Interaction Design Sketchbook by Bill Verplank

Frameworks for designing interactive products and systems.

1.SKETCHING – beyond craft to design – the importance of alternatives.
2.INTERACTION – Do? Feel? Know? Products, computers and networks.
3.DESIGN – motivation, meaning, modes, mappings.
4.PARADIGMS - brain, tool, media (toys, theater) life, vehicle, clothes

1. SKETCHING

Design is what people do. When we are being "more than animals", we plan and learn and think about what is to come. It is usually best to have some design before building or acting on the world. Sketches may be a first step in design but here I use sketches to capture the emergent frameworks of a professional practice.

DESIGN and CRAFT: Modernism and post-modernism.

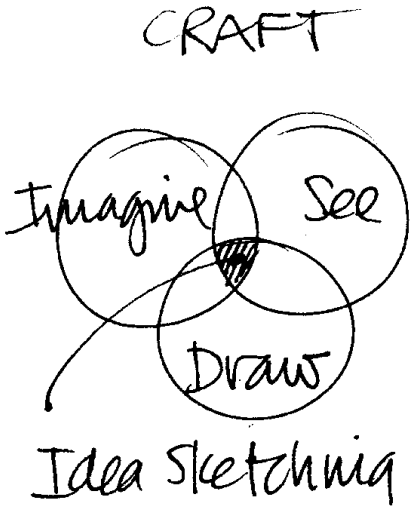
Computers are changing the process of design. It is easy now to copy and modify, to mimic and adapt, and to evolve from "working code" the next iteration of a system. This direct engagement with the materials, producing immediate results, is what makes for a craft tradition. There is no time to step back and plan or abstract and analyze. We need no principles, textbooks or classrooms, only studios. Masters pass on their practices to apprentices; the only learning is by doing.

The introduction of architecture and engineering as distinct from construction and manufacture made explicit the role of drawing and design. Modernism was a break with the past, freedom from tradition and habit. Post-modernism was a reaction to sterile functionalism, a celebration of emotion over reason, narrative over theory.

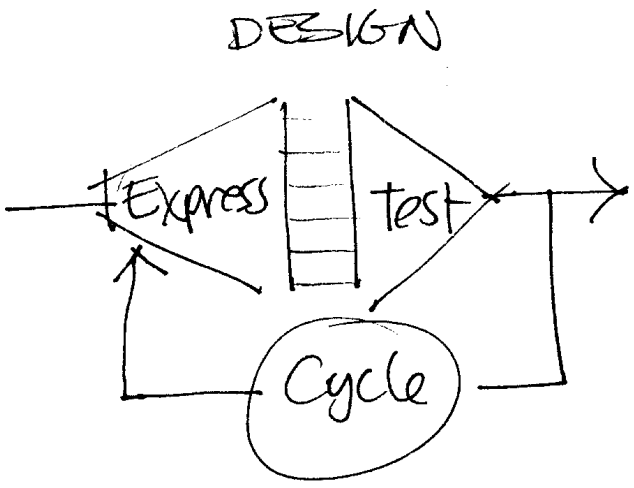
I think we can have both. Professional practice must necessarily rely on learning by doing, but it must also rely on anticipation and reflection. These sketches try to bridge the immediacy of craft with the perspectives of design.

Interaction Design is design for people – design for human use. When we interact with technology or with others through technology we are increasingly faced with computers. Computers are what make interaction design challenging. (EMBEDDED and UBIQUITOUS)

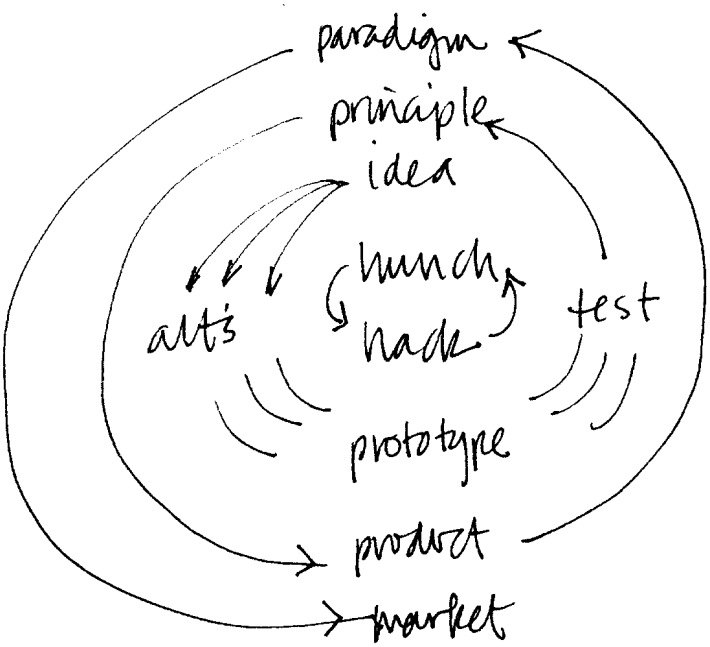
Sketches are an essential designer's tool for capturing preliminary observations and ideas. If they are fluent and flexible they support creativity. Sketches can be concrete or abstract, representational or symbolic, loose or tight, improvisational or rehearsed.



Robert McKim in *Experiences in Visual Thinking* teaches how to draw by teaching how to see and how to imagine. Seeing feeds drawing, drawing improves seeing. What we see is influenced by what we imagine; what we imagine depends on what we see. McKim's creative ideal of rapid visualization or idea sketching is the craft of doing all three at the same time. This is similar to the experience of any craftsman in direct engagement with his materials: imagining, shaping, seeing all at the same time.



McKim also describes the rapid search for alternatives as an uncritical mode of thinking that must be separated from criticism. Brainstorming is such a mode where the goals are fluency and flexibility – quantity and variety. If an idea is criticized before being expressed it dies prematurely. Design as opposed to craft has this quality of separate phases or modes. For example, an Express mode, producing many choices can be followed by a Test phase, followed by a Cycle phase where the next strategy is chosen. The basic design process is seen as cyclic or iterative.



There is a danger in iteration if alternatives are not considered, if you are only working on one design at a time, comparisons are never drawn, criteria are never challenged. At the core of invention might be a hunch followed by a hack followed by another hunch (craft) but an idea or generalization is needed for generating alternatives, prototypes and tests (design). The goal is principles, which organize the value of a product which creates a market which creates a

paradigm and we are back to a fixed orbit. Design is the "transfer orbit" that gets us out of a small orbit into a larger one.

2. INTERACTION

INTERACTION DESIGN and INDUSTRIAL DESIGN
Modes and mappings: the plasticity of computers.

Industrial design is a profession that grew up in the 20th century to shape manufactured products. It was a response to the design freedom provided by modern materials and manufacturing processes – especially plastics. With plastic, a product could take on almost any shape, color and pattern. It could mimic metal or wood, look sleek or substantial, reveal or hide. The most famous industrial designer, Henry Dreyfus, came from theater design. Happily, his contributions went beyond the illusions of stagecraft to include basic design guidelines for communication (Symbol Source Book) and anthropometrics (Human Scale).

Interaction design is a profession that will mature in the 21st century. The central concern is how to design for people – for their physical and emotional needs and increasingly for their intellect. With computers, we can make products take on almost any behavior. The response to human input can be delayed or repeated (mappings). From moment to moment, products can change how they respond (modes). With networks, the notion of a stand-alone product is obsolete. The effect of my actions may be local or remote.

INTERACTION DESIGNERS answer three questions: How do you do? How do you feel? How do you know?

Even the simplest appliance requires doing, feeling and knowing. I can flip a light switch and see (feel?) the light come on; what I need to know is the mapping from switch to light. The greater the distance from input (switch) to output (light), the more difficult and varied are the possible conceptual models; the longer the delay between doing and feeling, the more dependent I am on having good knowledge.

How do you do?

What if the light can be dimmed? Then I might use a continuous control or handle. One basic choice for how we do things is that of button or handle; discrete or continuous.

button

handle

A handle allows continuous control both in space and time. When I press a button (e.g. ON) the machine takes over. Buttons are more likely symbolic. Handles can be analogic. With buttons, I am more often faced with a sequence of presses. With a handle a sequence becomes a gesture. I use buttons for precision, handles for expression.

How do you feel?

The choice of senses (hearing, seeing, touching, etc) determines what we feel about the world. The medium is the message.

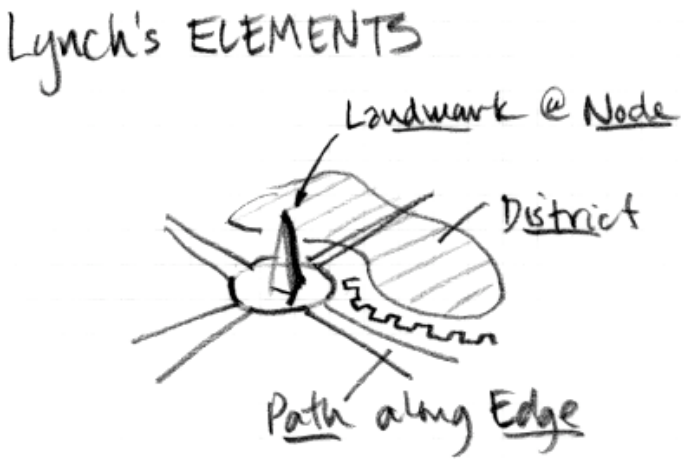
Marshall McLuhan divided all media into cool and hot. Based on the sensory qualities of media, he described indistinct or fuzzy media like TV as "cool" after the jazz of his age ('50s). In contrast, the high definition of things like print, he called hot – think of them as too "hot" to touch. McLuhan's cool media invite completion and participation; hot media are definitive and already complete, they discourage debate. Designers are continually faced with this choice of suggestion or clarity, metaphor or model, poetry or law.

How do you know?

The new challenge for Interaction Design is the complexity of behavior possible with ubiquitous computers. Some simple theory of how people know may be useful. A conscious consideration of what we are expecting of the people for whom we are designing is essential.

The easiest interaction requires knowing only one step at a time – path knowledge. Some situations call for immediate performance by first-timers, for example, emergency procedures like escaping an airplane. The best assumption about the user's model is that they are expecting step-by-step instructions.

Other situations benefit from map-like knowledge. Kevin Lynch, the city planner, believed that the best urban design supports not only efficient paths but mental maps. He called this quality "imageability".



Lynch asked people to describe paths and to sketch maps of their city. He classified everything mentioned as one of five elements: LANDMARK, DISTRICT, EDGE (between districts), PATH or NODE (where paths intersect). He found that more imageable cities, for example, have paths along edges so that relationships between districts can be seen, or landmarks at nodes so that they can be used for navigation.

There are a broad range of interaction designs from word processors and web browsers to watches and radios where Lynch's notions are of use. Paths are the sequences of actions or commands. Districts are modes or choices. If the "edges" between modes are visible, then I have a chance of constructing a more

complete map while I follow various paths. Memorable graphic devices at meaningful places in the interface help users construct coherent mental models from which new tasks and uses can be inferred.

Here, the choices for interaction designers are arranged around the three questions. Any product or system may feature one or the other but the best systems support both.

A novice needs a path, a learner needs a map. Skilled experts have their own efficient paths and maps to refer to when new problems are presented.

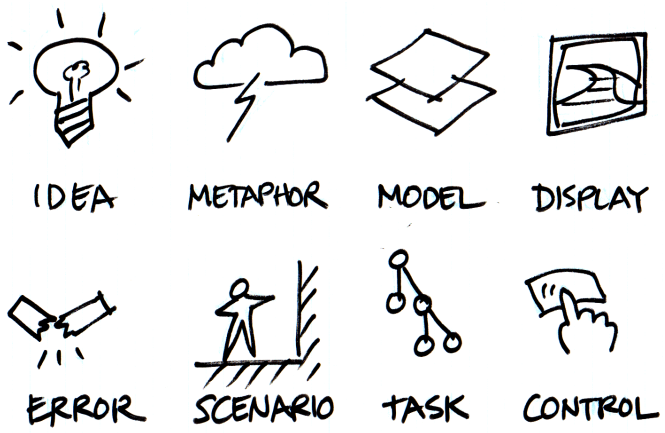
The mouse is a handle for moving among millions of pixels with a button for selecting one. Buttons with variation, for example, the keys of a music synthesizer keyboard with velocity and aftertouch allow not only discrete selections but expression.

The best web pages have “cool” attractors for engaging new visitors and also detailed and definitive “hot” information, for example, URL’s, product specifications or licenses.

Good interactions are the appropriate styles of doing, feeling and knowing plus the freedom to move from one to the other.

3. DESIGN

Successful interaction design involves balancing a variety of concerns using a variety of methods or representations. These are not suggested as stages in a design process but as framework for checking to see that the proper concerns have been addressed.

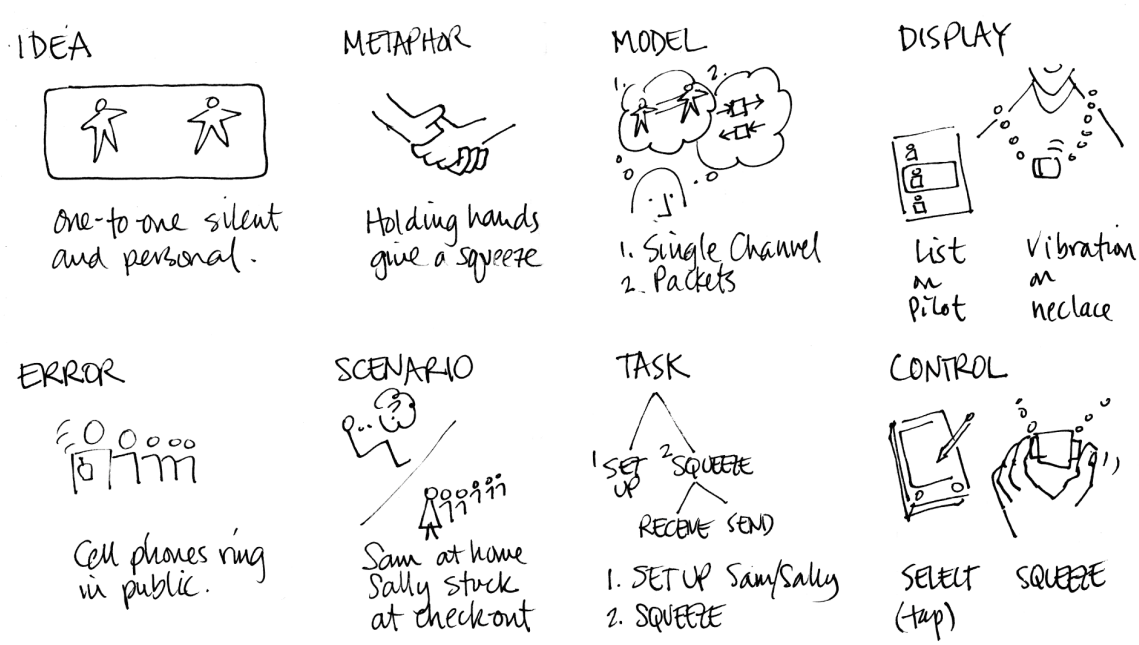


At the top are overviews, along the bottom are details. From left to right the columns could be called motivations, meanings, modes and mappings, the process from left to right might involve observation, invention, engineering and appearance.

The result of an interaction design is displays and controls and the behaviors that connect them (mappings). In order to create a coherent implementation there must be both a task analysis of the step-by-step interactions as well as an over-all conceptual model that organizes the behavior (modes) both for implementers and for users. The invention of an interaction involves not only one compelling

scenario and a unifying metaphor but consideration of a variety of scenarios and a wide exploration of alternative and mixed metaphors.

I will illustrate the framework with Celine Perrin's project for Music250a/CS377b CHI Technology: a two-way "Haptic Pager". The ERROR or annoyance is that cell phones ring in public. Her IDEA is a one-to-one silent and personal link: when holding hands, give a squeeze (METAPHOR). One SCENARIO has Sam at home wondering if Sally is just stuck in a check-out line at the store.



The necessary users' conceptual MODEL is to think of it as 1. A Single Channel where Sam and Sally are directly connected , and 2. Packets which are sent out, and at some time latter, replies are received. The corresponding TASK involves a SET-UP mode where the Sam/Sally link is chosen and then a SQUEEZE mode where haptic messages are exchanged. A proposed DISPLAY shows a list of people and the corresponding CONTROL is selecting with a tap of the stylus. The vibrator DISPLAY might be on a necklace for receiving and the CONTROL would be a squeeze of the necklace for sending.

The important thing about the framework is to use it as a check on the balance of approaches from invention to implementation and from overviews to details. It is not intended as a strict ordering of the invention and design process. Most of the projects from the class actually started with some sort of CONTROL idea and only later considered whose problem they might be solving.

With each perspective, alternatives can be considered. For example, how would the product change if it was being designed for a mother with three kids or an elderly parent living alone? What if the metaphor was dancing or arm-wrestling? The framework is also useful in communicating a finished design but my preference is to focus on quick sketches in early stages of design. That is where computers provide the least support and where new tools and techniques might focus.

4. PARADIGMS

The design of human-computer interaction has been organized around competing beliefs and professional establishments. It is important to realize how insular each of these paradigms can be and to consider how to cross paradigms.

Everything that comes between my environment and me presents an interaction design problem. McLuhan called these “extensions” and in particular, he was concerned with sensory extensions. We must extend McLuhan’s analysis beyond electronics (instantaneous) to computers (arbitrary). We will soon have computers in everything, they will sense and act and communicate with each other. How are we to design them so that we can best interact with and through them?

To look for the competing paradigms, start by thinking about McLuhan's extensions. Electronics are extensions of our senses (media). Clothing is an extension of our skin (fashion). Even architecture can be seen as an extension of our skin, which we leave behind. Cars are extensions (vehicles) that we take with us that need roads that stay behind (infrastructure). What happens when our clothing has computers in it? What happens when we think of computers as clothing?

The last fifty years of thinking about human-computer interaction can be understood as a competition between three paradigms: brains, tools, media.

Computers are electronic brains.

In the early days of computers, they were described as "electronic brains" and many a professional career has been organized around the idea of "artificial intelligence". This was just the latest challenge to humans (we had long given up the hope that we are stronger than machines) and technological pundits love to play on our pride. (Minsky, Kurzweil) The next challenges will be affect (emotional computers), consciousness (self-aware computers) and soul (spiritual computers).

Names: agent, recognition
Goal: intelligence and autonomy
Style: dialog and language, recognition, multi-modal
Result: better models for people (linguistics, cognitive science)
Failure: promises (anthropomorphism and animism)

In the end, trying to make computers more like us only helps to create a better mirror. These are very self-centered concerns. We may have better models for language or thought, for emotions and spirit, but we do not understand the world any better or how we might change it.

Computers are tools.

In reaction to the idea of artificial intelligence, Doug Englebart at SRI created a group dedicated to what he calls “augmented intelligence”. Earlier, JCR Lickleider had outlined the promise of such “man-machine symbiosis”; and earlier yet, Vannever Bush had dreamed about “how we may think”.

Englebart is important because he set in motion a style of human-computer interaction that has become the norm: direct manipulation.

Names: tool, task, use, HCI
Goal: empowerment, usability
Style: graphical user interfaces, direct manipulation, point and click
Result: personal computers, word processing and desktop publishing, the web
Failure: no fun, “user friendly”

Computers are Media.

If we shift our focus from tasks to communication and entertainment, we realize that computers are invading every medium from telephones and televisions to advertising and education. The focus is on expression.

Names: multi-media, the web, "being digital"
Goal: engaging, compelling, attention, expression
Style: flash, magic
Result: interactive TV
Failure: digital divide

Computers are Life.

Names: Artificial Life, Chaos,
Heroes: R.Brooks, C.Sims
Goal: play god, evolution
Style: evolution, simple rules / complex behavior
Result: pretty pictures, Rorschach
Failure: no generalizations, no understanding

Computers are Vehicles.

The metaphor of vehicle nicely captures the goals of transportation and navigation (vehicles of thought or expression) and as well as the necessity for roadways, rules and maps (infrastructure).

Underlying the tool metaphor is the larger task of making agreements about the underlying representations that the tools are manipulating: infrastructure. When I send a document to a printer, the representation used (Postscript) may be different from what I edit (Word) or send to someone else (RTF).

These representations limit what can be sent and received but also what manipulations are possible, how I can organize and re-organize, view, explore and edit.

Names: standards, infrastructure, super-highway
Heroes: ARPA, Berners-Lee
Goal: inter-operability, freedom/ownership/, compatibility
Style: open, dominance
Result: PC, Ethernet, Kanji/English
Failure: digital television, Microsoft

Computers are Fashion.

Heroes: Jobs
Names: wearables
Goal: belonging, recognition
Style: style
Result: pleasure
Failure: waste

How to deal with so many paradigms – don't get too serious. Beware fanatics – ignore them. Invent your own: INTERACTION DESIGN. Live and thrive on in the reality of multi-disciplinary teamwork.

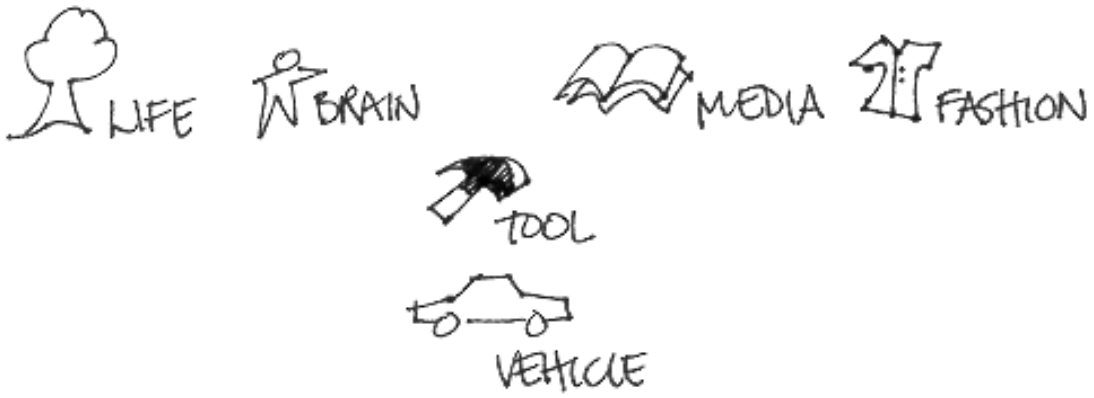
A deeper understanding of the essence of computers: REPRESENTATION for MANIPULATION.

Computers are simulators.

What computers do is to represent other things both real and imaginary. The form of representation is not arbitrary. The best representations are compact and extensible, efficient and widely available. The goal for representations is usually some form of manipulation or translation.

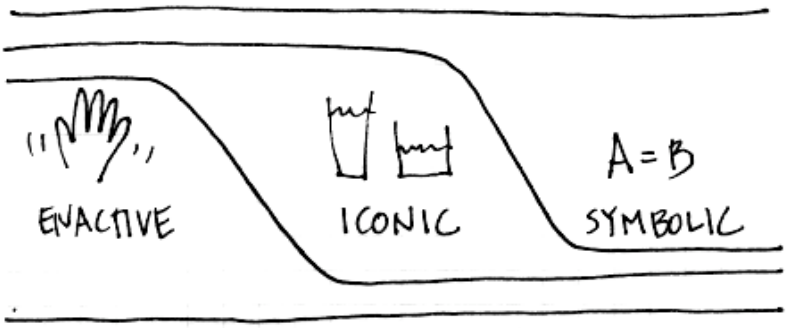
There is a considerable body of theory and experience in the business of representation. Shannon's measure of information, the bit, is the foundation but his definition goes no further than statistics; with the statistics of a signal, the most efficient code can be designed. Information theory is the foundation of coding but it does not cover the practicalities of history and meaning.

Linguistics and semiology are the study of representations. Representations for communication and thought.



From Brain to Tool to Media these three organize our differing approaches to the relation between people and computers. The broader concerns of not just Brains but Life sustain the prospect of autonomous, intelligent, evolving systems with which we live. Below Tools are the deeper concerns of the infrastructure needed for the Vehicles of transportation and communication. And ultimately, Media will both literally and figuratively lead to Fashion – how we respond to the need for belonging and self-expression.

Interaction Styles – history

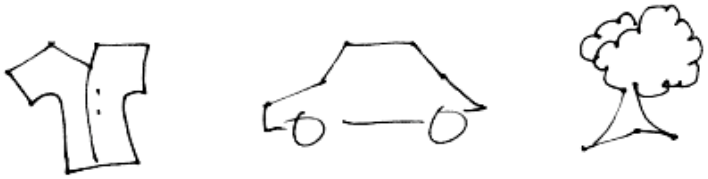


TUI GUI TTY

expression manipulation dialog

MEDIA TOOL PERSON

engage extend intelligence
immerse empower autonomy



FASHION VEHICLE LIFE
wearables infrastructure evolution

Piaget described three stages of learning. We are born with ENACTIVE or kinesthetic knowledge; we know how to grasp and suck. At a certain age we pay more attention to how things look; our ICONIC thinking is mistaken for example by a tall glass as "more". Only at a certain age do we understand conservation; then we are ready for SYMBOLIC thinking. Bruner says that we always have all three modes of thinking but in different proportions (this sketch is from Alan Kay). Gardner has extended this notion to seven intelligences and I suppose we could find a human-computer interaction style to correspond to each. For present purposes, three are enough.

The development of human-computer interfaces has followed the opposite path. The first interactive computers used teletypes (TTY) and the style of interaction was a dialog of symbols; I type and the computer types back at me. With CRTs we first emulated the old style with "glass teletypes" but with the invention of mouse and bit-map display, the iconic graphical "direct manipulation" interface became the dominant style. This progression suggests that the next stage is enactive interfaces, more suited to expressive musical interaction than with pictures or symbols. One possibility is Ishii's Tangible User Interfaces (TUI).

Computer-as-person motivates dialog where the goal is autonomy and intelligence. Computer-as-tool motivates direct manipulation where the goals are efficiency and empowerment. Computer-as-media motivates expression, engagement and immersion. In the expressive realm, beyond media are all the notions associated with fashion with wearables as the most obvious implementation. Underneath tools are all the vehicles that depend on infrastructure. Extending the autonomy realm are self-evolving computers that are thought of as forms of life.