

# **What Is Bret Victor Trying To Do?**

Antti Halme

Frequency  
05 March 2020

# Agenda

- Hello, Setup (19:00)
- **Introduction** (19:30-ish)
- Housekeeping
- **Silicon Valley kid, College**
- **Alesis, Apple, information design**
- **Research hobo**  
~break~
- **Towards a humane medium**
- **Dynamicland**
- **Discussion**
- Finish (21:30)



# Resources

**worrydream.com**

***@worrydream***

- *Track Changes #109*
  - *“Computing is Everywhere: Bret Victor and Dynamicland”*
- Carl Tashian’s profile
  - *“At Dynamicland, The Building Is The Computer”*



**Bret Victor**

@worrydream

media for thinking the unthinkable

[worrydream.com](http://worrydream.com)

# Introduction

- Silicon Valley culture and the romantic engineer
- EE → UI → dynamic tools → humane medium
- Principles
- Tools, representations, “unthinkable thoughts”
- Seeing, systems, simulation
- Dynamicland: social computing

# Housekeeping



# Silicon Valley kid

- **Born 1977**
- Grew up in East Bay, California
- Piano at six
- Programming at seven-eight
- Dork/Nerd in high school
- *Magic of technology*

## *Some context:*

1975 — BASIC

1977 — Apple II

1979 — Hofstadter: Gödel, Escher, Bach

1982 — Commodore 64

1984 — Amiga

1984 — Tetris

1987 — 80386

1988 — Korg M1

1989 — Prince of Persia

1989 — Nintendo Game Boy

1890 Vannevar Bush

1950 Steve Woz

1971 Elon Musk

1916 Claude Shannon

1955 Steve Jobs, Bill Gates

1973 Larry Page, Sergei Brin

1925 Doug Engelbart

1960 Tim Cook

1976 Jack Dorsey

1940 Alan Kay

1964 Jeff Bezos, Paul Graham

1984 Mark Zuckerberg

1942 Edward Tufte

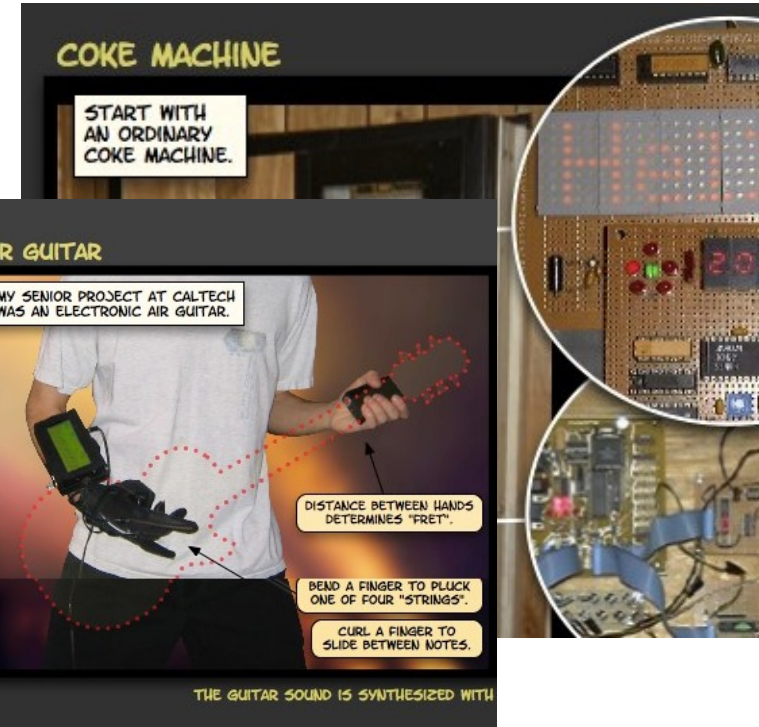
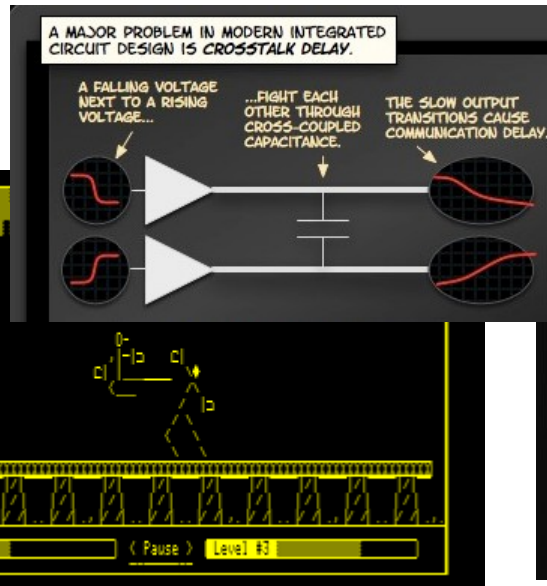
1967 Peter Thiel, Jony Ive

1988 Patrick Collison



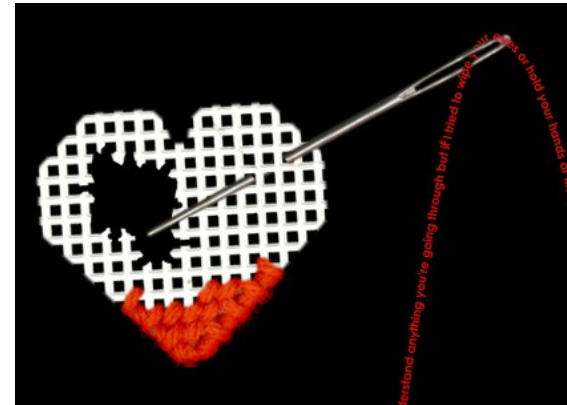
# College

- Electronic Engineering @ Caltech 1995-1999
- EECS Ph.D. programme @ UC Berkeley 99-01
  - Bailed out with a Masters in 2001
  - Drifting 2001-2002



# Culture

- Bret the Maker, Bret the Romantic
  - *"I am what I create. What else is there?"*
- Shumpond – a Berkeley commune
- Californian community ethos, hacker culture
  - Hippie legacy, Whole Earth Catalogue crowd and seedlings
- **Helping people**
  - Engineering with a purpose
  - September 2001





# Alesis (2002-2004)

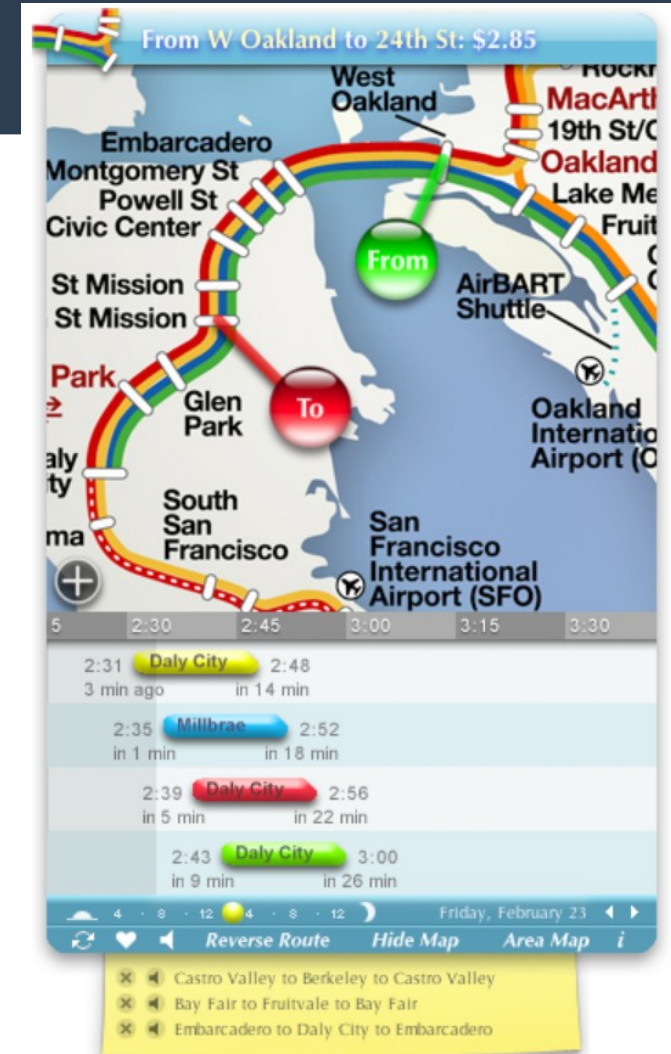
- Alesis, a pro audio maker
  - First job after grad school
- Products: *Ion*, *Fusion*, *Micron*
  - I/F: Sound synthesis engine
  - M: Full design, focus on music making  
→ ***User interface design, creative tools***
- Back to Berkeley (2005)
  - Keyboard startup with a friend
  - Vision of a radically new musical instrument



NOT pictured

# Magic Ink (2007)

- **BART Widget (2005)**
  - A novel UI for a train schedule
- ***Magic Ink: Information software and the graphical interface (2007)***
  - A GUI manifesto
  - Tools and thinking behind the BART widget
  - *“Focus on ‘interaction’ may be misguided.”*
  - *Showing the data, context sensitivity, etc.*
  - Tufte for the computer age
  - (cf. GMaps 2005, Citymapper 2011)



Apple Design Award  
Best Mac OS X Dashboard Widget

Macworld  
Nov 2005



# Apple (2007-2010)

- Experimental hardware platforms and input technologies
  - New user interfaces and application concepts
  - Internal demos to inspire people who would build the end user products
- Secrecy and the realities of corporate research
  - New interests not aligned with Apple's interests



MacBook 2005,  
iPhone 2007,  
iPad 2010,  
Watch 2014



# Research Hobo (2011)

- Living off a train
  - Visiting research groups all over US for a few months
  - “Toolmaker for hire”, a romantic vision
  - Writing essays on the road, from public libraries
  - Publish all that was bottled up during Apple years
- Three research streams
  - “plastic baggies of notes”
    1. *Dynamic Pictures*
    2. *Explorable Explanations*
    3. *Kill Math*



Wyatt Edward Gates - “The ‘digital nomad’ is the modern hobo”

# *Dynamic Pictures* (2011)

- A continuation of ***Magic Ink***
- Parametrisable images
  - “A dynamic picture looks different in different scenarios.”
- Focus on understanding and explanations
- Indirection in the creative process is bad
- Artists, makers, need immediate feedback
- Research language *Substroke* (2007)
  - Functional transform metaphor
  - Parametrisation of dynamic behaviour





# ***Explorable Explanations (2011)***

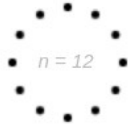
*"People currently think of text as information to be consumed. I want text to be used as an environment to think in."*

- **Enabling active reading**
- *Ten Brighter Ideas* (2010): proto reactive document
  - Reader can play with the premise and assumptions in claims
  - *"A spreadsheet without the spreadsheet."*
- *Tangle* (2011): A JavaScript library for simple document reactivity
  - Value sliders, with hooks to change content accordingly
- *Scientific Communication As Sequential Art* (2011)
  - A classic theory paper reorganised into a comic of sorts
- *Tom Oreb's Portrait of Ward Kimball* (2007): A "comification"

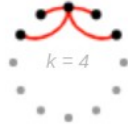
# Explorable Explanations (2011)

**ALGORITHM** To interpolate between regular and random networks, we consider the following random rewiring procedure.

We start with a ring of  $n$  vertices



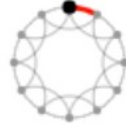
where each vertex is connected to its  $k$  nearest neighbors



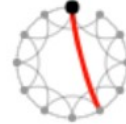
like so.



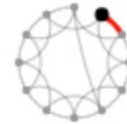
We choose a vertex, and the edge to its nearest clockwise neighbour.



With probability  $p$ , we reconnect this edge to a vertex chosen uniformly at random over the entire ring, with duplicate edges forbidden. Otherwise, we leave the edge in place.



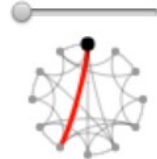
We repeat this process by moving clockwise around the ring, considering each vertex in turn until one lap is completed.



Next, we consider the edges that connect vertices to their second-nearest neighbours clockwise.



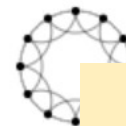
As before, we randomly rewire each of these edges with probability  $p$ .



We continue this process, circulating around the ring and proceeding outward to more distant neighbours after each lap, until each original edge has been considered once.

As there are  $nk/2$  edges in the entire graph, the rewiring process stops after  $k/2$  laps.

For  $p = 0$ , the ring is unchanged.



As  $p$  increases, the graph becomes increasingly disordered.

$p=0.15$



At  $p = 1$ , all edges are rewired randomly.

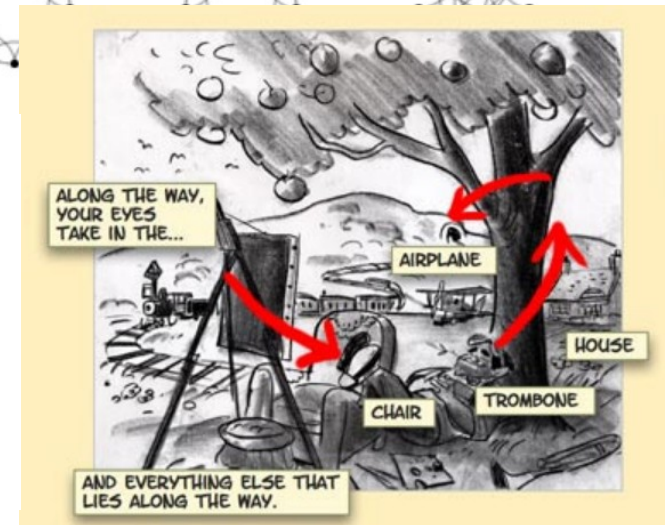


*Analysis:*

Suppose that an extra \$11 was charged to 10% of vehicle registrations. Park admission would be free for those who paid the charge.

This would lose \$36 million (\$31 million from the tax, minus \$67 million lost revenue from admission) for a total state park budget of \$364 million. This is not sufficient to maintain the parks, and 177 parks would be shut down at least part-time.

Park attendance would rise by 34%, to 100 million visits each year.





# ***Kill Math (2011)***

*"Math needs a new interface."*

- Issues with the commonly used mathematics tools
- Yearning for “concrete, visual, tangible, direct” representations
- Imagining the interpretation of abstract symbols – a flawed model
- *Scrubbing Calculator* (2011): a calculating utility for playing around with a free variable in app context
- *Interactive Exploration of a Dynamical System* (2011): an example of a tool for studying a dynamic system
- *Ladder of Abstraction* (2011): a comprehensive treatment of what working in a richer medium could look like
- *Simulation as a Practical Tool* (2009): Early prototype, a *tour de force*

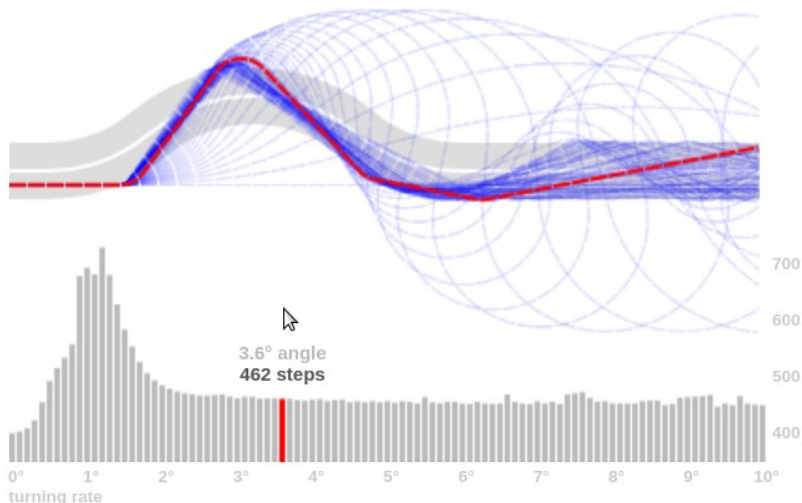
# Kill Math (2011)

## At each step:

Move forward 1 pixel.

If left of the road, turn right by  $3.6^\circ$ .

If right of the road, turn left by  $3.6^\circ$ .

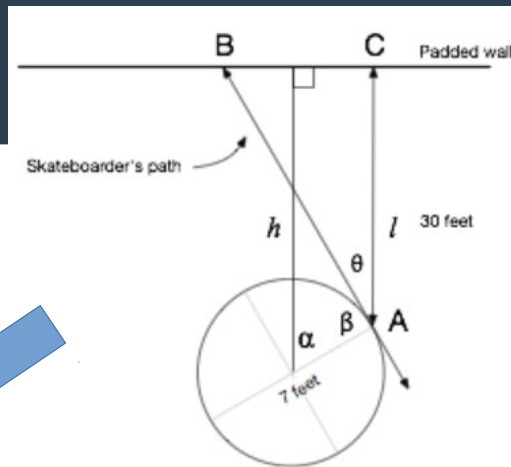
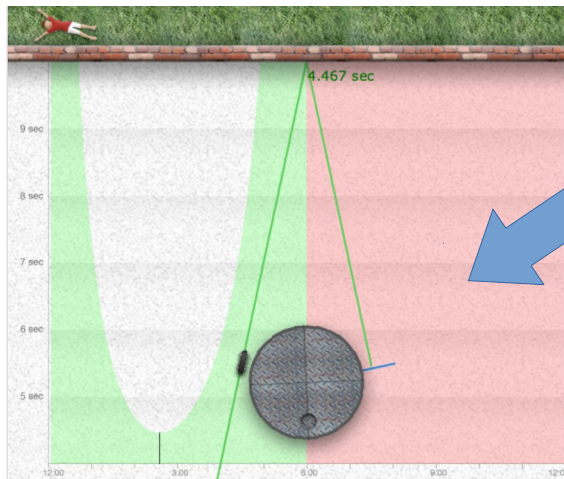


## Unlocking



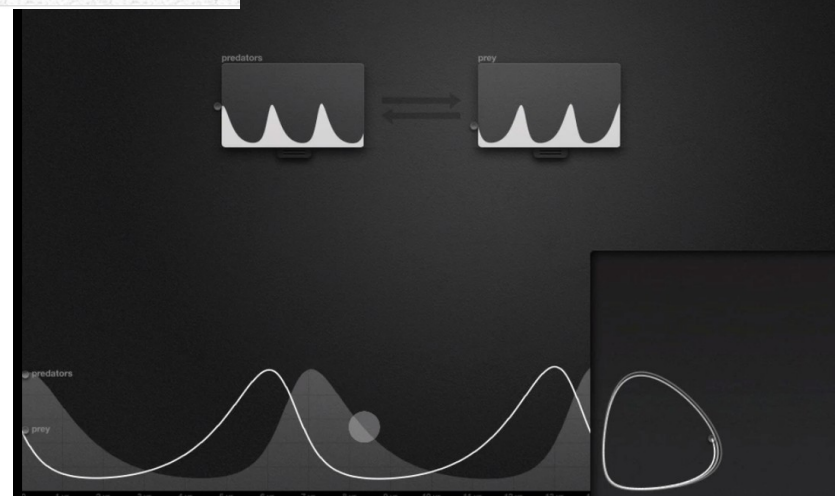
Back to the problem with the bar graph:

$$63 \text{ top margin} + 140 \text{ bottom margin} + 8 \times 20 \text{ gap} + 9 \times 45 \text{ bar height} = 768$$



## Predator/Prey Relationship

The populations of a predator and its prey are dependent on one another. As the predator population grows, they overhunt the prey and the prey population shrinks. The predators then starve and their population shrinks, allowing the prey population to grow back.



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# Towards a humane medium (2012-2014)

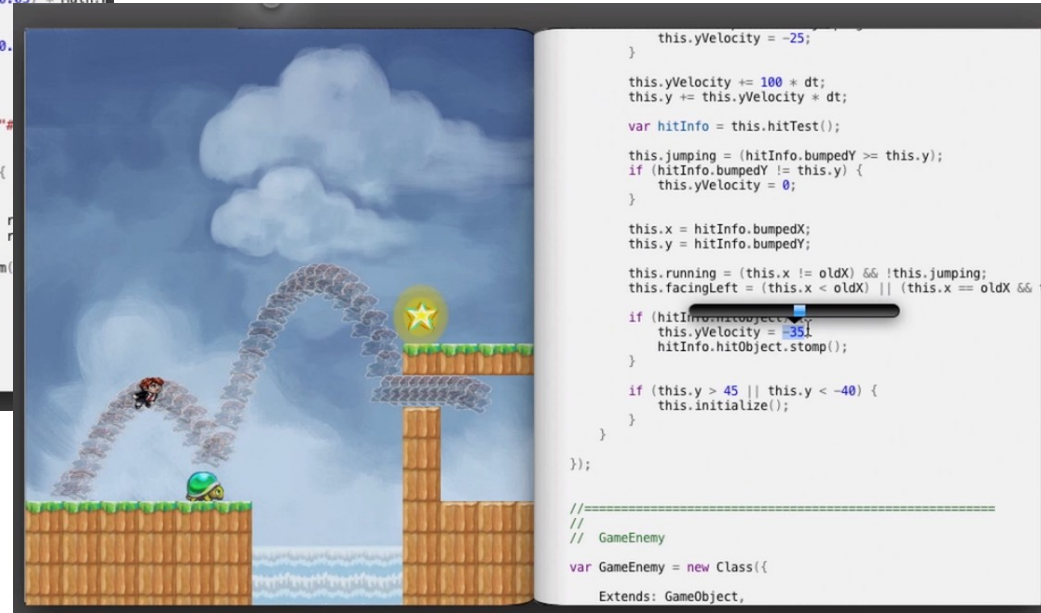
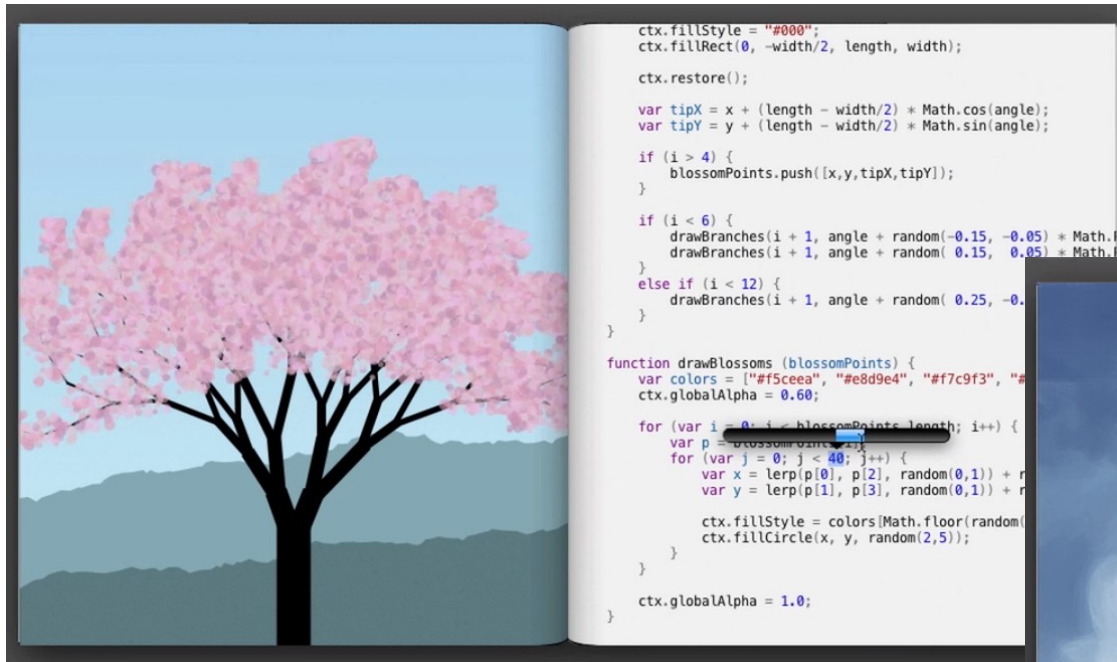
- **Beginning of Victor's independent research career**
- **Internet fame**
- **A series of talks, essays, prototypes**
  - *Inventing on Principle* (2012)
  - *Drawing Dynamic Visualisations* (2013)
  - *Stop Drawing Dead Fish* (2013)
  - *Media for Thinking the Unthinkable* (2013)
  - *The Future of Programming* (2013)
  - *Learnable Programming* (2012)

# *Inventing on Principle* (2012)

*"I followed my principle, and it guided me to what I had to do."*

- **Post-Apple Enlightenment**
- ***Principles* as guide to a professional career**
- The principle behind Victor's research
- Other people's principles, your principle
- Examples, which proved to be *too amazing*
  - Demos were so incredible that people missed the point of the talk!
  - Everybody jazzed about *immediate feedback*

# Inventing on Principle (2012)



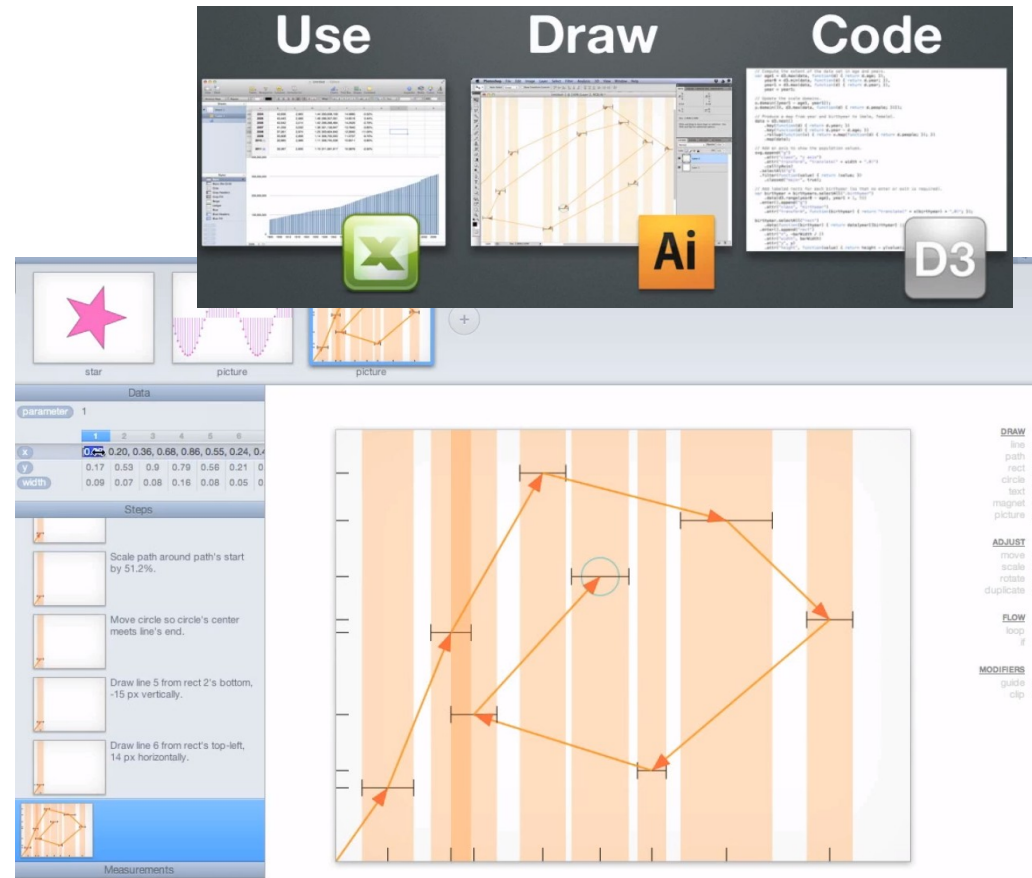
*“Creators, authors, need immediate feedback”*



# Drawing Dynamic Visualisations (2013)

"Every thought can have its own unique picture."

- Spreadsheets, drawing, code
  - Each useful for *something*
- Being limited to one at a time is restricting, a limit on the thoughts people can think
- Dynamic Drawing
  - Drawing data parametrisable visualisations



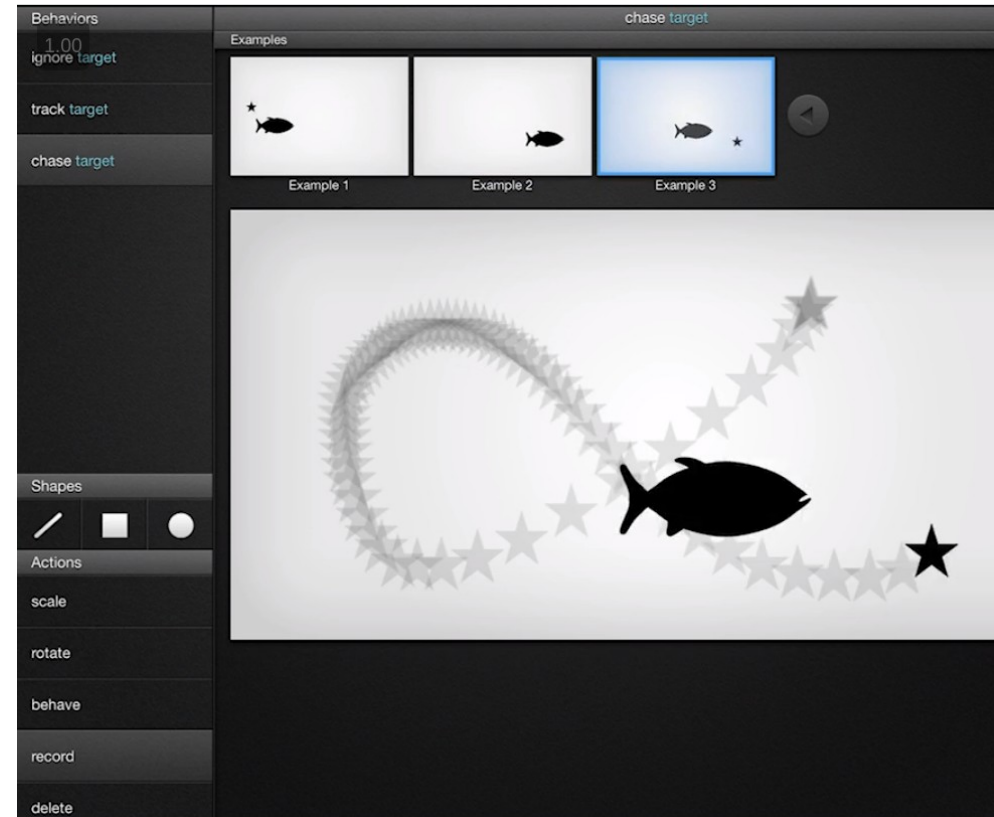


# ***Stop Drawing Dead Fish (2013)***

*This is not a fish.*

- Talk aimed at creatives
- Demonstrations of dynamic behaviour in creative tools
- Simulation as expressive tool
- The computer as an art medium

*“In this medium, this [silhouette still] is a **terrible** representation of a fish.”*



# ***Media for Thinking the Unthinkable (2013)***

*"Our representations are how we understand a system."*

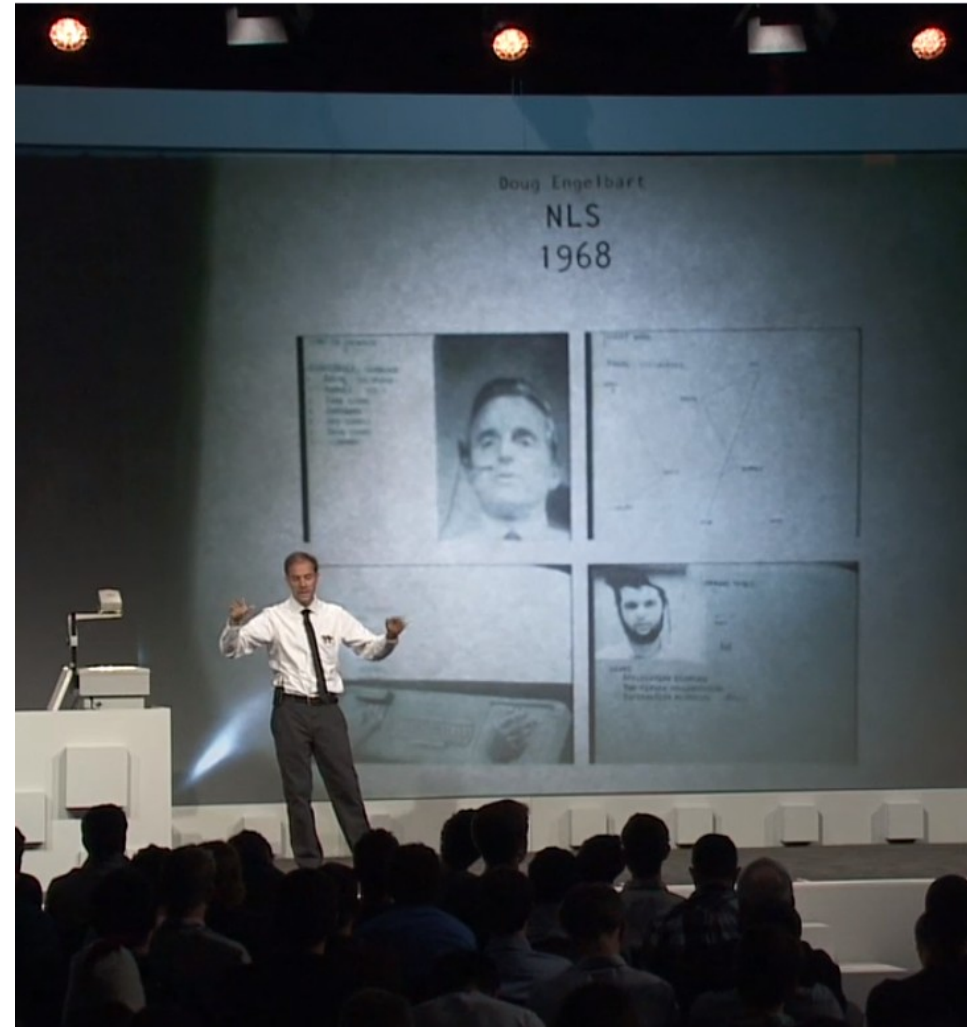
- A manifesto for new tools, **a whole new medium** for expression and use in thinking/science/engineering
  - For a deeper understanding, for unthinkable thoughts
  - Tools beyond what pencil and paper maths have to offer
- **Seeing behaviour:** show the system in action
- **Seeing the entire behaviour:** see all variables at once
- **Multiple representations:** Explorable Explanations
- **Interact with behaviour:** *transformations, behaviour search*
- **Linked representations:** *documentation and artefact*
- **Creating representations:** Dynamic Drawings

# *The Future of Programming (2013)*

- **A history lesson, *a rant***
- **Latest research in software systems and programming techniques**  
...from the 1960s

*"We don't know what programming is."*

*"The most dangerous thought you can have as a creative person is to think you know what you're doing."*



# ***Learnable Programming (2012)***

- **Programming is a way of thinking, not a rote skill**
  - Support and encourage powerful ways of thinking
- **People understand what they can see**
  - Programmers need to see and understand program execution

**Trip with no context**

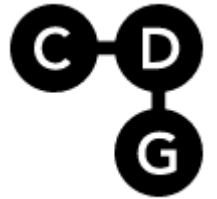
Start at 20th St. and Harrison St.
Go north on Harrison St.
Turn right onto Grand Ave.
Turn right onto El Embaracadero.
Turn right onto Lakeshore Ave.
Continue to Brooklyn Ave.

**Trip with context**



# CDG, HARC (2014-2018-??)

- Get the band together with Alan Kay in 2014
- Fickle Funding
  - German software giant SAP seed funding
  - “Communications Design Group”
  - Y Combinator, Sam Altman → HARC
  - Oakland location
- Foundations of Dynamicland
  - Research and prototypes, **RealTalk**
- **Seeing Spaces (2014)**
- **The Humane Representation of Thought (2014)**



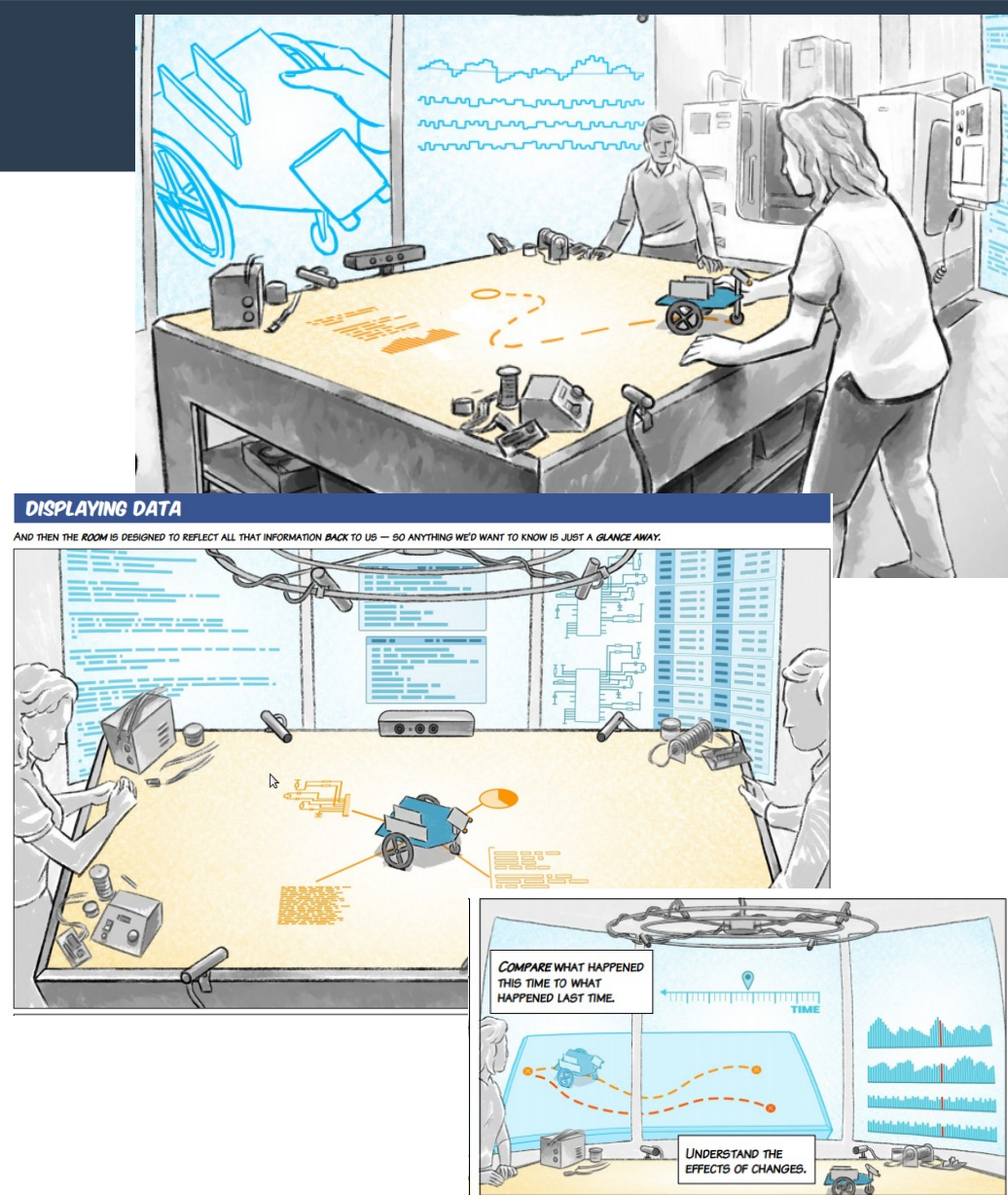
**HARC**

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# Seeing Spaces (2014)

- A **vision** for a new kind of work environment
  - **An augmented maker space**
- Focus is on seeing *into* systems and behaviour
  - Tools for deeper understanding
- For engineers, designers, creatives, craftspeople
  - Inherently social enterprise
  - Shared power tools
- Ubiquitous sensing and data visualisation, dynamic controls
  - Record, replay, rewind live runs



# ***The Humane Representation of Thought (2014)***

- **Bret Victor's vision for the future**

- The most complete articulation of what Bret Victor is about
- An outline for a research programme for the next few decades

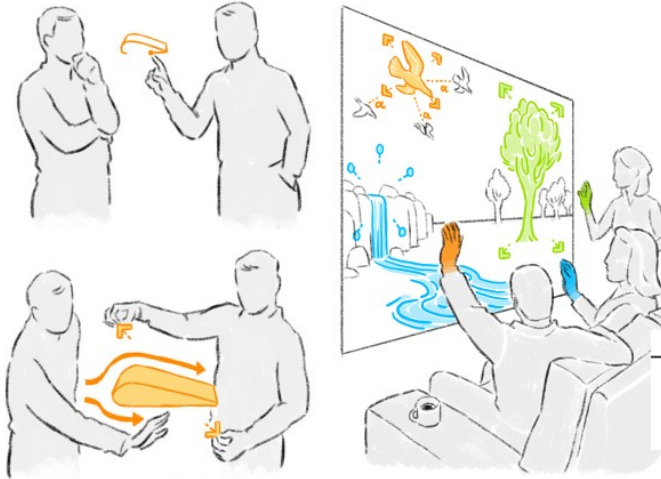
*"An attempt to unearth the demons that have driven my work over the last decade, and to draw a map of the destination they're trying to get to."*

- A dynamic medium is now available, but we are missing dynamic representations  
→ Reinvent the way we represent thought
- **Bring each mode of human communication into the dynamic medium**
  - Let people use their whole body to think, to understand
  - New tools for new thoughts



# The Humane Representation of Thought (2014)

## Face-to-face



**Dynamic Conversation**  
I see what you're saying

**Dynamic Creative Play**  
friends, drinks, and dynamic authoring

## Reading

**Dynamic Reading**  
this is not a printing press



**Dynamic Spatial Media**  
books you walk around in



## Writing

**Dynamic Authoring**  
direct manipulation of dynamic behavior



## Creating new knowledge

## Browsing, discovering, connecting



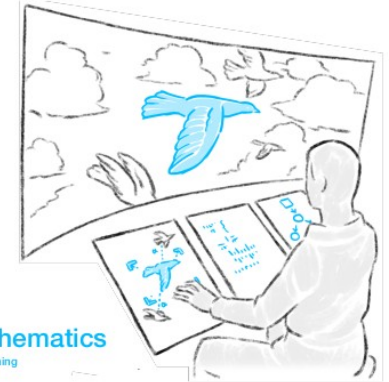
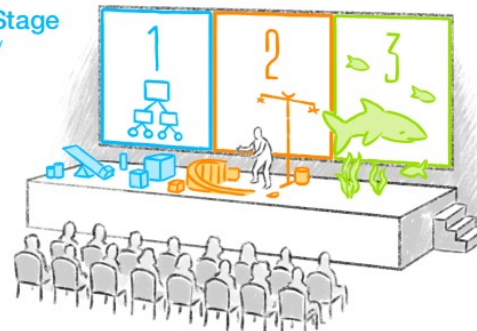
**Dynamic Library**  
walk through the world's knowledge



**Dynamic Environments**

**Dynamic Stage**  
explaining with the body

## Presenting



**Dynamic Mathematics**  
the direct manipulation of meaning

# ***The Humane Representation of Thought (2014)***

***VIDEO***

***The first few minutes of  
The Humane Representation of Thought***

# Dynamicland (2018-)

*"The whole building is the computer."*

- A new kind of **research space** for inventing and exploring a shared computational medium
  - **Bret Victor's research laboratory**
- A *communal computer*, a human scale computationally enriched physical environment
- Facilitates intrinsically **humane** ways of working *within* the dynamic medium
- Powered by **RealTalk**, a novel programming model
- In Oakland, California

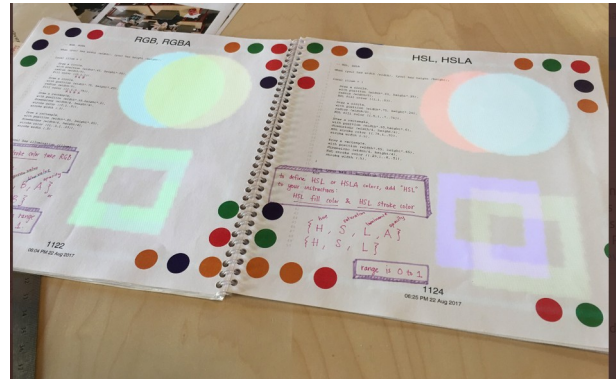
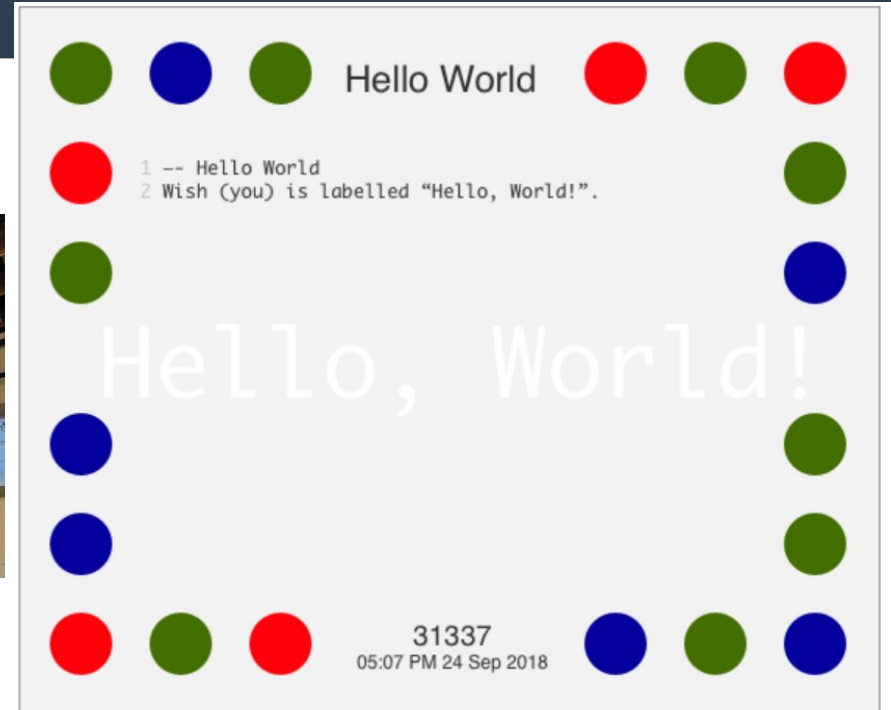
# Dynamicland (2018-)



Toby Schachman  
@mandy3284



Getting the program out of the screen and on to the table helps us learn from each other @Dynamicland1



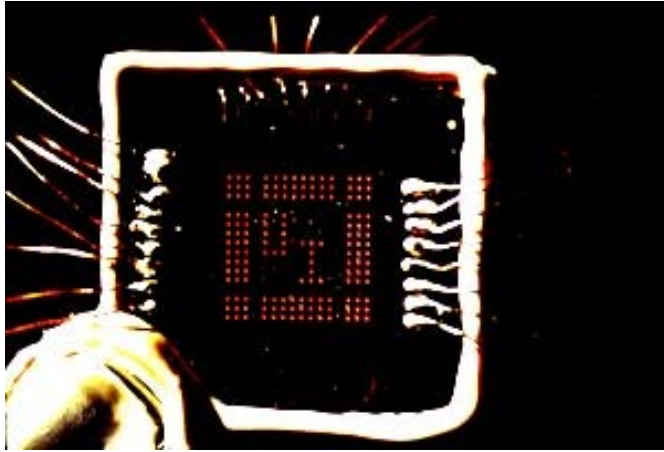
What Is Bret Victor Trying To Do? — Antti Halme



# Conclusion

- Bret Victor is trying to:
  - Share the magic of computers and dynamic media
  - Help people, do engineering with a higher purpose
  - Build creative tools for human expression
  - Allow people to see and understand, through insightful representations and humane interfaces
  - Provide direct manipulation and immediate feedback
  - Liberate us from constraining tools and bad ways of doing
  - Encourage active reading and informed discourse
  - Reinvent the way we represent thought
  - Build career around a guiding principle

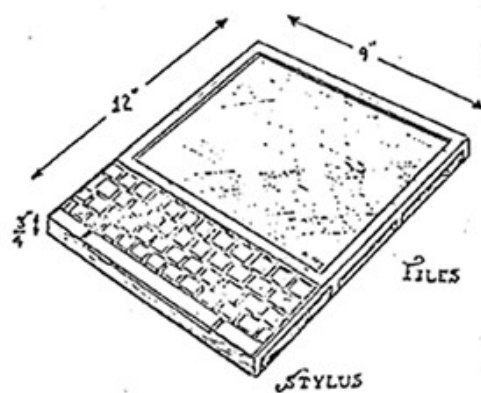
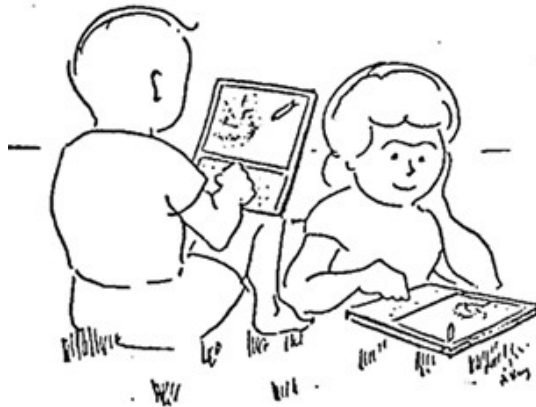
# Epilogue



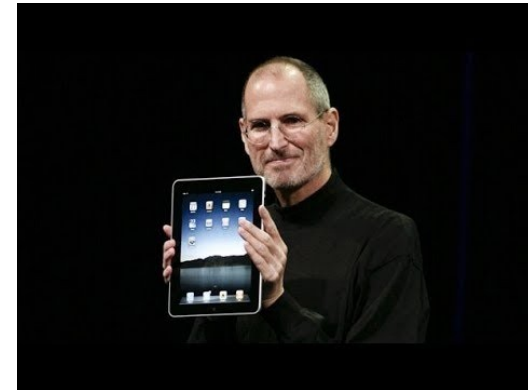
*"In **1968** — three years before the invention of the microprocessor — **Alan Kay** stumbled across Don Bitzer's early flat-panel display.*

*Its resolution was 16 pixels by 16 pixels — an impressive improvement over their earlier 4 pixel by 4 pixel display.*

*Alan saw those 256 glowing orange squares, and he went home, and he picked up a pen, **and he drew a picture of a goddamn iPad.***



2010



# Questions

- What is your interest in Bret Victor's research?
- What's the big idea?
- Why is Dom Cummings / No10 interested in Seeing Spaces?
- What implementation challenges can you see?
- Is Victor just “an idea guy”?
- “A library for the 21<sup>st</sup> century” – what happens there and who will be doing it?
- Is Victor right? Is modern computing inhumane?
- Will anything come out of this research?