Context-awareness and smart spaces

tforms

drawing

What are Smart Spaces?

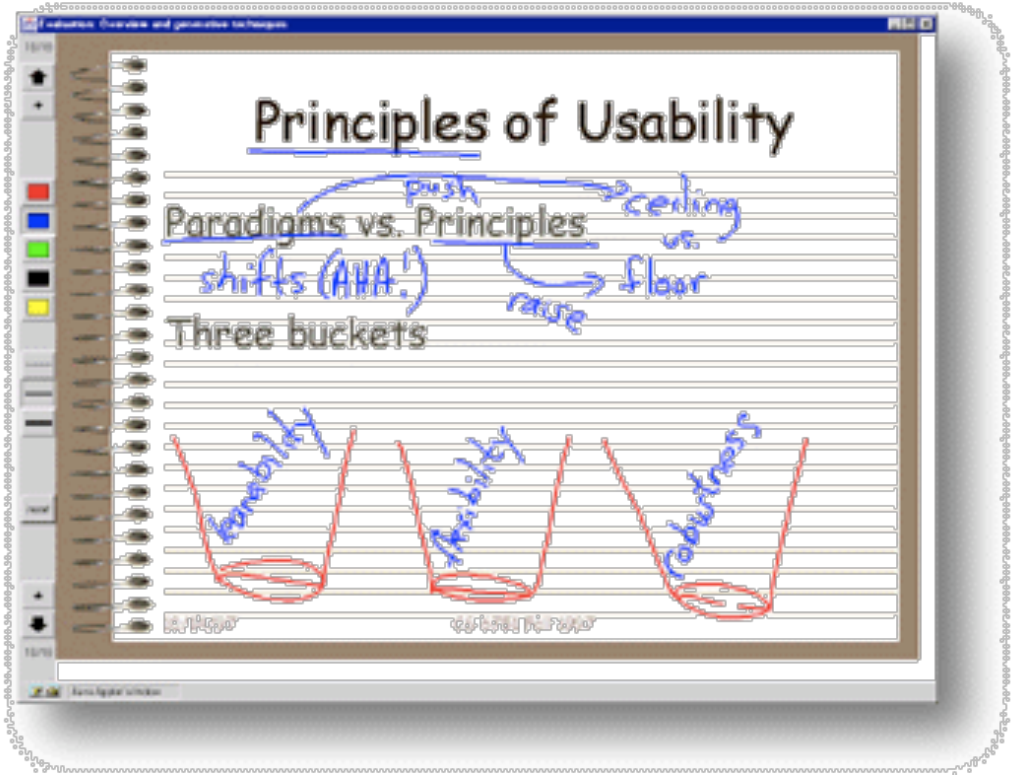
- Instrumenting physical spaces with computers to provide useful services
  - Support cooperation & coordination (remote and co-located)
  - Automated capture

- Some issues to consider:
  - Interaction with non-desktop computers (walls, tables)
  - Discovery (how to know what can you do in a smart space?)
  - Interoperability
  - Cost (infrastructure, setup, maintenance, learning)

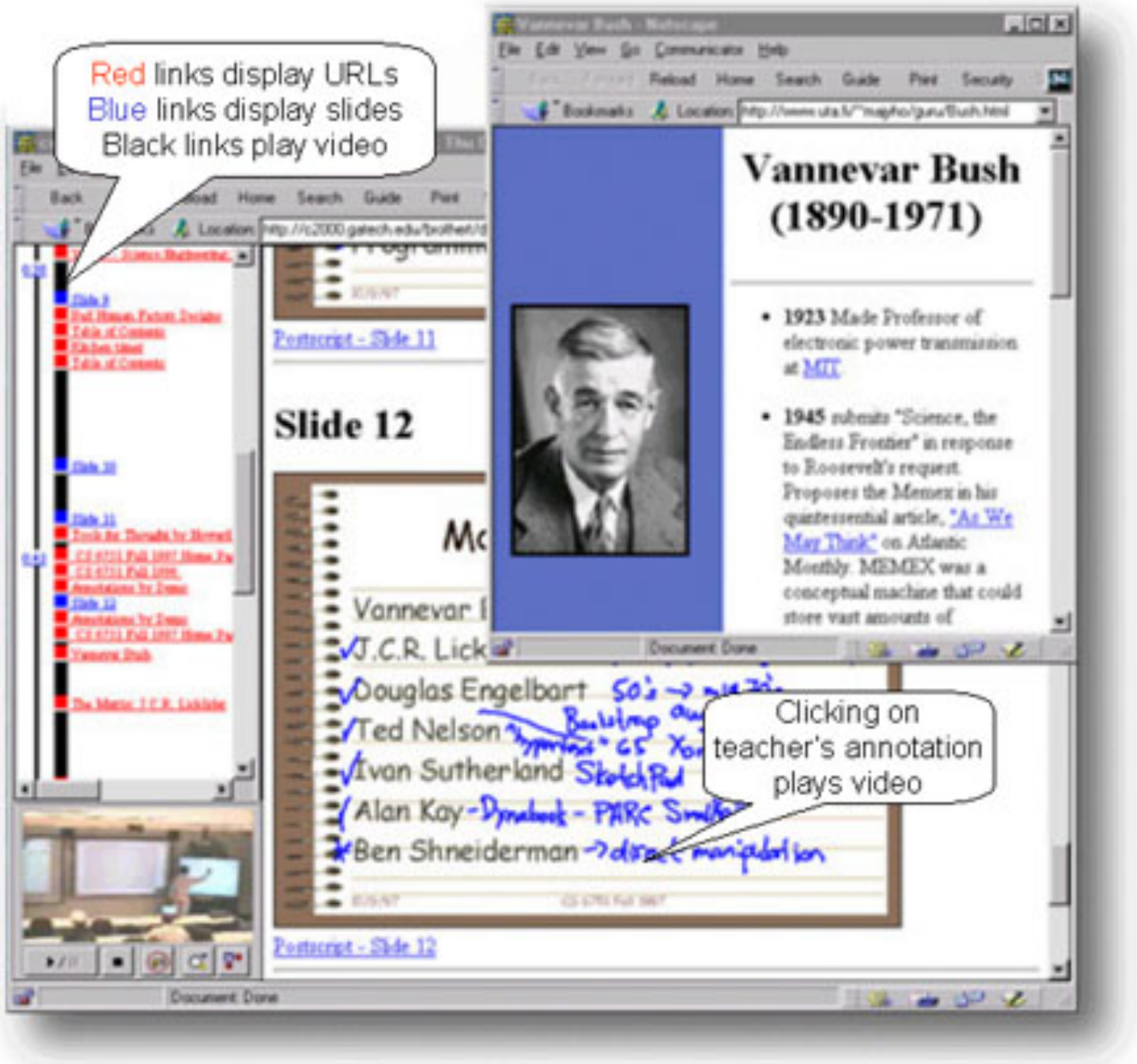
eClass (formerly Classroom 2000)

eClass

- Captures the lecture experience
  - Audio, Video, Lecture Notes on Smart Board

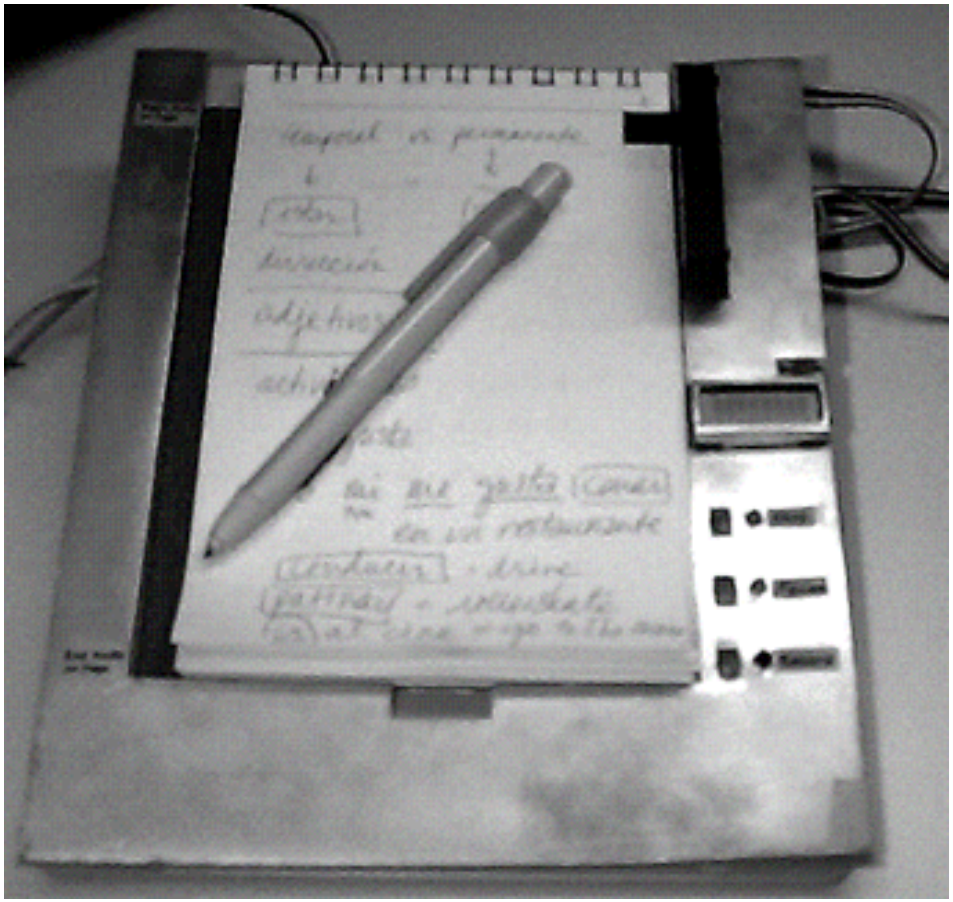


- Integrates everything for easy replay


Red links display URLs
Blue links display slides
Black links play video
Vannevar Bush
(1890-1971)
Slide 12
Clicking on teacher's annotation plays video

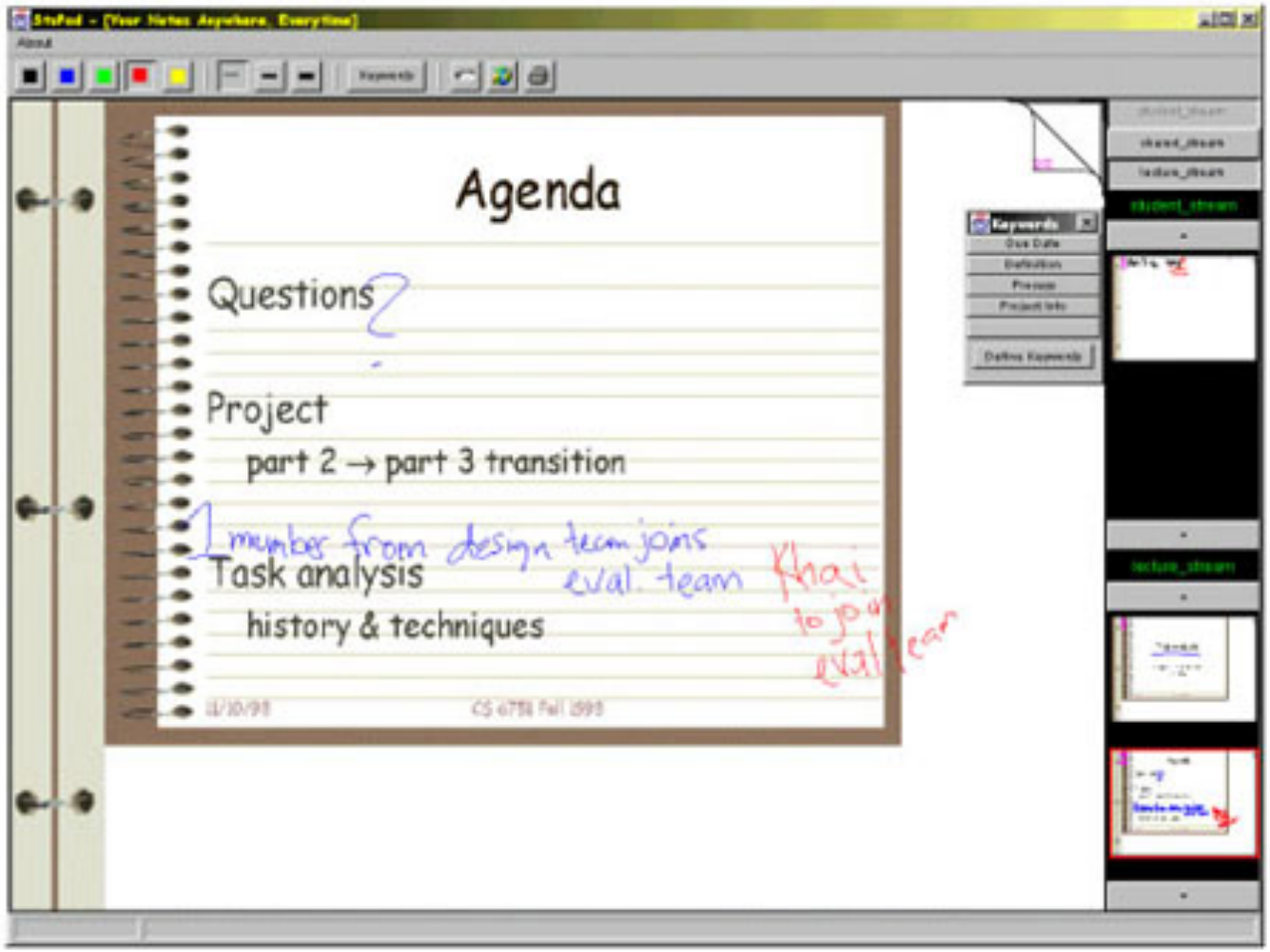
Aside: Audio Notebook

- Records ink and audio, allows playback
- Simple architecture, not a lot of interpretation



eClass – Student Notes

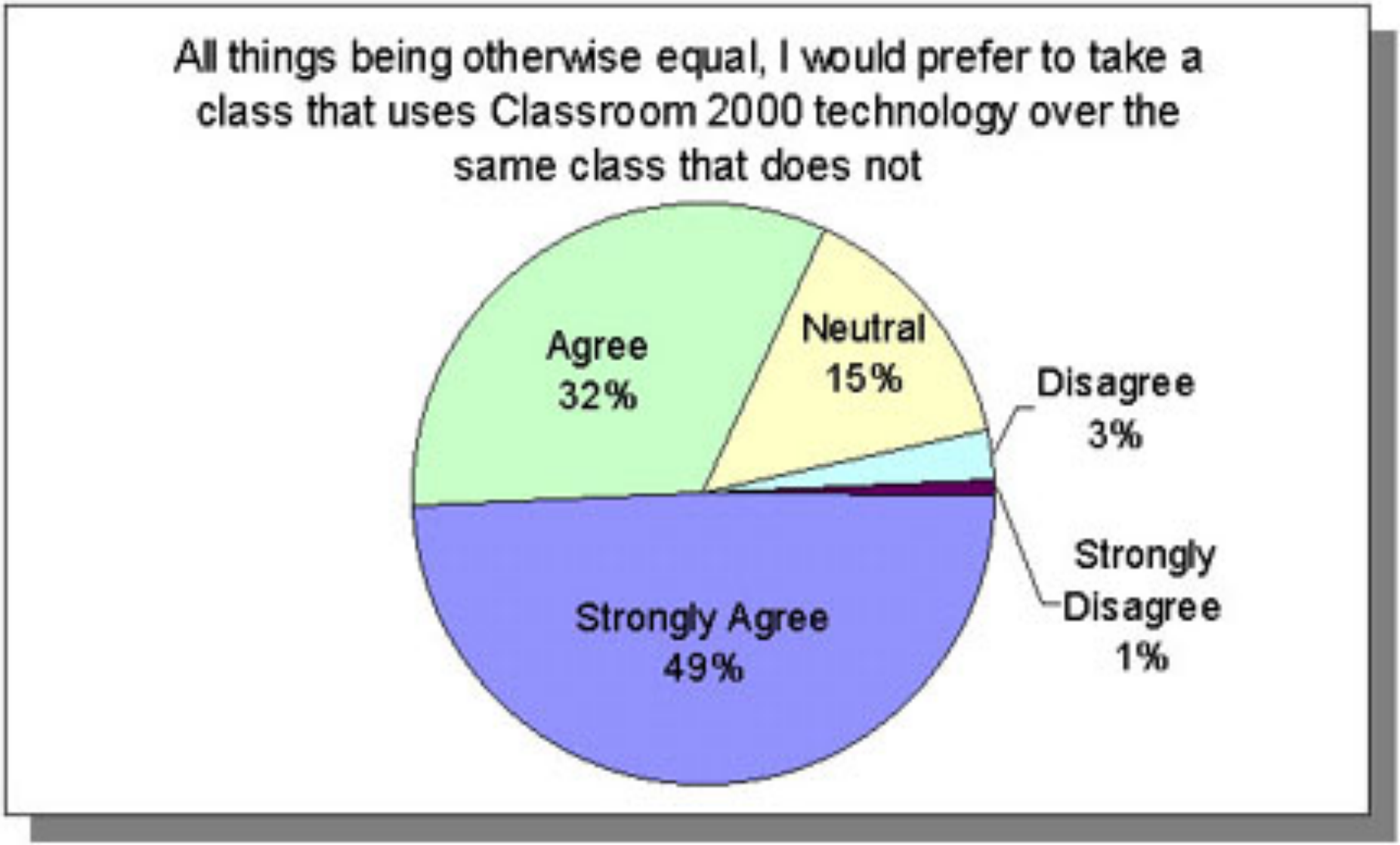
- StuPad (poorly named ☺)



eClass – Student Feedback

- Guesses on student feedback?
  - Do students prefer using it?
  - Is video useful?
  - Is audio useful?
  - Are slides useful?
  - Does it encourage skipping class?

eClass – Student Feedback



eClass – Student Feedback

- Video not too useful (remember tech constraints)
- Being able to access slides and audio useful
- Divided about if eClass encourages skipping class
  - 40% yes, 34% neutral, 26% no

eClass – Learning

- In 1998, compared two sections of Software Eng
  - one with and one without eClass

- Any guesses?
  - When were things accessed most?
  - Any effect on exam grades?
  - Any effect on note-taking?
  - Any effect on attendance?

eClass – Learning

- Greatest access before exams (of course! ☺)
- No significant effect on exam grades
- Students took far less notes
- No effect on attendance

- Captured notes useful as a “safety blanket”

- http://www.research.ibm.com/journal/sj/384/abowd.html

Capture and Access

Personal Audio Loop

Abaris

Some Discussion Points

- Several installations around Georgia
  - Georgia Tech, Kennesaw State U, Georgia State U
- Privacy issues
  - eClass has cameras only on front area rather than students
  - PAL has short loop (~5minutes)
  - Generally relies on social constraints rather than technical
- How to know what's being recorded and when?
- How to convince faculty to use it?
- Cost?

Sony Computer Science Lab

Pick and Drop

- A variant of ToolStone
  - Way of easily transferring data
  - Way of using mobile computer like a palette

Sony Computer Science Lab
Augmented Surfaces

- Make it easy to exchange digital info between laptops, table and wall displays, and physical objects

Microsoft Research

Connecting Devices

- Bumping
  - Bump two computers together
  - Have accelerometers in the two devices
  - See co-occurring acceleration data
  - Link
- Stitching
  - See co-occurring pen drag data

Some Discussion Points

- Affordances?
  - How to know what you can do?
  - Walk in a room, what's going on?
- Feedback?
  - How to know that things are working correctly?
- Cost?
- Why is it faster to connect to a server in Seattle (Amazon.com) than it is to connect two laptops?
  - What are ways of speeding things up?

RoomWare

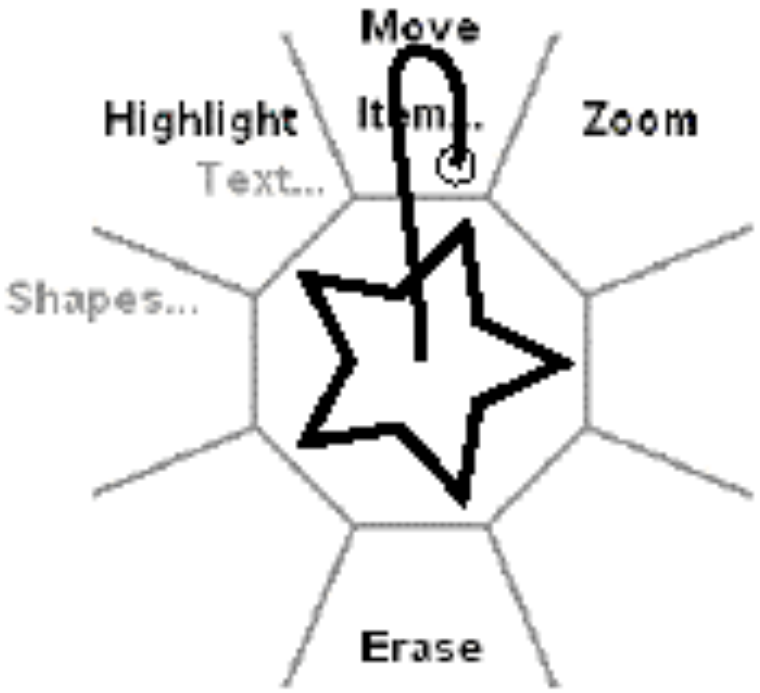
- Augment furniture to support collaboration

Stanford iRoom

Stanford iRoom

FlowMenu

- Like a pie menu, can specify object, operation, and parameters in a single pen stroke



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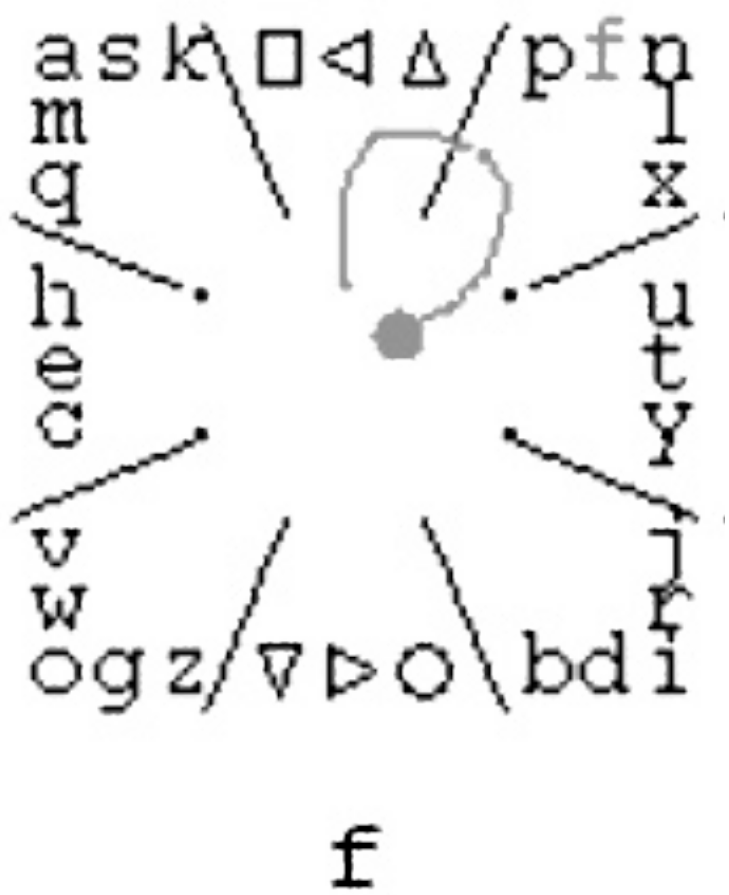
Stanford iRoom

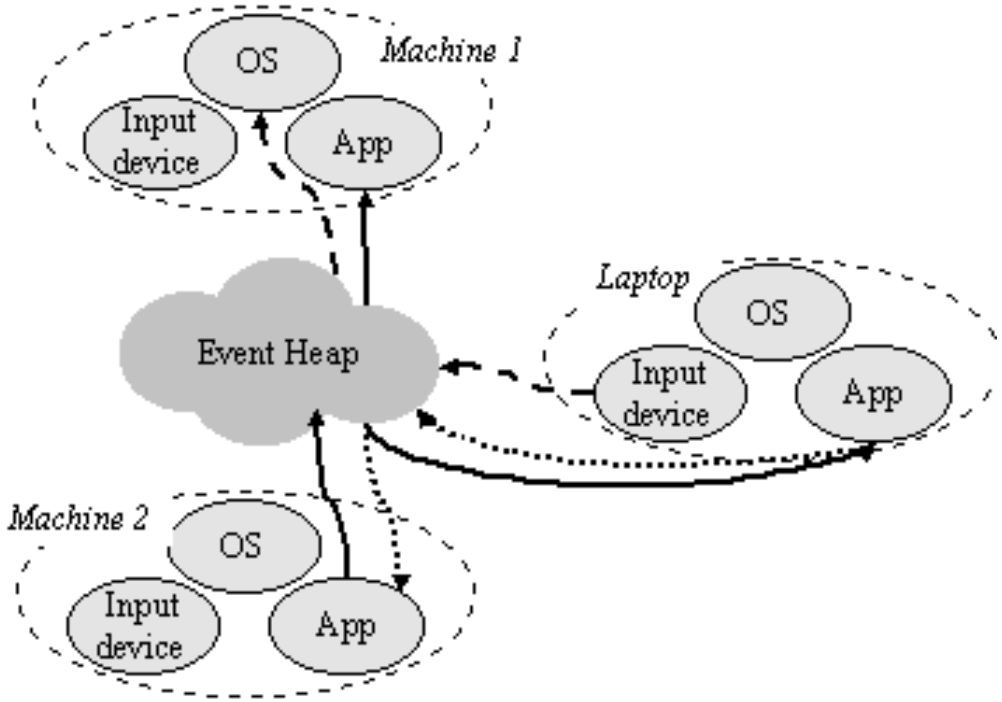
FlowMenu

- Based on QuikWriting



Stanford iRoom
EventHeap

- Way of gluing software and hardware together
  - Analogous to Event Queue
  - All inputs and outputs connect to Event Heap
  - One Event Heap per room



Stanford iRoom

EventHeap

- Event Heap implemented as a Tuple Space
  - Essentially a Blackboard architecture (from multimodal)
  - Why an event heap? Why not an event queue per room?

Smart Homes

- Aware Home
  - For aging
- “Green” Homes
  - For energy

- Some Opportunities
  - Game systems (Sony, Nintendo, Microsoft)
  - Entertainment (Samsung, Philips, Panasonic, …)
  - Mobile (Nokia, Motorola)
- Digital Living Network Alliance

Summary

- Systems
  - eClass
  - Pick and Drop
  - Augmented Surfaces
  - Bumping and Stitching
  - Roomware
  - Stanford iRoom
- Issues
  - Basic interaction
  - Capture and Access
  - Discovery
  - Interoperability
  - Cost