Introduction

Creation and exploration

dynamic spatial media decades before the proper technology exists

We intend for the computing system to be "built in itself" to the extent possible. The system will be designed around the same principles of visibility, physicality, and in-the-world-ness as the media that it supports.

y and will happen in stages. V We cannot set forth a "grand As we come to understand what spatial computing is, the system will gradually ransition from drawing on conventional techniques to being its own

is a means to an end. The goal is a medium for Jated to mathematics, science, and human affairs. understanding systems hypothesis is that the necessary medium can't fit on a computer screen, so the first step is escaping the tiny rectangle.

Manifesto

other windows could appear to persist.

Forty-some years later the ubiquitous virtual location in The Cloud (itself a vessel computer. for dismal illusions--choose from a stable one of these iPad applications is rarefied and beyond. arcane-its macho, brogrammer/beardo techniques could hardly be further from the It is with all this in mind that we at CDG are infantilizing ease of use that is packaged and promoted.

The delicate illusion and metaphor of recede into a virtual "tab" or otherwise dissolve and allow our precious pixels to process a new notification.

The Desktop Metaphor introduced at PARC The revivified old ideas of "Virtual" and in the 70s was a breakthrough. It was "Augmented" Reality both accelerate the nothing more than an illusion, but this illusion illusory stakes. The former proposes to create was foundational for the comprehension and a synthetic world with such fidelity that we may adoption of mainstream computation. In step out of the real, while the latter attempts a short, by employing the Desktop Metaphor, high-framerate, personalized synchronization computer users could believe that their of the virtual on the real. When faced with a documents and applications lived inside a set choice between modifying reality before it of icons spatially arranged on a CRT display. reaches our eyes or cutting it out entirely, we When icons were activated, their contents reject the set-up as a false choice. We wish to would appear in a 2-D "window" with create and co-inhabit with all our senses a simulated occlusion, so that the Desktop and reality larger than our screens and richer than even our imaginations. And if there was something valuable in our word processors and web browsers, we will find a way to bring it Desktop is giving way to the "home screen," into the world. For too long has "computer documents are dissociated from even a interface" meant contorting the human to the

mainframe or the vaporous Desktop), and Our zeal may have us mistaken for retrograde the UNIX shell lives on through TTY fundamentalists. We are zealots. We are emulators as "ground truth" in the networked students of a forgotten past. And we are everage. While cats and toddlers swipe at iPads concerned with the foundational units of our and in some ways computing has never been new world-to-be. But we are pragmatic easier or more accessible, the knowledge prototypers at heart, and we will submit to and expertise necessary to create or modify great pains to catch a glimpse of what might lie

focused on our room. We're tongue-tied to talk about it, because the history of our language and our computer interfaces fixate on metaphor, and we are attempting to transcend personal computing is losing its coherence: mere analogy. When we point at a printout on the pixel-art trash can is now an ill-defined the wall and say that it is code to transform "archive." We seem to be saving everything, laser coordinates, when we point at a glowing and yet when the signal drops out or the chart and say it is the print queue, or when we battery fails we have nothing. Even when we point our laser at an e-mail label, we are not are "online," which is most of the time, the pointing to metaphors or illusions pretending to omnipresent search bar only offers us a be code and documents, we are pointing at the search in the narrowest sense, for we must thing itself. That's the goal at least. It's not a already know a name for what we're seeking. "view" on a git-backed directory. Our room is Never can we see the shape of the whole. not play-acting from a 3-D model we built of Images and text flash onto our screen, but no CDG. If we are still using inode-backed file sooner have they appeared then they must systems and constructing virtual perspective transforms, that is only because we lack the meta-materials and cheap-as-sand circuitry to truly bake our bits into the room.

Principles of Spatial Media Axioms Urges



We Want This

spread out! context and connections (seeing local structure)

shape of the whole, boundedness (seeing global structure)

openness and transparency

parallel representations

single viewpoint

Not This

speech-like

<u>Not This</u>



Physicalit

We Want This

persistent, stable, reliable	
physical, tangible, real	
writing-like	
the real world is the truth	

hands, feeling and manipulating computer input devices direct manip of real-world objects GUI



In-The-Worldness

We Want This

<u>Not This</u>

the room is the computer out and around, moving, looking situated — "here" is not "there" thinking with the body being with real people

sitting and staring cartesian dualism isolation, virtual avatars



A COMPUTING SYSTEM FOR DYNAMIC SPATIAL MEDIA

seeing things in isolation, reliance on memory

amorphous boundless space

black box, under-the-hood

peek-a-boo, ephemeral, fleetin virtual, ethereal, weightless, illusory

the database is the truth

the screen is the computer anything can appear anywhere

References

[filter example]

[representation gallery]

[seeing spaces poster] [unthinkable poster]

[big board] [identity and persistence 2/1 [virtual sprawl]

References

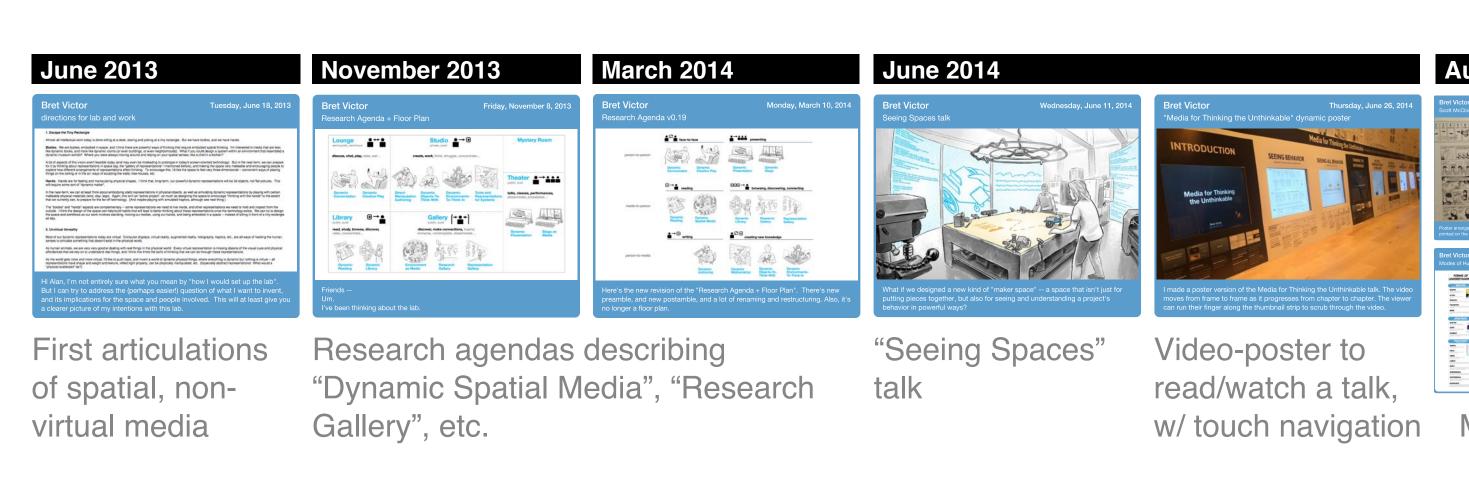
[identity and persistence 1/31] [virtual sprawl] [identity and persistence 1/31]

References

[dynamic spatial media] [dynamic environments-to-think-in] [identity and persistence 1/24] [brief rant end]

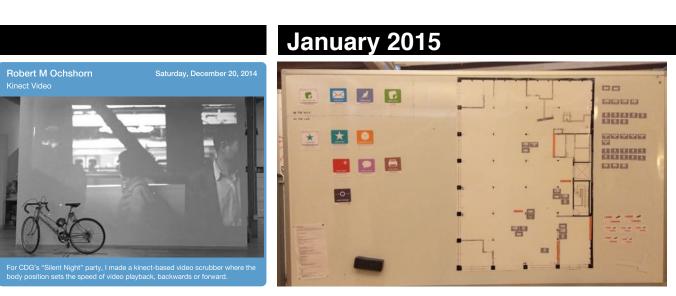
[identity and persistence 2/1] dynamic creative play]

History of Spatial Thinking at CDG

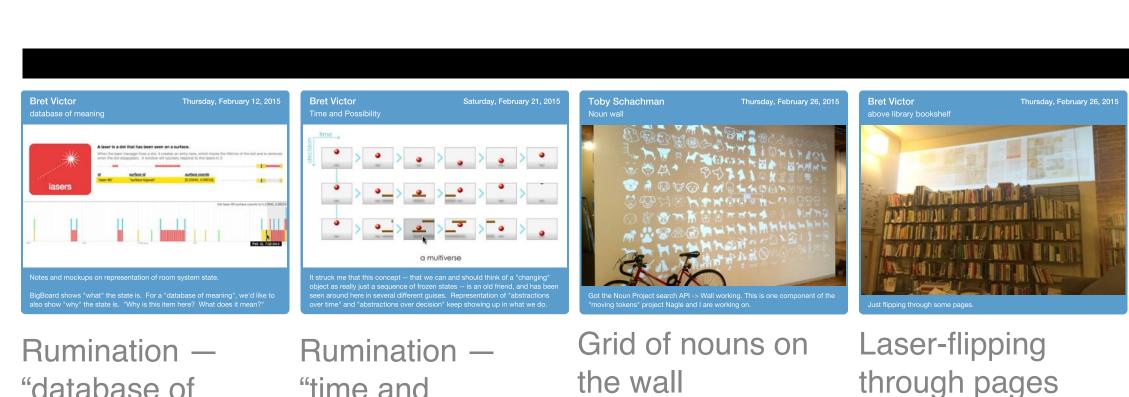




with movement of the body



the body system.



database o meaning" possibility

Proposal for a camera-projectorcomputer box World"

in a poster comic



-Typercard in the with dynamically- by placing a block World" running, highlighted books in a location built in itself (v2)

Laser-selecting

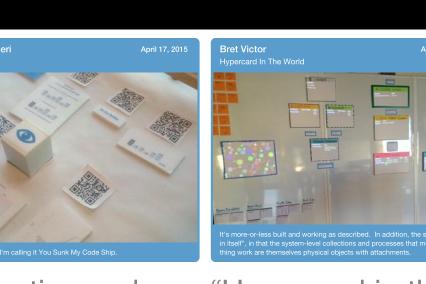
books on a shelf

April 2015

Proposal / spec for Navigating video Navigating code "Hypercard in the Ceiling archive of

above bookshelf

and respond to lasers.



processes" that can project "windows" on "surfaces"

art exhibition

retractable posters email archive

June 2015 La Case Hinshi Sakaguchi Austin Peralta

whiteboard comic to add to

Research gallery documentary

Proposal to use

) is up and running, with

in sync



Lunch table "Why Big Box? touch display Who's Chipper"

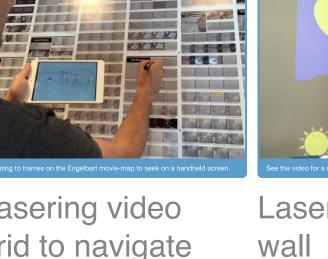
Navigating a video Rumination -

by lasering panels "virtual sprawl"

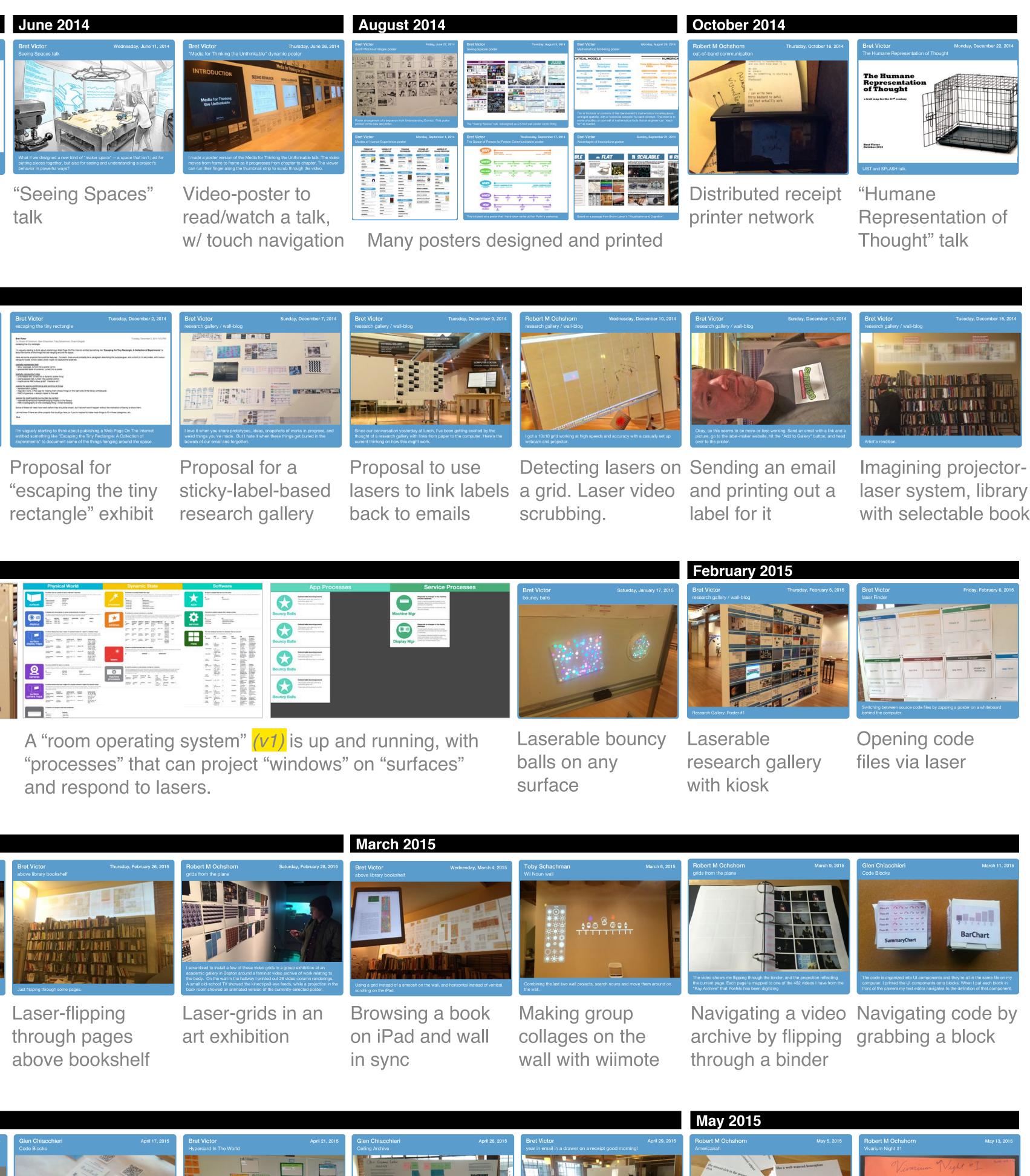
make sounds video on iPad

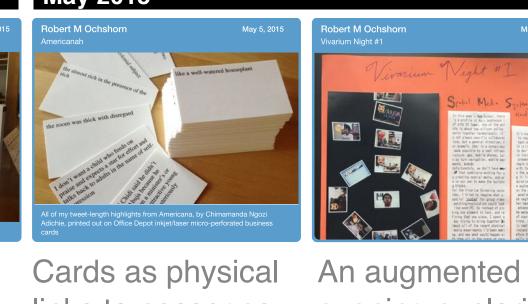
Lasering video lasered animals grid to navigate wall

projector



tools for discussing a book palette





links to passages evening exploring

a video archive

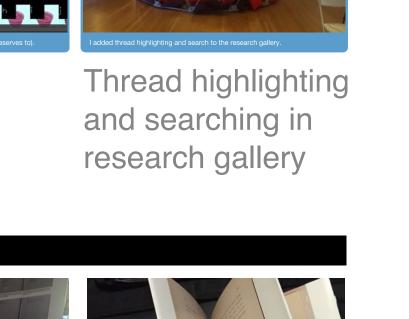
Poster context for Recognition of

icon tiles

in a book



Wall painting with Physical token Codex play-doh color with files virtually attached

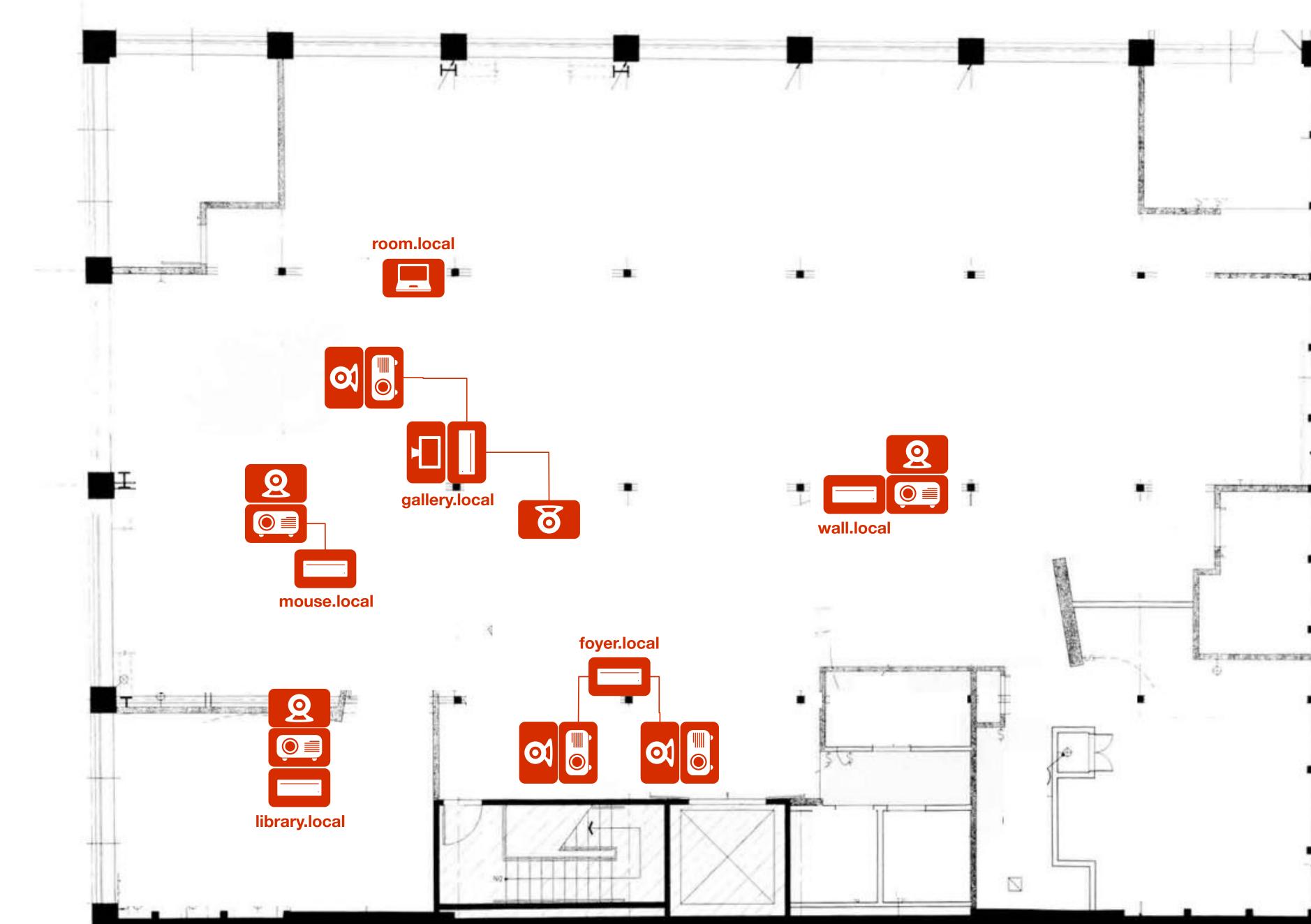


seeing spaces poster



HINGS THAT HAVE BEEN MADE IN "HYPERCARD IN THE WORLD

HARDWARE LAYOUT



Current Status as of July 2015

serengeti

NUMBERS OF THINGS

6 Macs, 6 projectors, 7 cameras

379 physical objects (18 root objects, 361 contained objects) 951 attachments

44 code attachments (18 daemons, 26 illuminations)

58 running processes (17 active daemons, 28 active illuminations, 13 machine processes)

30 code things "outside the system" in the filesystem (20 modules, 10 web apps)

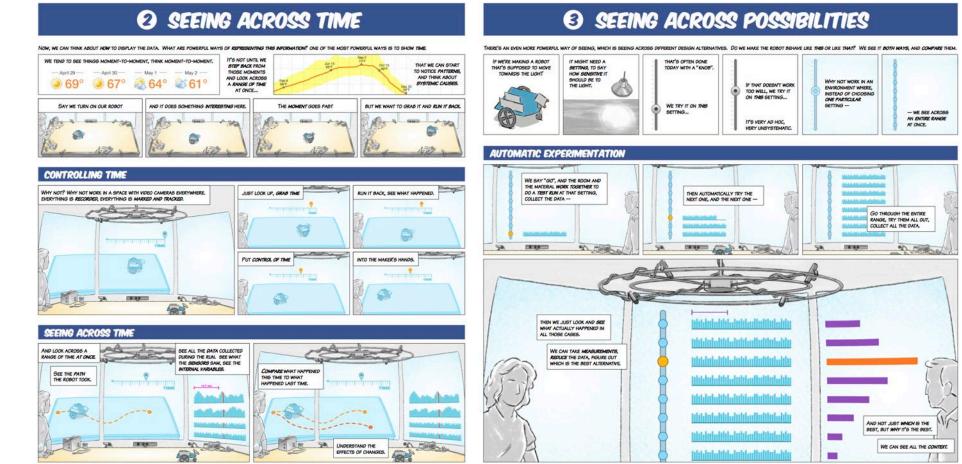


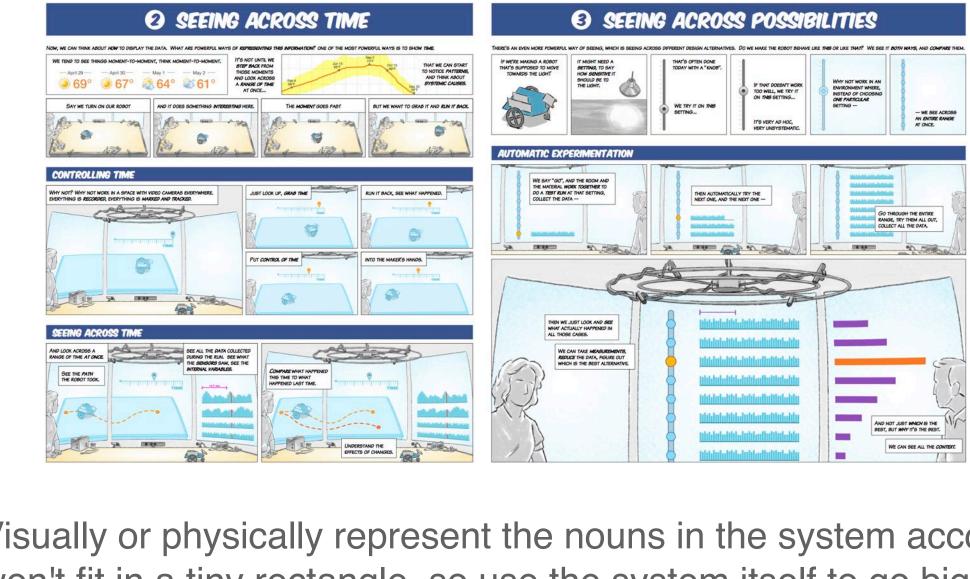


wall painting













Significantly build out the equipment. (100's of projectors/cameras/etc)

The goals are to get "programming" out of the tiny rectangle, and to eliminate "code" to the extent possible. Perhaps "programming" by direct manipulation of large-scale objects and tangible, physical objects, using the hands and the body, etc.

Use the concepts and infrastructure from the previous phase to expand directmanipulation verbs beyond just programming the system itself, to creating dynamic behavior more broadly. This gets into the verb-oriented agenda items, such as -







Roadmap Goals Visions

tainly won't develop as described here. This roadmap is just another way of trying the

1 APPLICATIONS (escaping the tiny rectangle)

Build the "escaping the tiny rectangle" exhibits, using "Hypercard in the World".

Relevant research agenda items include —

Dynamic Library	Research Gallery	Representation Gallery
		

2 **SYSTEM** (nouns)

nplement a data model oriented around space, time, and possibility.

Visually or physically represent the nouns in the system accordingly. This probably won't fit in a tiny rectangle, so use the system itself to go big and spread out.

Build out the equipment as needed. (10's of projectors/cameras/etc)

3 **APPLICATIONS** (nouns)

Use the capabilities implemented in the previous phase to make would-havebeen-impossible spatial applications, particularly Seeing Spaces-like spatial "time and possibilities" representations.

Play with applications related to the noun-representation-oriented agenda items, such as -

Dyn Spatial Media	Dynamic Stage	Dynamic Library	Dynamic History
			
 Wakable environments that are published and downloaded, as websites are today. Knowledge material that is "watal" pysicily and a significant antemporter to a maxem galety, both inferens studying, organing, espatial lettbocks. A percent learns linear job yeaking through human-scale environment and interacting with inferens studying, organing, espatial lettbocks. A percent learns linear job yeaking through human-scale environment and interacting with programs through objects. The learner programs through the space as the resel of understanding and add line programs, they proprising through to durins of a significant of a significant of additional and scale organizes, through a subject three learners are tor gasting in model by understanding of a subject. These interactions display, additional display, built environment that is meat waken through. Spatial research papers. Scientific throngs are published as physical environments that the mader wake through. And so on. The could so the space as the transition is applied in a server the "spatial web" for its own sake, but to invest powerful new representations of throught which may require such a medium. 	 The stage is a medium — a carva — and participates in the presentation by losting luman-scale representations. Concept space in reapent to physical space. Different areas of the stage represent different concepts. The presenter builds up a conceptual space and a violate space in parallel, and non-magnetism in that space which discussing. The presenter physical proves atrauch the stage as the message moves between typics. Conceptual carva conceptual car be seen a connections across physical space. The addition of the presentation between concepts can be seen as connections across physical space. The stage of the presentation is mainted in the logical of the stage. All states, the addition can be wheth the presenter has already through a vibib. we discuss the state of the presentation being "one flexing" to the state. All states of the states are already through a vibib. The stage is a dynamic medium, and the present states and integration and the states and integration is a state of the presentation being space during the presentation, the presenter can download environments authored at home. 	The branches of knowledge are represented by distinct areas that field inviting, approachable, and campting, like the lands at Binnydard. Simply walking around the space gives one an abase grounding in anthropology, and invites deeper exploration. Wandhring into the Anthropology action gives one a base grounding in anthropology, and invites deeper exploration. Material provides involvedge at all distance actives: 12 feet any (organized provides involvedge) and from the generation of the space of the	

Become familiar with thinking in room-scale nouns.

4 SYSTEM (verbs)

Represent behavior by direct manipulation of noun representations.



5 **APPLICATIONS** (verbs)



PHYSICAL INTERFACE

Detect and parse voice Detect laser identity / buttons Scan walls and objects

Actuate and move objects Print or fabricate objects

High-resolution illumination

We'd like to do these in the long term.

should be better engineered.

Very long term.

METAPHORS

Morph objects

Attachments, ins nstead of virtual filesystems and databases. Computational processes and data collections are virtually attached to physical objects.

Responding to the environment, ir istead of messaging. Processes are ordinated not by direct communication, but by influencing the physical state (e.g moving) or virtual state (e.g. adding data to a collection) and observing such changes around them.

Seeing the world, instead of querying a database. Objects look around themselves in space and time, and notice changes of interest. Objects see each other.

Dynamic ether? Perhaps the space between objects (the air, the background or "game board") can run processes and hold data.

WORLD MODEL

Literally global. ry object on earth can be can be referenced with a unique id.

Gracefully incomplete. The real world is truth. The computer's model of the world is necessarily incomplete, and perhaps even inferred probabilistically.

Query across space. O Objects can see other objects. Queries can involve spatial scope and orientation.

Objects can see everything that has ever been. Queries can Query across time. O involve temporal scope, or can operate over time (like signal processing filters).

Query across possibility. Objects can fantasize. Queries can involve simulated future scenarios in parallel worlds.

Provenance and influence. Where did this data come from, and where did it go? It should be possible to reconstruct an entire chain of events.

First-class people? Perhaps a person should not be an "object".

INTERPRETER / RUNTIME

in the STEPS sense. Can be looked at and understood. Simple implementation, in Perhaps realized physically.

Flexible. Instead of provisions for anticipated features, the language should allow features to be added as their need is recognized.

Instant update. One can make fluid code changes (e.g. dragging a slider) and the process should update immediately and fluidly.

Full control. We can change the runtime into what we want.

Inspectable. We can see and visualize the inner workings of the interpreter.

FFI? We need some way of incorporating foreign code when necessary.

LANGUAGE

First-person objects. The author thinks from the perspective of the object.

First-class space, time, and possibility. The author thinks in terms of what the object sees, has seen, and could see.

Evocative queries. Query syntax is not "blind", but is written or performed in the context of what is being queried.

Images, graphs, etc., can be part of the code. (And not merely as Richer than text. comments.)

Directly-manipulable. The language is designed for making continuous changes

Transition path away from screen. Towards programming by manipulating