Communications
Design Group SF

RESEARCH AGENDA AND FORMER FLOOR PLAN

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Premise

New **representations of thought** — written language, numerals, mathematical notation, data graphics — have been responsible for some of the most significant leaps in the progress of civilization, by expanding humanity's collectively-thinkable territory.

Definition

A representation captures some aspect of a concept or phenomenon in a human-understandable form, thereby enabling a person to perceive and think about it.

For example, a piece of music can be represented as a verbal description or as a page of music notation (pictorially) or excerpted pitch or rhythmic patterns (numerically). Each representation, in its specialized way, facilitates the pattern of finger movements which playing the piece delightful, or the experience of seeing around an orchestra quickly.

Paradoxes

- Before the 19th century, multiplication was considered a highly abstract concept only for the mathematical elite. Once place-value Arabic numerals replaced Roman numerals, multiplication and division became mundane. It became a pen-and-paper procedure that a merchant could delegate to a clerk.
- Before the 17th century, mathematician calculated using a **physical abacus**. The invention of algebraic notation made mathematical structure visible, and allowed for abstracting mathematical ideas into symbols and rules. This was a **cognitive prosthesis**.
- Before the 19th century, data was presented in tables. Playfair invented the data plot. Without this form of representation, modern **scientific discovery and communication** would be impossible.
- Feynman's representation of vapor-phase reactions as "trees of Feynman" inspired Maxwell's theory, which he wrote as equations. Feynman's diagrams are a visual language of vector analysis specifically to resolve Maxwell's equations in four simple trees. The representation is the theory. **Representation = cognition**.
- Galois's elements were a great leap, with no computer illustration or presentation power. Mendeleev found a way to represent the patterns of chemical properties with a "periodic table". This representation enabled, for the first time, a theory of **chemistry**.

Why representations matter

Representations are powerful in more scientific "discoveries". Each of them essentially enabled all subsequent scientific breakthroughs thereafter. A powerful new form of representation affects everything. Forever.

Opportunity

The **dynamic medium** now exists. But dynamic representations of thought do not. Humanity is using the dynamic medium merely to emulate and extend static representations from the era of paper.

The dynamic medium looks effectively like an animated paper:

- representation
- dynamic behavior determined by computer
- connected (net-exchange information with other such artifacts)

Dynamic material is the "stuff" that an author creates in the dynamic medium, to communicate to others.

Today, this might be called "software", but the distinction between artifacts, networks, protocols, etc. will break down soon. More importantly, the focus is on human communication — modeling and understanding a concept — not the engineering of a system.

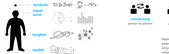
Dynamic authoring is creating dynamic material.

Today, this might be called "programming", but again, the focus is on capturing and conveying an idea to a person, not the engineer problem of "making it work". This certainly doesn't mean "writing code".

Dynamic watching is representation authoring in reverse, "in the speech of thought". Creating working dynamic material in seconds. Today, this is not possible.

Intention

Use the dynamic medium to reinvent the representations of thought. Invent a way of thinking — imagining, understanding, creating, explaining — via dynamic representations that engage **all modes of thought** and **respect the whole human being.**



Strategy

The representations of thought are reflected in the representations used to communicate. Humanity uses each **mode of human communication** into the dynamic medium, reinventing it around the whole person.

Face-to-face

Dynamic Conversation

mind-melding and dynamic authoring

Mode of communication

- Conversation means person-to-person, face-to-face, realtime, improvised, unjudged.

Today

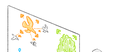
- Concepts are represented with spoken words, hand waving, static sketches.
- One person's "picture in their head" can't be seen by the other.
- Ideas are "lost" in minutes.
- People ponder and convince through dissembling and rhetoric, not evidence and explorable models. Words are terrible at representing systems.

Vision

- A medium in which ideas can immediately be **relived and filled out**. People can discuss a concept collaboratively.
- Imagine Alice and Bob. Bob tells Alice he's planning a trip to Paris. Alice pulls up her model of Bob's schedule, and visually inspects possibilities to explore and discuss, as if sketching on a whiteboard. Today, "collaborating" means Alice describes her model to Bob, who must imagine it in his head, or build it into a realtime system.
- The medium encourages **evidence-backed** representations over guesses.
- Everyone can "program" — understand and modify models — because it is explorable and visible during a live, shared, working of variables.
- The participants' focus remains on **each other** and the concepts represented between them, not on the computer or software.
- Long-term — entire conversations taking place through improvising and manipulating visual tactile representations intermixed with scattered words and gestures, new language that would be unintelligible to someone today.

Dynamic Creative Play

mind-melding and dynamic authoring



Mode of communication

- Friends hanging out in the evening, casual, playful, realtime, improvised, shared experience.

Today

- Representations are shared back-and-forth over the same thing **passive** (watching TV) or **non-digital** (playing games).
- Programming is **isolating**, even in groups. People stare at laptops, focused on their own screens.

Vision

- Code is **anti-social**. A program cannot be immediately understood, modified by a friend in minutes.
- Friends authoring together for fun, in a casual, shared space. Creating dynamic playables ("mods", perhaps). Similar to playing with Legos or Play-Doh.
- Everyone is focused on the **same thing**.
- Everyone can **see** what everyone else is creating.
- Everyone can **understand** how everyone else is making it.
- Everyone can "jump in" and **participate** in what others are making.

Rationale

- If this dynamic medium is to be the foundation of a new literacy, people must be able to author **casually and socially**. Authoring shouldn't be "work", it shouldn't require a "mindset", it shouldn't be disconnected from the immediately understandable and multifaceted lives embedded.

Australian Ballet

Reading

Dynamic Reading

deep and a-passing gaze

Mode of communication

- Reading means media-to-person, solitary, deliberate, prolonged, contemplative.

Today

- Concepts are represented with words, words, words. The author's "picture in the head" is not conveyed to the reader.
- The author explores and develops understanding and refines, not realtime and explorable models. Words are terrible at representing systems.
- Material is mass-produced, so everyone gets the same thing.

Vision

- A stimulating **multi-channel** book of written communication. A few general minutes of words, followed by hours of exploring the ideas behind them.
- **Skimmable.** Get the gist in 5 seconds. Get "enough" of an understanding to make associations with lower 1-10 seconds. Go slower in particular areas as needed.
- **Transformable.** View many different representations of the same knowledge, without an author having anticipated each representation.
- **Explorable.** Assumptions and explanations are backed by data and models. Adjust premises and assumptions, and see consequences.
- **Collaborative.** Share models, not just words. Add your unique lens every reader and every reading.
- Combine the reader's brain understanding and computer reads.
- **Interruptible.** Have a dialog with the material. Get clarifications and examples, without an author having anticipated the questions.

Hypothesis

- Within a basic form of writing, concepts that today take hours to understand, could become quickly understandable. What today takes weeks can take hours. What is impossible today, because it would take more than a lifetime to synthesize, becomes possible.

Dynamic Spatial Media

decide you want another a-room

Mode of communication

- Like reading, — media-to-person, personal, prolonged, contemplative — but focused on expanding knowledge of a spatial environment.

Today

- The primary objects for acquiring knowledge — books and computer screens — confine representations to a rectangle.
- Representations are only two-dimensional, and static.
- Peripheral vision and visual scanning are wasted.
- Only one representation can be viewed at a time, leaving its brother out of sight. The association between two ideas is left to memory.
- Books consists of pages of text, which convey almost no information at a glance. The assumption is that a book will be "read" over many hours, and books not provide knowledge on any shorter time scale.

Vision

- The branches of knowledge are represented by their own **place**. Visiting a place means that a "field" by walking around it, in any direction, and seeing what is there. Fields have no "edges", and can be explored at any level of detail.
- **Spatial textbooks.** Fundamental knowledge is organized into a human-scale environment and interacting with physical tactile-audio objects. The learner progresses through the space at their level of understanding and skill progresses, like progressing through chapters of a textbook. Ideas are not "hidden" behind a page-turn, but are visible and ready to be pulled out and used. Ideas are not "lost" after a few minutes, but are always within a few steps of a place where they are used and reused. These textbooks "wear" and "age" with use, and become comfortable and familiar, like a well-used tool.
- **Spatial research papers.** Research findings are not confined to a page, but are represented in a spatial environment that the reader walks through.
- Collaborative **annotation** is a key part of the medium. Just as it is easy for a book to mount the "spatial wall" for its own sake, but to instead provide non-spatial notes and critiques which can inspire such a change.

Writing

Dynamic Authoring

direct manipulation of dynamic behavior

Mode of communication

- Authoring is person-to-media, deliberate, prolonged.

Today

- Words, material — illustrations, films, books — is created by directly manipulating a literal representation of the material.
- Dynamic material is created by "writing code" — directly manipulating symbols. The author sees and manipulates the program, not what it produces. Even those who they give rise to (systems behavior).
- Directly manipulating symbols" is a hallmark that people have been mathematized. Programming is mathematics.

Vision

- The author **sees the dynamic behavior** they're creating, and sees it as they're developing it. — **interface of explanation** — tactile and methodic, like "training" a child, "teaching" a dog, or "coaching" a person.
- The author uses **multiple representations** in parallel — multiple levels on the "ladder of abstraction", multiple instances of abstractions, and the lines connecting them, to keep track of what is happening and why.
- The author expands representations, in forms of understanding — linguistic, visual, tactile, spatial — are in use all of time, all kinds of activities.
- The author creates the material by **directly manipulating representations of behavior and data**, instead of manipulating a structure. Manipulation takes place in the representation.

Rationale

- The increased new form of thinking centers upon creating and exploring dynamic representations. Thinkers must be able to create these representations with as little friction as possible, so the dynamic medium can function as an extension of the mind.

Presenting

Dynamic Presentation

pen and tell

Mode of communication

- Presentation means person-to-group, realtime, prepared audience but improvised details.

Today

- Presentation at a blackboard uses static representations (up to fully flexible, if you go to any distance). Linear and topic, respond to audience.
- A presentation on a computer must stick to the script. All material must be authored in advance, and the speaker is stuck in front, stiltedly, dynamic speaker, if the presentation itself is completely static.
- Static material forces the value item of explanation is the anecdotal narrative — the presenter must be a storyteller.
- Everyone is focused on the **same thing**.
- Everyone can **see** what everyone else is viewing.
- Everyone can **understand** how everyone else is viewing it.
- The focus remains on **participants** — what others are making and understanding — not on the computer.

Rationale

- If this dynamic medium is to be the foundation of a new literacy, people must be able to author **casually and socially**. Authoring shouldn't be "work", it shouldn't require a "mindset", it shouldn't be disconnected from the immediately understandable and multifaceted lives embedded.

Dynamic Stage

conversing with the crowd

Mode of communication

- A stage (in the **spatial environment** in which a presentation takes place.

Today

- The audience sees a generic stage which contributes nothing to the explanation of concepts. The presenter's material does not change with the stage.
- By contrast, a play, even the stage at a bar, where each part of the space serves a purpose in the story, and the actors interacted with. Shows Greek and performance take place on a dramatically-rich stage, and the presentation (imagination is required).

Vision

- This stage is **medium** — a canvas — and **human-made representations** replace nature.
- **Concept space is mapped to physical space**. Different concepts are placed in different concepts. The presenter builds up a conceptual space on a crowd, which is shared and understandable. The audience is then able to interact with discussions. The presenter physically moves around the stage as they switching dynamic behavior. Connections between concepts can be seen as connections some physical space.
- Imagine Alice and Bob. Bob tells Alice he's planning a trip to Paris. Alice pulls up her model of Bob's schedule, and visually inspects possibilities to explore and discuss, as if sketching on a whiteboard. Instead of the presentation being "one floating thing after another", the audience sees a tour through a visible, well-structured space.
- Alice and Bob, in a conversation, can easily incorporate sections and interacts with human-scale dynamic representations. In addition to sketching ideas during the presentation, the presenter can **download environments** contained at hand.

Browsing, discovering, connecting

Dynamic Library

walk through the world's knowledge

Today

- A library is a walkable environment for browsing and encountering knowledge.

Vision

- A library consists of sections of shelves, which convey almost no information at a glance. The assumption is that a book will be "read" over many hours, and books not provide knowledge on any shorter time scale.
- Material provides knowledge at **distance scales**. Of feet-plus (overview of topic), 5 feet, 1 foot. 10 inch (personal reading). In foot-this-details-and-explanation-and-exploration, and 10-inch-I-am-reading-this-and-thinking-about-it. Or 15-seconds-understand-the-gists, 5-minutes-understand-the-gists, 5-minutes-understand-the-gists, 5-minutes