Questions

- How are students, technologies, and academia changing?
- What pressures are these changes putting on public technology spaces?
- How can we better support pervasive, mobile computing?
- How can we better support partner and small-group collaboration?
Outline

- Rethinking technology spaces
  - Changes in student users and technology
  - Changes in curriculum, pedagogy, and campus life
- Real-time, real-space group collaboration
  - Interactive Workspaces project
  - TeamSpace software
- Pilot implementation
  - Academic Computing—Computer Science collaboration
  - Space design considerations
  - User studies
  - Sustainability and scalability
- Discussion

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Public technology spaces in education

- Outside the classroom
- Specialized spaces
- Purposes
  - Learning, teaching
  - Creativity, production
  - Recreation, socializing
- Future: Immersive environments, VR, simulation
Our legacy tech spaces

- Created to provide access to computing
- But still used for…
  - Quick-hit email, Web, IM, etc.
  - Printing, production work
  - Productivity software
  - Course-specific software
  - Alternative study space
  - Group/partner work
- Workstation usage declining

Nomadicity <-> digital natives

- 89% laptops for first-year students
- Proliferation of wireless
- Proliferation and convergence of devices (phone=camera=iPod=messaging)
- “Digital native” multitasking, collaboration, communication, cybertecture, new ways of learning
- (Trickle-up) pervasive computing has arrived
Changing curricula and pedagogies

- Project-based learning, problem-based learning (PBL)
- Multimedia production, presentation
  - Required
  - Student-initiated
- The new literacy, e.g. new Stanford Writing Requirement
- CS2c, “Intermediate Computing at Stanford”

Changing campus and residential life

- Pervasive communication and connectivity
- Merging of academic, social, personal, and community-building activities
- Virtual and residence communities/IM your roommate
- Extracurricular cybercommunities, digital production needs
Specific needs for technology spaces

- The same old stuff (workstations, printers, software)...
- High-end digital production
- Multimedia presentation, performance, rehearsal
- Partner and small-group collaboration
- Laptops and emerging devices

Interactive Workspaces Project

- Stanford CS Dept (Winograd, Fox); http://iwork.stanford.edu
- Collaborate across multiple devices, OSs, applications
- iRoom: ubicomp environment + iROS meta-OS
- Production classroom version in Wallenberg Hall
iRoom / iROS

![Diagram of iRoom and iROS components]

Mac app
Java app
Event Heap Server
Win app
Java app

iROS Manager

iRoom classrooms in Wallenberg Hall

![Image of Wallenberg Hall classrooms]

http://wallenberg.stanford.edu/

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TeamSpace@Stanford
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TeamSpace software

- “Zero-Admin” lightweight appliance
  - Installation quick and easy
  - Configuration minimal and centralized
  - Clear boundaries of interaction defined
  - Recoverability from transient hardware and software failures
- iROS Manager, PointRight, MultiBrowse
- Simple GUI

User interface

Server: iROS Manager

Client: TeamSpace
Departmental collaboration

- Academic Computing
- Computer Science Department
  - IWork research group
- Wallenberg Global Learning Network
- Stanford School of Engineering (grant)

Space design considerations

- What are you seeking to enable?
- What user experience(s) are you creating?
- What rhythms are you creating?
- As you shape the space, how does the space shape you?
Space Design Considerations

- Flexibility over fixed
- Convertibility
- Versatility
- Modifiability
- Cultural & social engineering
- Physical vs. technology investment


Collaboration Design Considerations

- Seating, shape, orientation=eye contact
- Work surface
- Same document or divide labor
- Private vs. public information space

Collaboration Technologies
- Horizontal/Vertical displays
- Multiple displays
- Tangible interfaces
  - Physical object interfaces the virtual
- Integrated environments
  - iRoom


User studies
Parameters
- Departure from public computing
- Move data & control
- New way to structure collaboration
  - Working “over the shoulder” on one unit
  - Discuss and work separately, reconvene
- Extension of the laptop
- Share large displays
  - “See” the workspace
- Public and private space

User studies
Design and Results

- One and two screens
- Groups
  - Randomly formed groups
    - Assignment: Develop presentation
    - Find comfort level in communication and space
    - Verbal communication
  - Pre-existing groups
    - Class project or student organization
    - Greater ease in using the environment


User studies: video
Resources


Support issues

- Transitioning research project to real world
- Does “Zero-Admin” = “Zero-Maintenance”? 
- No difference in supporting a cluster computer
  - File save/location
  - User understanding
- Wired vs. wireless — “leaving the conversation”
- Security
Current status and scalability

- TeamSpace (Open Source)
- Tidebreak (www.tidebreak.com): Overface
  - PointRight
  - Interface control
- FileWarp
  - Drag/drop file moving among attached devices
- CrossPaste
  - Paste information between attached devices
- ActionTrack
  - Archive/track meeting files
- Transient Screen Annotation

What’s next?

Discussion

- Your experience with changing users, technology, student culture, academic needs?
- To what extent do you feel similar pressures on your public technology spaces?
- Your experience with space design considerations, other ways to support collaboration, laptop users?
- Suggestions, comments about TeamSpace?