

A black and white photograph of Albert Einstein, with his characteristic wild hair and mustache, wearing a dark jacket. He is standing in front of a chalkboard, looking back over his shoulder towards the camera while writing on the board with his right hand. The text on the board is written in a casual, handwritten style.

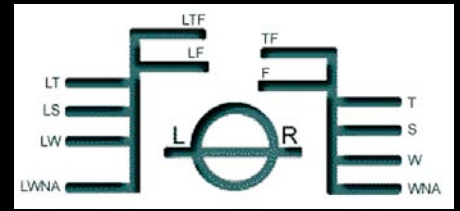
Learning Spaces and
the Technologies That
Support Them

Phillip D. Long
MIT

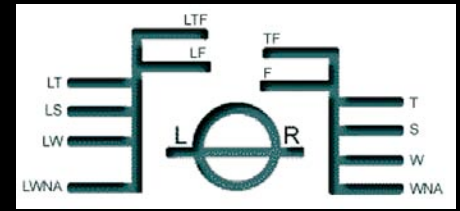


SOME RIGHTS RESERVED

Plimsoll Marks

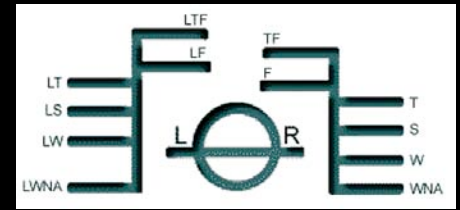


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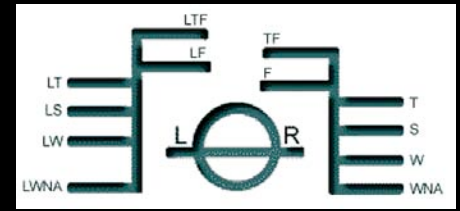
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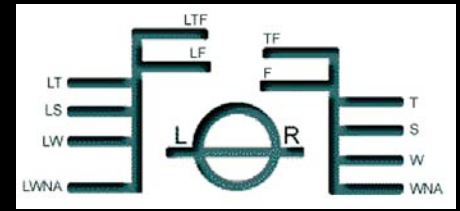
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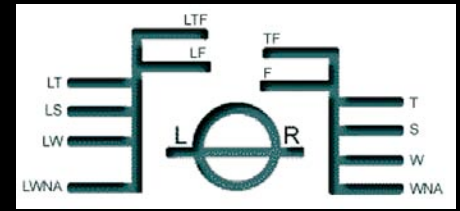
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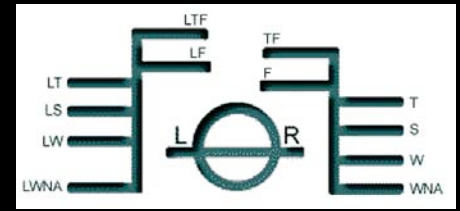
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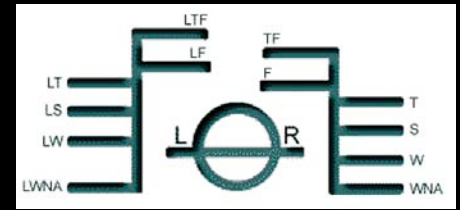
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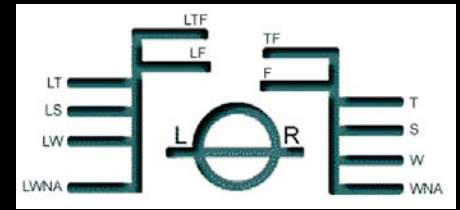
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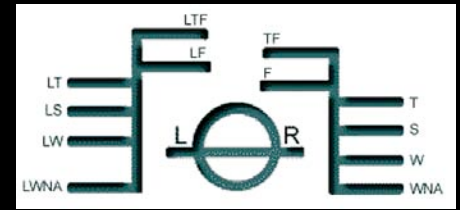
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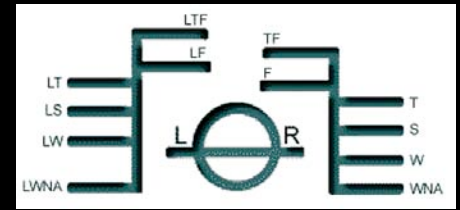
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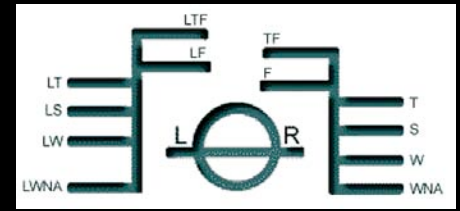
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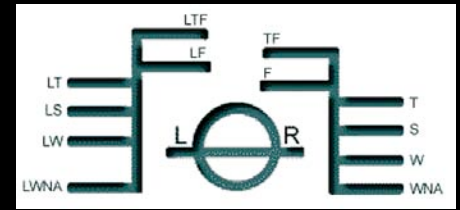
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Once P.A.D.D.
Now Normal

Story Arc of this Talk

Physical or immersive surroundings directly impact mind & body

Story Arc of this Talk

Story Arc of this Talk

environments matter

Story Arc of this Talk

environments matter

Design of spaces suggests their use and the roles you are expected to play in them

Story Arc of this Talk

environments matter

Story Arc of this Talk

environments matter

they predispose behavior

Story Arc of this Talk

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Learning environments can be enhanced or diminished by their attributes, including the technologies in them

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Story Arc of this Talk

environments matter

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technology matched to purpose enhances

Story Arc of this Talk

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How we learn persists, what we learn is more transient

Story Arc of this Talk

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Story Arc of this Talk

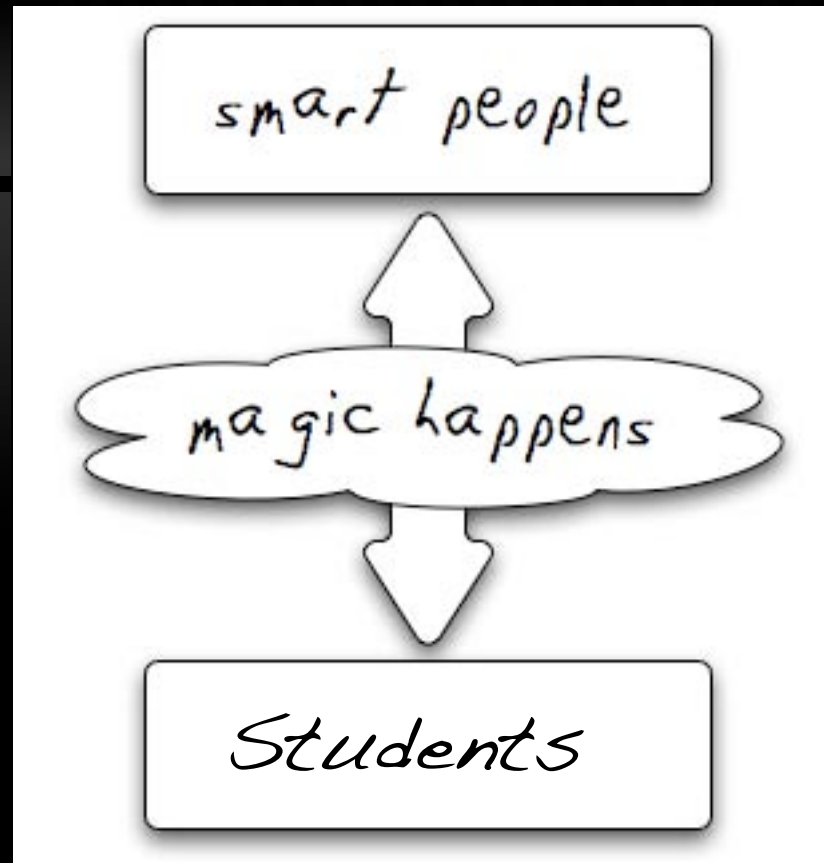
environments matter

they predispose behavior

technology matched to purpose enhances

process ontologies are replacing content ontologies

The Romantic View of Learning



Do learning environments really matter? Two examples:

- The importance of view
- The case of art on the wall



1. The Importance of the View

Ulrich (1984). View through a window may influence recovery from surgery. *Science*, 224, 420-1.

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Patients

- Cholecystectomy
- 23 matched pairs
- 1972-81

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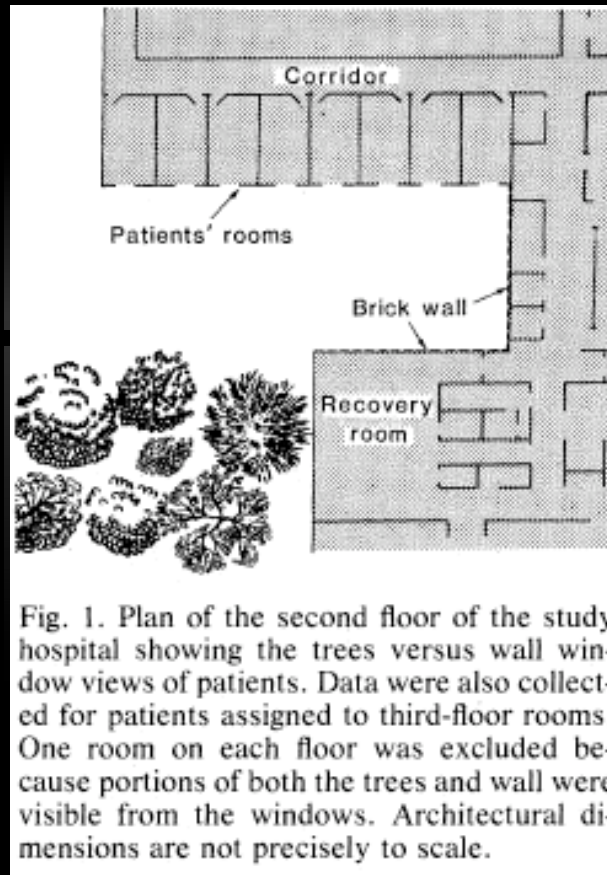


Fig. 1. Plan of the second floor of the study hospital showing the trees versus wall window views of patients. Data were also collected for patients assigned to third-floor rooms. One room on each floor was excluded because portions of both the trees and wall were visible from the windows. Architectural dimensions are not precisely to scale.

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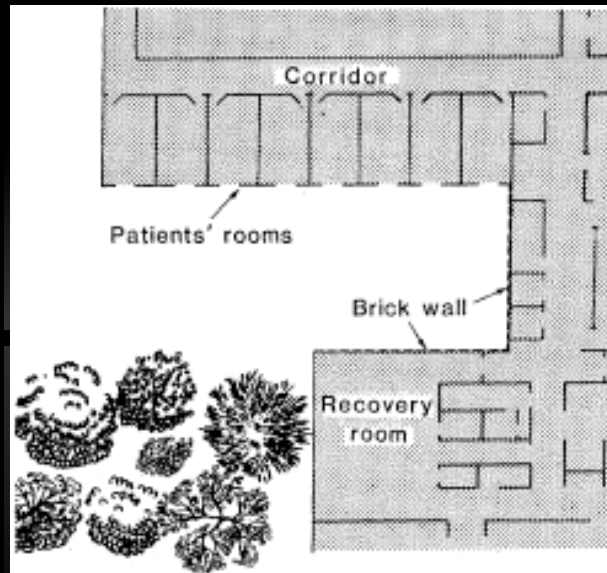


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	Days 2-5	
	Wall	Tree
Strong	2.48	0.96
Moderate	3.65	1.74
Weak	2.57	5.39

Analgesic doses per patient

Ulrich (1984). View through a window may influence recovery from surgery. *Science*, 224, 420-1.

Perceptual Input Affects Human Physiology

In summary, in comparison with the wall-view group, the patients with the tree view had shorter postoperative hospital stays, had fewer negative evaluative comments from nurses, took fewer moderate and strong analgesic doses, and had slightly lower scores for minor postsurgical complications. Although the findings suggest that the natural scene had comparatively therapeutic influences, it should be recognized that the "built" view in this study was a comparatively monotonous one, a largely featureless brick wall. The conclusions cannot be extended to all built views, nor to other patient groups, such as long-term patients, who may suffer from low arousal or boredom rather than from the anxiety problems typically associated with surgeries. Perhaps to a chronically understimulated patient, a built view such as a lively city street might be more stimulating and hence more therapeutic than many natural views. These cautions

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No Art

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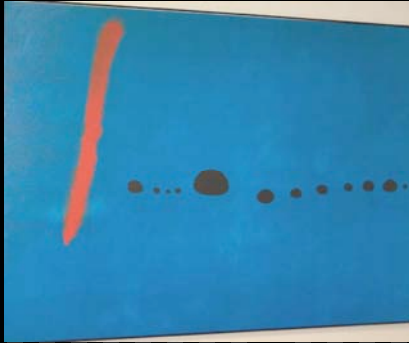
Art



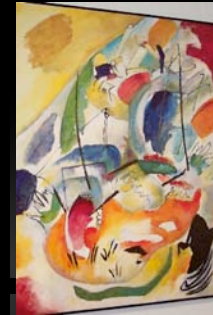
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Stimuli

Modern Art



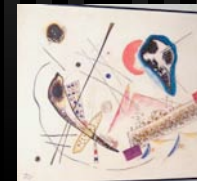
Bleu
II
Miró



Improvisation
31
Kandinsky



Composizion
e
Miró



Composition
Lyrique
Kandinsky



Phenomena: Continental
Shelf
Jenkins



Signal
Field
Robinson

Stimuli

Nature Scenes



A River Through the Woods
Zacho



After the Rains
Stephenson



Reflections of Spring
Fontaine



Ile St. Martin
Monet



Autumn Tapestry
Forsberg



Vetheuil in Summer
Monet

Anger Inducing Tasks

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- **Angle Matching**

- All uppercase instruction
- No matching angles
- Negative social comparison

feedback

- * “You are WRONG”

- * “Out of 8 trials, we counted 2 correct.

The average number for subjects tested so far is 4.”

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- **Automated Teller**

- User Hostile
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 - * "You are TOO SLOW!!" accompanied by a loud BEEP.
- Vague Instructions
 - * "UNPACK BYTES"

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- Difficult due to the rapid display
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- **Object Tracing**

- Computer glitches
 - * Mouse freezes
 - * Ghost lines
- Negative social comparison

feedback

- * Told they were far less accurate (34% vs. 75%) than their peers

- **Automated Teller**

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Self Ratings

Trait Anger

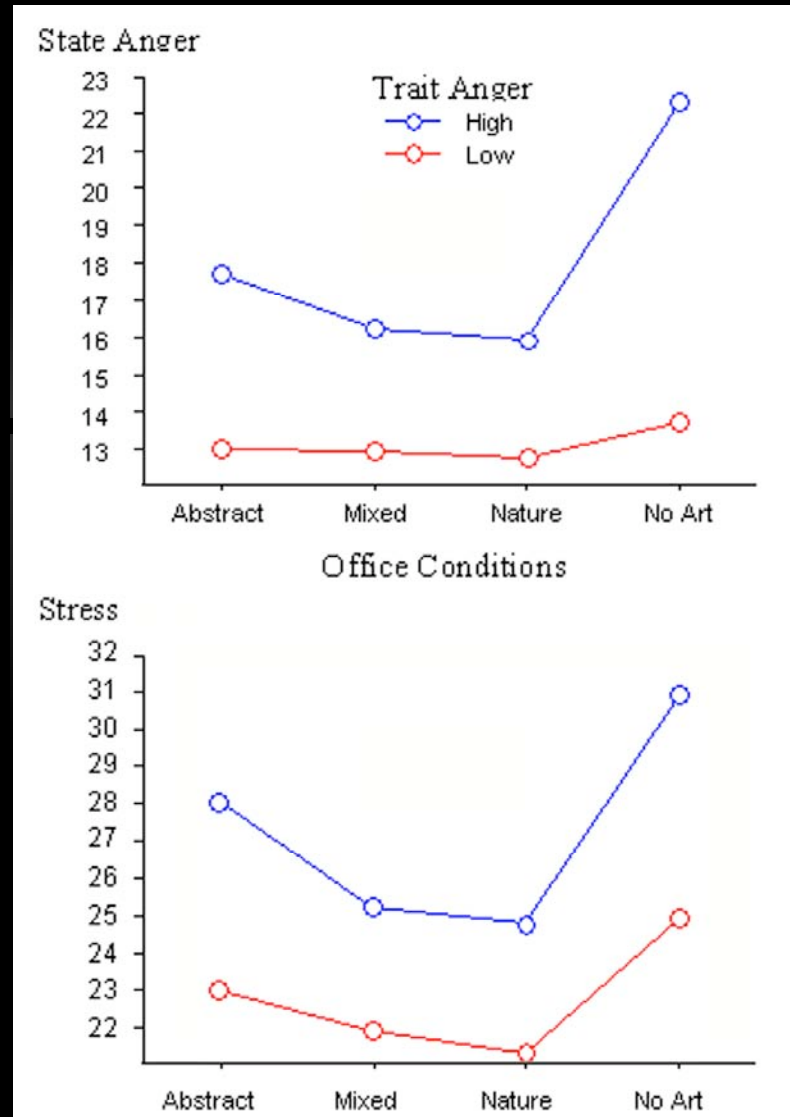
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State Anger

“...an emotional state or condition that consists of subjective feelings of tension, annoyance, irritation, fury and rage, with concomitant activation or arousal of the autonomic nervous system” (Spielberger, 1996).

Stress

“The process by which an individual responds psychologically and physiologically...to a situation that is challenging, demanding, or threatening to well-being” (Baum, Fleming, & Singer, 1985).



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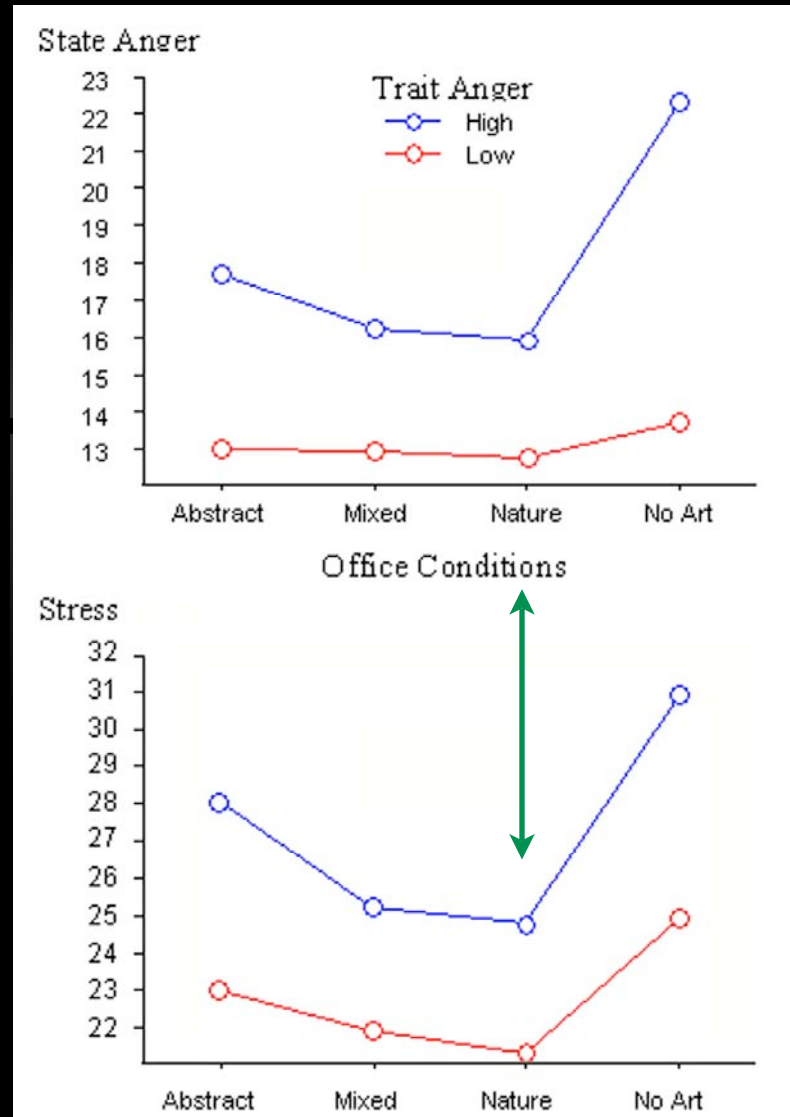
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CLASSROOM DESIGN INFLUENCES LEARNING

IT TELLS STUDENTS HOW THEY ARE GOING TO INTERACT WITH INFORMATION & EACH OTHER

TRADITIONAL CLASSROOM MODELS



TRADITIONAL CLASSROOM MODELS

- Formally organized



TRADITIONAL CLASSROOM MODELS

- Formally organized
- Lecture based



TRADITIONAL CLASSROOM MODELS

- Formally organized
- Lecture based
- High room utilization



TRADITIONAL CLASSROOM MODELS

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- Low room adaptability



TRADITIONAL CLASSROOM MODELS

- Formally organized
- Lecture based
- High room utilization
- Low room adaptability
- High student/furnishings/space ratio

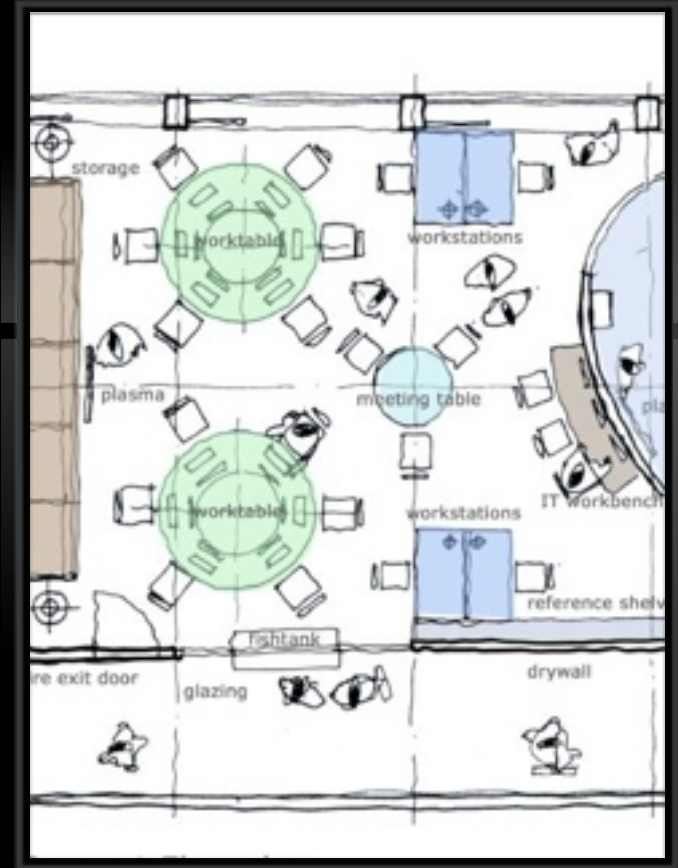


NEWER MODELS FOR LEARNING SPACES



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- Group/team oriented



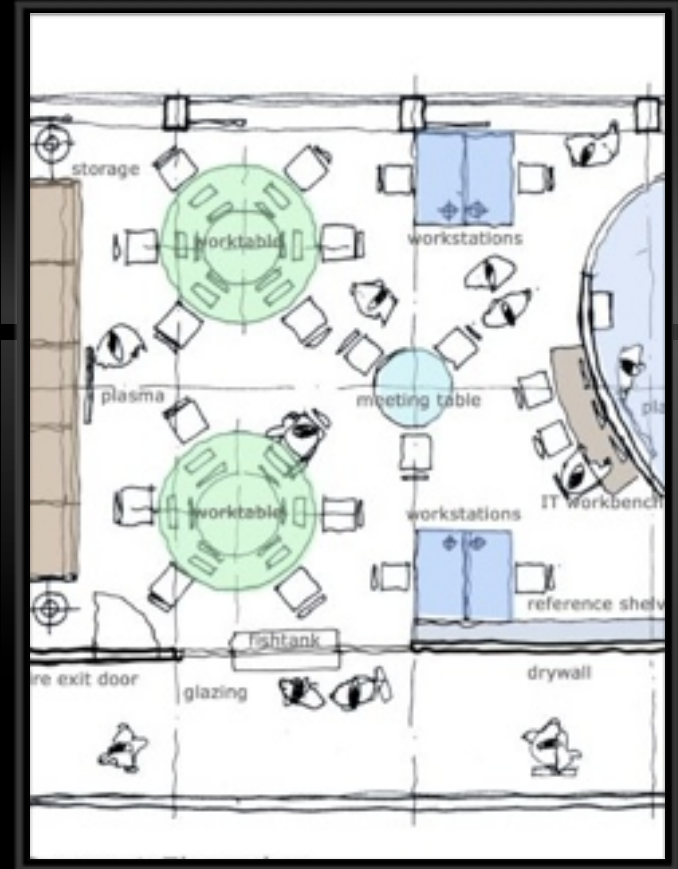
NEWER MODELS FOR LEARNING SPACES

- Group/team oriented
- Multi-venue



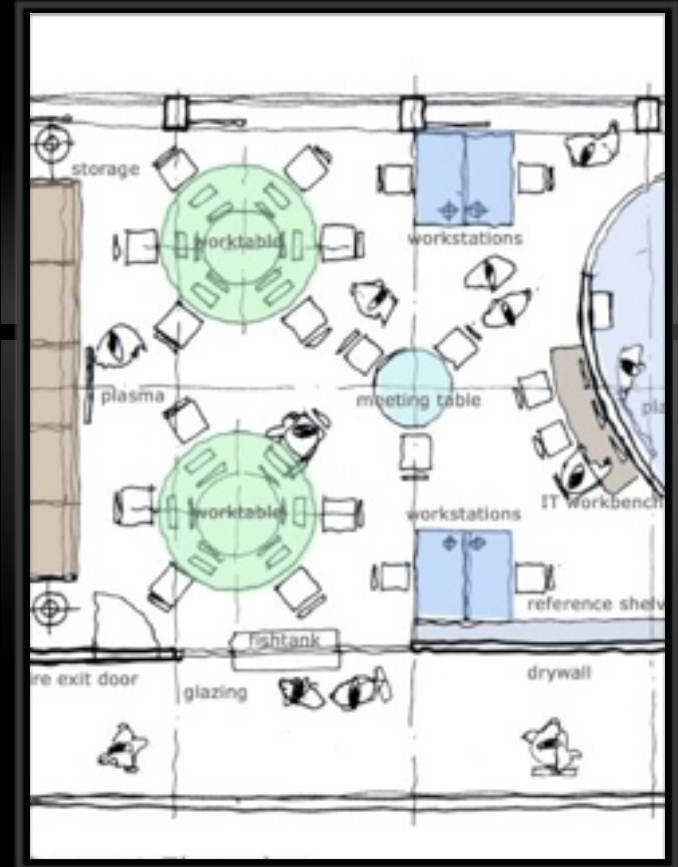
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- Group/team oriented
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NEWER MODELS FOR LEARNING SPACES

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- Potentially lower room utilization rates



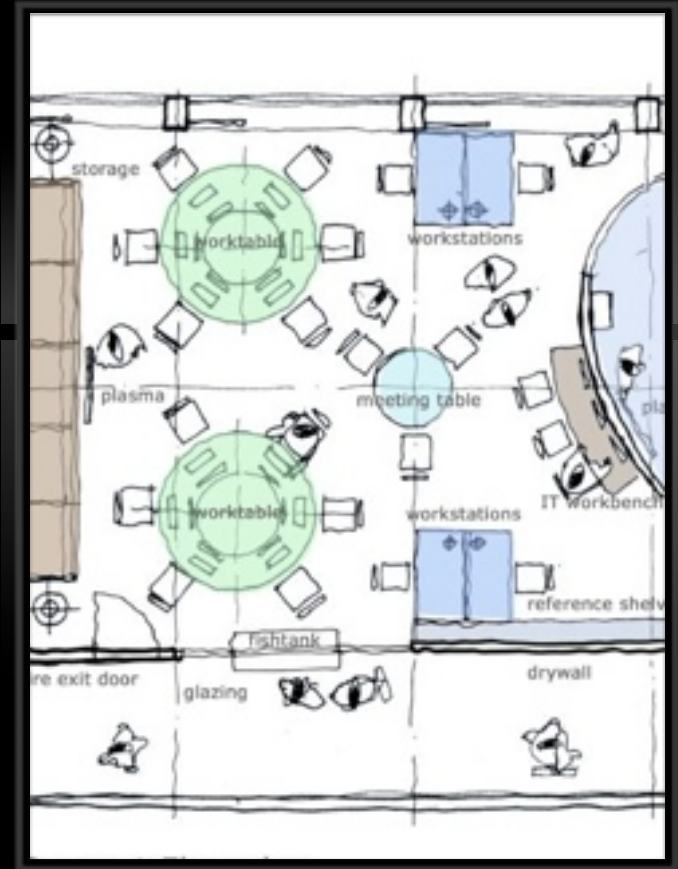
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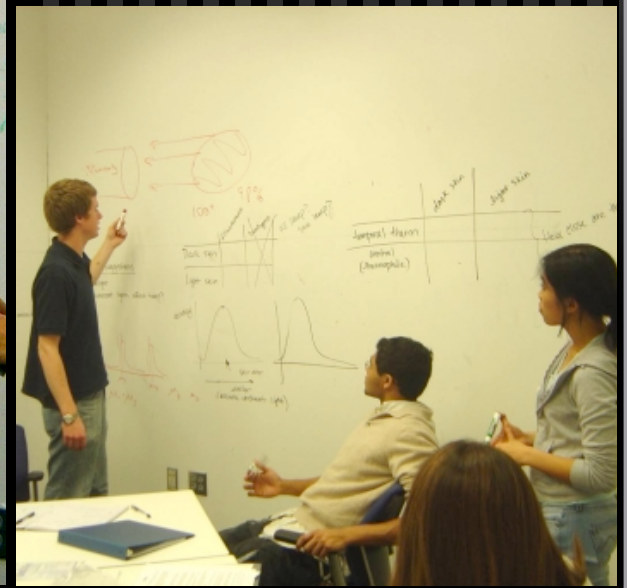
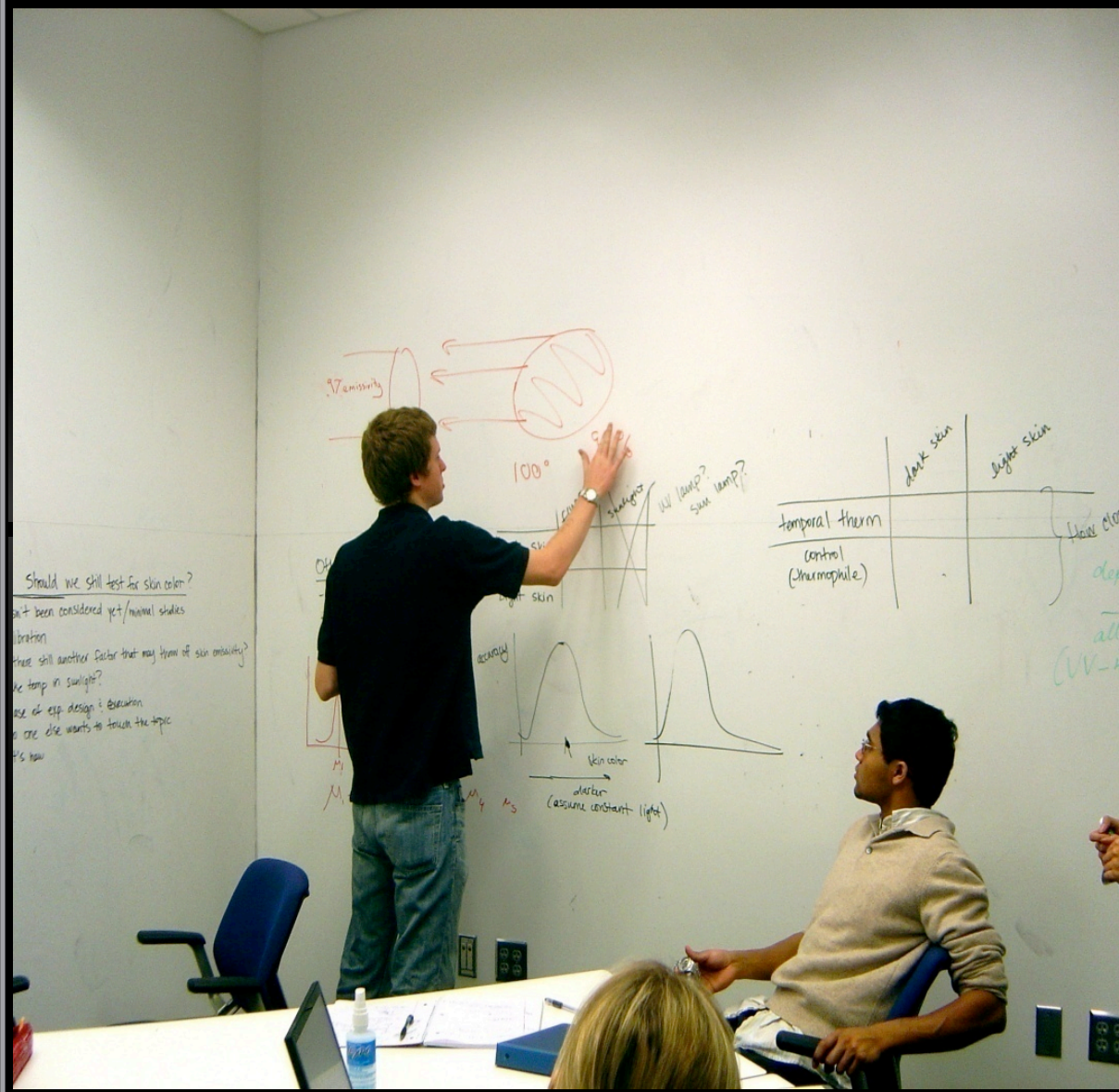
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NEWER MODELS FOR LEARNING SPACES

- **Group/team oriented**
- **Multi-venue**
- **Support families of pedagogy**
- **Potentially lower room utilization rates**
- **Higher room adaptability**
- **Lower student/furnishings/space**





PROBLEM-BASED LEARNING SPACES

GEORGIA TECH BIOMEDICAL ENGINEERING UNDERGRADUATE PROGRAM (WENDY NEWSTETTER)



3-735



SEMINAR SPACES



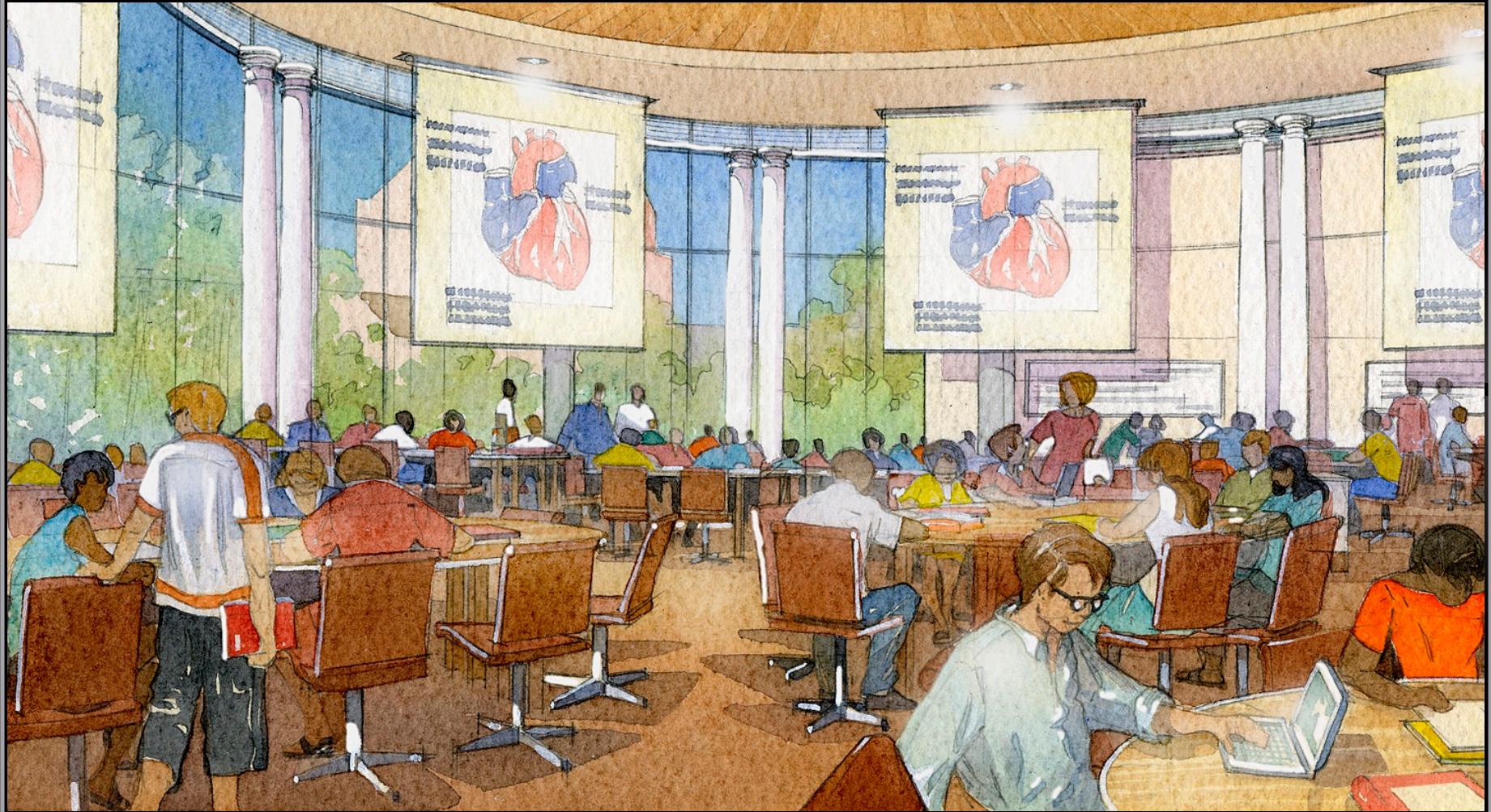
Distributed communities interconnected



Distributed communities interconnected




Non-formal learning spaces



MEDICAL EDUCATION BUILDING / UNIVERSITY OF VIRGINIA

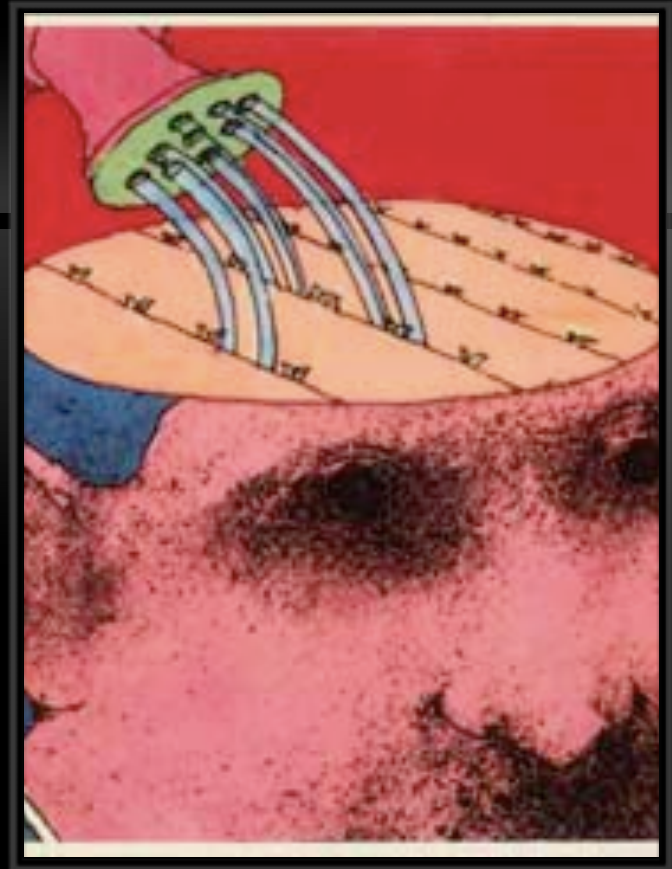
ACTIVE LEARNING – UVA LEARNING STUDIO



PHYSICS ACTIVE
LEARNING
CLASSROOM,
TEAL @ MIT

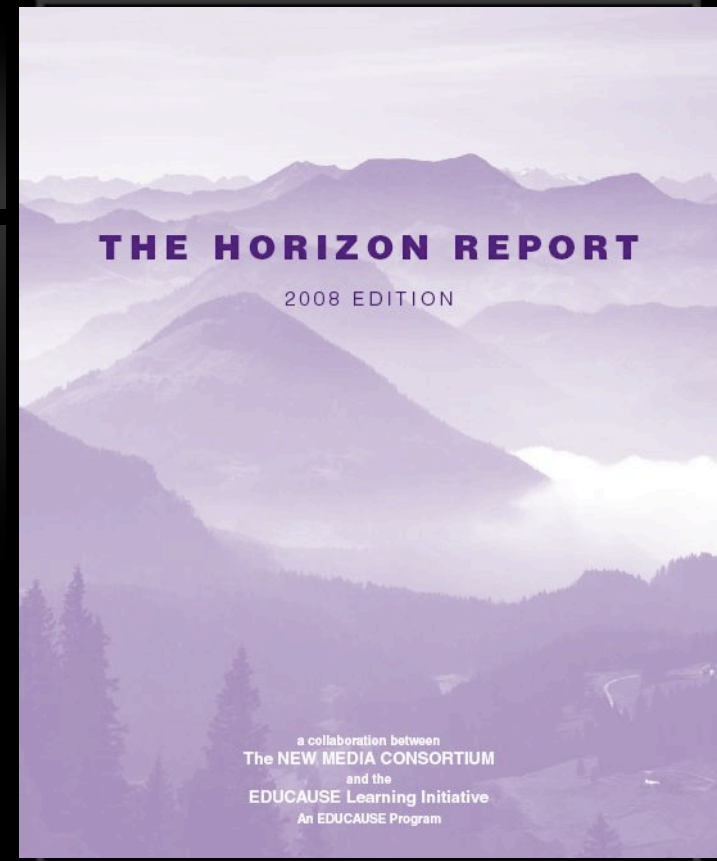
What are on the technologies horizon?

- ▶ **Web 2.0 and social networking**
- ▶ **Collaboration Webs**
- ▶ **Mobile Broadband**
- ▶ **Data Mashups**
- ▶ **Virtual Worlds**

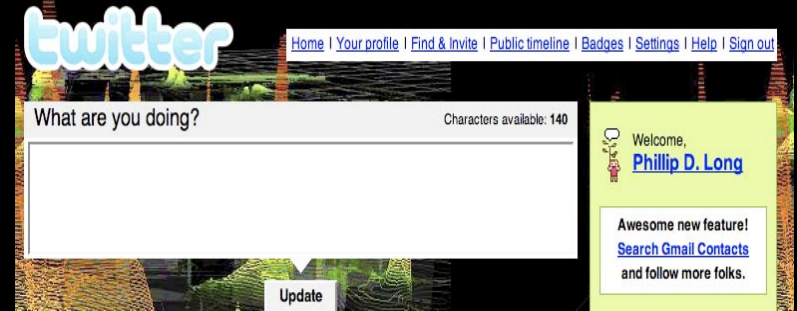


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Web 2.0 and social networking



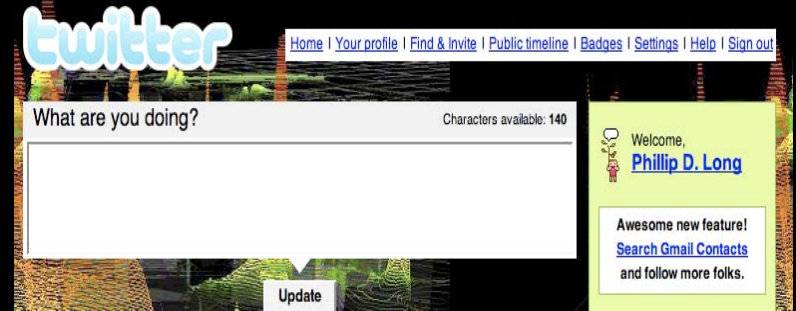
The Twitter Life Cycle

with apologies to Kathy Sierra ;-)



Web 2.0 and social networking

Establishes a *6th sense* - a proprioceptive social connectedness independent of proximity



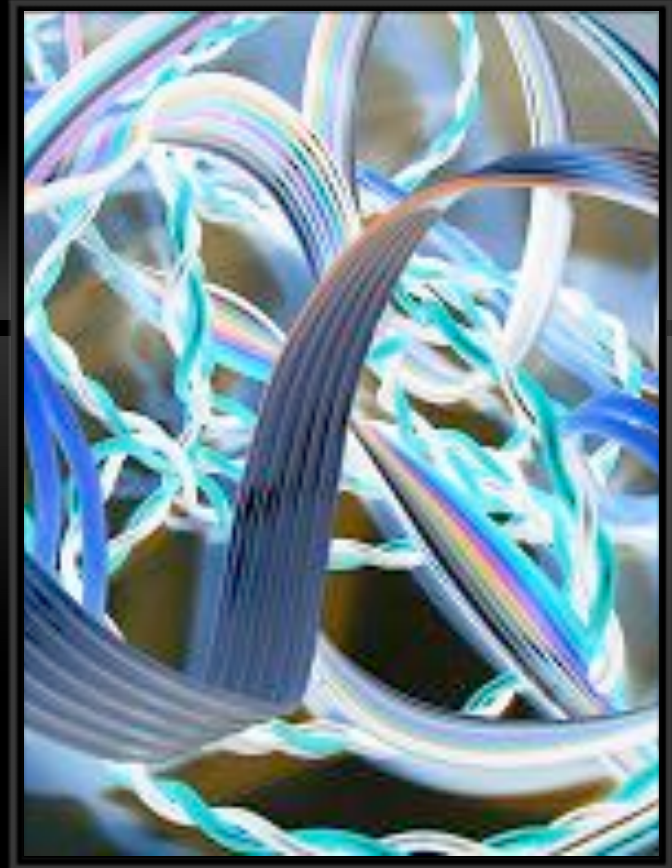
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Collaboration Webs

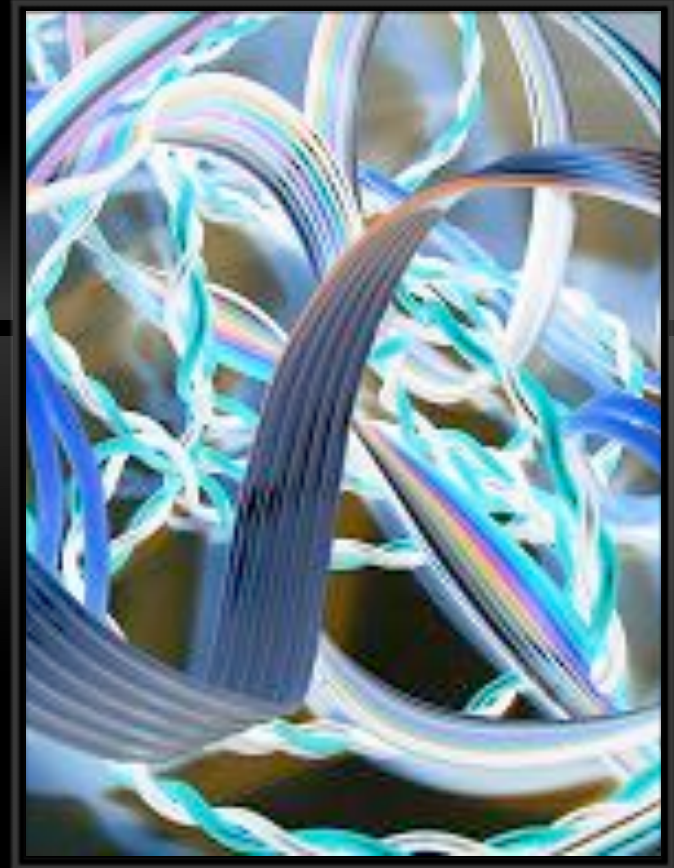
1 year or less



Collaboration Webs

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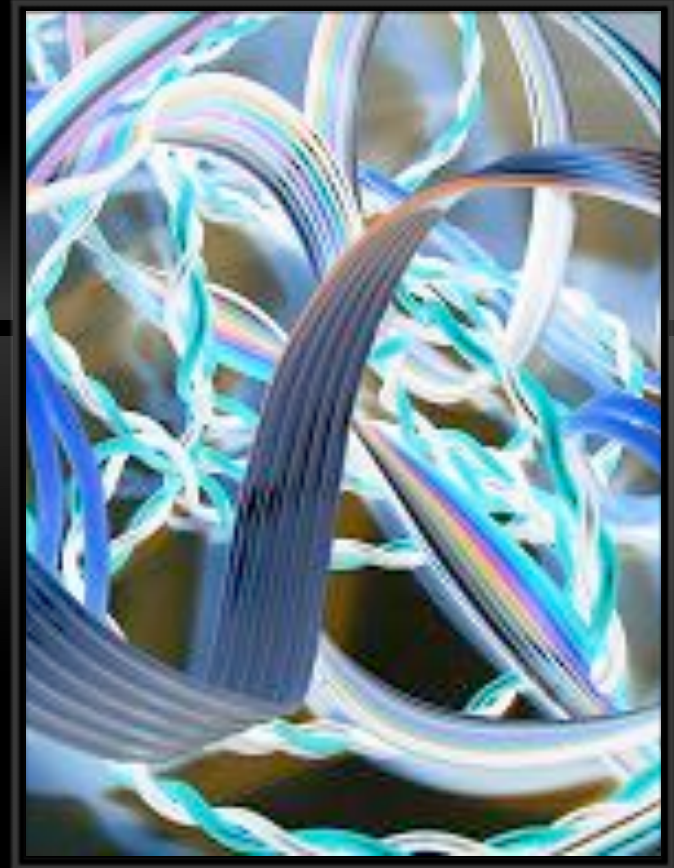
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Collaboration Webs

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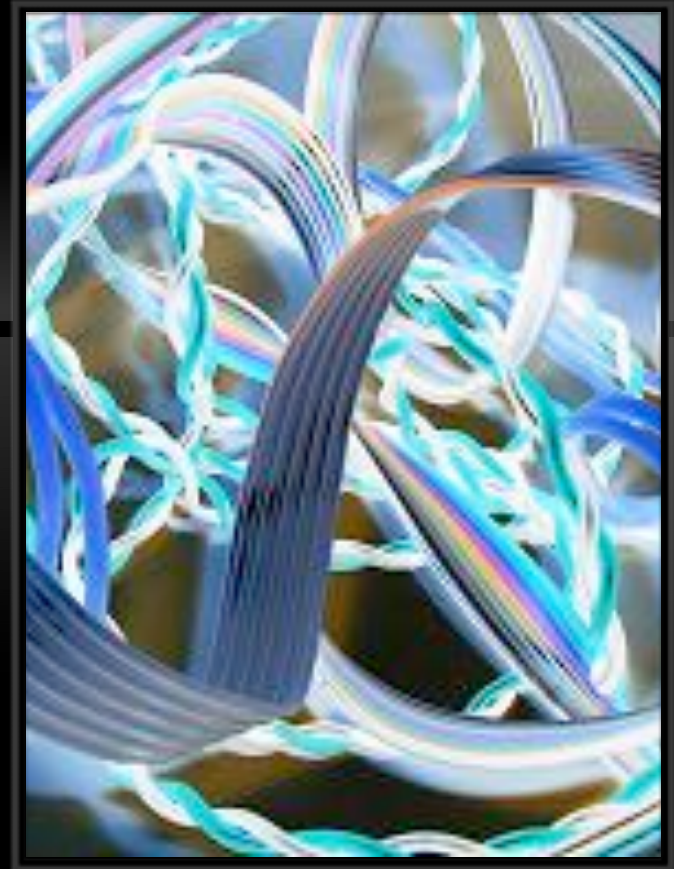
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- **Multimedia authoring/ editing not far behind** (e.g. <http://www.splashup.com>)

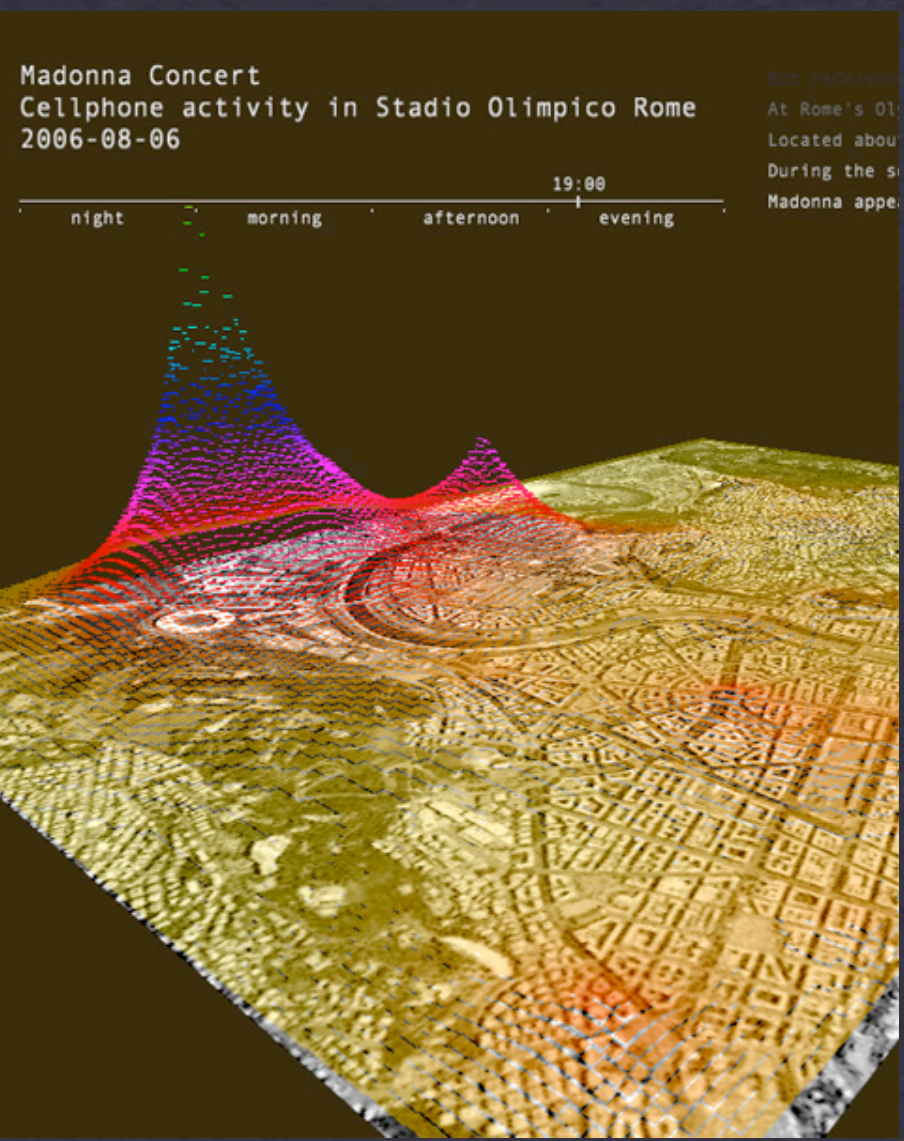
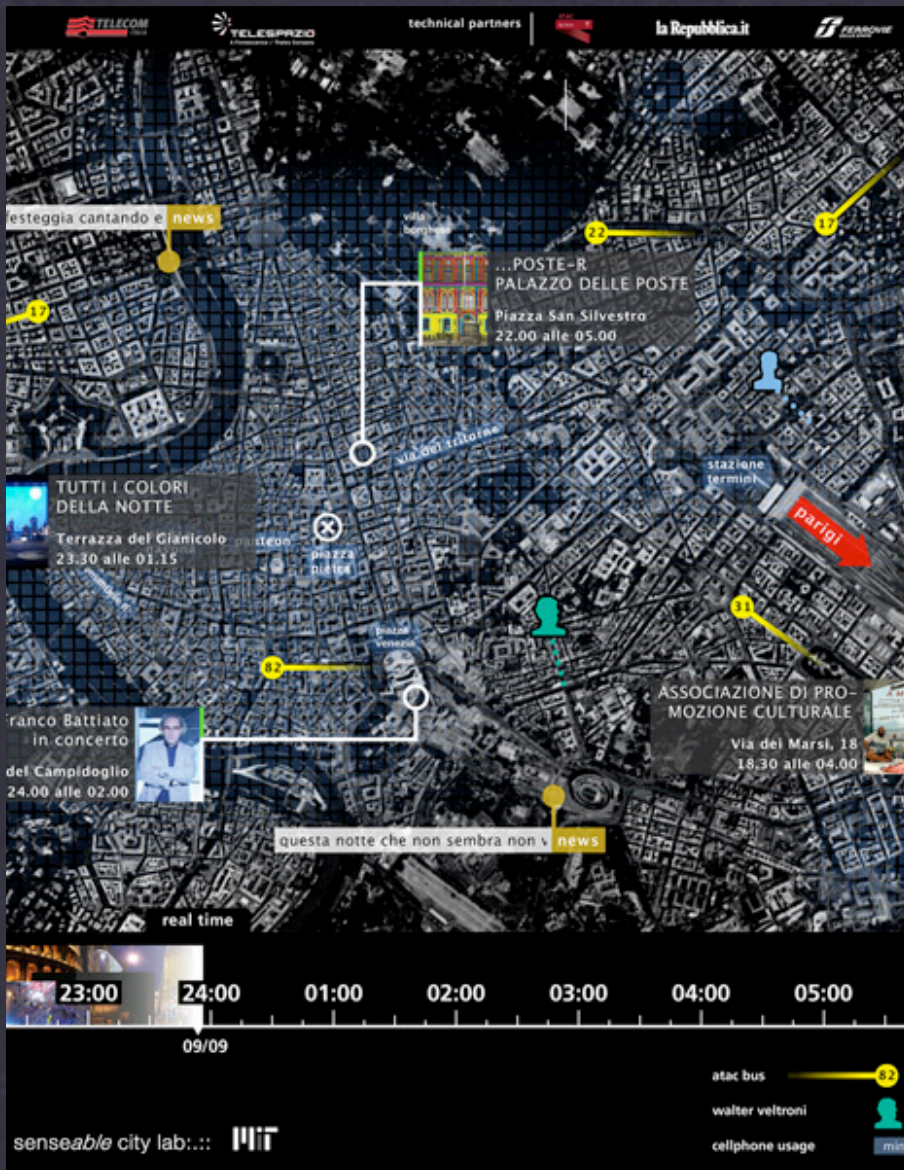


Collaboration Webs

1 year or less

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- **Multimedia authoring/ editing not far behind** (e.g. <http://www.splashup.com>)
- **Integrated social networks with data feeds** (e.g., <http://student.pageflakes.com/?track=community-pages-page>)





MOBILE BROADBAND - 2-3 Years

MIT'S WIKI CITY ROME PROJECT - NOTTE BIANCA ALLOWS PEOPLE TO ACCESS THEIR REAL TIME DATA DYNAMICS THAT OCCUR IN THE VERY PLACE THEY FIND THEMSELVES



Music/Video Mashups

now

A comedy 3,000 years in the making...



Data Mashups

2-3 years

Combining data sets from multiple sources (.e.g., NMC Horizon Report Combined across 2004-2008)

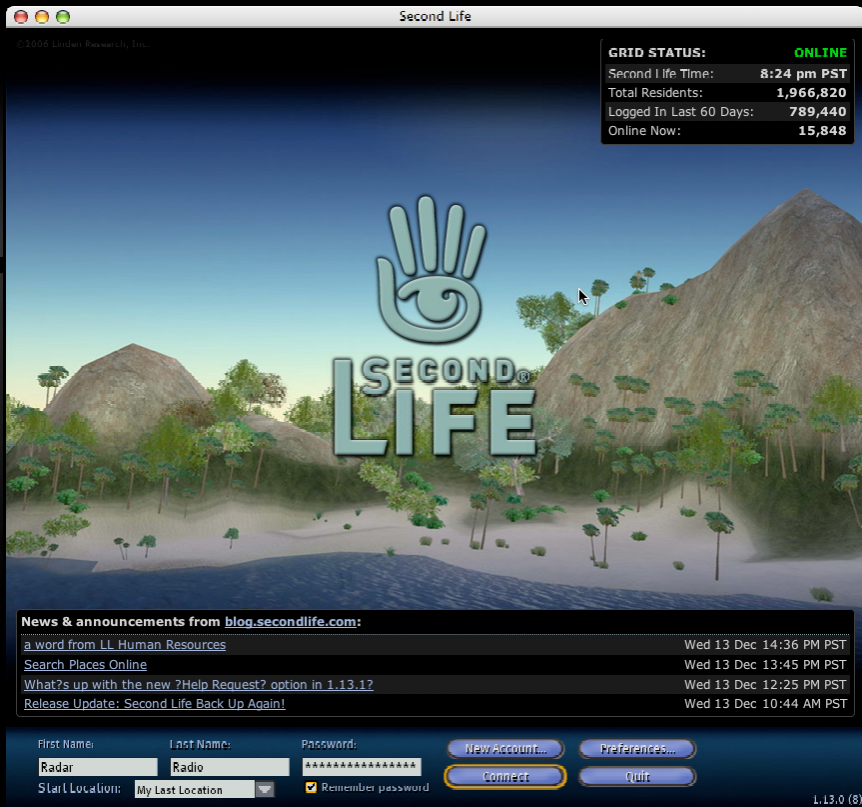
Quantitative comparisons



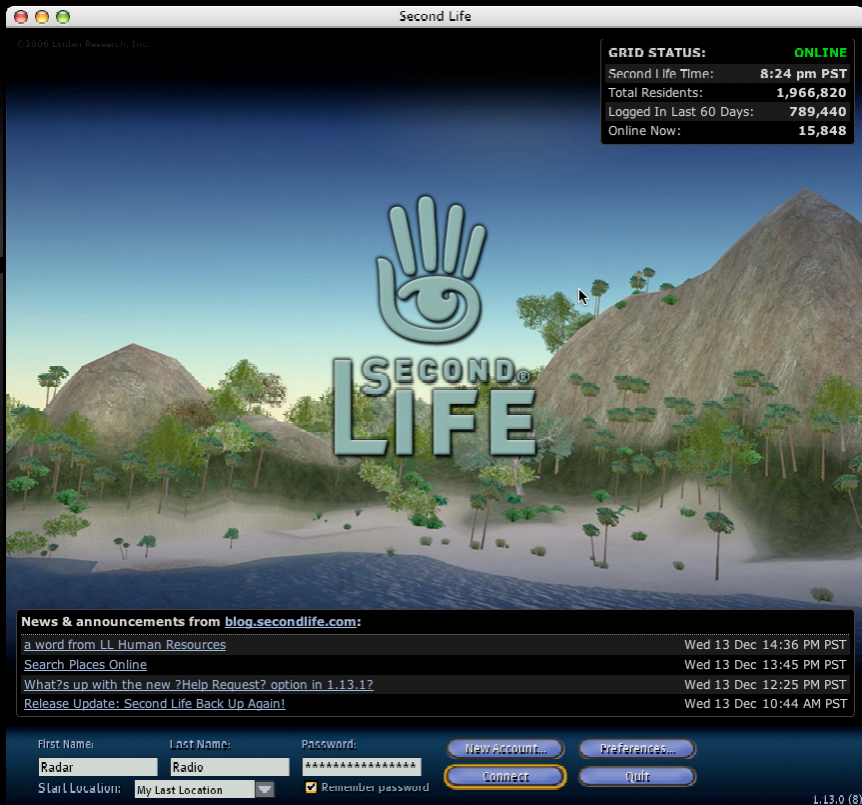
<http://services.alphaworks.ibm.com/manyeyes/view/SmAgULsOtha6VJGQCNEoL2->

Extend Real Life into Second Life

Extend Real Life into Second Life



Extend Real Life into Second Life



Extend Real Life into Second Life



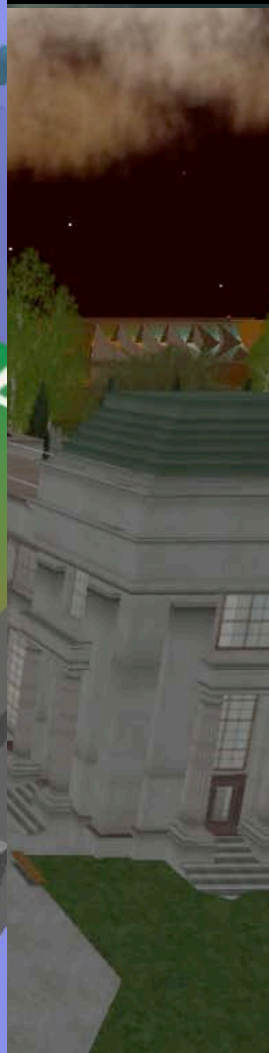
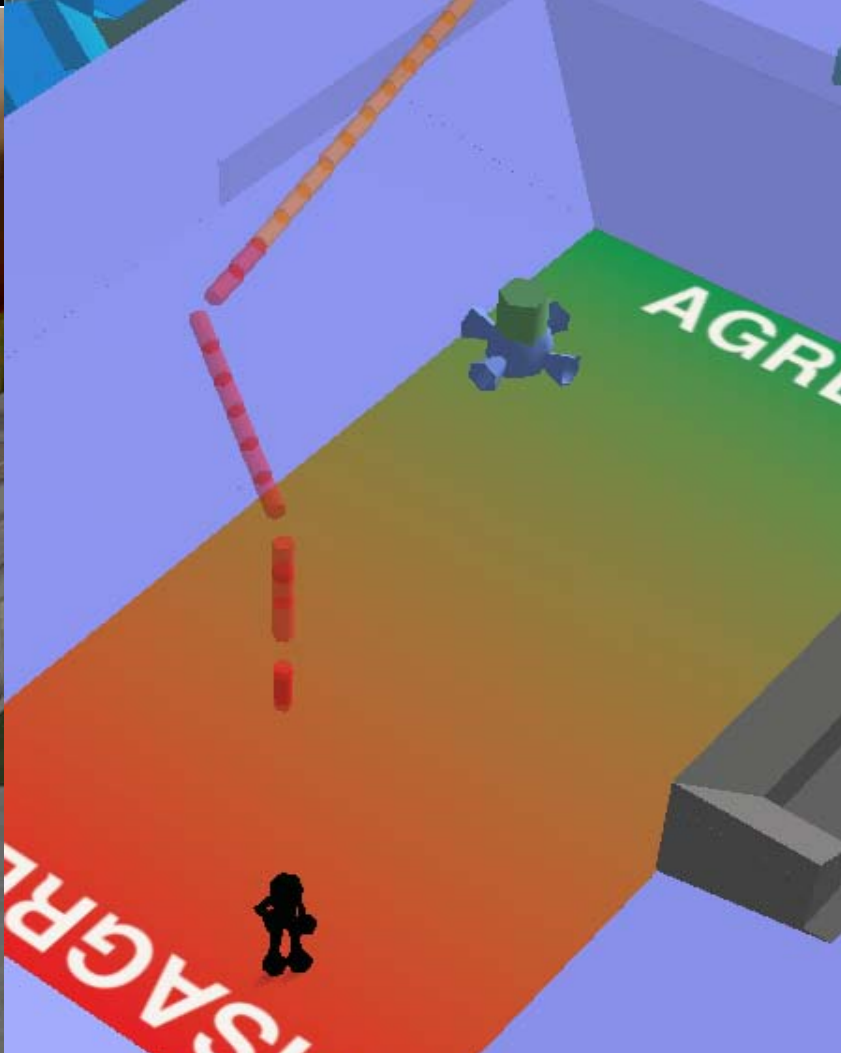
Extend Real Life into Second Life



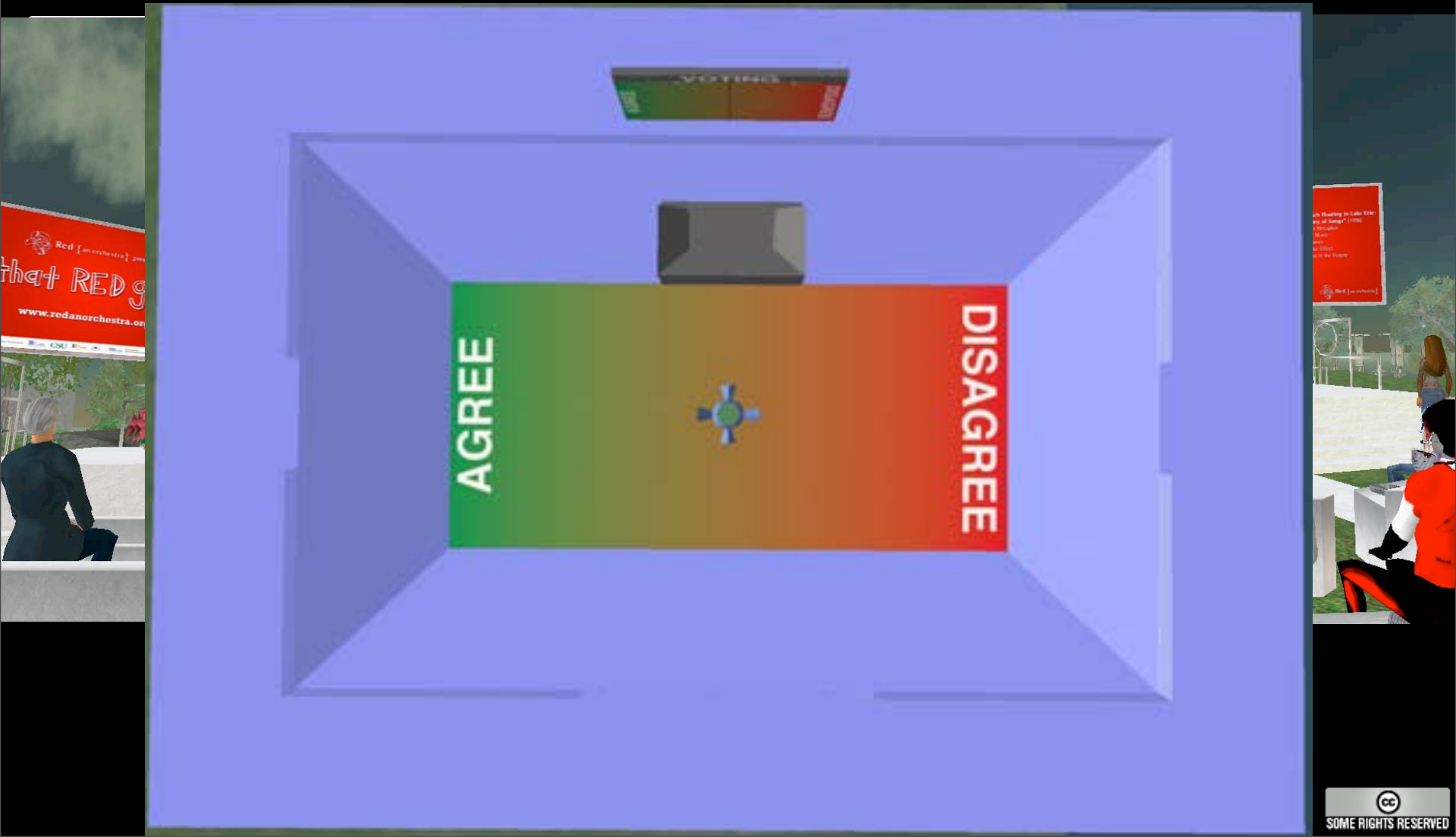
Extend Real Life into Second Life



Extend Real Life into Second Life



Extend Real Life into Second Life



Media Relations

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2007 PRESS RELEASES

Gartner Says 80 Percent of Active Internet Users Will Have A "Second Life" in the Virtual World by the End of 2011

Analysts Identify the Five Laws for Virtual Worlds During Gartner Symposium/ITxpo 2007 Emerging Trends, Analysts Say IT Leaders Must Take the Initiative to Innovate

STAMFORD, Conn., April 24, 2007 — By the end of 2011, 80 percent of active Internet users (and Fortune 500 enterprises) will have a "second life", but not necessarily in Second Life, according to Gartner, Inc.

[View Printer-friendly](#)[2007 Press Releases](#)[2006 Press Releases](#)[2005 Press Releases](#)

Wimbledon



<http://eightbar.co.uk/2006/06/27/wimbledon-in-second-life/>

« Hursley Fantasy World Cup

The nicest place In Second Life »

Wimbledon in Second Life

IBM, amongst other things, runs the official Wimbledon website during the event. This has lots of exciting well designed tennis information, real time scores and we deal with a large volume of traffic. Most years I am onsite for a period of time, helping explain how we bring innovation to our customer as part of a large cross IBM team. In the lead up to the event, and with what I know about the data we have, I decided to take on a mini proof of concept to bring Wimbledon to Second Life.



Future Virtual World Apps



3D Mailbox
www.3dmailbox.com

Future Virtual World Apps

I hope NOT!

3D Mailbox
www.3dmailbox.com

Bringing the physical and virtual together

<http://education.mit.edu/ar/>

Environmental Detectives

Bringing the
physical and
virtual together

<http://education.mit.edu/ar/>

Environmental Detectives



<http://education.mit.edu/ar/>

Melbourne - FINDERSTREET STATION

ADD TO FAVES BLOG THIS ALL SIZES



Melbourne, Australia - FINDERSTREET STATION

Comments



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www.semapia.org/map/show/228474787

browse on the semapia map
Posted 14 months ago. ([permalink](#))

Uploaded on August 29, 2006
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cologne555's photostream

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Tags

- semapia
- wikipedia=<http://en.wikipedia.org/wiki/Melbourne>
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<http://www.semapia.org/map/show/228474787>



Skuair is a second-generation 2d code.

Shot codes can hold any kind s of data; text, URLs, , etc.



Technology Trends: Freeing Design of Spaces to Support Pedagogy

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- Enabling devices students have support their scholarship

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- Enabling devices students have support their scholarship
- Spaces less constrained by technology infrastructure requirements

Technology Trends: Freeing Design of Spaces to Support Pedagogy

- Enabling devices students have support their scholarship
- Spaces less constrained by technology infrastructure requirements
- Classrooms represent 'built pedagogy', intentionally supporting & enabling certain kinds of interactions

Why Bother?



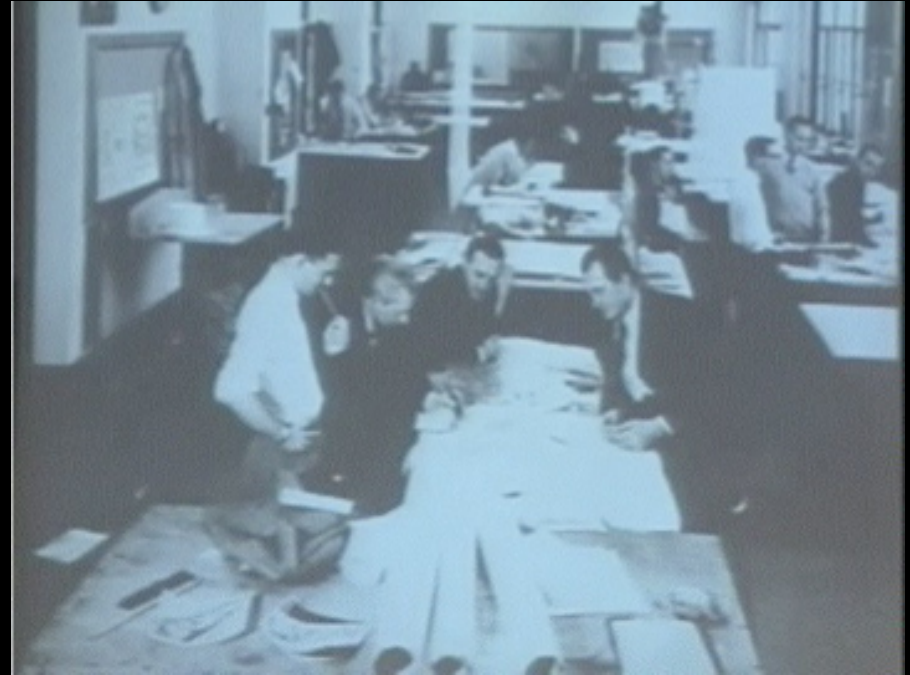


Is college memorization and regurgitation? Or, is it becoming part of particular discipline/professional communities?

Scalable Apprenticeship

reconnecting to
students to the
disciplines

Can technology
enable us to recapture
the learning power of
studio
apprenticeships?



Learning is about relationships

Relationships between **people**

and **with artifacts**





ACTIVE LEARNING IN CS - 6.01:EECS I

SCALABLE APPRENTICESHIP



ACTIVE LEARNING IN CS - 6.01:EECS I

SCALABLE APPRENTICESHIP



ACTIVE LEARNING IN CS - 6.01:EECS I

SCALABLE APPRENTICESHIP



Univ. of Melbourne - Chemistry Learning Lab

NEUTRON SPECTROSCOPY REMOTE LAB

MOVING FROM HANDS-ON TO “MINDS-ON” [HTTP://OPENILABS.MIT.EDU](http://openilabs.mit.edu)





NEUTRON SPECTROSCOPY REMOTE LAB

MOVING FROM HANDS-ON TO “MINDS-ON” [HTTP://OPENILABS.MIT.EDU](http://openilabs.mit.edu)

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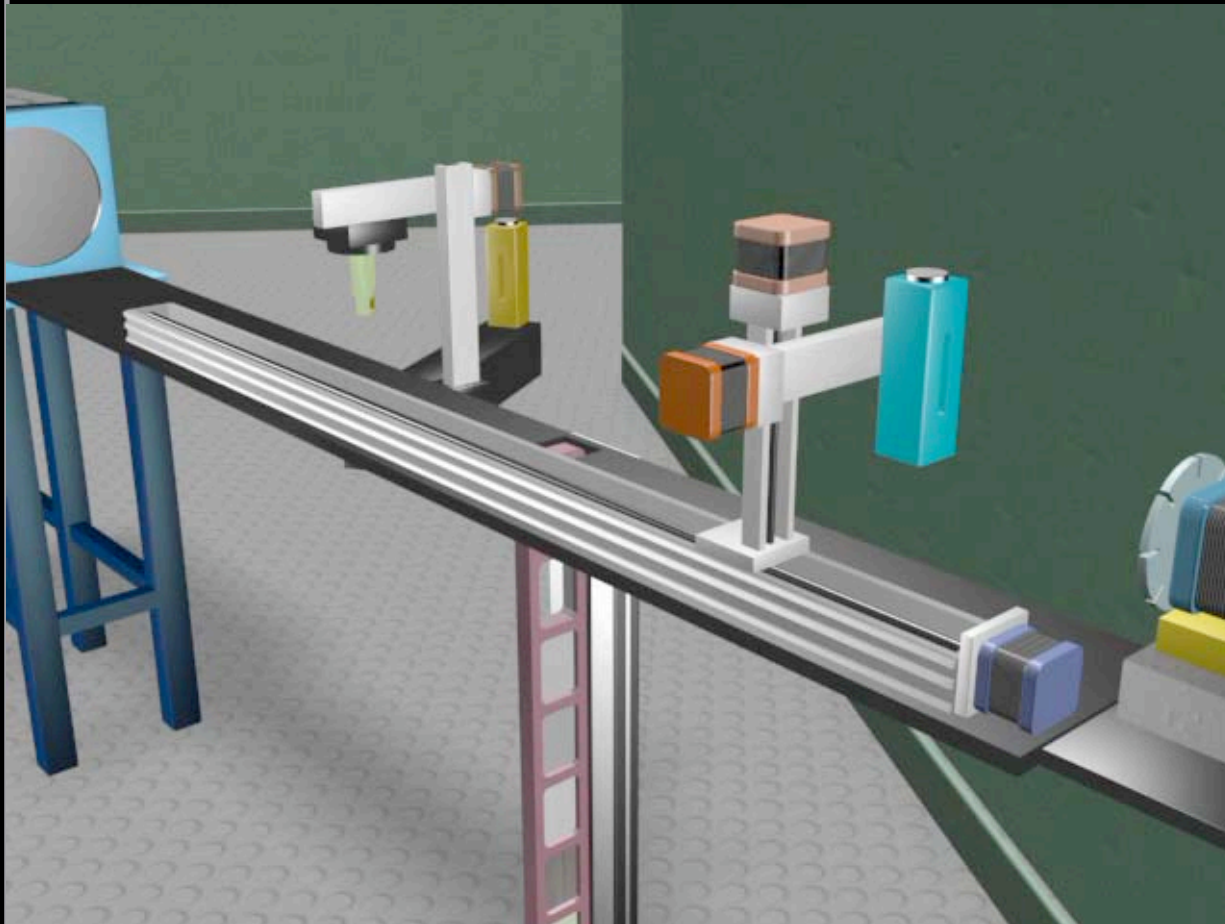


BRINGING THE LAB TO THE STUDENT

NEUTRON SPECTROSCOPY REMOTE LAB

MOVING FROM HANDS-ON TO “MINDS-ON” [HTTP://OPENILABS.MIT.EDU](http://openilabs.mit.edu)

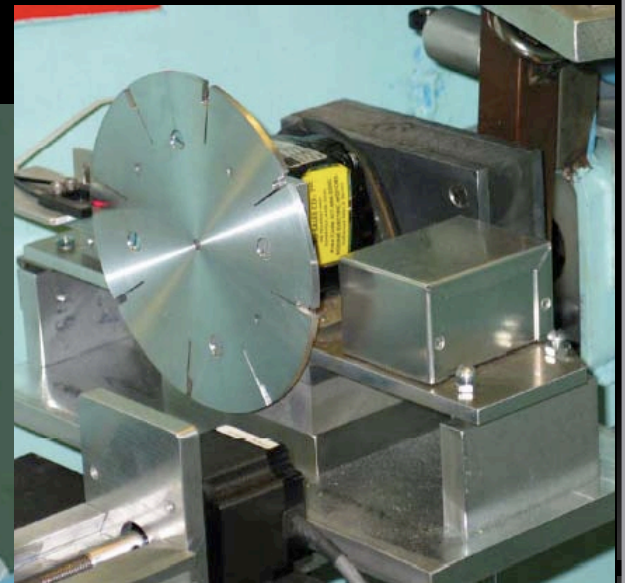
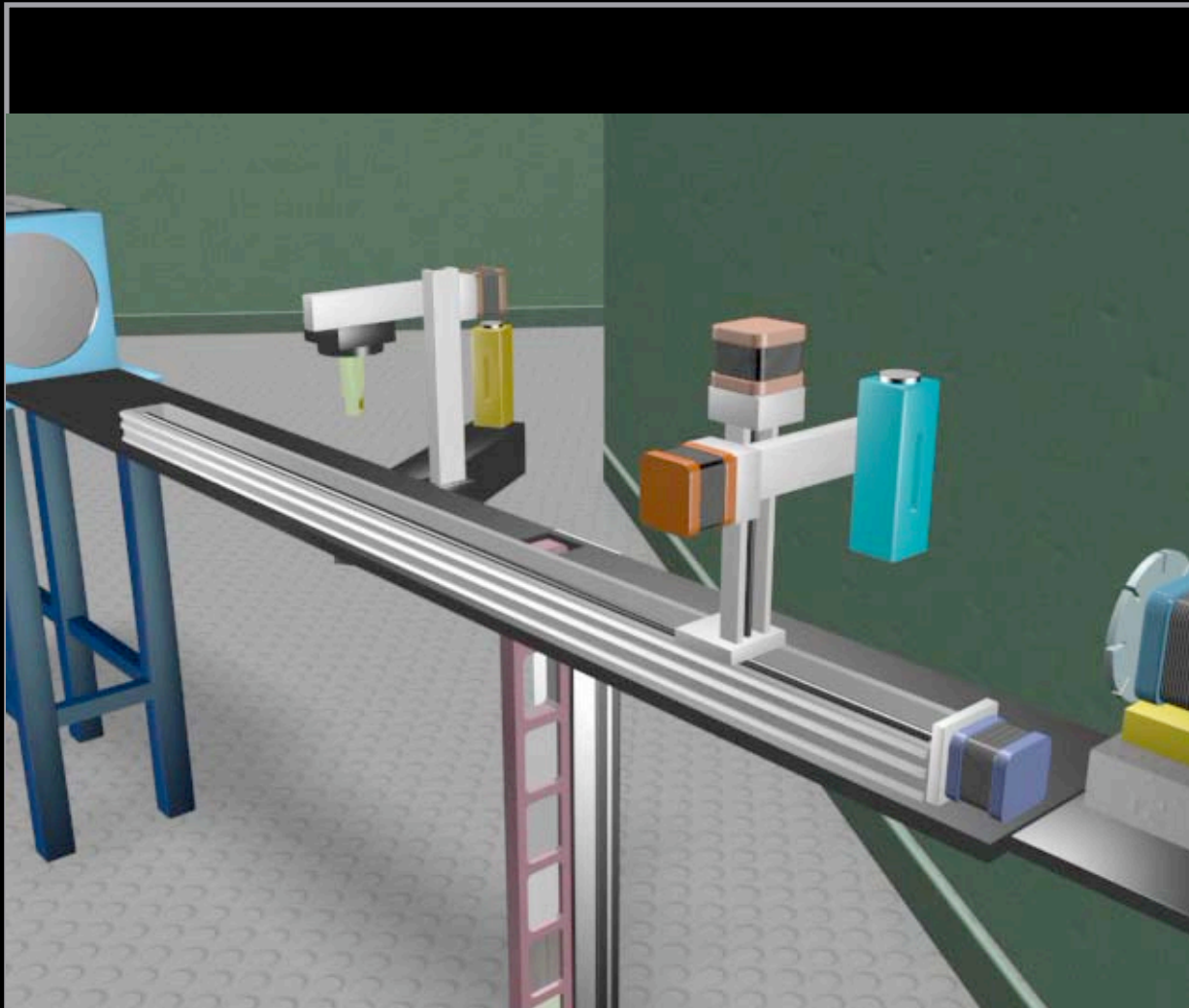




BRINGING THE LAB TO THE STUDENT

NEUTRON SPECTROSCOPY REMOTE LAB

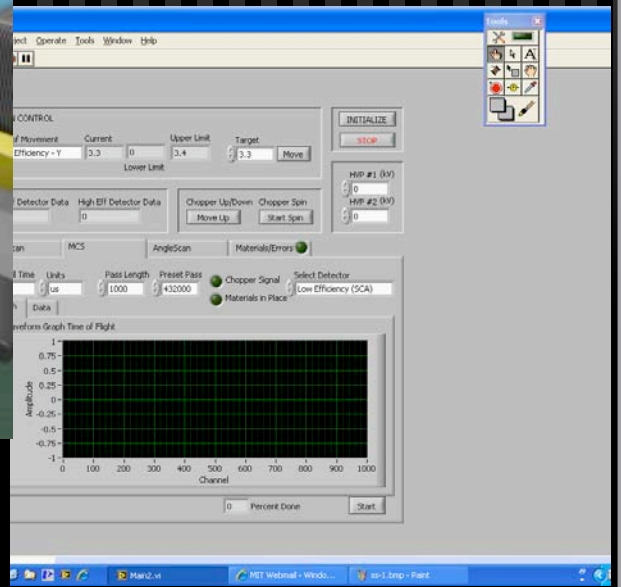
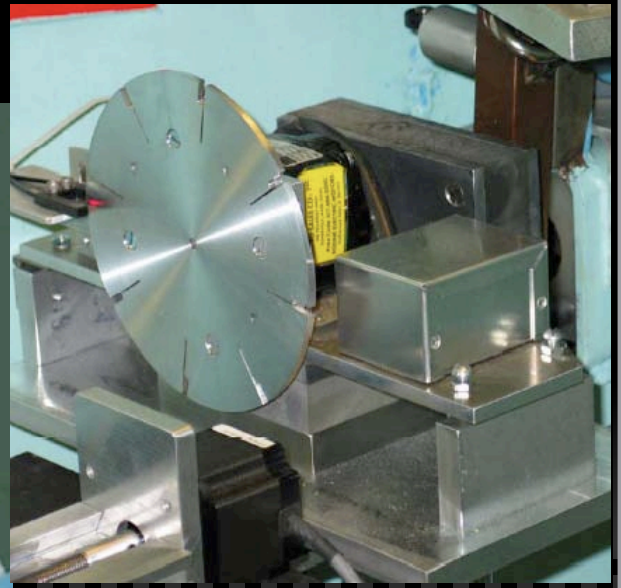
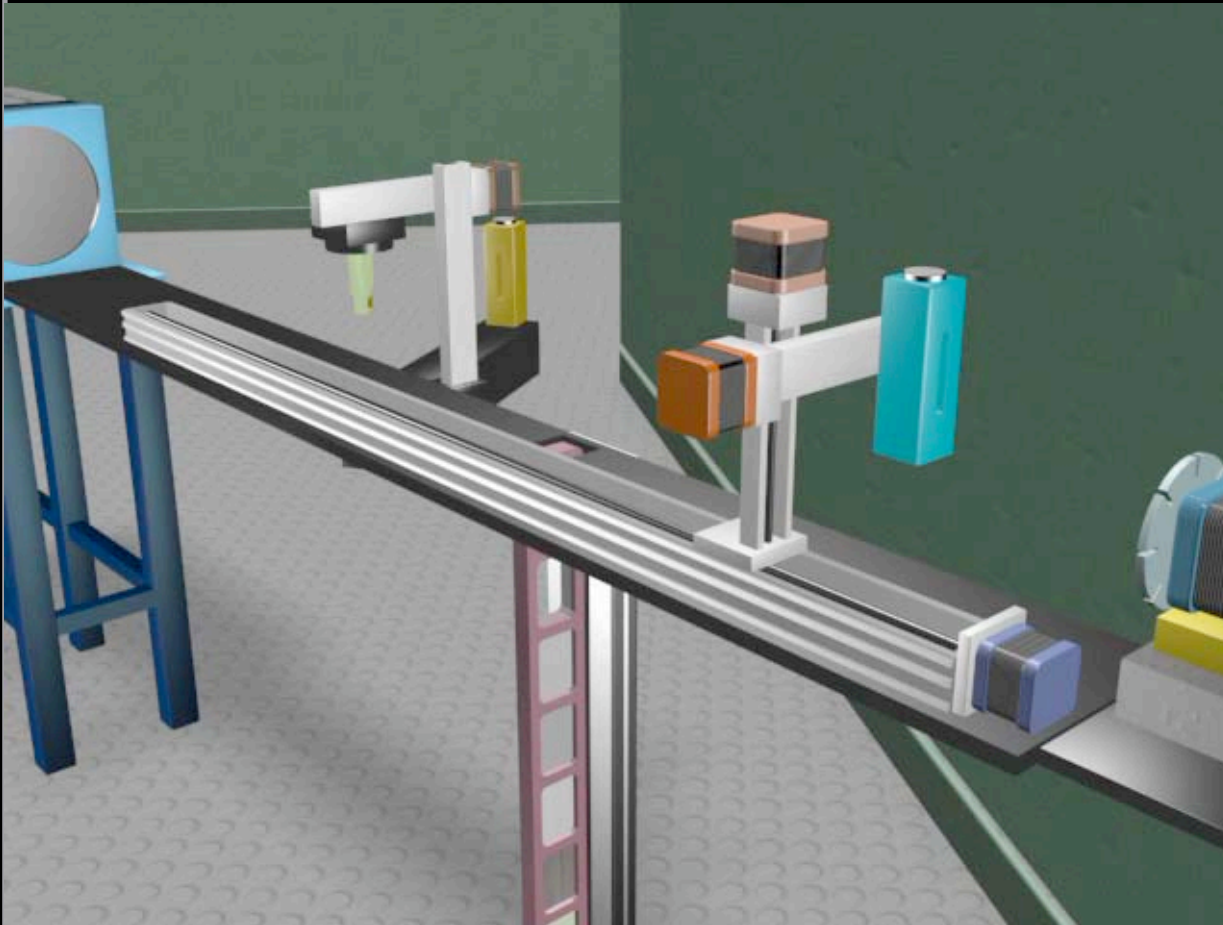
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BRINGING THE LAB TO THE STUDENT

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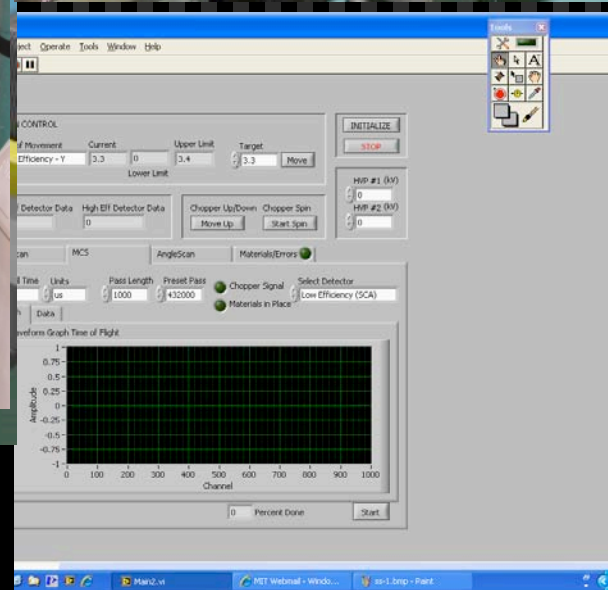
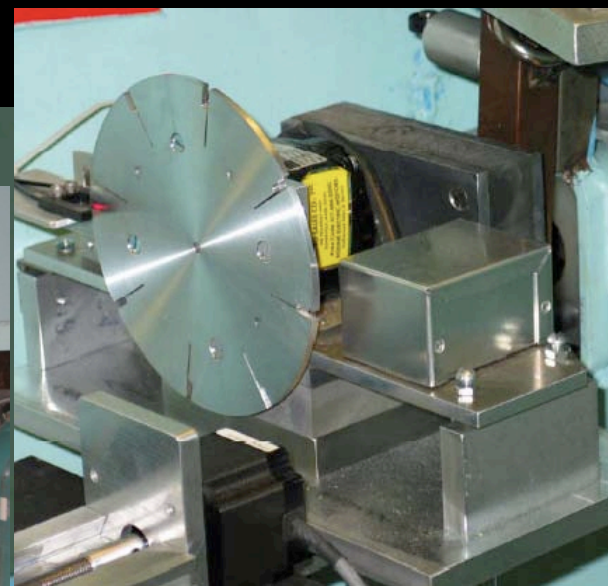
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BRINGING THE LAB TO THE STUDENT

NEUTRON SPECTROSCOPY REMOTE LAB

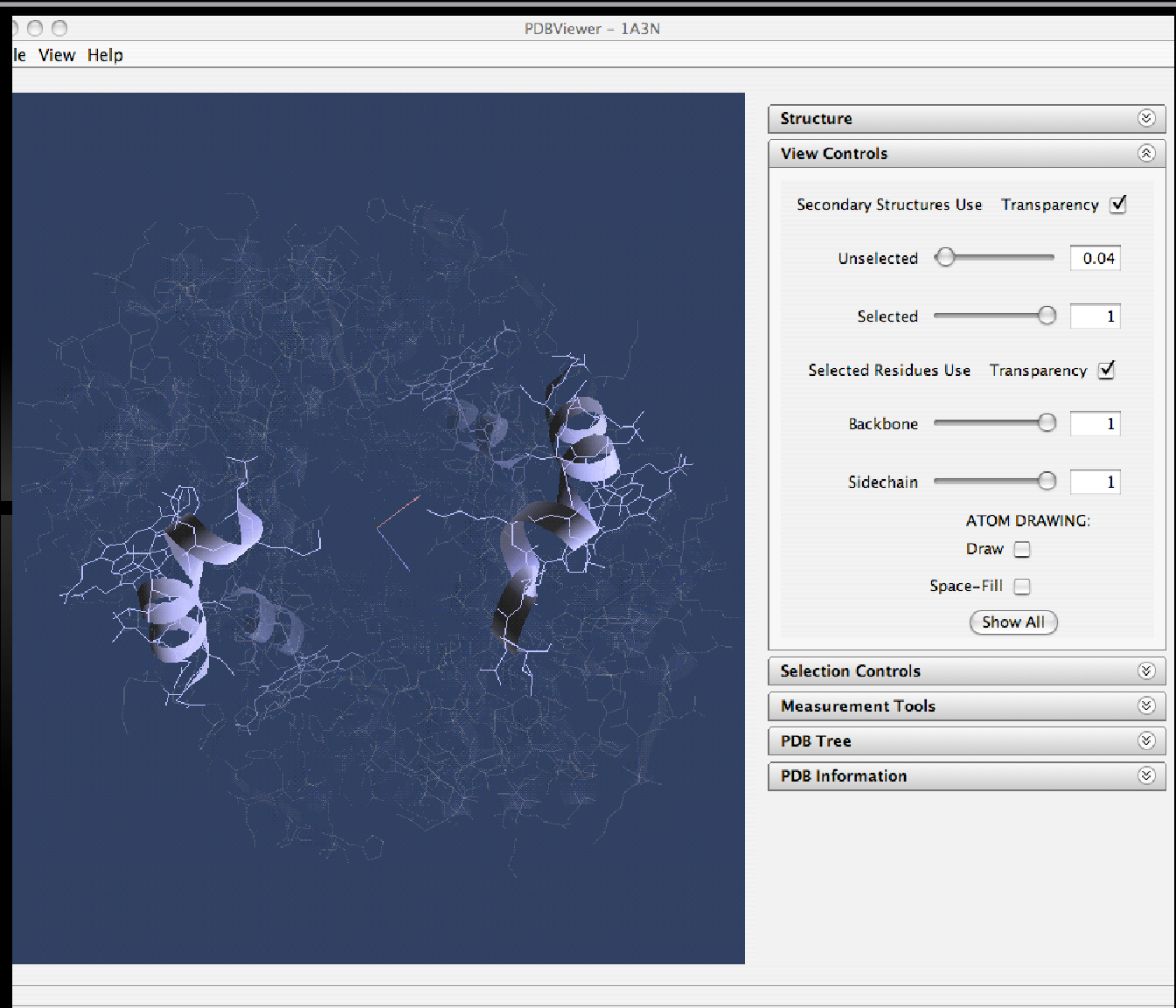
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BRINGING THE LAB TO THE STUDENT

NEUTRON SPECTROSCOPY REMOTE LAB

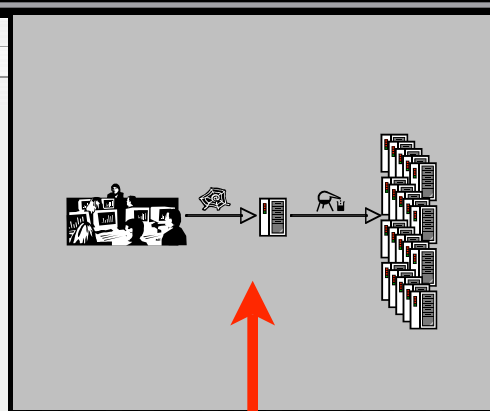
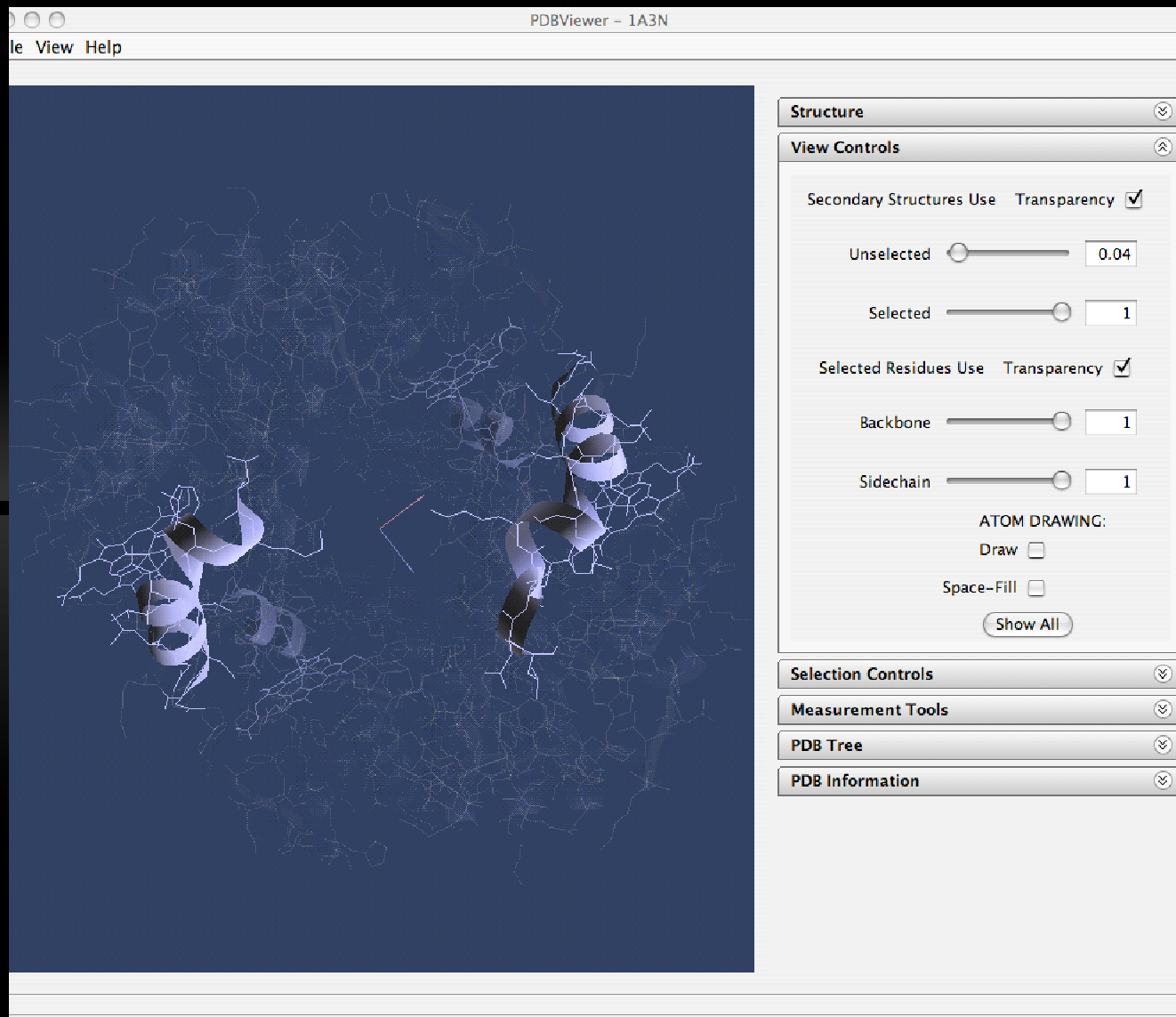
MOVING FROM HANDS-ON TO "MINDS-ON" [HTTP://OPENILABS.MIT.EDU](http://openilabs.mit.edu)



3D Protein modeling
for students based on
PDB data set

RESEARCH TOOLS IN THE CLASSROOM
DOING STEM TO LEARN STEM

<http://web.mit.edu/star>



Work flow system for complex modeling, parallel computing, etc.

3D Protein modeling for students based on PDB data set

RESEARCH TOOLS IN THE CLASSROOM

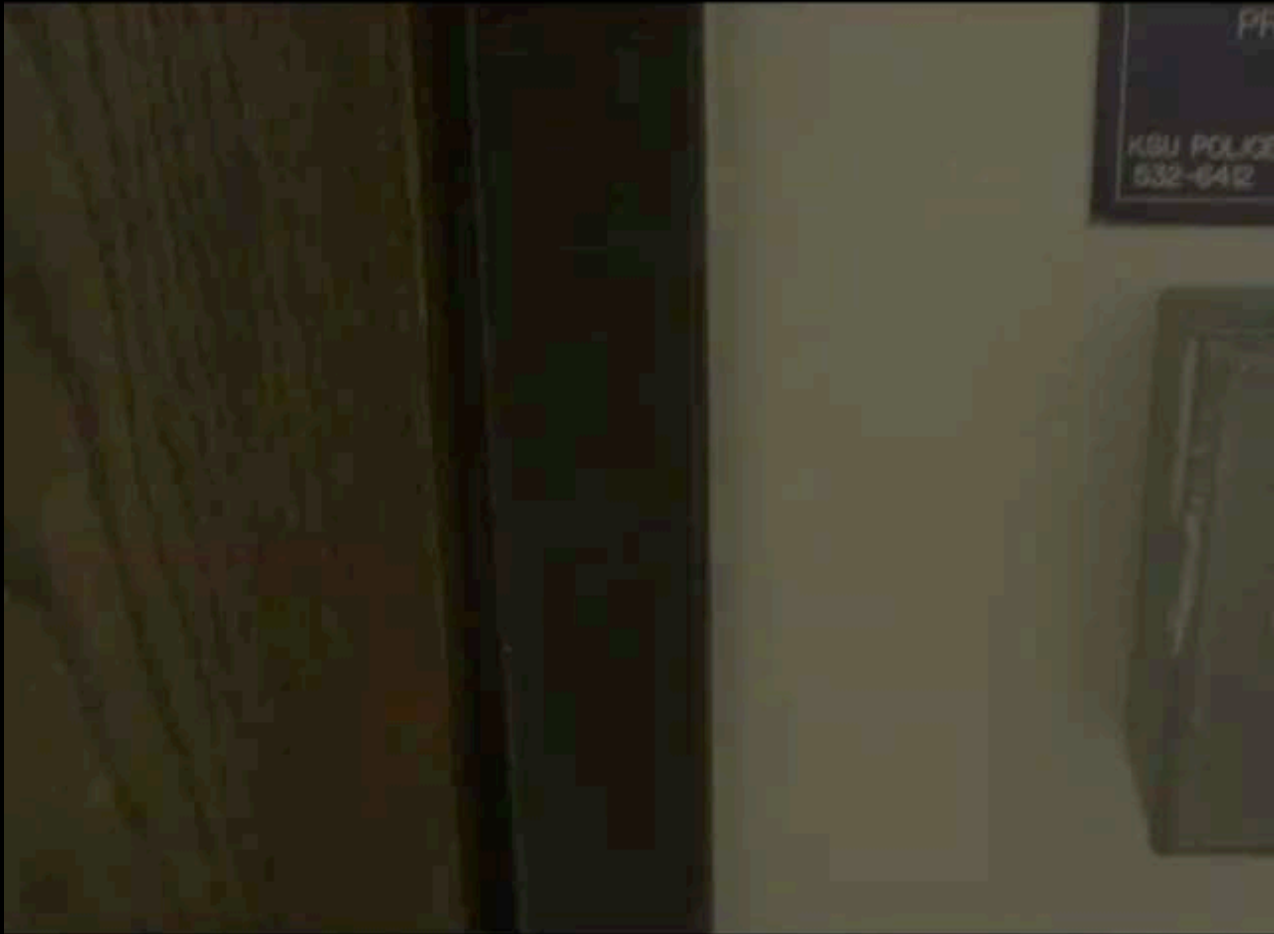
DOING STEM TO LEARN STEM

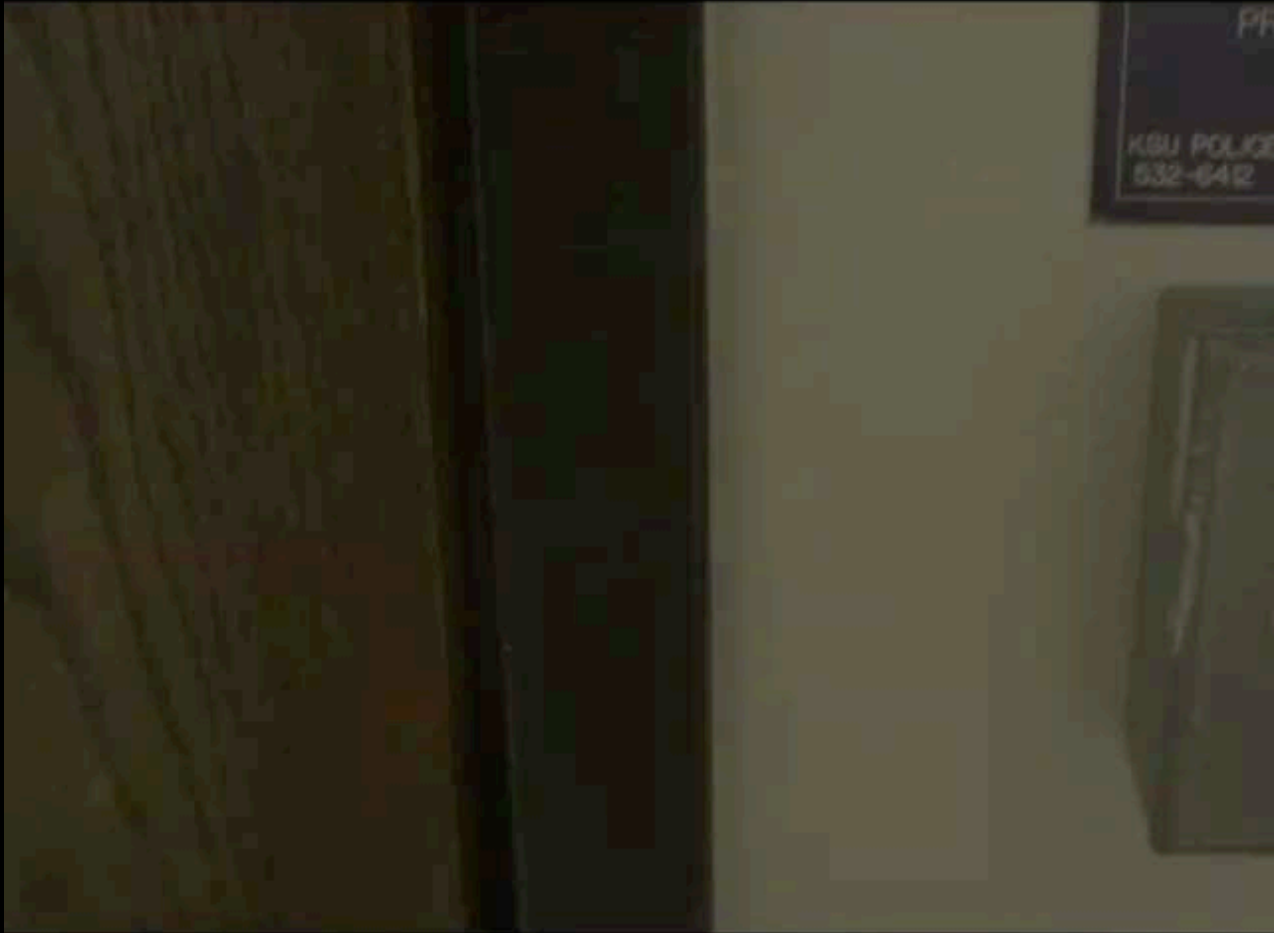
<http://web.mit.edu/star>

- ▶ Seek relevance
- ▶ Over scheduled
- ▶ Socially hyper-connected
- ▶ Educationally disconnected

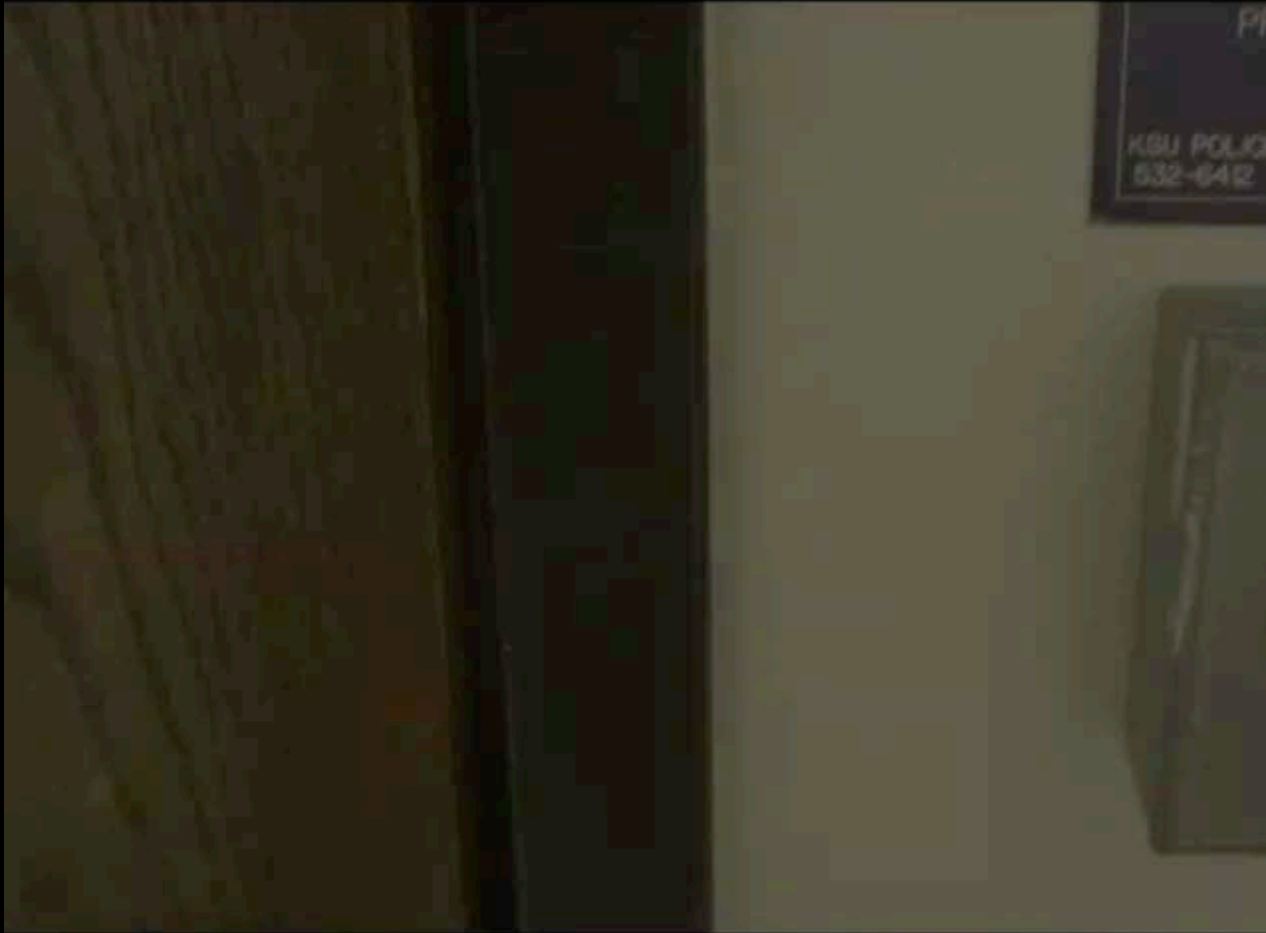


STUDENTS TODAY - SEEK RELEVANCE





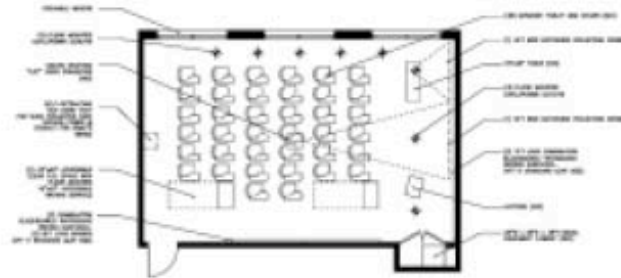
Thank You



Thank You

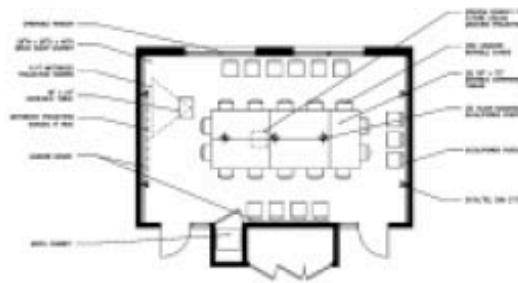
longpd@mit.edu

LEARNING SPACE NOMENCLATURE



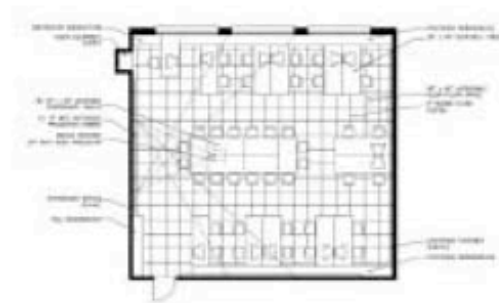
Classroom

- 25 - 75 seats
- Flat floor
- Tablet arm - 16sf / student
- Table / Chair - 21sf / student
- Open use



Seminar Room

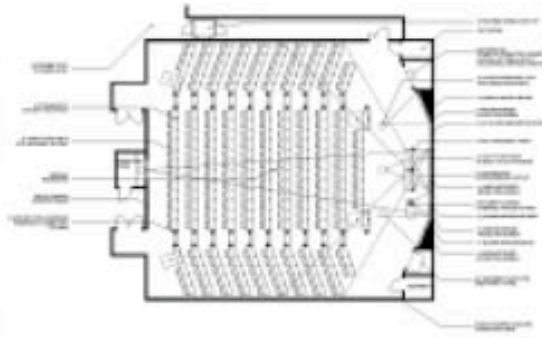
- 15 - 25 seats
- Flat floor
- Nested Table / Chair - 20sf / student
- Conference Table / Chairs - 23sf / student
- Open use



Skills Classroom - Multi-Venue

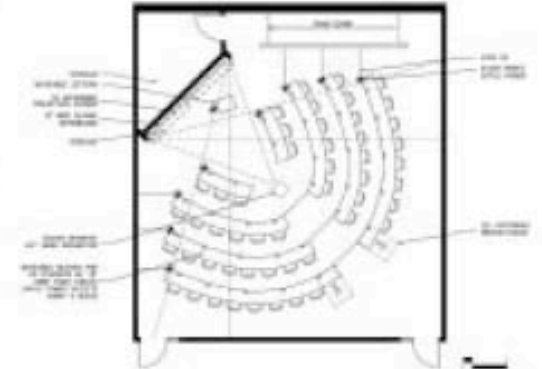
- 15 - 25 seats
- Flat floor
- Perimeter Computer Workstations / Central Conference - 50sf / student
- Curriculum use

LEARNING SPACE NOMENCLATURE



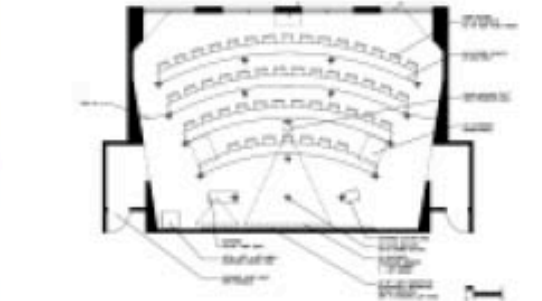
Lecture Hall

- 75 - 350 seats
- Stepped / sloped floor
- Tablet arm - 15sf / student
- Table / Chair - 20sf / student
- Open use



Caseroom

- 50 - 120 seats
- Table / Chair - 27sf / student
- Stepped floor
- Curriculum use



Discussion Classroom

- 35 - 75 seats
- Table / Chair - 25sf / student
- Stepped floor / sloped floor
- Curriculum use