

Context-awareness and smart spaces

forms

drawing



What are Smart Spaces?

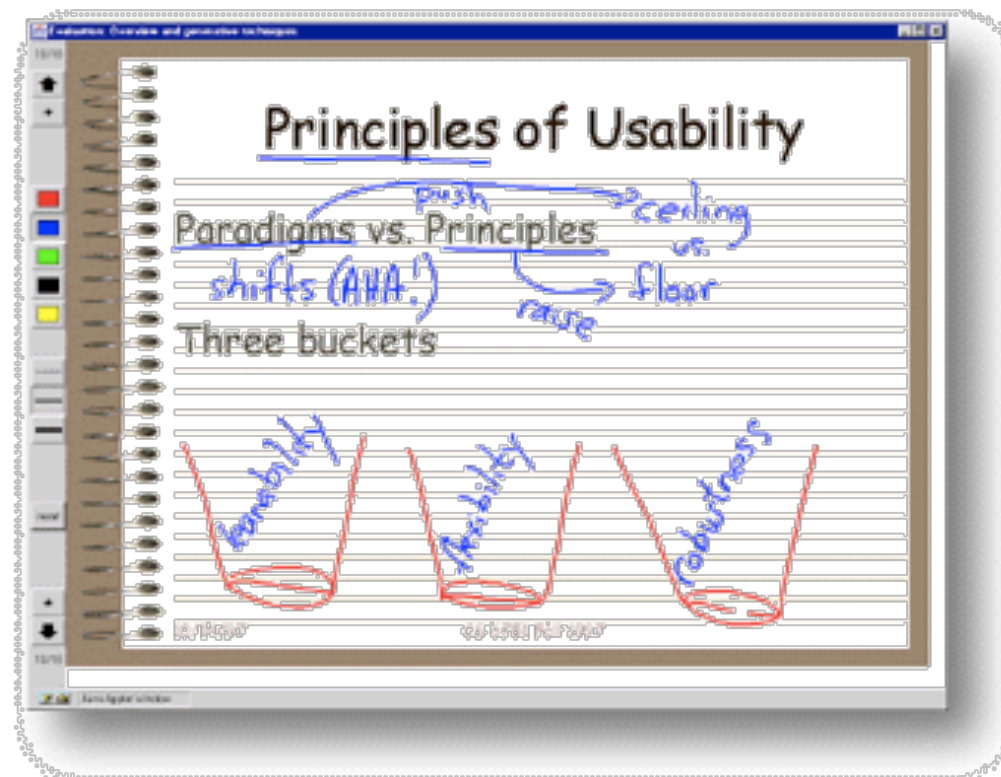
- Instrumenting physical spaces with computers to provide useful services
 - Support cooperation & coordination (remote and co-located)
 - Automated capture
- Some issues to consider:
 - Interaction with non-desktop computers (walls, tables)
 - Discovery (how to know what can you do in a smart space?)
 - 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

The screenshot shows a web browser window titled "Vannevar Bush - Wikipedia". The address bar shows the URL "http://www.uta.fi/~magho/guru/Bush.html". The main content area features a portrait of Vannevar Bush and a list of bullet points:

- 1923 Made Professor of electronic power transmission at [MIT](#)
- 1945 submits "Science, the Endless Frontier" in response to Roosevelt's request. Proposes the Memex in his quintessential article, "[As We May Think](#)" on Atlantic Monthly. MEMEX was a conceptual machine that could store vast amounts of

A sidebar on the left contains a list of links, some of which are red, blue, and black. A small video player is visible at the bottom left of the sidebar.

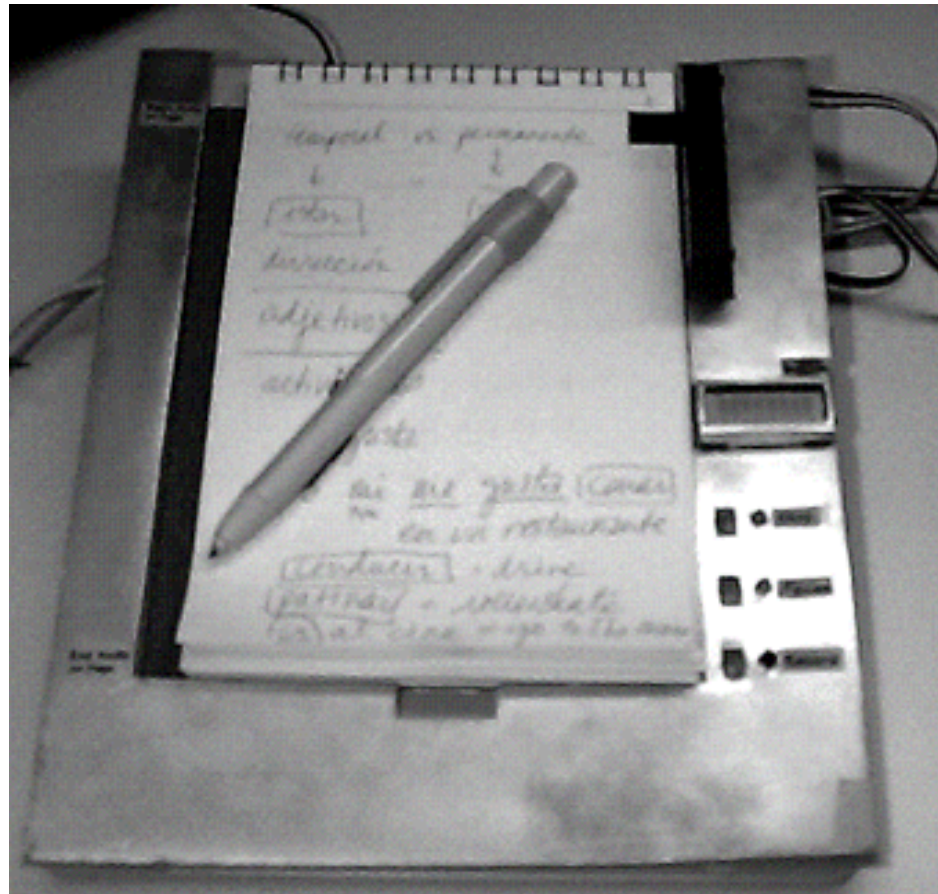
Below the main content area, there is a list of names with checkmarks and handwritten notes:

- ✓ J.C.R. Licklider
- ✓ Douglas Engelbart *50's → 60's*
- ✓ Ted Nelson *Building a better mousetrap*
- ✓ Ivan Sutherland *Sketch Pad*
- ✓ Alan Kay - *Dynabook - PARC*
- ✓ Ben Shneiderman *→ direct manipulation*

A speech bubble points to the list of names, stating: "Clicking on teacher's annotation plays video".

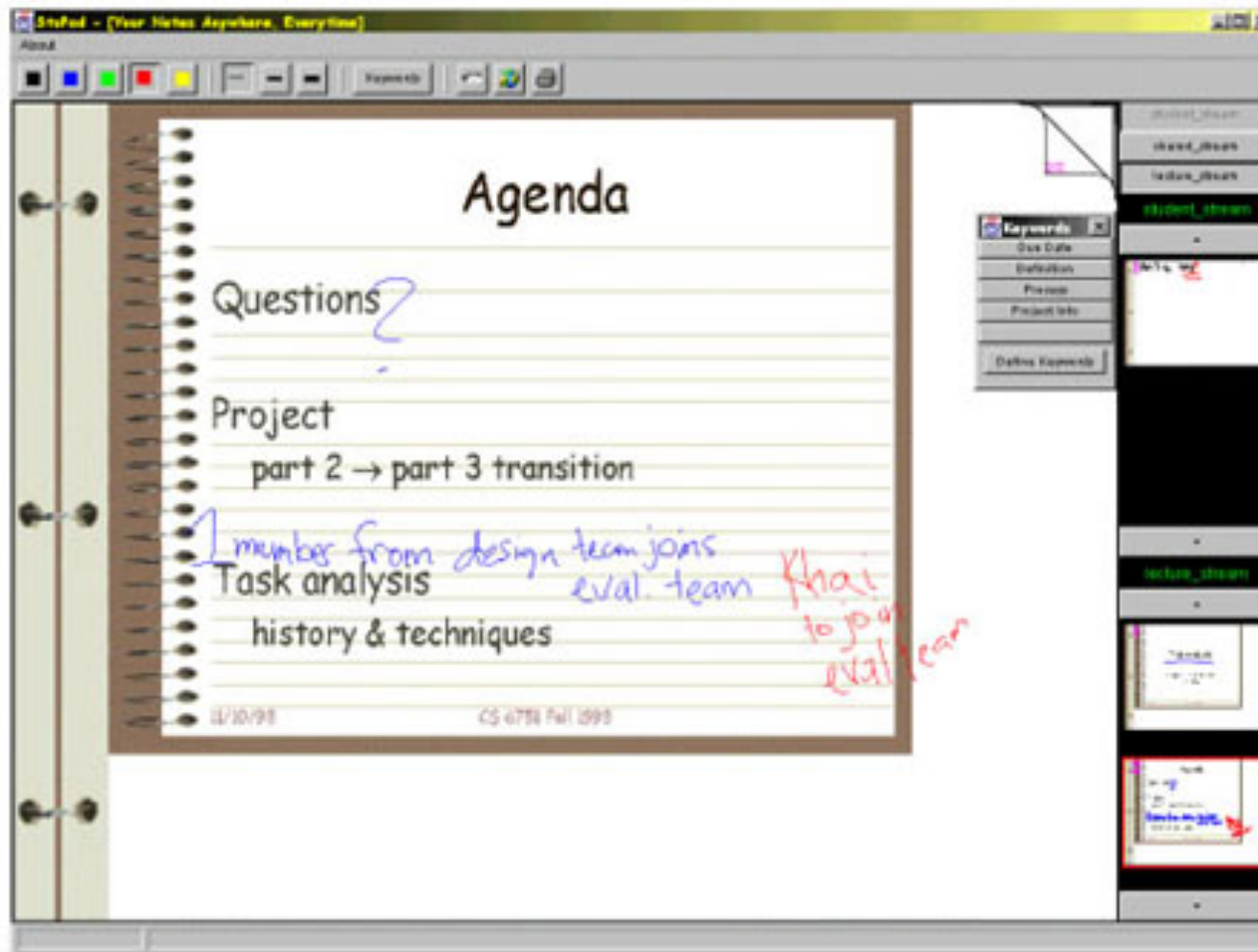
Aside: Audio Notebook

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



eClass – Student Notes

- StuPad (poorly named ☺)

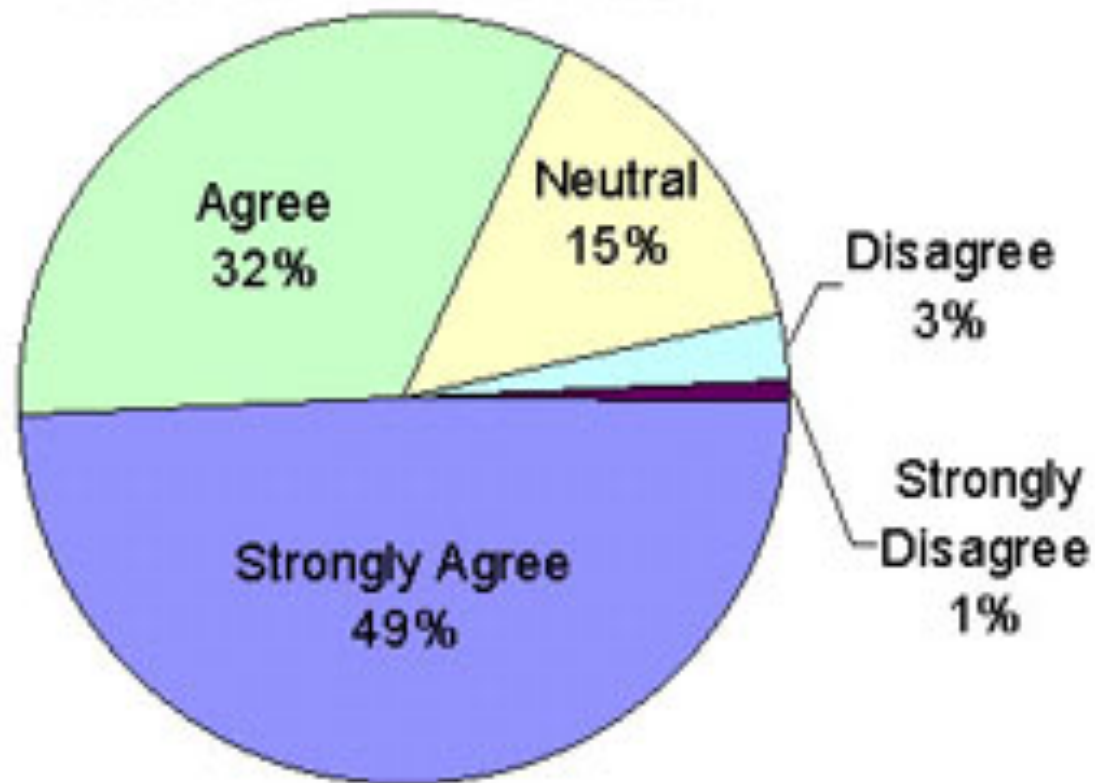


eClass – Student Feedback

- 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

All things being otherwise equal, I would prefer to take a class that uses Classroom 2000 technology over the same class that does not



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



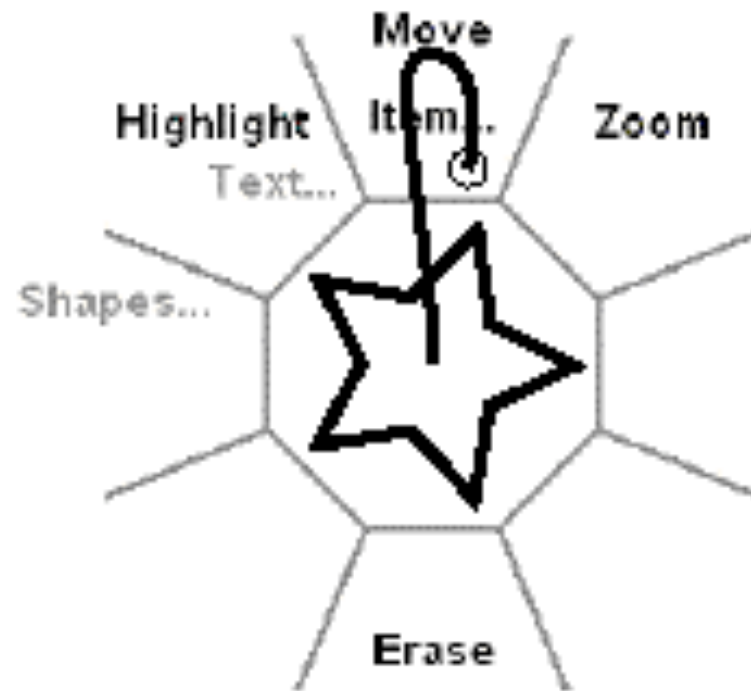
Stanford iRoom



Stanford iRoom

FlowMenu

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



Stanford iRoom

FlowMenu

- Based on QuikWriting

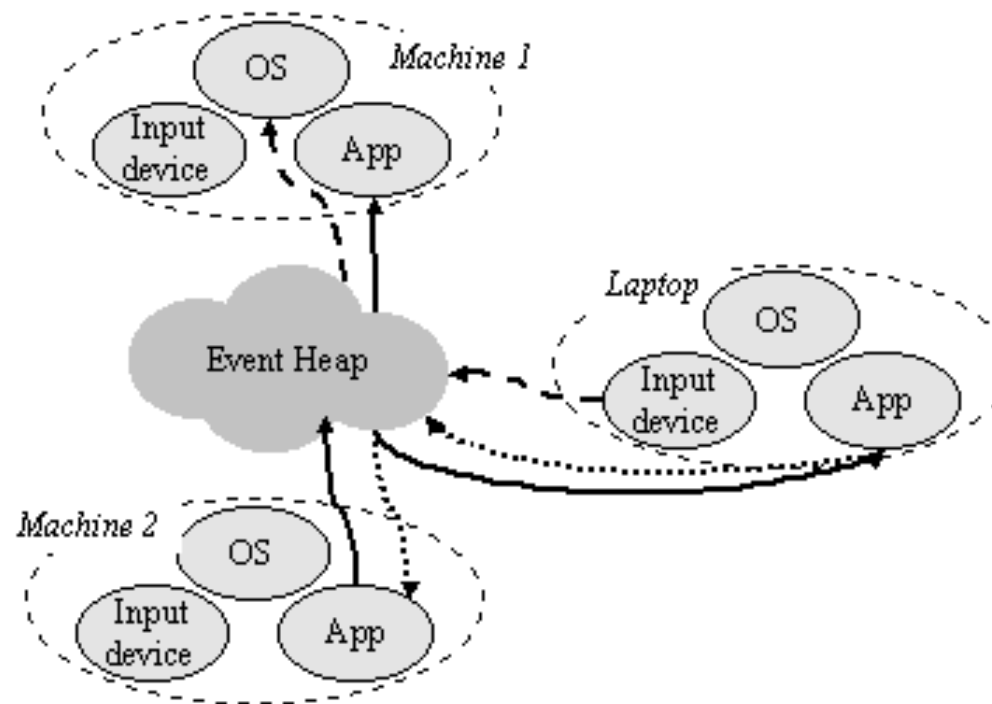


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Stanford iRoom

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