Carnegie Mellon University

RUBY: **R**eminiscing about **U**ser interfaces by **B**rad over the **Y**ears

Brad A. Myers
Human-Computer Interaction Institute
School of Computer Science
Carnegie Mellon University
http://www.cs.cmu.edu/~bam
bam@cs.cmu.edu

40th Anniversary!

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Carnegie Mellon University

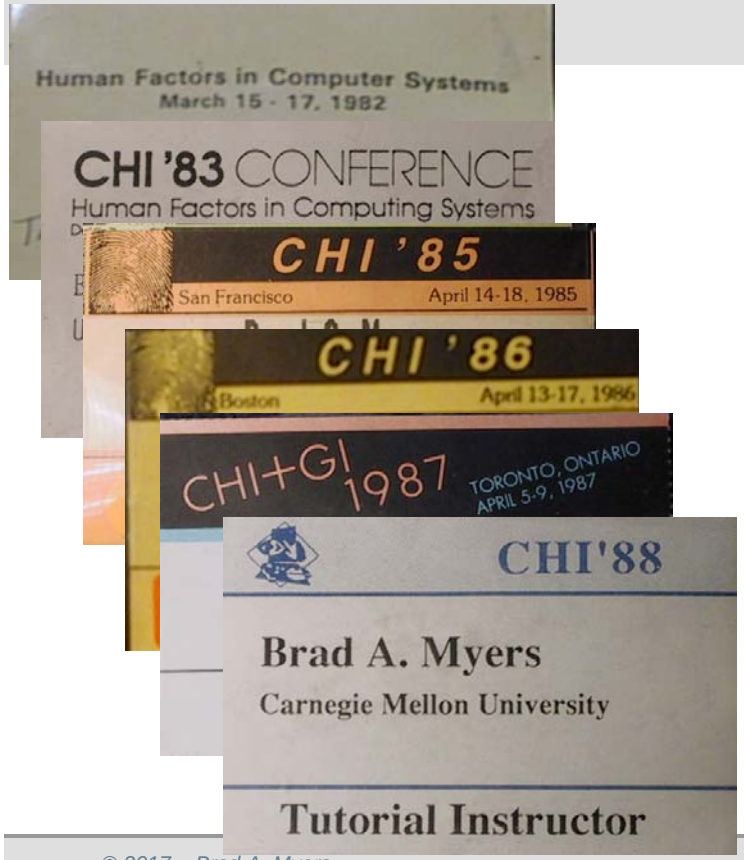
RUBY

Reminiscing about
User interfaces by
Brad over the
Years

Human-Computer Interaction Institute
Carnegie Mellon University

35 CHI conferences: 1982 - 2017

Human-Computer Interaction Institute
Carnegie Mellon University



Lots of Badges

Human-Computer Interaction Institute
Carnegie Mellon University

35 CHI conferences: 1982 - 2017

Human-Computer Interaction Institute
Carnegie Mellon University

Conference ribbons

1990

(Thanks to Ben Shneiderman for the picture)

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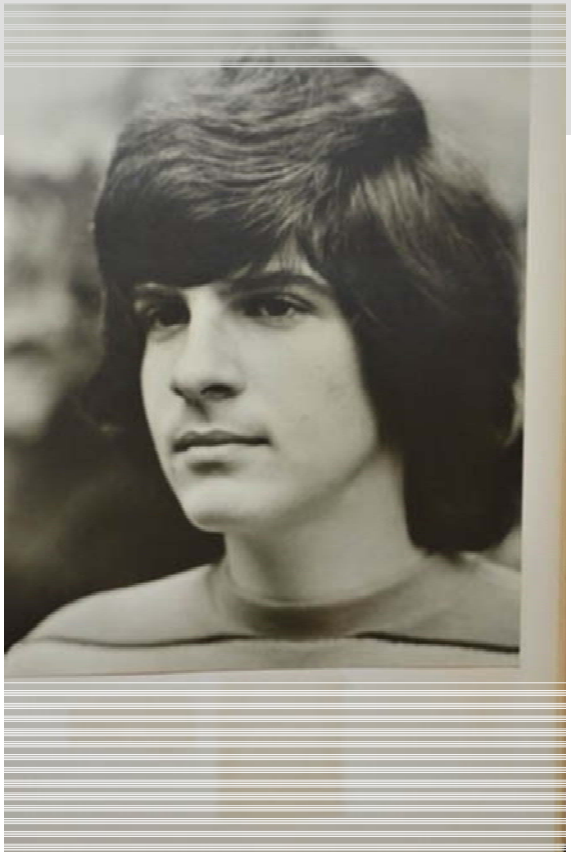
Baby me

Brad with Hair



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Nerdy me

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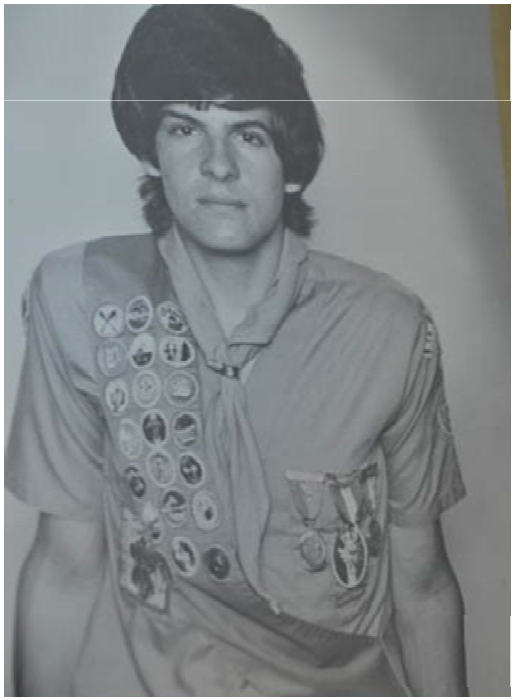
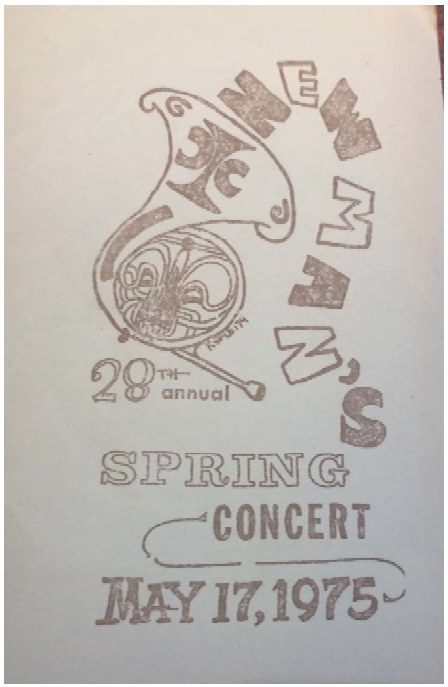
Carnegie Mellon University





~1974 - Teletype

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```
5 LET S = 0
10 MAT INPUT V
20 LET N = NUM
30 IF N = 0 THEN 99
40 FOR I = 1 TO N
45 LET S = S + V(I)
50 NEXT I
60 PRINT S/N
70 GO TO 5
99 END
```

By Jamie - Flickr: Telex machine TTY, CC BY 2.0, https://commons.wikimedia.org/w/index.php?curid=19282428

MIT

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Observations

- Brad is really old…
- If you don't keep stuff, you won't have it 40 years later!

Spatial Data Management System (SDMS)

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- ~ 1977
- MIT Architecture Machine Group
  - Predecessor of MIT Media Lab
- Undergraduate research

Christopher F. Herot, Richard Carling, Mark Friedell, and David Kramlich. 1980. A prototype Spatial Data Management System. In *Proceedings of the 7th annual conference on Computer graphics and interactive techniques* (SIGGRAPH '80). ACM, New York, NY, USA, 63-70. DOI=http://dx.doi.org/10.1145/800250.807470

Xerox PARC

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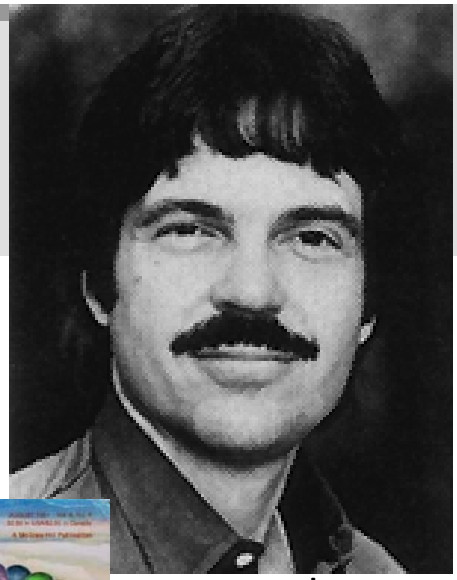
- Important research lab
- Summer intern

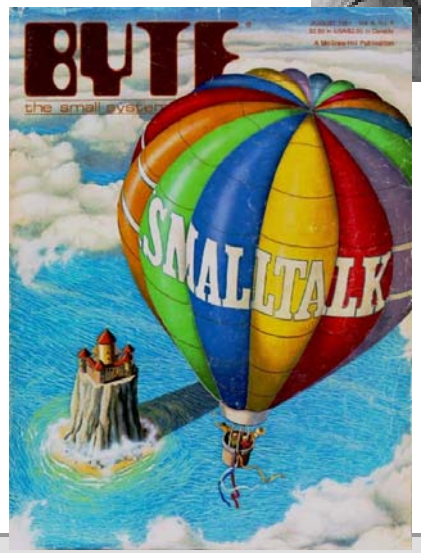
Picture credit: http://www.digibarn.com/collections/locations/xerox-parc/

Smalltalk group at PARC

- Summer 1977
- Systems Sciences Lab (SSL)
- Alan Kay
- Also: Dan Ingalls,
  Adele Goldberg,
  Ted Kaehler,
  Bruce Horn, etc.

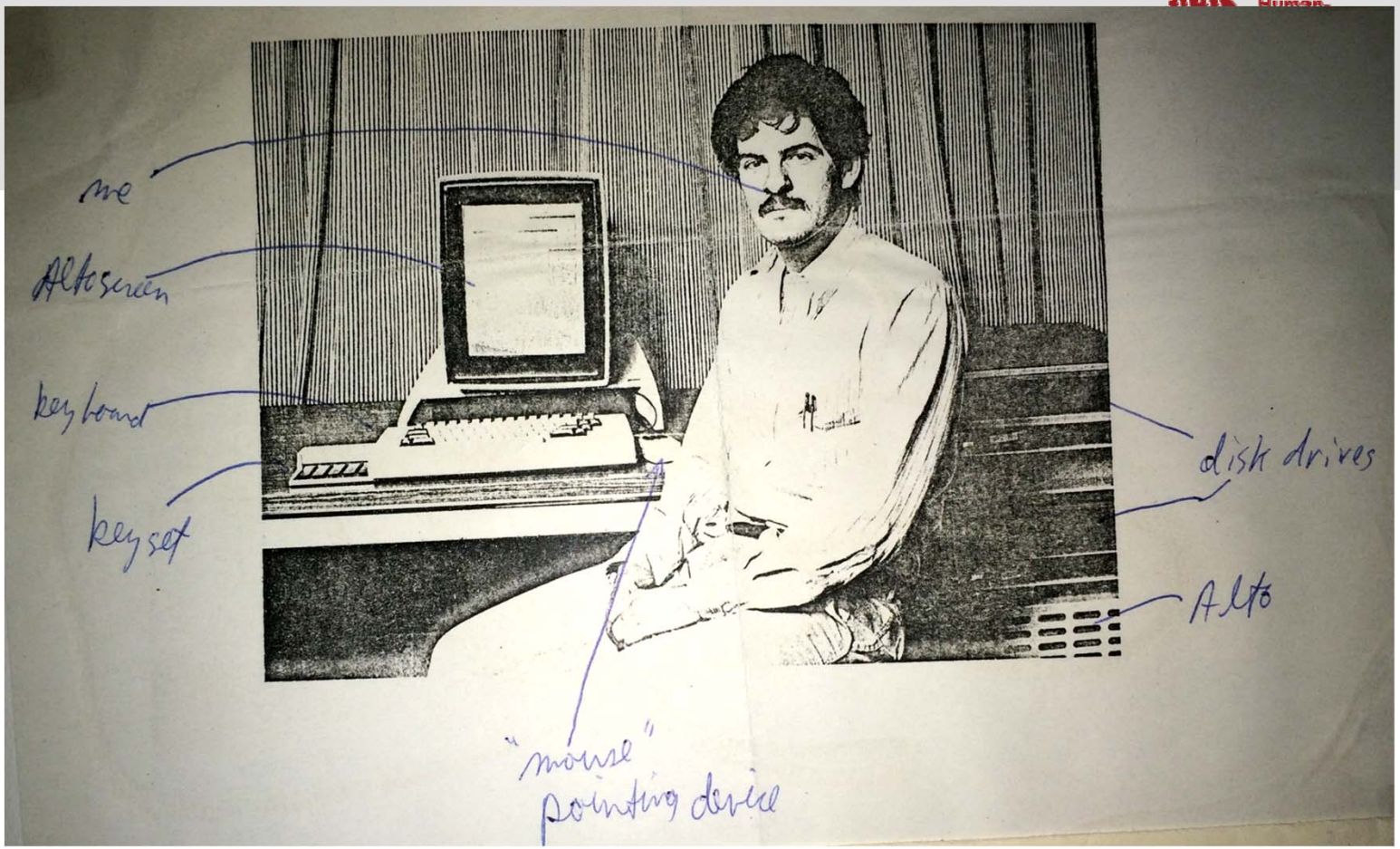


Alan Kay



Xerox Alto

- 1979



Computer Sciences Lab (CSL) at PARC

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- Summer 1978
- Summer & Fall 1979 – Master's Thesis
- Used the "Mesa" programming language
- Advised by: Dan Swinehart (PARC) and David Reed (MIT)
- Helped by: John Warnock, Ed Satterthwaite, Butler Lampson, Warren Teitelman, Bill Paxton and Paul Rovner

Incense

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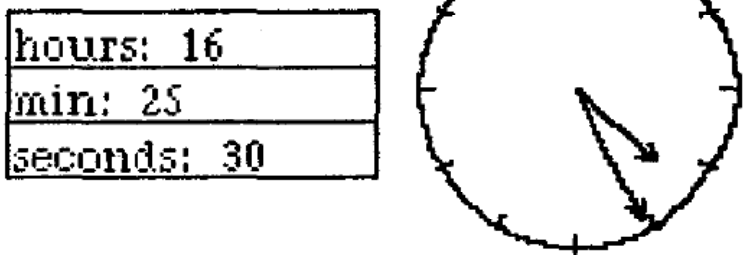
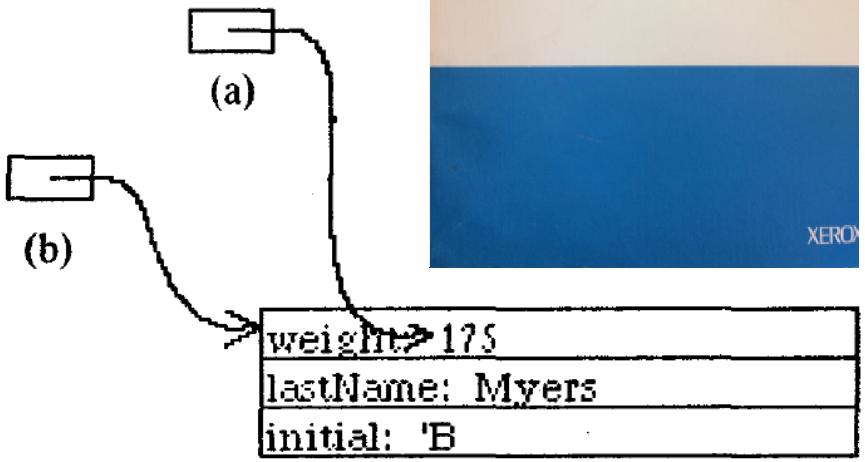
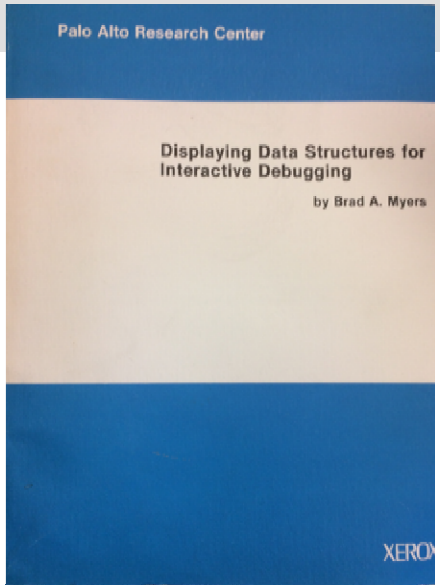
- Displays data structures similar to how they might be drawn on a blackboard
- Customizable





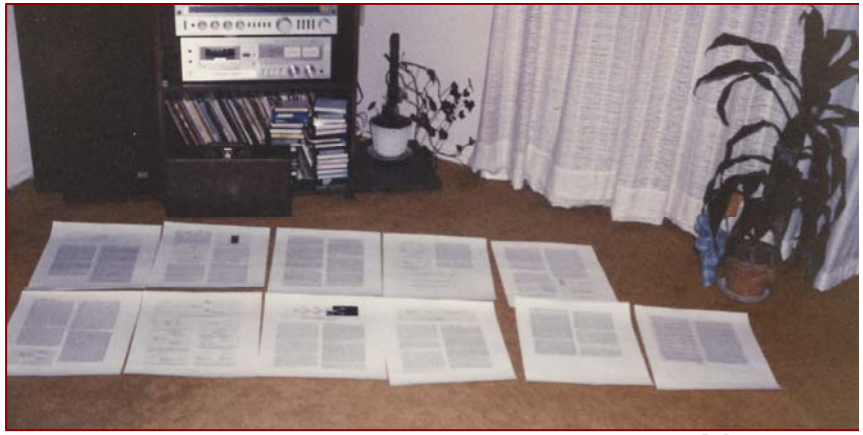


SIGGRAPH'83

Computer Graphics Volume 17, Number 3 July 1983

INCENSE:
A SYSTEM FOR DISPLAYING DATA STRUCTURES

Brad A. Myers*
Xerox Palo Alto Research Center, California



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Observations

- It's better not to write out and read a talk.

Three Rivers Computer Corporation

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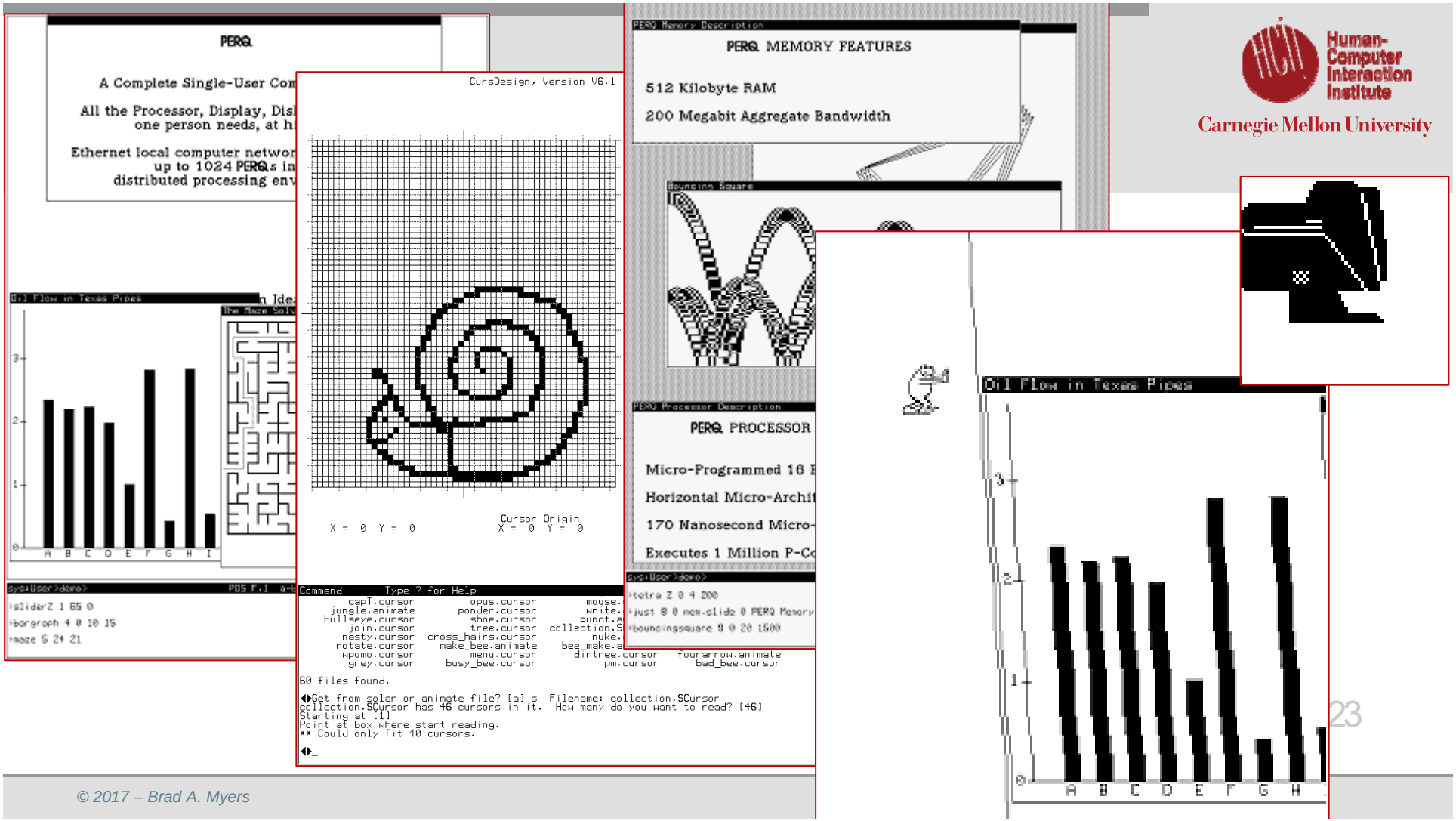
- 1980-1983
- Pittsburgh, PA
- PERQ workstation



Bernita

- 1982

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Bernita

- 1982
- 35 years!

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Sapphire for PERQ

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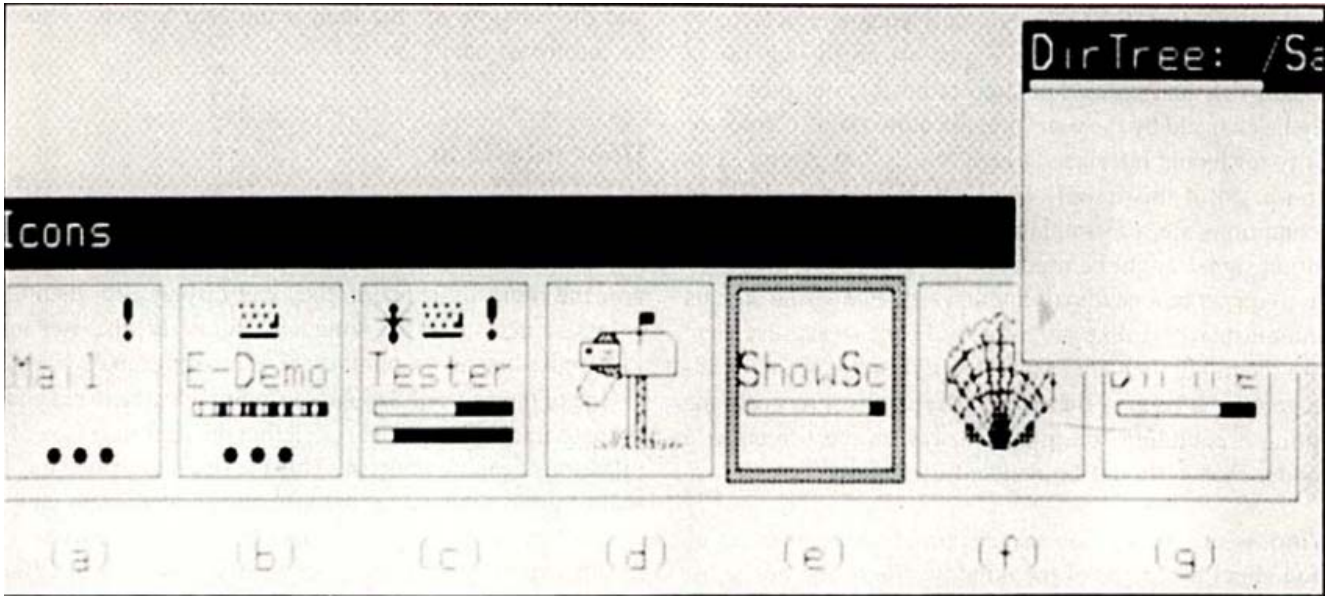
- 1983
- **SAPPHIRE**
  Screen
  Allocation
  Package
  Providing
  Helpful
  Icons and
  Rectangular
  Environments



1983 - 1987

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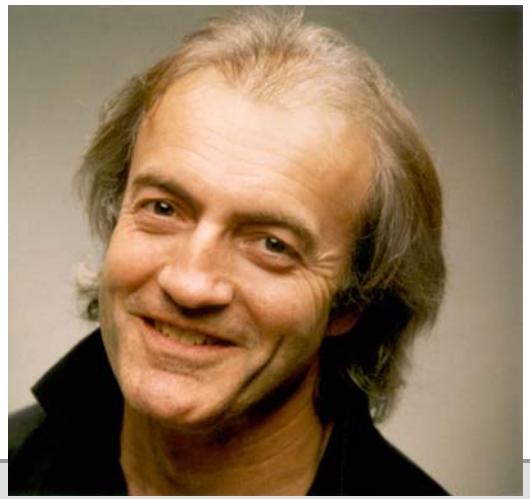
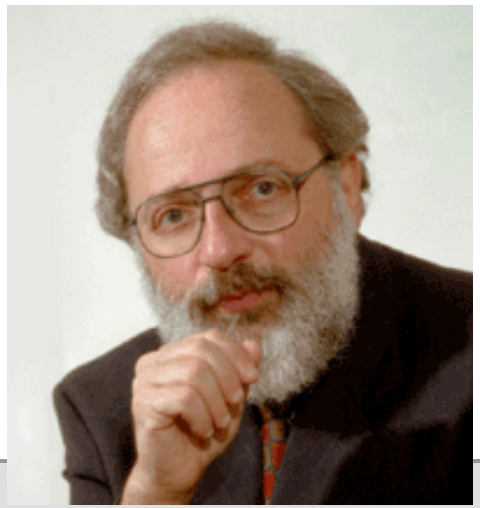
Computer Science
UNIVERSITY OF TORONTO





Percent-Done Progress Indicators

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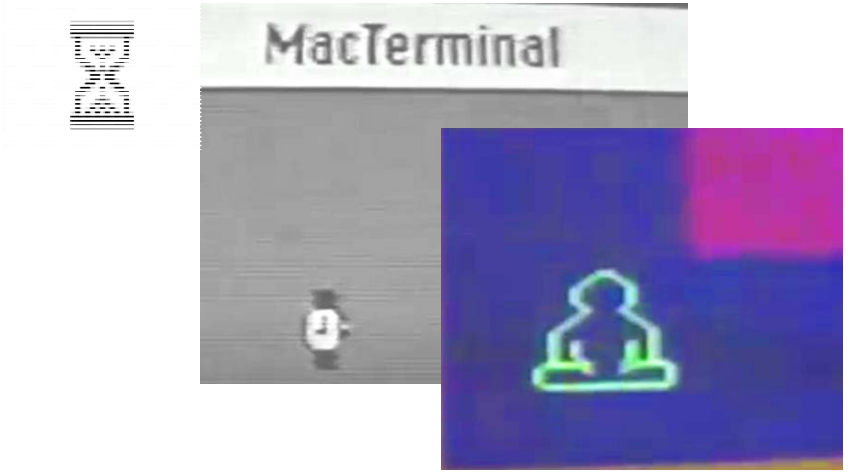
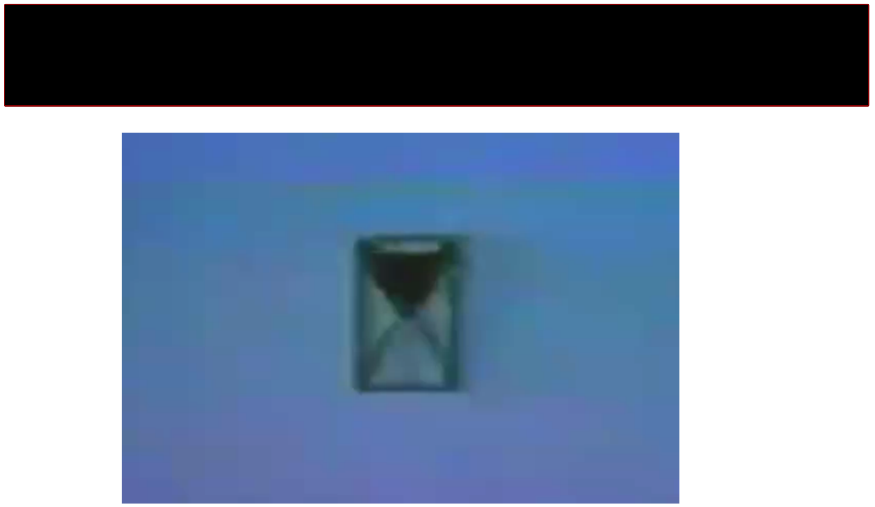
- CHI'1985 paper



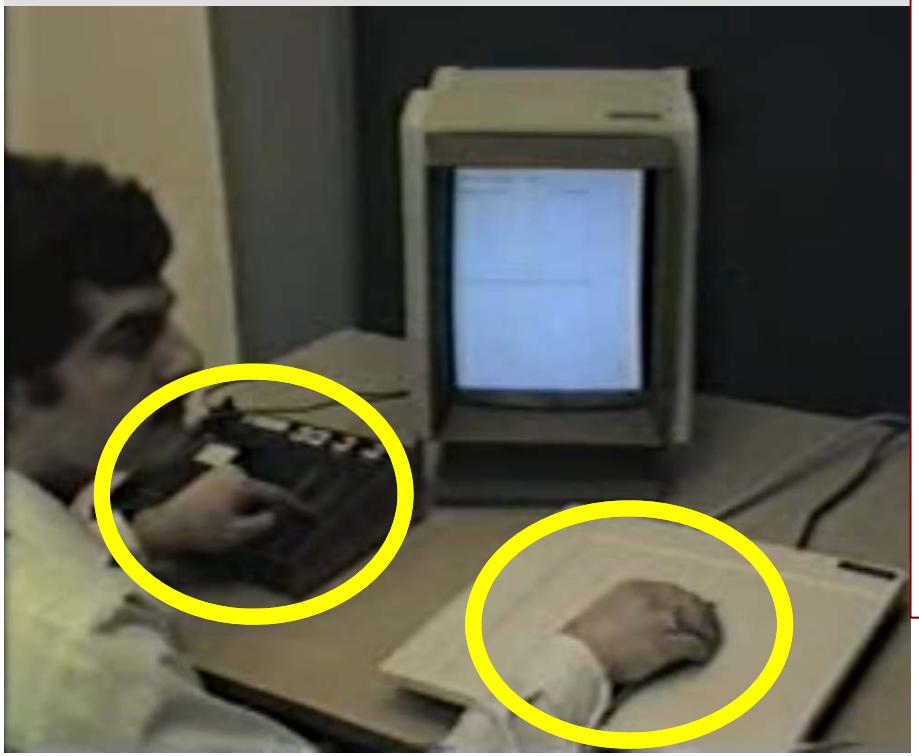
Static busy signals

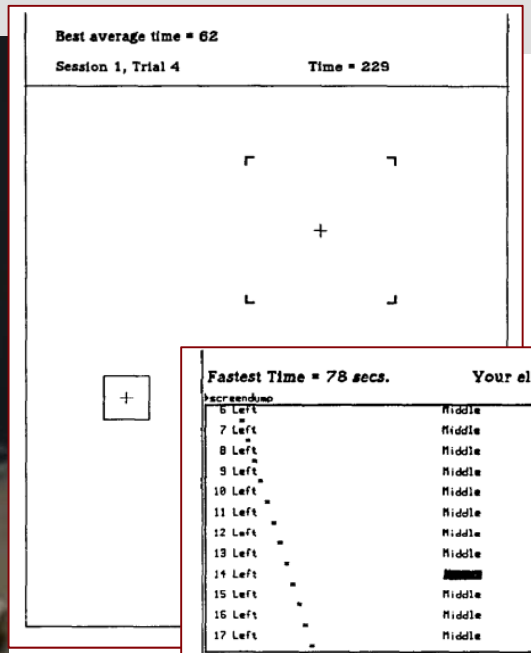


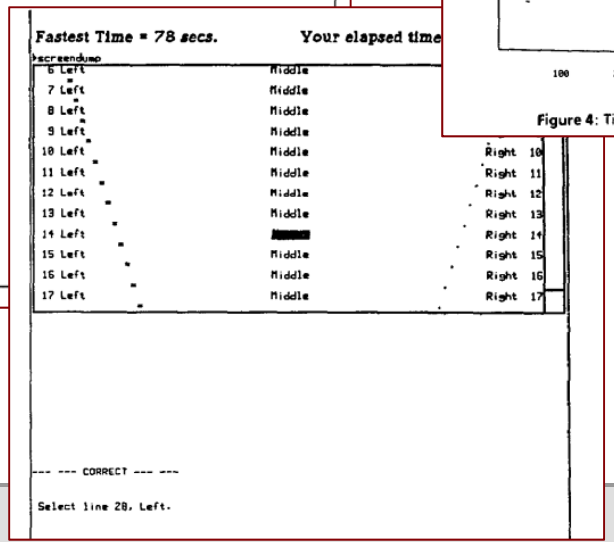
Progress indicators are better

Two-Handed Input

[Buxton and Myers, CHI'1986]







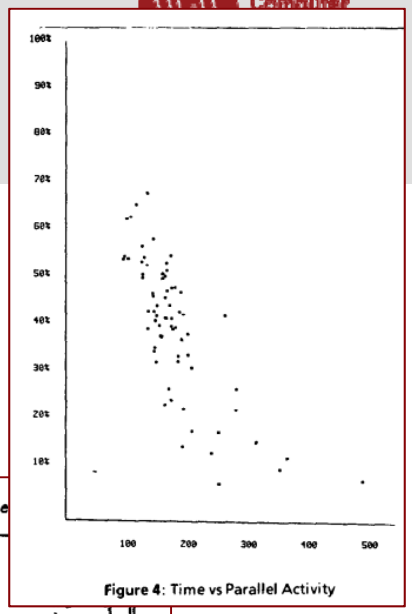


Figure 4: Time vs Parallel Activity

Taxonomy, 1986

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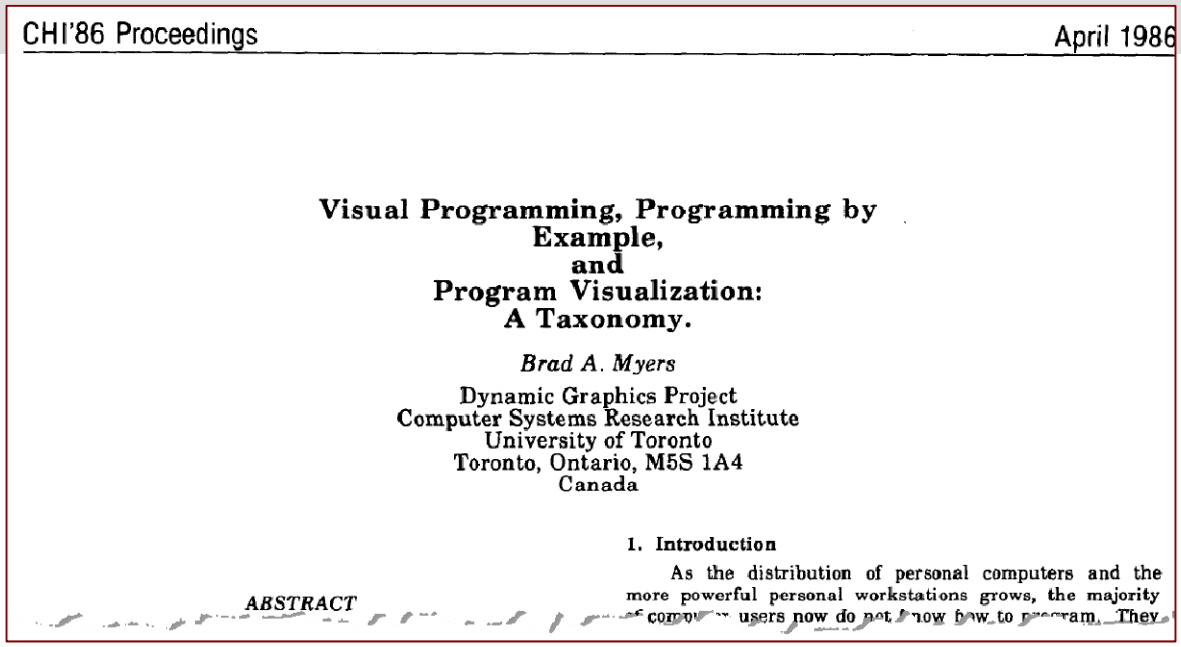
- Programming by Example vs. with Example
- Visual Programming vs. Program Visualization



CHI'86 Proceedings April 1986

Visual Programming, Programming by Example, and Program Visualization: A Taxonomy.

Brad A. Myers

Dynamic Graphics Project
Computer Systems Research Institute
University of Toronto
Toronto, Ontario, M5S 1A4
Canada

1. Introduction

As the distribution of personal computers and the more powerful personal workstations grows, the majority of computer users now do not know how to program. They

ABSTRACT

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Observations

- A good taxonomy or survey can be a nice contribution

Peridot, 1986-87

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Carnegie Mellon University

- **PERIDOT**
  Programming by
  Example for
  Real-time
  Interface
  Design
  Obviating
  Typing

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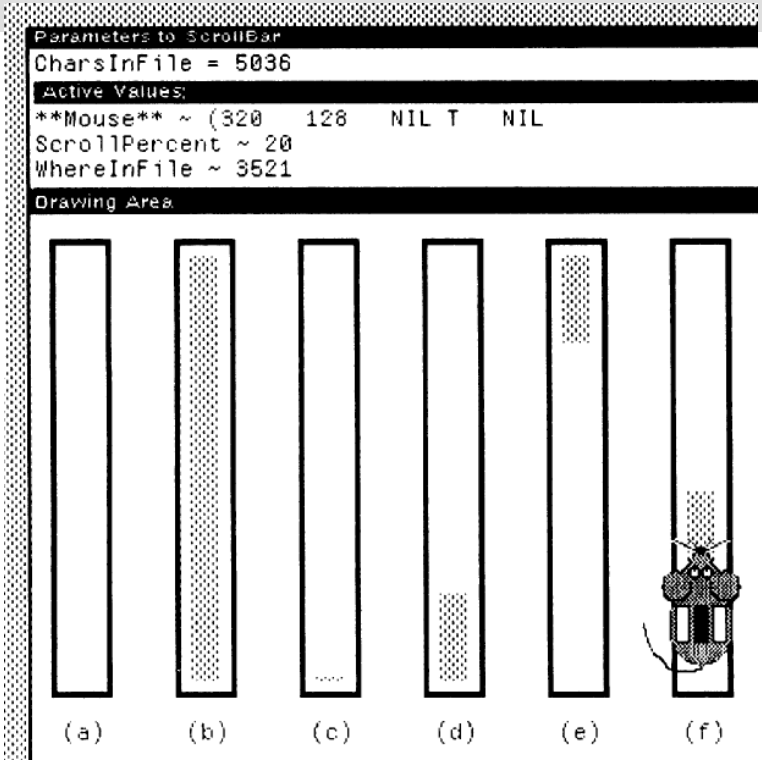
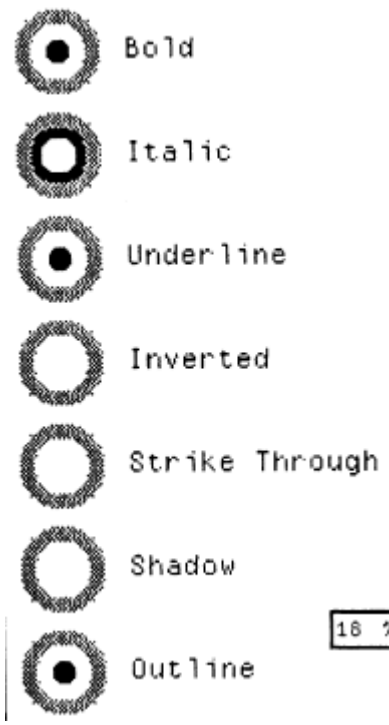
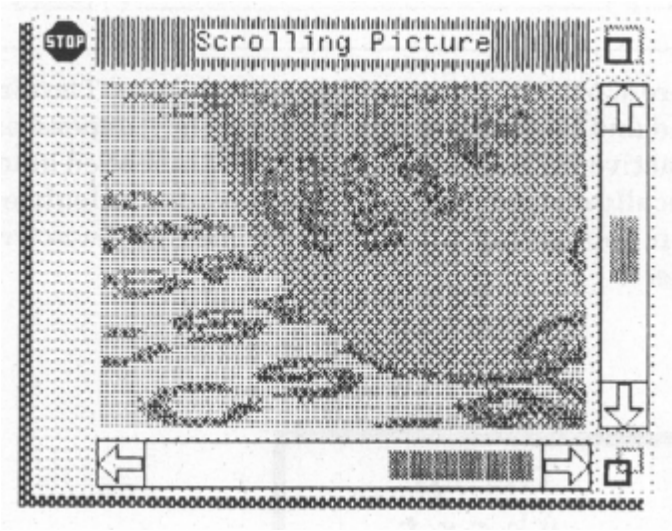
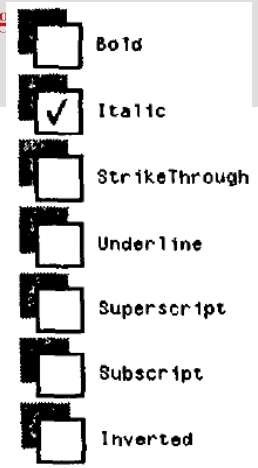


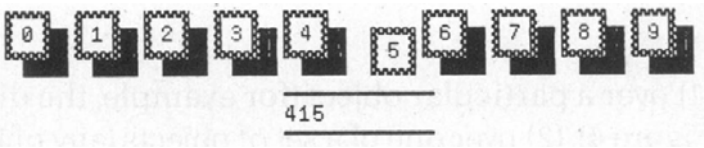
Peridot, 1986-87

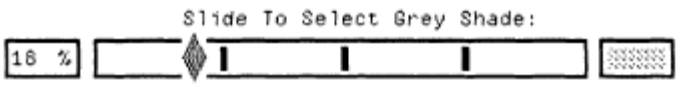
Human-Computer Interaction Institute

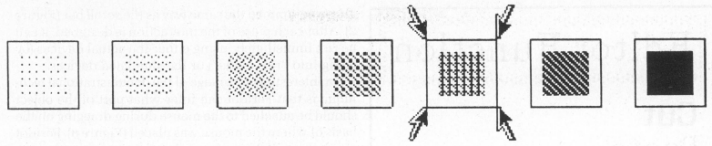












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Observations

- If you are first, then you can just show "it can be done"
- To show "better" requires different evidence
  - User study or measurements
- Showing it can be used by certain users
- Depends on what you want to claim

Human-Computer Interaction Institute

Carnegie Mellon University

Peridot

Observations

- Having kids while a graduate student can work out since you have more flexible time than when you are a professor.

Ryan Myers was born in Toronto, Canada in August, 1985

My Four Sons, 1993

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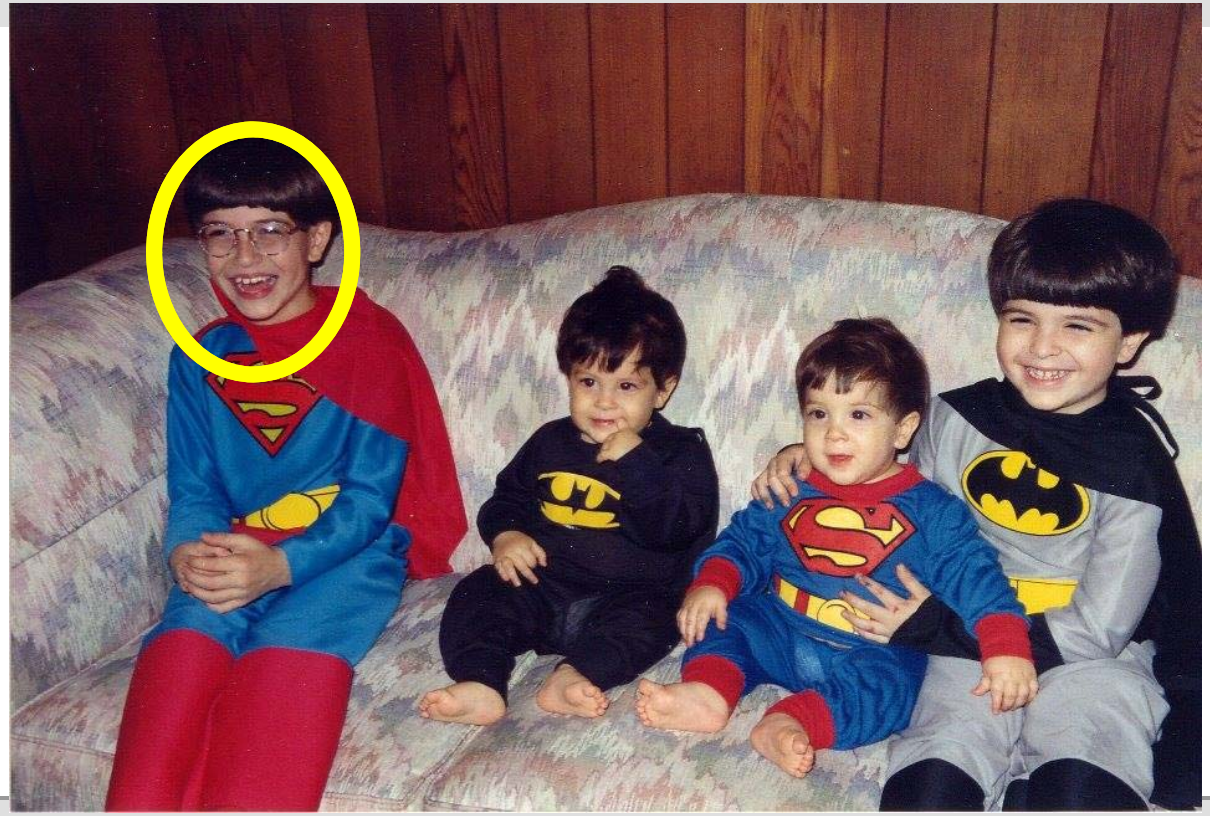

Family Today

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Carnegie Mellon University

- 2016

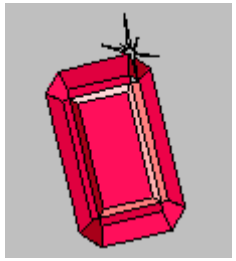
Carnegie Mellon University, 1987…

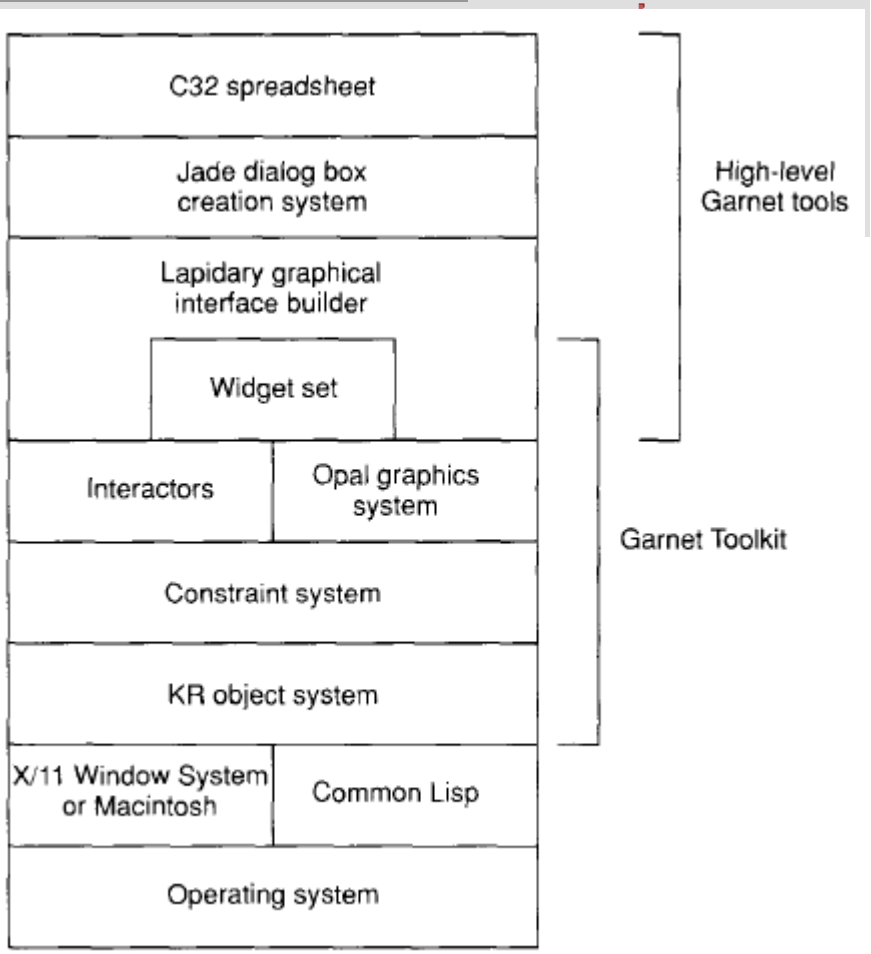
Human-Computer Interaction Institute
Carnegie Mellon University

- 30 years this summer!

Garnet, 1988 - 1994

- **GARNET**
  Generating an
  Amalgam of
  Real-time,
  Novel
  Editors and
  Toolkits





Prototype-Instance Object System

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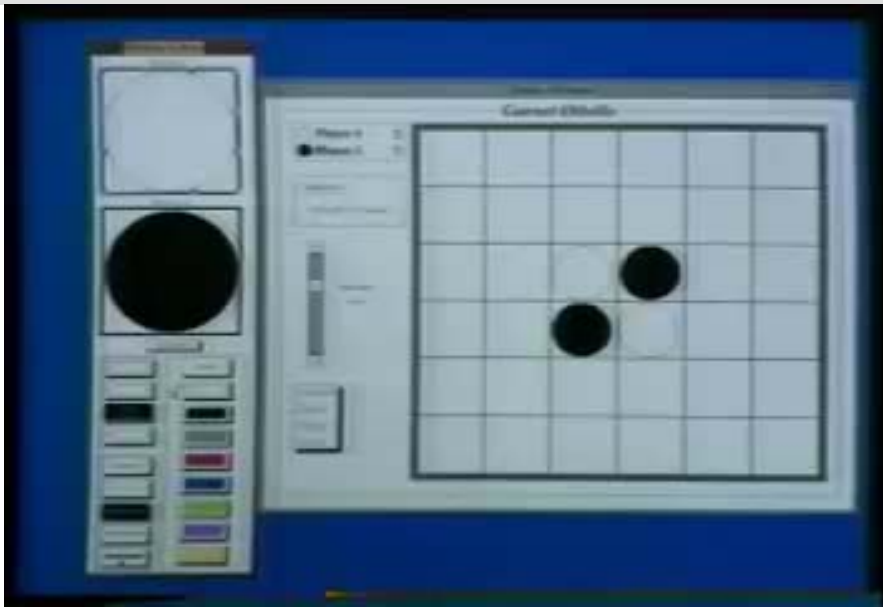
- Any object can be the *prototype* for other objects
- Now used by JavaScript
- Changes to prototype propagate
- Structural inheritance



Constraints

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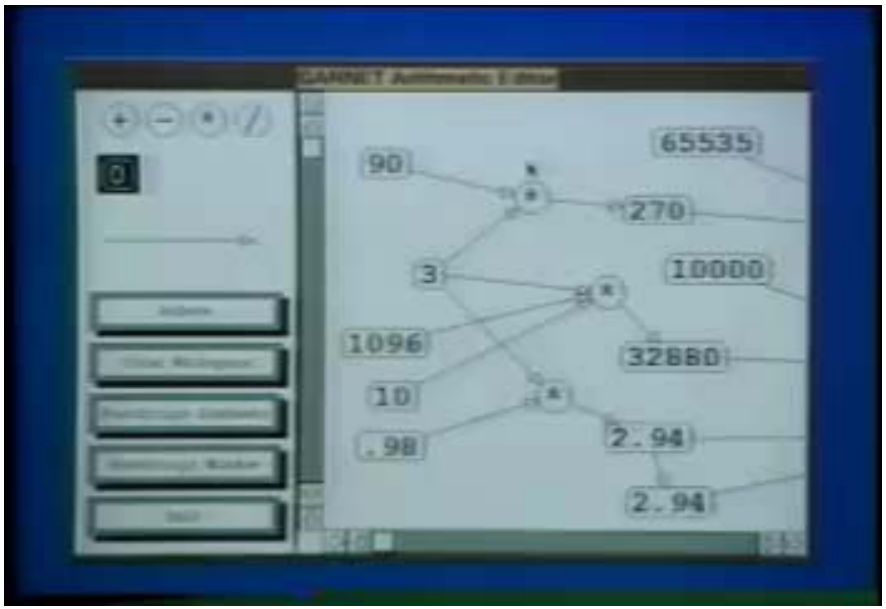
- Values automatically computed based on dependencies
- Connect graphics
- Showed useful for copying values
  - "Data bindings"
- Introduced "pointer variables" for constraints
  - E.g., "same size as *whatever is selected*"



Retained Object Model

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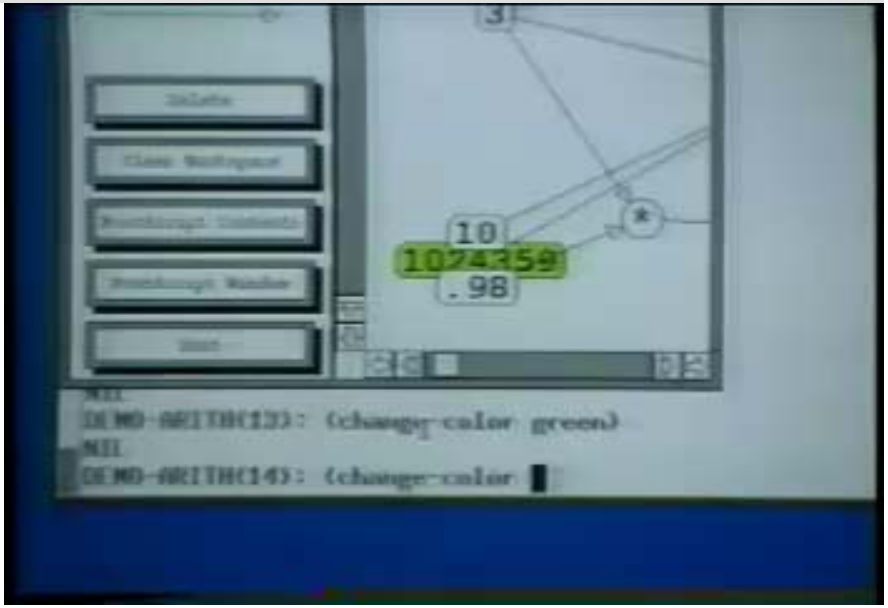
- "Display list" for graphics
- Automatically handles refresh
- Like DOM for web pages today



"Interactors" Input Model

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- Parameterized objects for each kind of behavior
- Key behaviors used in GUIs
- Independent of the graphics
- Reusable for *all* interactions
- Never need to write event handlers
- Concept used by Adobe Flash Catalyst, etc.

—Menu-Interactor—select,
—Move-Grow-Interactor—position,
—New-Point-Interactor—position,
—Angle-Interactor—orient,
—Text-Interactor—text,
—Trace-Interactor—path.

Higher Level Tools in Garnet

Human-Computer Interaction Institute
Carnegie Mellon University

LAPIDARY
Lisp-based
Assistant for
Prototyping
Interface
Designs
Allowing
Remarkable
Yield

AGATE
A
Gesture-recognizer
And
Trainer by
Example

GILT
Graphical
Interface
Layout
Tool

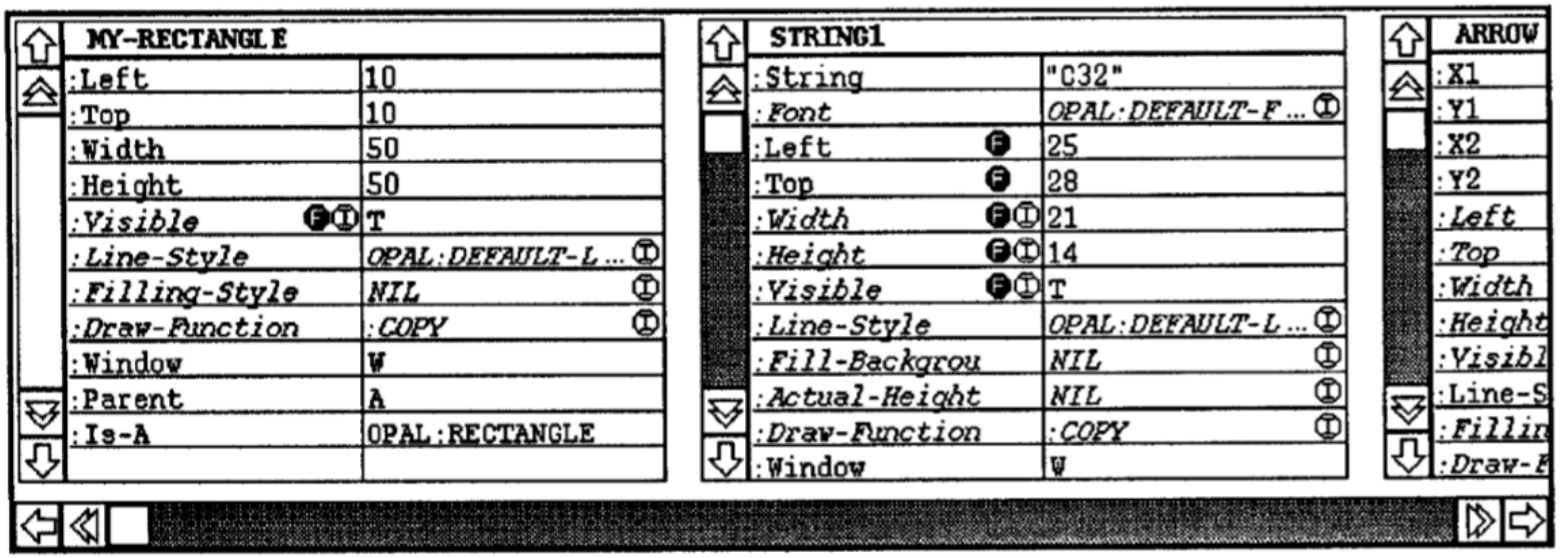
JADE
Judgment-based
Automatic
Dialog
Editor

MARQUISE
Mostly
Automated,
Remarkably
Quick
User
Interface
Software
Environment

C32

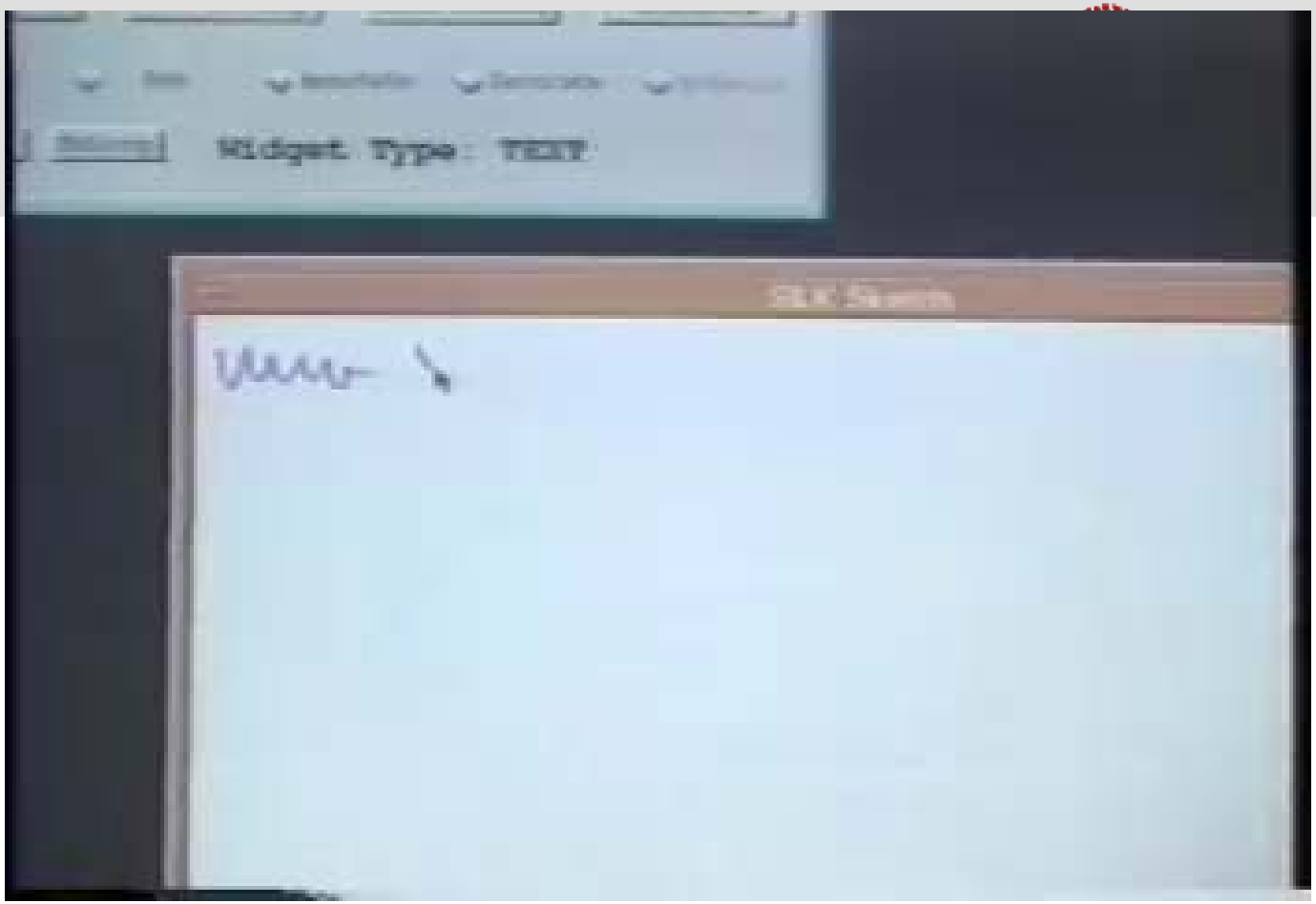
C32
CMU's
Clever and
Compelling
Contribution to
Computer Science in
CommonLisp which is
Customizable and
Characterized by a
Complete
Coverage of
Code and
Contains a
Cornucopia of
Creative
Constructs, because it
Can
Create
Complex,
Correct
Constraints that are
Constructed
Clearly and
Concretely, and
Communicated using
Columns of
Cells, that are
Constantly
Calculated so they
Change
Continuously, and
Cancel
Confusion.

- CHI'1991



Silk

- James Landay PhD, 1996
- **SILK**
  Sketching
  Interfaces
  Like
  Krazy



3 Generations of CHI Academy

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- Baecker, Buxton, Myers, Landay

Programming By Demonstration

TOURMALINE
Text-formatting
Ought to
Use and
Rely on
Macrostyles
And
Layout
Inferred
Nicely by
Example

GAMUT
Games
Are
Made
Using
This

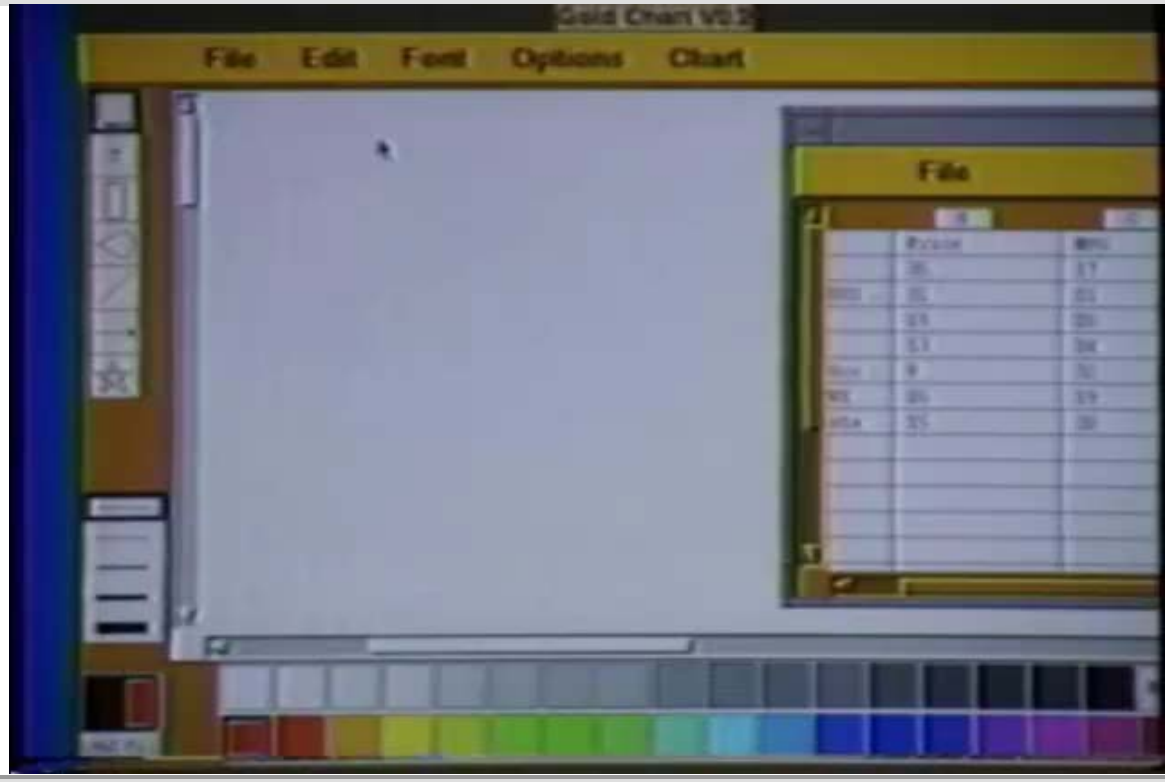
Programming By Demonstration

Human-Computer Interaction Institute
Carnegie Mellon University

TOURMALINE
Text-formatting
Ought to
Use and
Rely on
Macrostyles
And
Layout
Inferred
Nicely by
Example

GAMUT
Games
Are
Made
Using
This

GOLD
Graphs and
Output
Laid-out by
Demonstration



All the Widgets, CHI'1990

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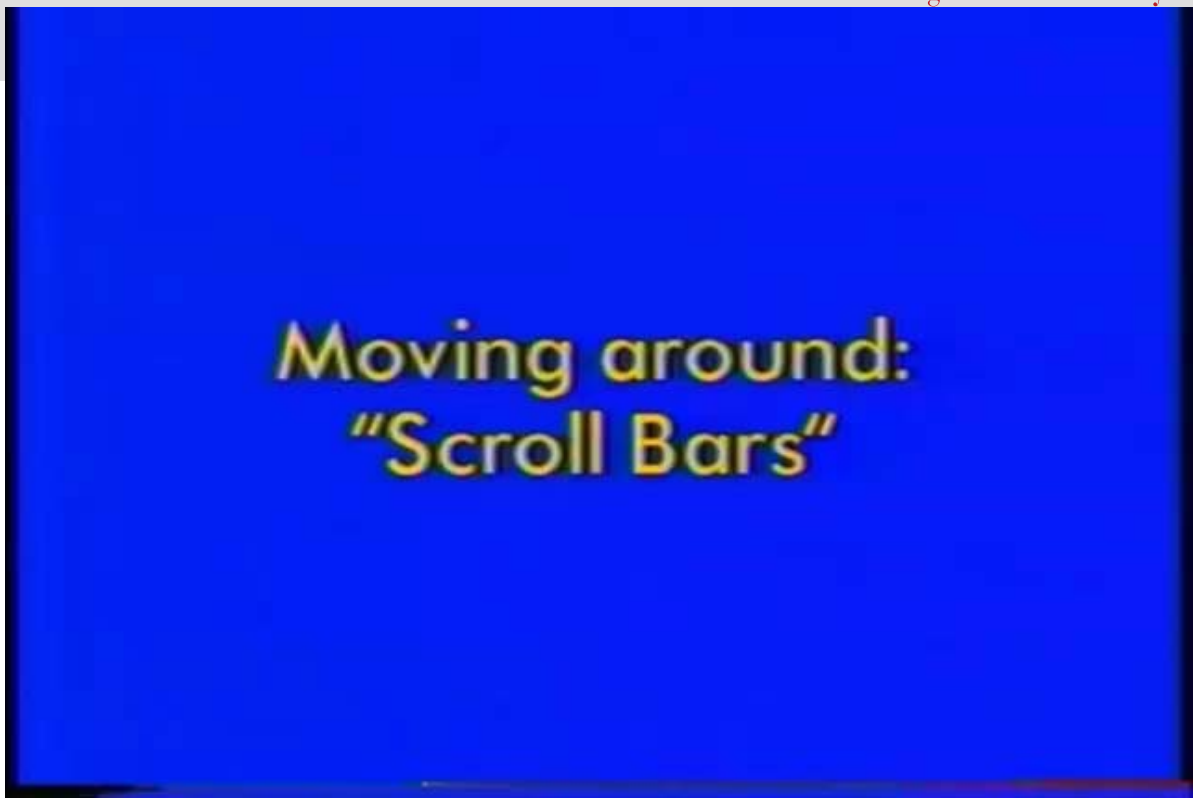
- Scroll Bars
- Menus
- Palettes
- Command Buttons
- Radio Buttons
- Check Boxes
- Text Selection
- Basic Text Editing
- Dialog Boxes
- Selecting Graphics
- Basic Editing of Graphics
- Desktops
- Window Manager Commands



Amulet: 1994 – 1998

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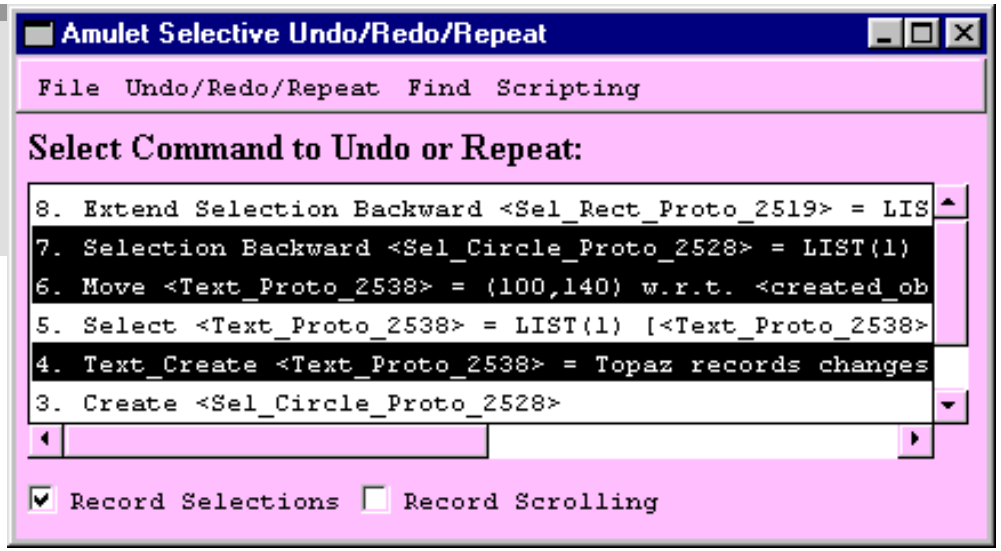
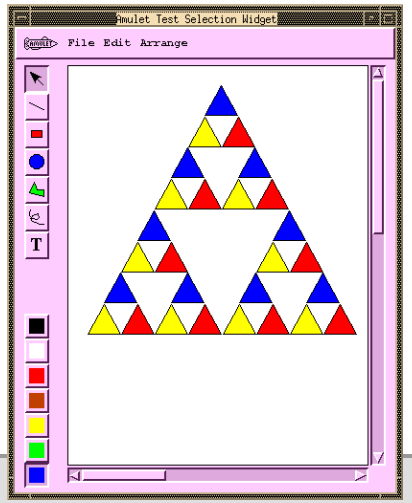
Carnegie Mellon University

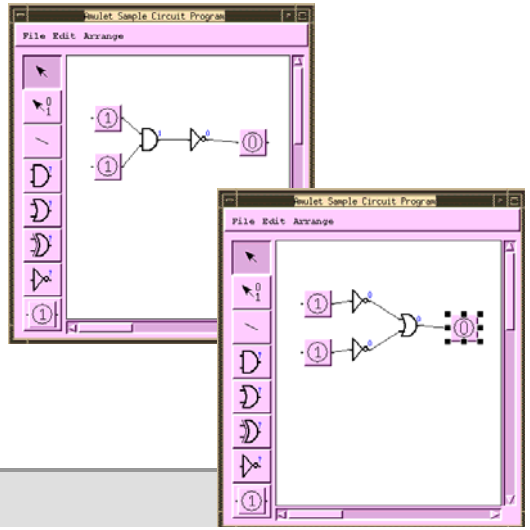
- **AMULET**
  Automatic
  Manufacture of
  Usable and
  Learnable
  Editors and
  Toolkits

Command Objects

- **TOPAZ**
  Transcripts
  Of
  Programs
  Activated with
  Zeal

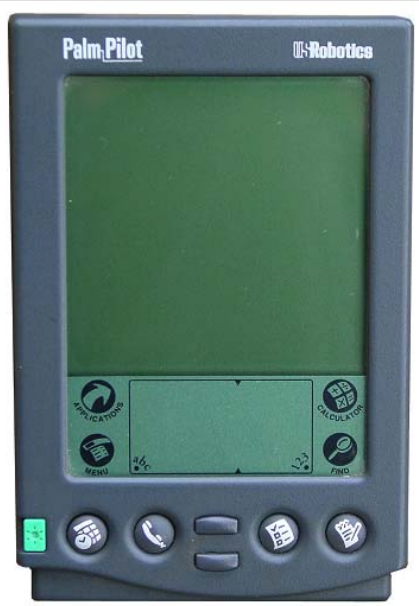




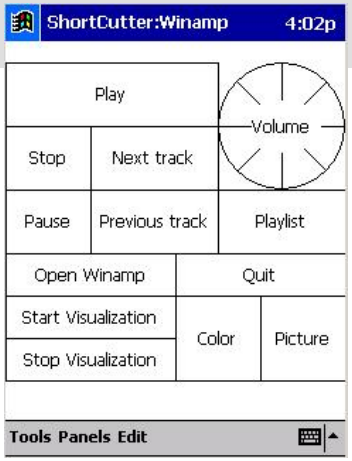


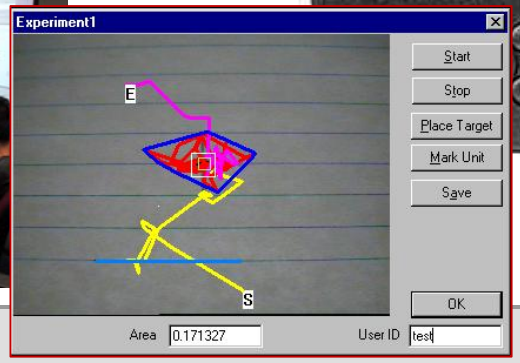
Pebbles, 1998 -

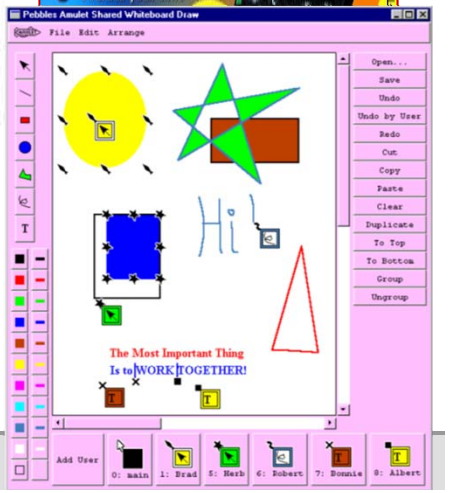
- **PEBBLES**
  PDAs for
  Entry of
  Both
  Bytes and
  Locations from
  External
  Sources



Pebbles Projects







Pebbles Projects

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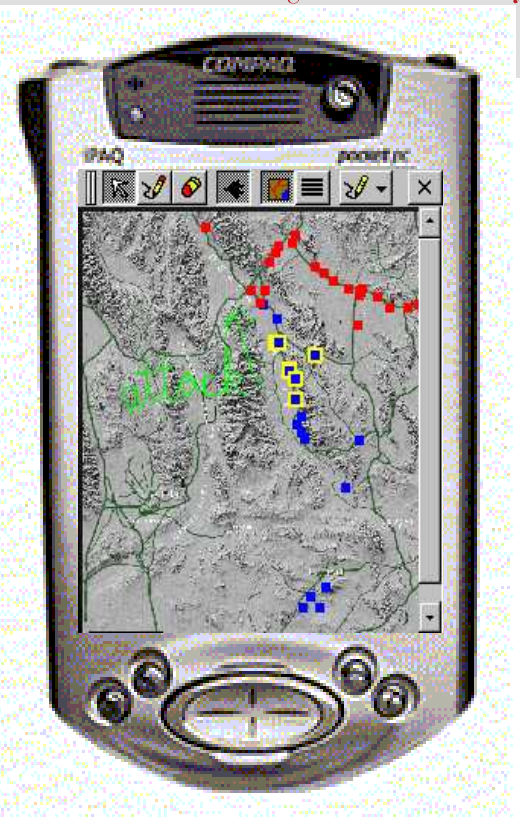
CPOF

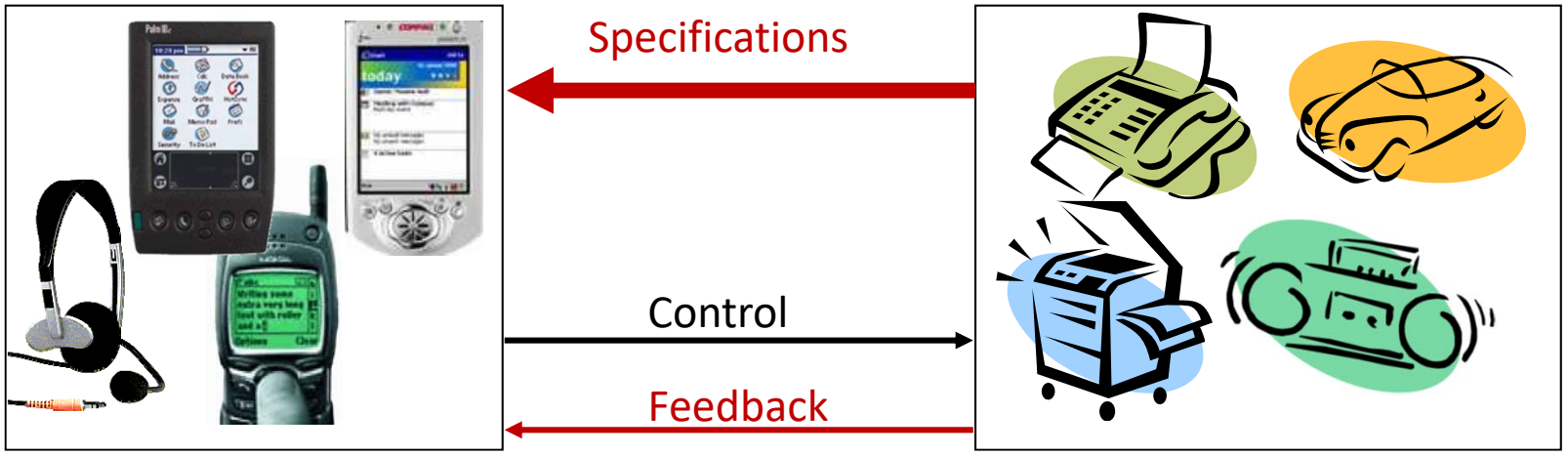
- Command Post of the Future
  - Successful DARPA program
  - Expected to be about speech/gestures
  - Actual issues were mainly situation awareness
    - Including connected mobile devices



Personal Universal Controller (PUC)

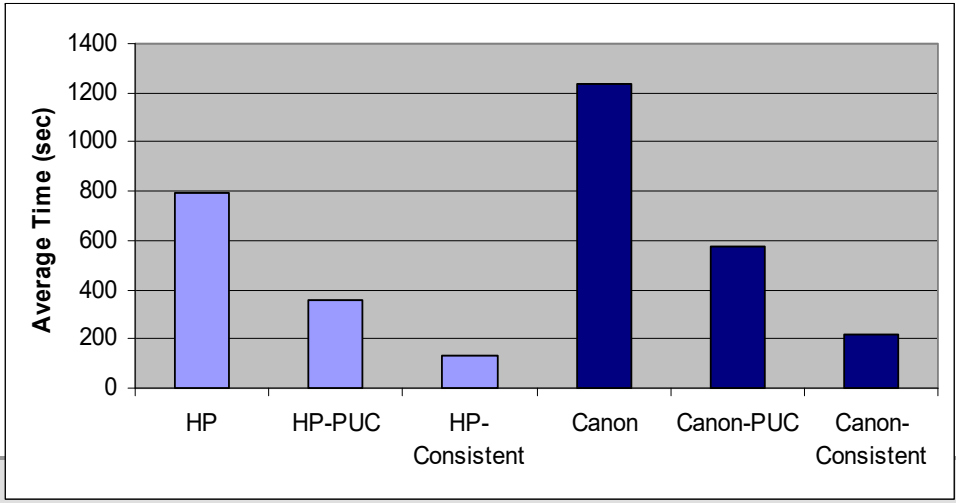
Human-Computer Interaction Institute
Carnegie Mellon University

- Jeff Nichols PhD, 2006



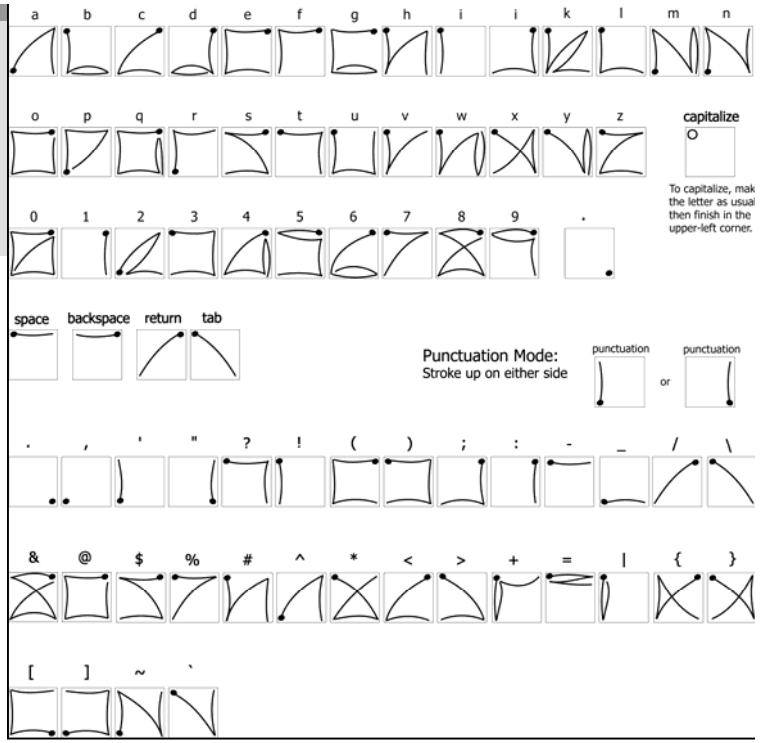
Personal Universal Controller (PUC)

Human-Computer Interaction Institute
Carnegie Mellon University



EdgeWrite

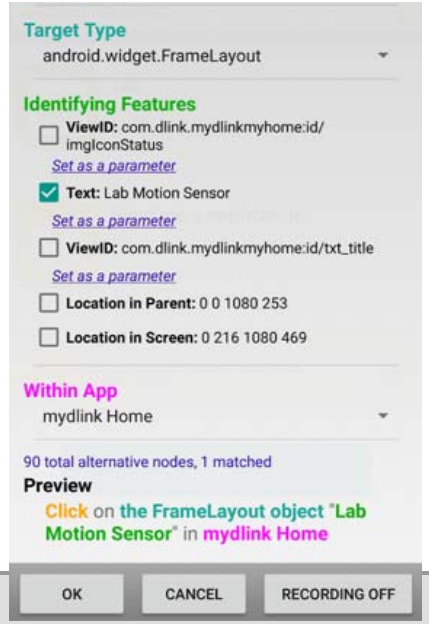
- Jake Wobbrock, PhD, 2006

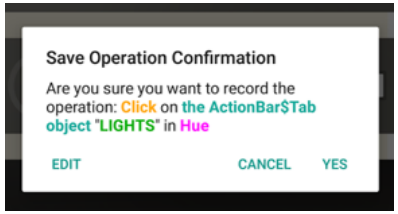


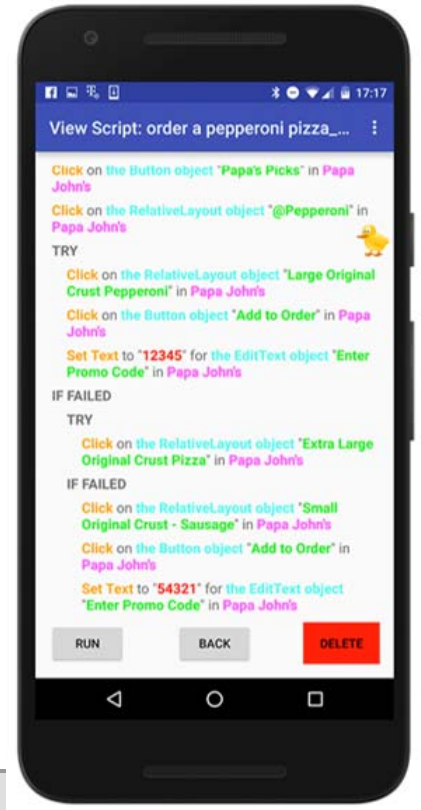
Sugilite

Human-Computer Interaction Institute
Carnegie Mellon University

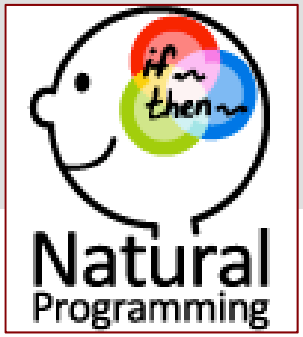
- Current PhD work of Toby Li
  - See our paper, Thurs, 11:30 - 12:50 in Room 203
- **SUGILITE** *(come to the talk to see what it stands for!)*







Natural Programming, 1995-



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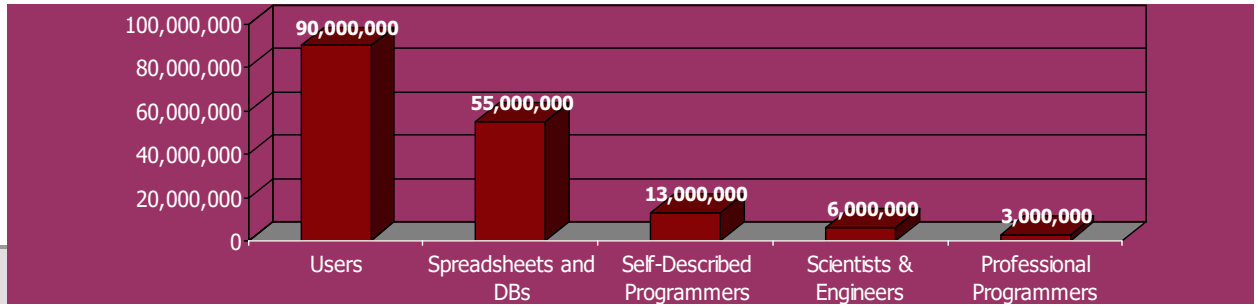
- Make programming easier and more correct by making it more *natural*
  - Closer to the way that people think about algorithms and solving their tasks

EUSES
End Users Shaping Effective Software

- Novice, expert, and "end-user" programmers

[Scaffidi, Shaw and Myers 2005]



HCI Study of Programmers

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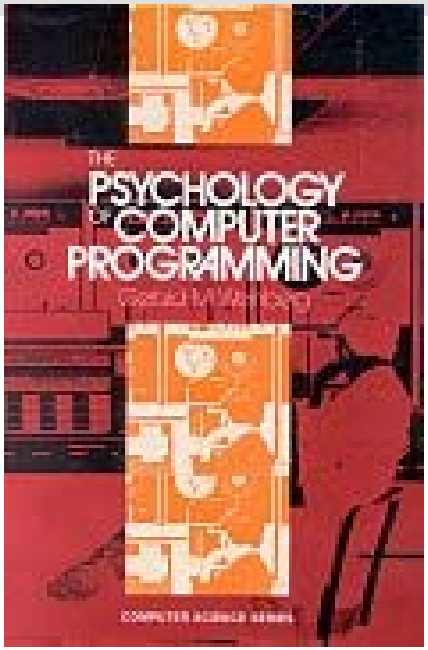

1973

1980

Allen Newell and Stuart Card, 1985

- "Millions for compilers but hardly a penny for understanding human programming language use. Now, programming languages are obviously symmetrical, the computer on one side, the programmer on the other. In an appropriate science of computer languages, one would expect that half the effort would be on the computer side, understanding how to translate the languages into executable form, and half on the human side, understanding how to design languages that are easy or productive to use.... The human and computer parts of programming languages have developed in radical asymmetry."

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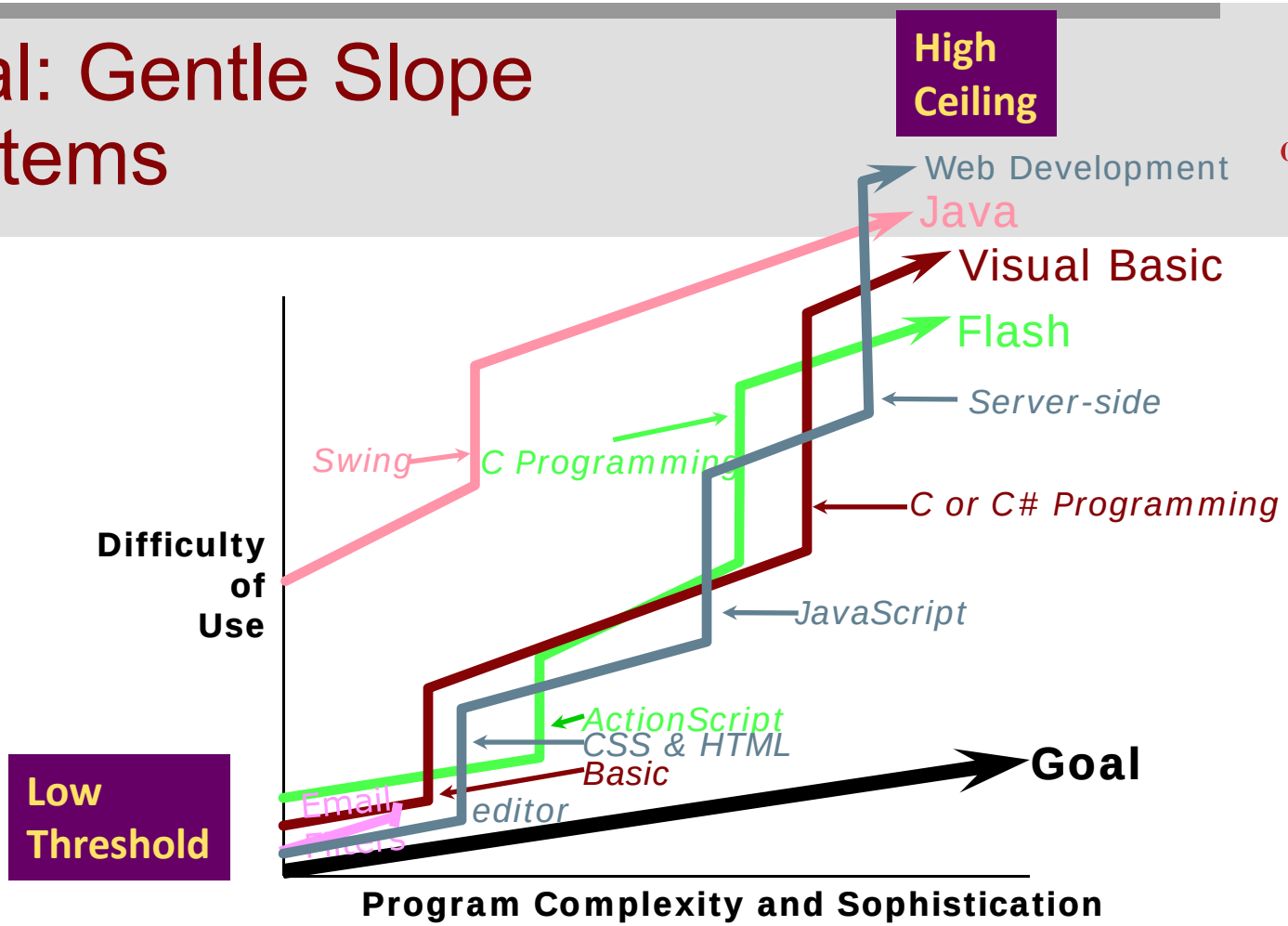
Observations:

- Intuitions of programmers about what would be helpful are often wrong
- Need to do studies of programmers

Goal: Gentle Slope Systems



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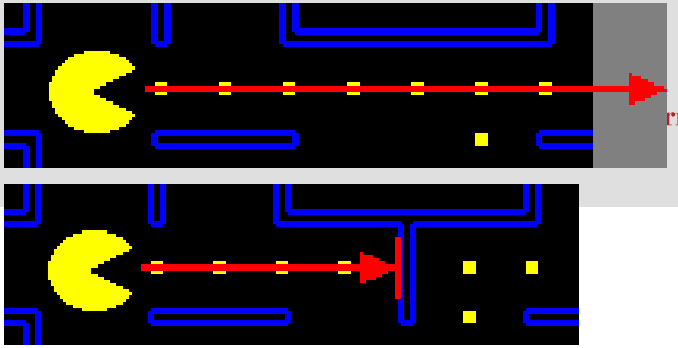
Making Programming Easier

- Key focus of most of my research
- Life-long pursuit

HANDS



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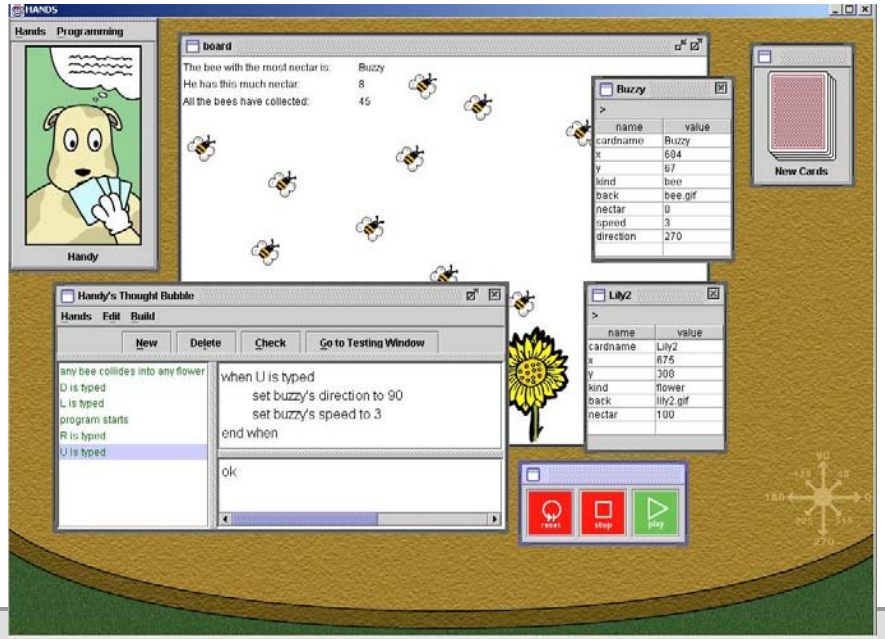
- John Pane, PhD 2002
- **HANDS**
  Human-Centered
  Advances for
  Novice
  Development of
  Software



Lapis

By Hannes Grobe - Own work, CC BY-SA 2.5, https://commons.wikimedia.org/w/index.php?curid=3415430

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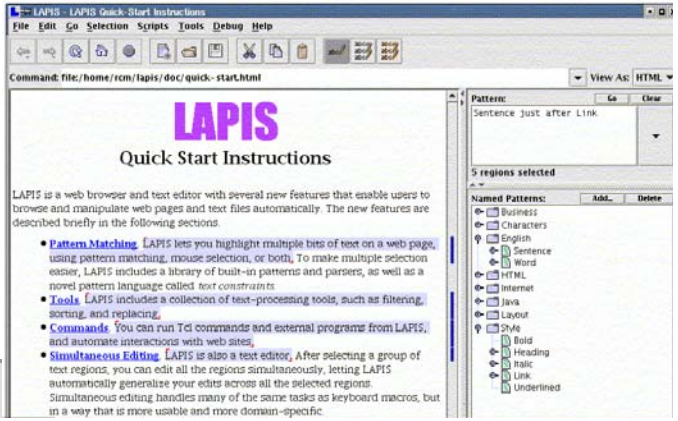
- Rob Miller, PhD 2002
- **LAPIS**
  Lightweight
  Architecture for
  Processing
  Information
  Structure

- Informal parsing and reuse of semi-structured text databases
- Simultaneous editing
- Outlier finding



Whyline

Human-Computer Interaction Institute
Carnegie Mellon University

- Andy Ko, PhD, 2008
- **WHYLINE**
  Workspace that
  Helps
  You
  Link
  Instructions to
  Numbers and
  Events

- Causes of software defects
- Understanding software maintenance tasks
- Working sets when programming
- Navigation takes 35% of the time

Whyline

Human-Computer Interaction Institute
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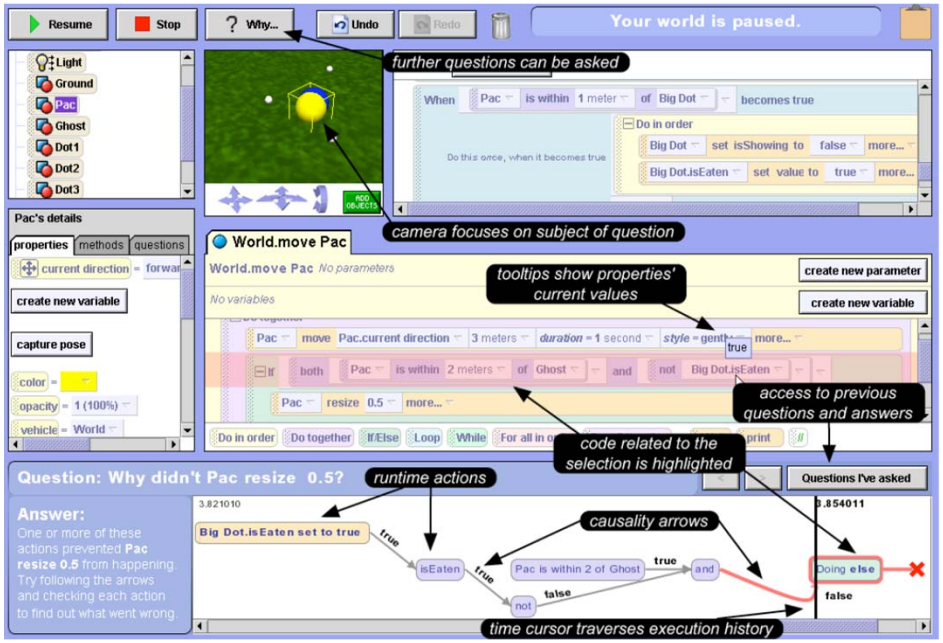
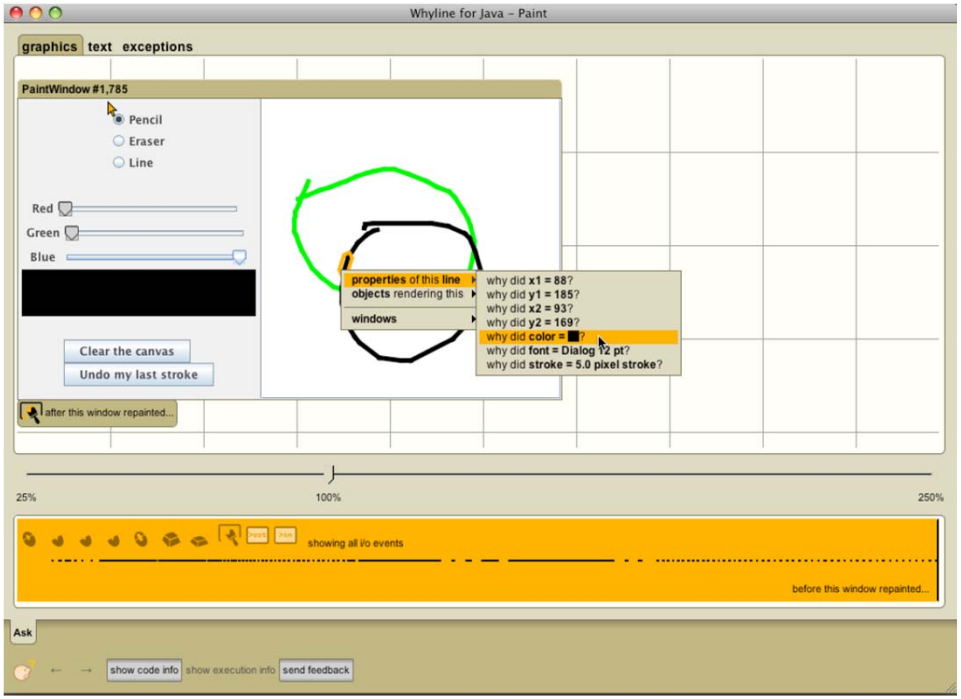
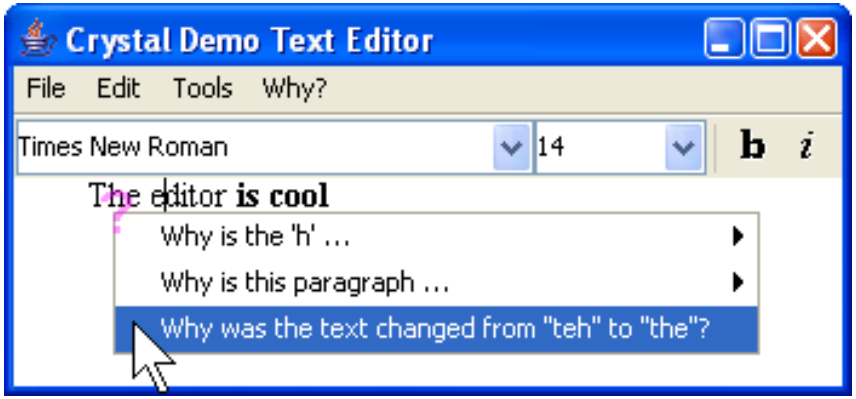




Crystal

- Ask “why” for everything else!
- **CRYSTAL**
  Clarifications
  Regarding
  Your
  Software using a
  Toolkit,
  Architecture and
  Language



Understanding Unfamiliar Code

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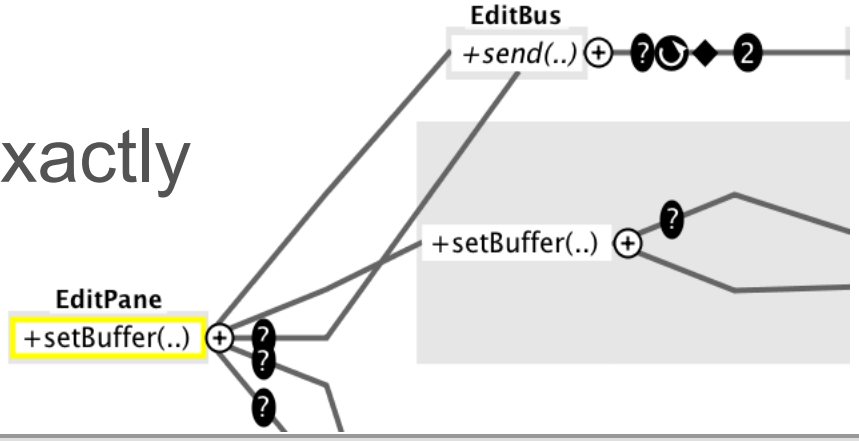
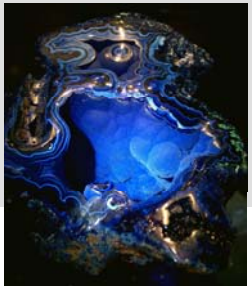
- Thomas LaToza, PhD 2012
- Hard to answer questions about code:
  - *Control flow* = "reachability"
  - 100s of others
- "Reacher" visualizes exactly the paths of interest



Backtracking During Editing



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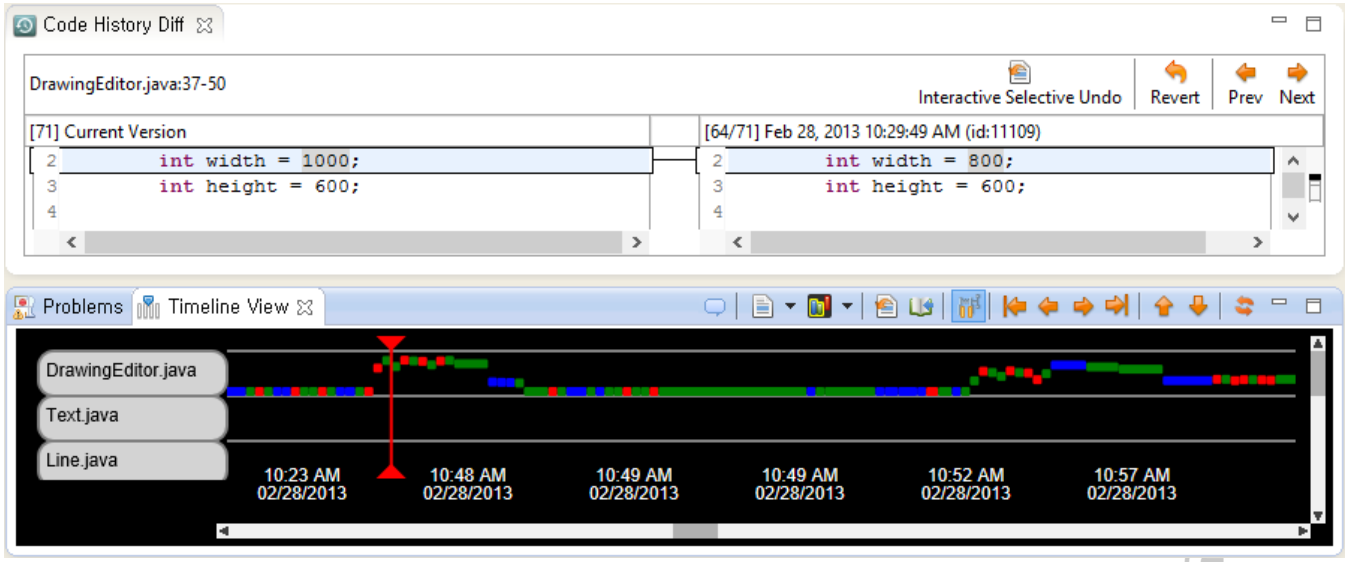
- YoungSeok Yoon, PhD 2015
- **AZURITE**
  Adding
  Zest to
  Undoing and
  Restoring
  Improves
  Textual
  Exploration



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Observations

- Viewing the code is central!
  - Visualizations of code are mostly useful as navigation aides
- Search is useful across many dimensions, e.g.:
  - Search along control flow
  - Search backwards in time

API Usability

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- Jeff Stylos, PhD 2009
- **A**pplication **P**rogramming **I**nterface
  - Libraries, frameworks, SDKs, …
  - Now: web services, middleware, …
  - User interface between programmer and functionality in code
- Patterns that decrease usability
- New documentation tools to compensate

API Usability Tools

Human-Computer Interaction Institute
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MICA

Makes
Interfaces
Clear and
Accessible

JADEITE

Java
API
Documentation with
Extra
Information
Tacked-on for
Emphasis

CALCITE
Construction
And
Language
Completion
Integrated
Throughout
Eclipse

EUKLAS
Eclipse
Users'
Keystrokes
Lessened by
Attaching
Samples

GRAPHITE
GRAphical
Palettes
Help
Instantiate
Types in the
Editor

APATITE
Associative
Perusing of
APIs
That
Identifies
Targets
Easily

DACITE
Design
Annotations for
Complementing
Interfaces
Targeting
Effectiveness

Glacier and Obsidian

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Carnegie Mellon University

- **GLACIER**
  Great
  Languages
  Allow
  Class
  Immutability
  Easily and
  Readily
- **OBSIDIAN**
  Object-oriented
  Blockchain
  State
  Interaction and
  Development
  Implementation
  And
  Notation

- Michael Coblenz's PhD work
- Key Goal: Design more usable programming languages
- Glacier:
  - Immutability – declare that instances cannot change after constructed
- Obsidian:
  - Easier blockchain programming

InterState

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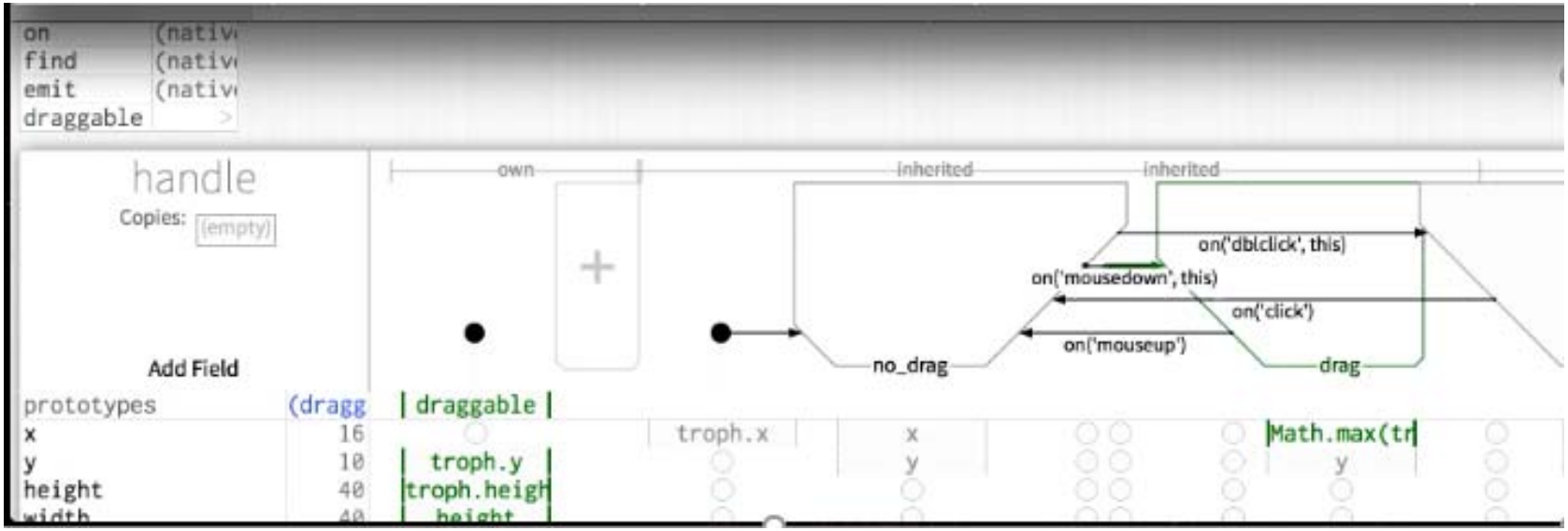
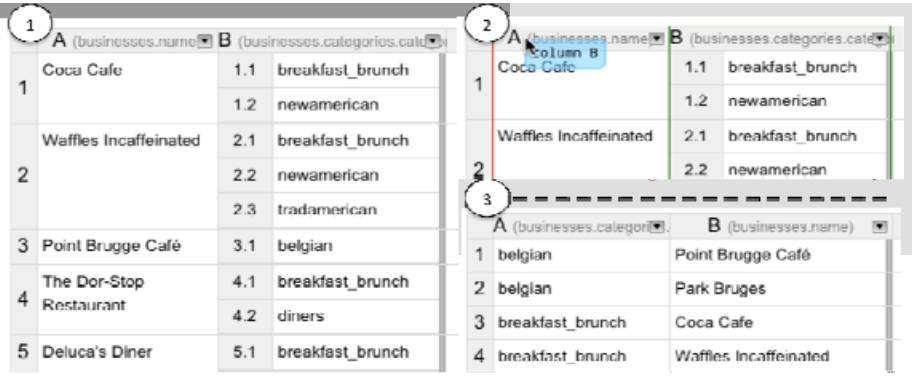
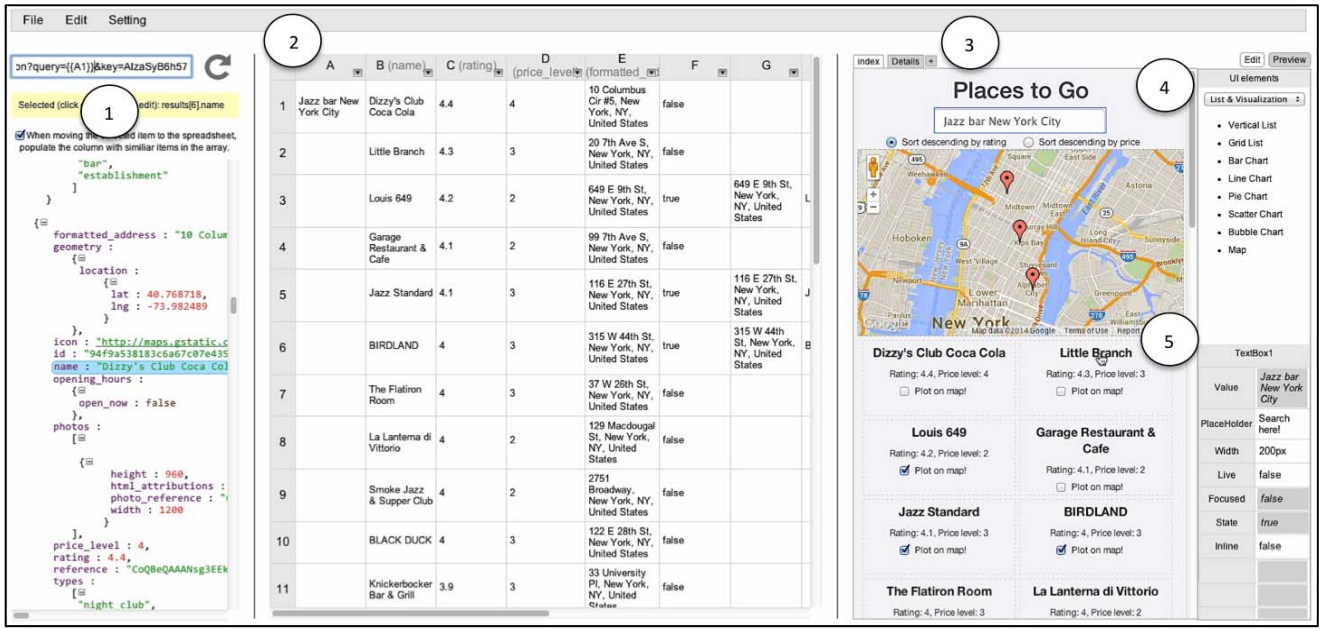
- Stephen Oney, PhD 2015



Gneiss

- Kerry Chang, PhD 2016
- **GNEISS**
  Gathering
  Novel
  End-User
  Internet
  Services using
  Spreadsheets

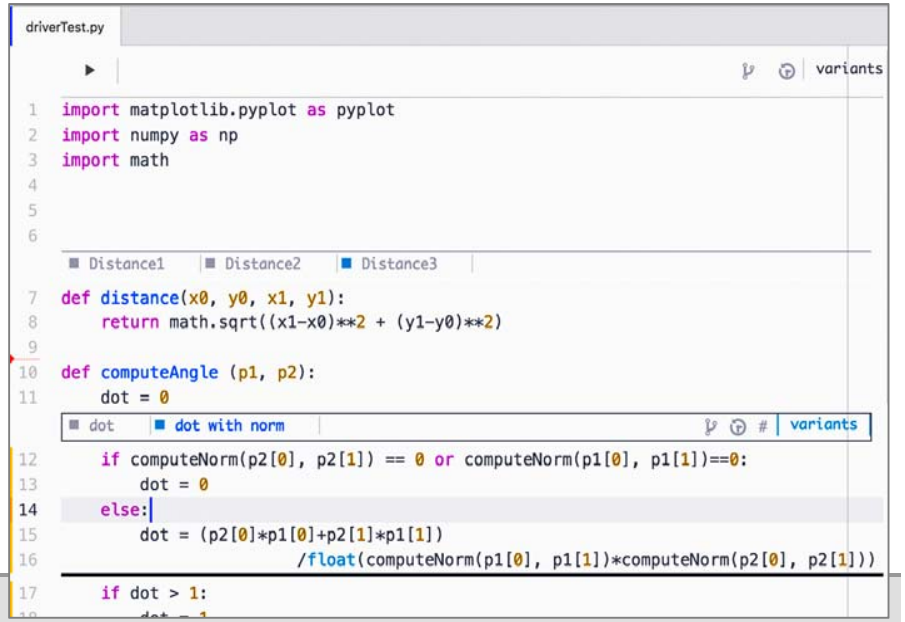




Variolite

Human-Computer Interaction Institute
Carnegie Mellon University

- Current PhD work of Mary Beth Kery
  - See our paper, Tuesday, 9:30 - 10:50 in Room 111/113
- **VARIOLITE**
  (come to the talk to see what it stands for!)
- Exploratory Programming



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Observations

- Always make a video – demos will stop working
- Having a group culture, fun "signature", e.g. for acronyms and gemstones, ribbons
- One good idea makes attending a conference or reading an article worthwhile

Thanks!

Human-Computer Interaction Institute
Carnegie Mellon University

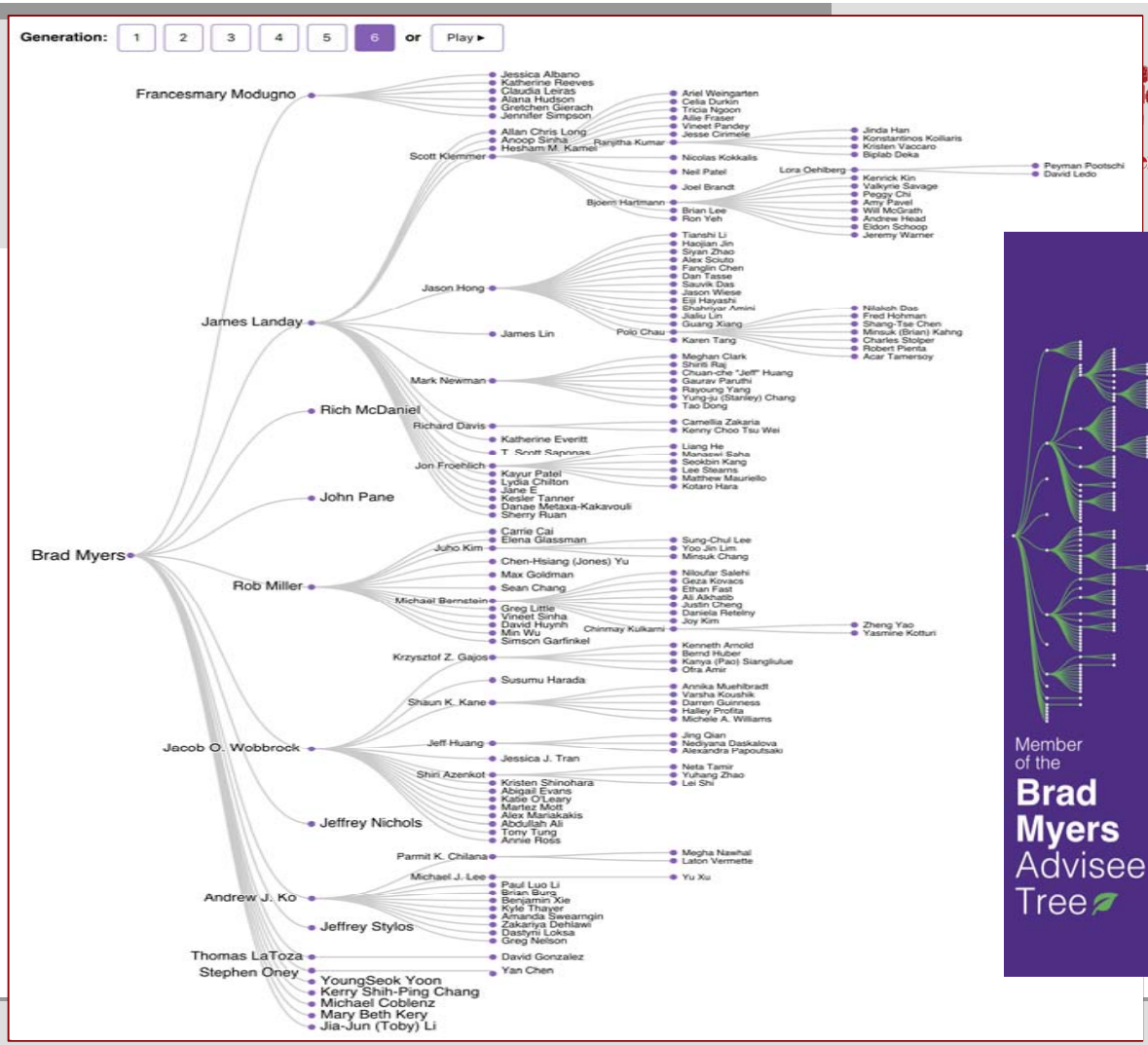
- Funding from Xerox PARC, UofT Fellowship, DARPA, NSF, NIH, Microsoft, SAP, Google, Adobe, IBM, Apple, and many others
- My wife and family
- My mentors, colleagues, and especially the hundreds of students
  - Bachelors, Masters, and PhD at CMU

Advisee tree

Generation	Count
1	Me
2	16
3	61
4	71
5	22
6	2
TOTAL	172

Thanks to: *Fred Hohman (gen. 5), Robert Pienta (gen. 5), and Polo Chau (gen. 4) for animation and ribbon design*

See: http://tinyurl.com/myersadviseetree



RUBY: Reminiscing about User interfaces by Brad over the Years

Brad A. Myers

For More information:

- Brad's home page: bradamyers.com
- Brad's 66 acronyms: http://www.cs.cmu.edu/~bam/acronyms.html
- Brad's 172 advisees tree: http://tinyurl.com/myersadviseetree