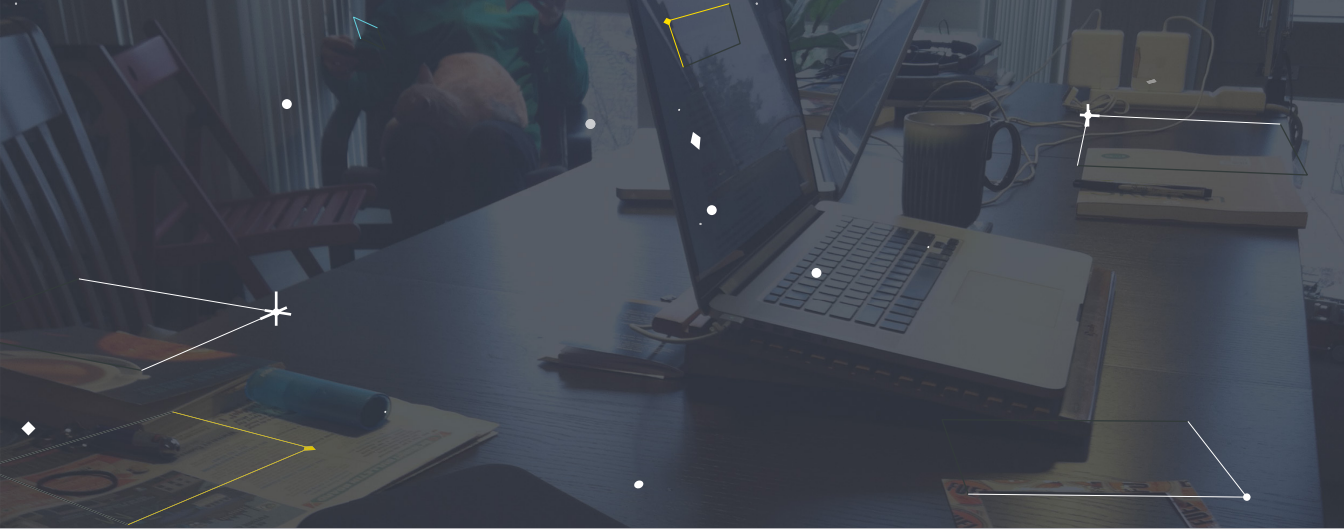


Figure 5.1.a.  
Knowledge nodes, planes


After the initiating node, *mmx* traces the user's view transits to different information sources and analyzes the relationships between these sources. *mmx* leaves *related nodes* or *peripheral nodes* on items that the user sequentially considers. Distinctions between related and peripheral items are identified according to the priority determined by the user's eye movements and gaze patterns. If there is an overlap on a user's knowledge node, another user's overlapped nodes are displayed in a different color. *mmx* can also recommend information based on an analysis of the user's exploration patterns.

## Planes

Planes distinguish the media of a particular information source and frame the area of attention on the source. the *mmx* system also remembers the plane as a screenshot to remind the user of the information source.

## Knowledge scape

People often gaze off into space unconsciously when they are thinking something over. An active way of to represent this habit is to create a sticky note board on the wall. Thus a conceptual or physical layer of space is employed for rearranging and overviewing a history of explored information.



In *mmx*, Knowledge Scape provides the history of a user's exploration of his or her information sources as this conceptual layer. By displaying the linkages between the user's knowledge nodes and planes with the visual cue of the information source, the Knowledge Scape view enables the user to recall and project knowledge nodes and planes.

To activate the Knowledge Scape, the user signals to *mmx* by gazing at a blank plane like a ceiling or wall. *mmx* then sorts and projects knowledge nodes and planes onto the two-dimensional surface, allowing the user to rearrange and reorganize the linkages between items and put his or her ideas in order.

Multiple *mmx* users with similar linkage patterns can see the overlaps in their Knowledge Scares. The concept of Knowledge Scape is not, however, an active sharing one. The user "recognizes" the overlaps from *mmx*'s input, not that of another user. *mmx* curates how other trails of knowledge are connected to the same information source and then expands. The overlapping items are defined and selected by the system based on the history of the user's information exploring. This constellation-like curation provides a spatial overview that expands the user's knowledge.

Figure 5.1.b.

Knowledge scape view



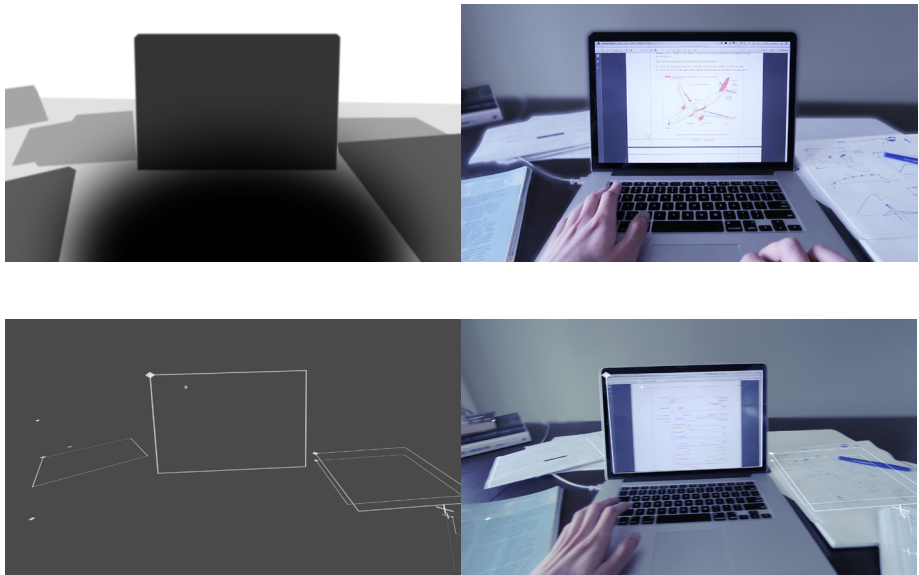


Figure 5.2.

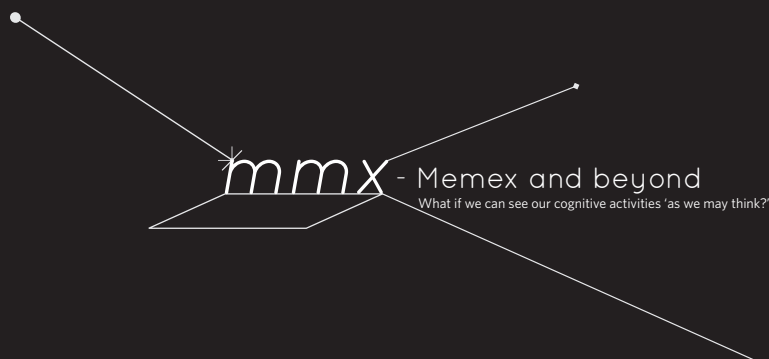
Image processing for  
semantic enhancement

## 5.2. Semantic enhancement of the user's field of view

*mmx* enhances the user's field of vision according to the priority of information sources (Figure 5.2.). This prioritization is made apparent by a clear visual hierarchy; the primary items appear in focus in real time while secondary items recede. From this enhancement, users can experience the exploration of knowledge in a more immersive setting.

## 5.3. *mmx* the video

The following frame sequence is from the video prototype I produced for the Henry exhibition illustrates *mmx* experience. The video sketches a designer's process of designing a flight deck display, in steps of initiating, exploring, reviewing and expanding knowledge.





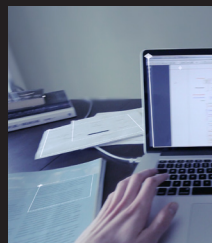
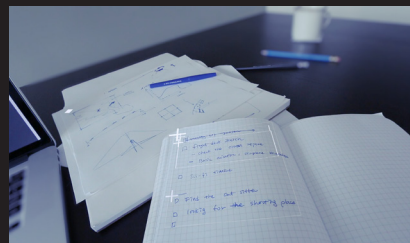
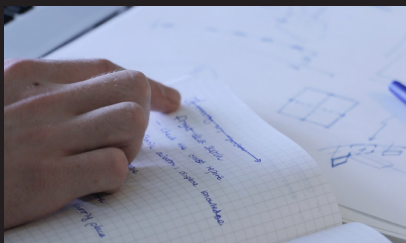
## 00. Introduction

Jesse, an interaction designer, is working on a flight deck design project. He browses his various research materials through *mmx*, which can take any wearable form that is available at its time.



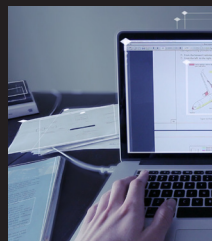
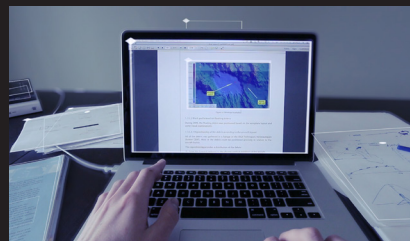
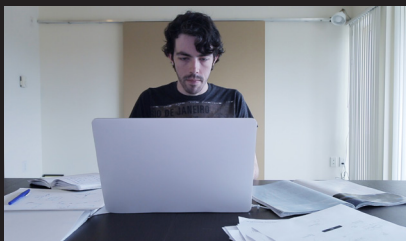
## 01. Initializing

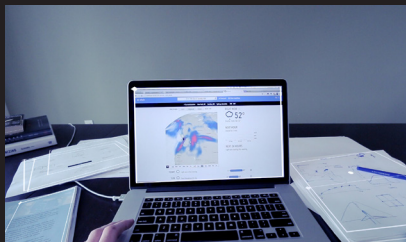
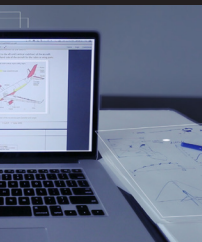
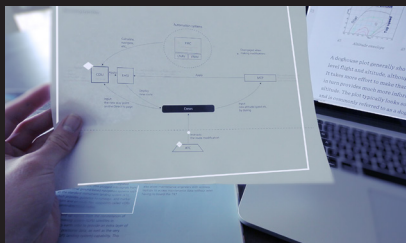
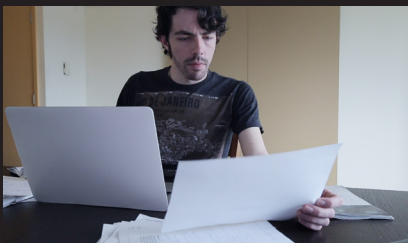
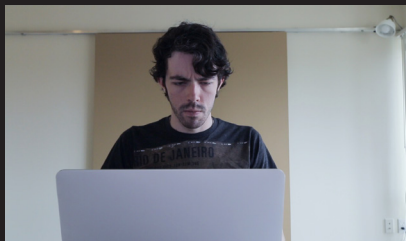
As Jesse starts his work by tapping on his to-do list, *ttttv* renders an initiating node on the list. It starts tracking every material Jesse looks at and saves the history of his interactions with them.



## 02. Exploring

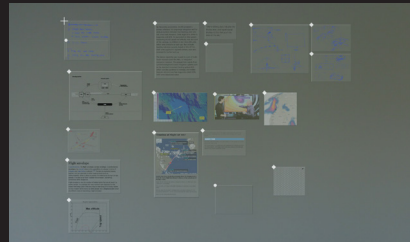
Jesse relates one information source with another to understand them and get an idea for his design. He learns how airplane sensors detect the motion of air, and thinks that he can visualize aero-dynamics like a map for pilots.





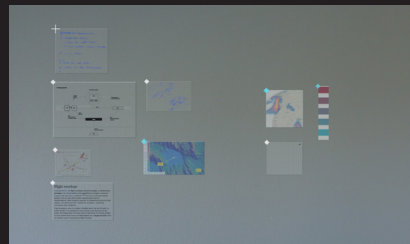
### 03. Reviewing

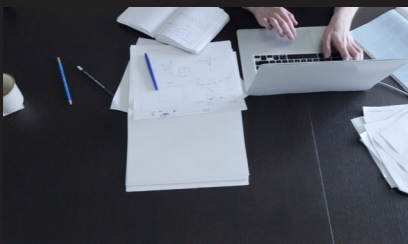
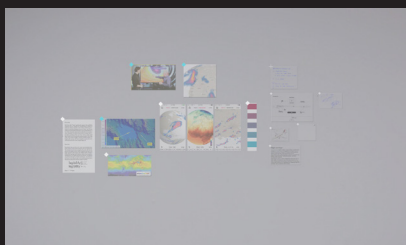
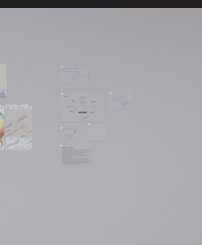
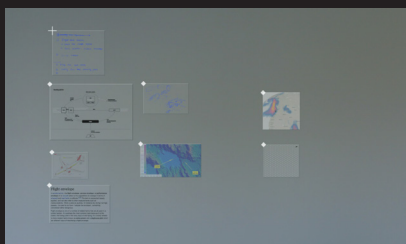
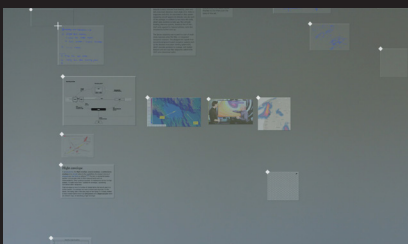
Jesse looks at the wall to see his Knowledge Scape, the history of his exploring so far. He thinks that the information about maps and weather graphics are useful for his design, so excludes the items that are not related with maps and weather graphics.



### 04. Sharing

Parker, a graphic designer, notices Jesse's exploring on weather graphics from her Knowledge Scape. She shares a color swatch with Jesse. Her input helps Jesse to employ weather graphic colors on designing the flight deck display.

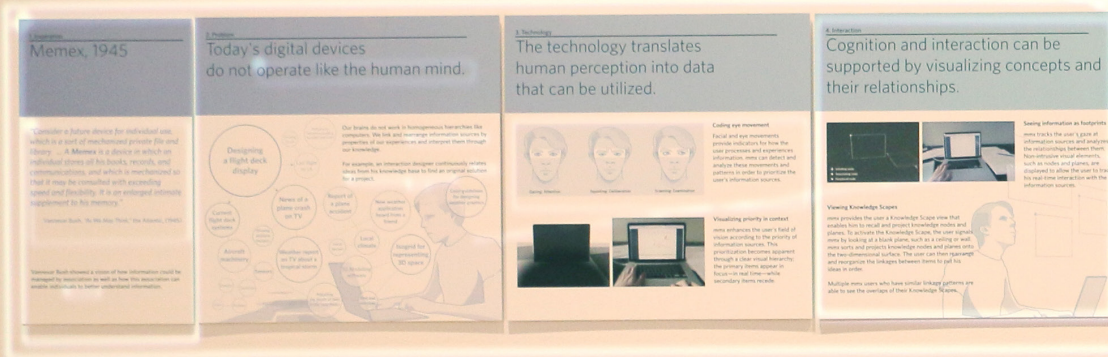






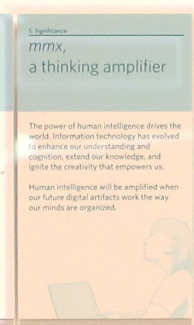
# Memex and beyond

What if we can see our cognitive activities 'as we m





ay think?'



*“... Knowledge goes far beyond mere facts and data. For information to become knowledge, it must incorporate the relationships between ideas. And for knowledge to be useful, the links describing how concepts interact must be easily accessed, updated, and manipulated.*

*Human intelligence is remarkable in its ability to perform all these tasks. Ironically, it is also remarkably weak at reliably storing information on which knowledge is based. The natural strength of today’s computers are roughly the opposite. They have, therefore, become powerful allies of the human intellect because of their ability to store and rapidly retrieve vast quantities of information.”*

Raymond Kurzweil, “When Will HAL Understand What We Are Saying?”  
*HAL’s Legacy* (1988)

# Reflection

Technology shapes our thinking. Our instant access to vast amounts of information via the Internet has challenged the human memory to work as an index (Thompson, 2013). The opportunities offered by technology are neither good nor bad, but we need to look back to see if they are being utilized properly. If information technology does not support the full potential of human intelligence, this means that it lacks understanding about human beings. Digital information technology should exist in order to support the potential of human intelligence, and interaction design plays a part in envisioning what form and qualities the technology might take.

In the project, “*mmx* - Memex and beyond,” I have tried to visualize cognitive activities as the linkages between knowledge nodes, and I employ visualization as the element of a natural interface for thinking processes. I wanted to demonstrate the potential to expand and amplify our knowledge according to the innate ways we think.

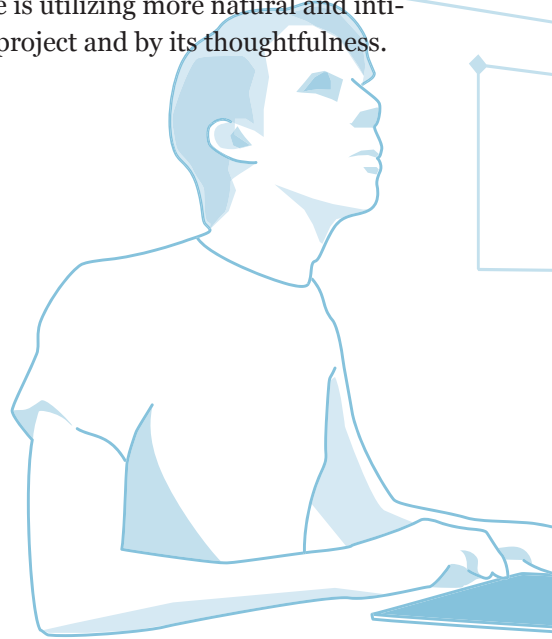
By completing this thesis project, I have practiced how an interaction designer can present a vision of utilizing the many possibilities of digital technology and the processes of research, analysis, and execution needed to present such a vision. However, I regret that this document is missing some theoret-



ical background; information organizing studies of human perception and cognition would support how the graphical interface of *mmx*, especially for the knowledge- scape view, assists the accomplishment of rearranging one's creative tasks. Moreover, many tasks remain in order to complete this project. Presenting other potential uses of *mmx* in occupations other than those related to traditional knowledge will support a broad utilization of *mmx*. Additionally, a more-comprehensive illustration of the process and its effects on "knowledge amplification" through *mmx* could be presented in the video prototype and this text. These missing pieces are mainly because the project became larger than I initially conceived of it being. I hope I will have the opportunity in the future to continue to explore and revise this project.

Personally, I became fascinated, as an aspiring information forager, by what memex envisioned for the expansion of knowledge. I have to admit that all the new information I encountered during this project greatly stimulated my mind and eventually made me even more desirous of a new memex. However, designing a complete memex system—which works as metamedia or an operating system—and all the numerous possibilities branching from it would be an extremely difficult project for an individual designer to undertake. Finally, as a designer who creates systems based on research and insights into human affairs, I wanted to be careful that this project would not be interpreted as a delusion with no groundwork.

Again, I want to note that this project is not about Vannevar Bush's vision. Bush's memex is an amazing example of a profound insight and thoughtfulness about human intelligence. Technology and design together enable the development of fascinating effects and attract public attention. And it is true that such attention is a virtue of these two. However, attraction and usability must be based on thoughtfulness toward human beings. I hope that interaction designers of my generation, whose role is utilizing more natural and intimate technologies, will be inspired by this project and by its thoughtfulness.



The background of the page features a light blue line-art illustration of a person with long hair, seen from the side, sitting at a desk and working on a laptop. Scattered throughout the background are numerous thin, light blue rectangular outlines of various sizes, some of which are slightly tilted, creating a sense of floating or falling papers. The overall aesthetic is clean and modern.

## Acknowledgements

I would like to thank Dr. Axel Roesler, who guided this project and was nearly as excited about it as I was. Thank you also to thesis advising committee members, Sang-gyeun Ahn and Dominic Muren, and other design faculty members at the University of Washington for their valuable lessons; to fellow MDes students for their collegiality; and to my family for supporting and believing in me.

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## **Appendix.** Exerpts of video prototype production note

## Camera View

- C Front (dolly)
- Side
- Behind Jesse (dolly)
- D Overhead (dolly, timelapse)

- B Close-up (head)
- Extreme close-up (eyes)

Noticing

- E First-person \_ desk front
- First-person \_ note on desk
- First-person \_ laptop
- First-person \_ ceiling
- First-person \_ front - over the air
- First-person \_ seeing over (TV)

~~Kinect view~~

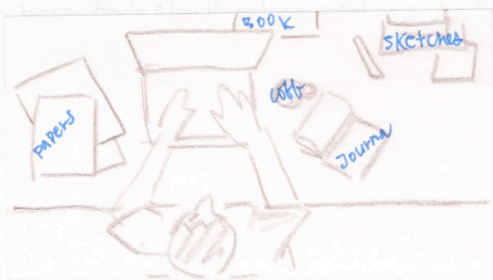
~~Another user's desk~~

## Location -

a designer's room with a big desk and a TV  
someone else's work place (studio)

## Actor

- a designer-look person (male)
- Glasses (only few scenes in the intro)
- Short sleeve T shirt
- Designer-like look



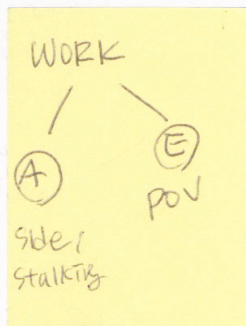
## Check list: equipments.

- / Dolly
- / Stabilizer
- / POV - backpack, pillow, belt, weigh
- / Lights
- / Tripod
- / Memory
- / Lenses - default, wide, pancake(?)
- / Big white board
- ~~/ Time lapse remote~~
- / Laptop
- / knowledge media - note, files on laptop,
- / some books - cog in wild, 787 book
- ~~/ memo on desk & wall~~
- / desk
- / chair
- / chair without back (for first person video)
- / TV
- / masking tapes
- / post its
- / a circle tape on index finger for tracking?

→ Laptop COVER

## laptop preset

- / white jpg - for annotation
- / Adobe s/w
- / Chrome
- / PDFs



DOLLY / NO DOLLY  
WIDE / 135  
A 15 (AFTERMATH)  
3.5 16 1/3sec  
30FPS 60FPS  
Rubber band panning



## Synopsis

Jasse is a freelance designer. He's at home and working on his project about airplane cockpit display.

When he takes out his note from his bag at his desk and sees his to-do list for the project, the mmx, an augmented vision starts tracking what he sees. He has many materials for his work on the desk such as a memo from the meeting with his clients, materials about air craft and cockpit, and his sketches.

As he checks his materials on desk and some new information on the internet, he develops his sketches and writes some notes on his sketchbook. (The camera follows what he sees in first-person view.) Sometimes he gazes on a paper or sees something closely. The mmx system puts some visual cues on what he sees and reads. The visual cues are linked together.

He reads an airplane crash report on the computer screen.

In there, he sees that the sensor for wind was frozen and broken, cause the malfunction of the plane --- he highlights it.

He thinks, 'The weather was bad.' weather...

'How do we see the weather?'

After thinking a moment, he sees his TV. He gazes at TV screen and rotates his head slowly. mmx browses the history of images he saw on TV and finds a weather report. He sketches a heat map on his sketchbook.

When he looks at the ceiling in his room, he can see the nodes and their linkage projected on the ceiling so that he can see how the relationship of them as a big picture. While he's seeing the links on the ceiling, he lowers his head and gaze in the air to move the linkage visual to where he feels comfortable to see it. He revisits the linkage sometimes while he keeps working and mmx keeps updating what he sees.

Alexa is a graphic designer. When she was working on her project through there mmx, she sees one of her nodes overlaps with someone's - Jesse's - node. She shares related nodes to Jesse.

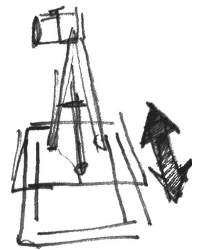
Jesse finds Alexa's color swatches on his linkage and uses it for his cockpit design.

## 1. introduction

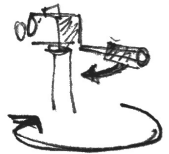
4/6

Jesse is a freelance designer. He's at home and working on his project about airplane cockpit display.

*J: Approaches and sits at the desk*



*J: Sees the computer screen*



*J: Eyes focused on the computer screen*



*He's wearing two different glasses (in transition)*



### 3. Working

6/6

He has many materials for his work on the desk such as a memo from the meeting with his clients, materials about air craft and cockpit, and his sketches.

#### Panning

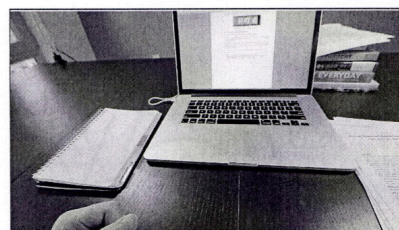
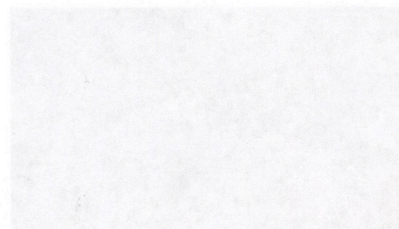
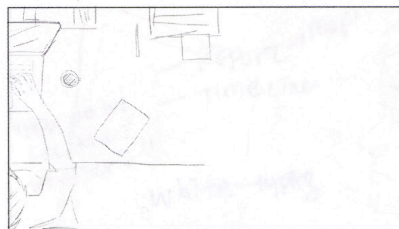
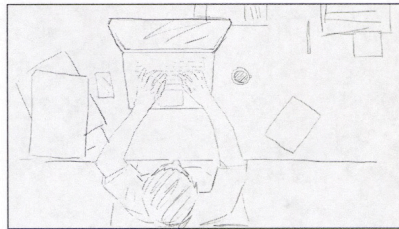
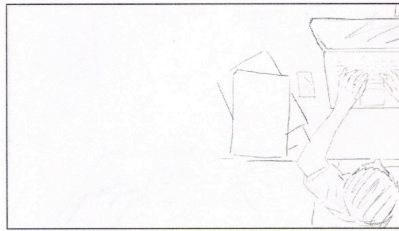
Showing his materials on the desk one by one

*sketches*  
*Take a paper and read it.*  
*Check some printed graph.*  
*(Repeat above, "work" with random materials.)*

*Look at the papers (you saw before) closely*  
*Thinking face*  
*Read slowly (it's like you're drawing something)*

As he checks his materials on desk and some new information on the internet, he develops his sketches and writes some notes on his sketchbook. (The camera follows what he sees in first-person view.) Sometimes he gazes on a paper or sees something closely. The mmx system puts some visual cues on what he sees and reads. The visual cues are linked together.

J: **'Work'**  
 See the computer screen  
 Sketch - (put some arrows and note on prepared sketches)  
 Take a paper and read it.  
 Check some printed graph.  
 (Repeat above, "work" with random materials.)



DOLLY  
WIDE  
f/16+

No dolly/PDV  
WIDE  
f/16+



