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## A Mixed Reality Teaching and Learning Environment

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上海交通大学  
Shanghai Jiao Tong University



SAN DIEGO STATE  
UNIVERSITY



Sun  
microsystems



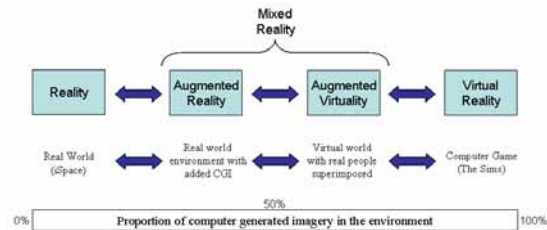
University of Essex

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## What is Mixed Reality?

- Milgram's Reality-Virtuality (RV) Continuum.
  - Mixed Reality bridges the real and virtual worlds.
  - Categorised by the ratio of real-world to virtual content.



- Augmented Reality
  - Mostly real with added virtual components.
- Augmented Virtuality
  - Mostly computer generated with added real world components.

## eLearning – connecting with remote students

From this ...



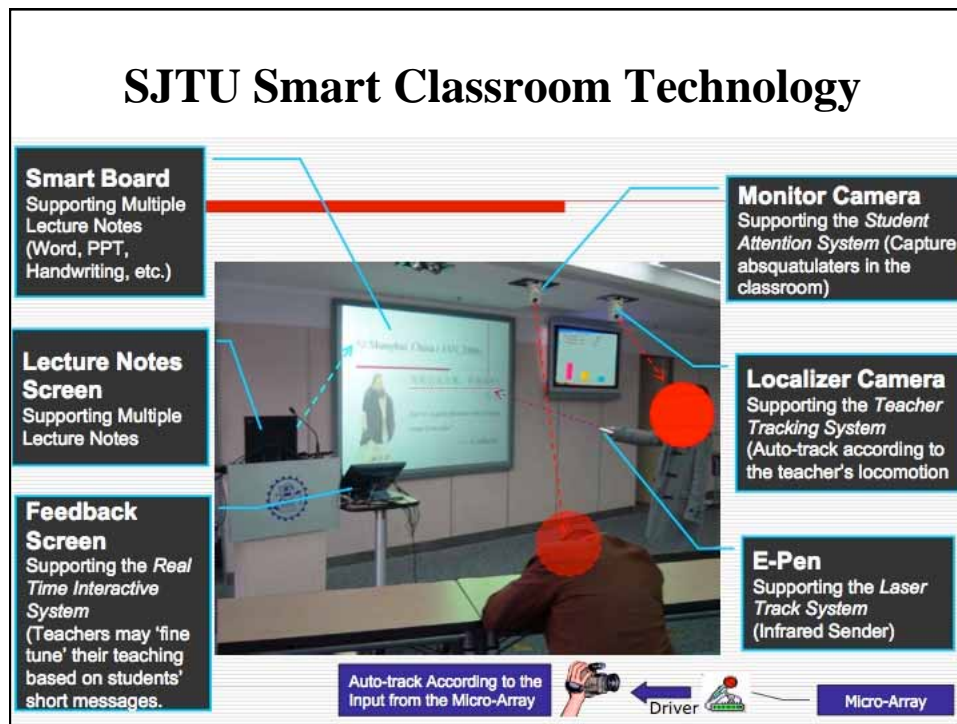
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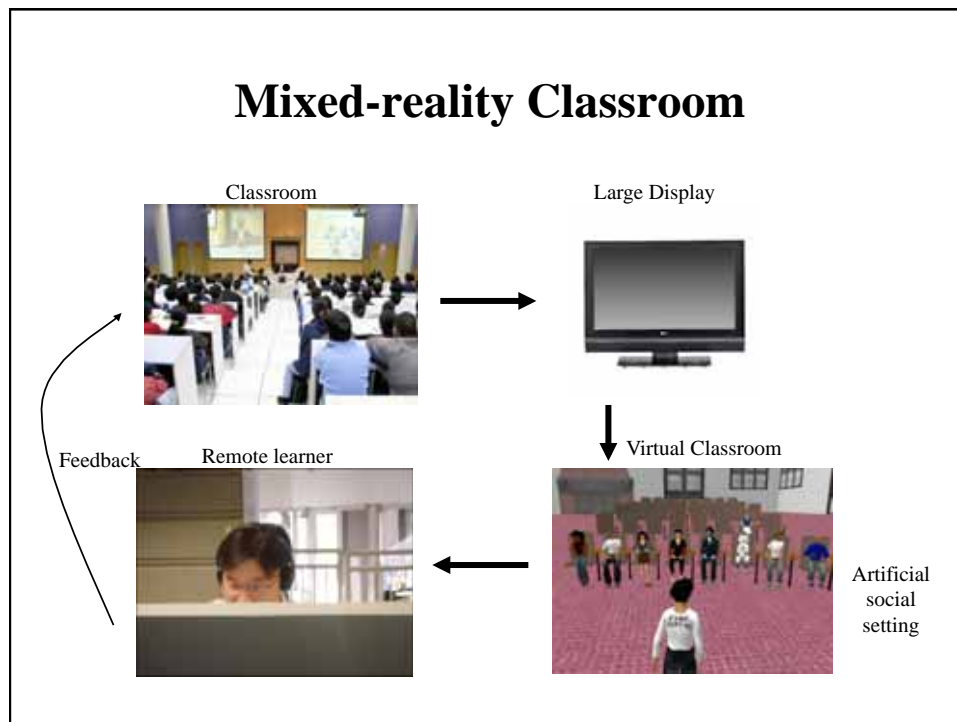
Physical & social divide



## MiRTLE: Mixed Reality Teaching & Learning Environment



Project to investigate the benefits that mixed-reality can offer eLearning



## Sun Darkstar & Wonderland



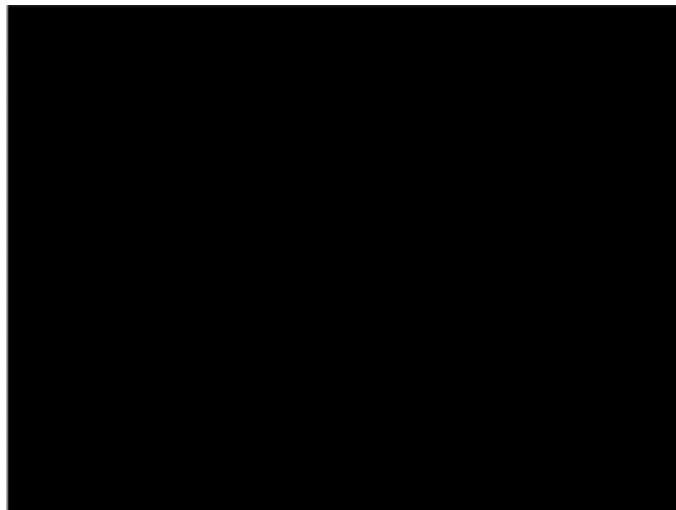
### Foundation Technologies

- Project Darkstar - provides the scalable, persistent server software infrastructure
- Wonderland – offer a set of environment programming tools that includes:
  - Java 3D - provides the scene graph on which the 3D world and scene manager is built
  - Project Looking Glass - provides the 3D scene manager
  - Sun™ Labs Voice Bridge - provides realtime stereo audio with distance attenuation

## **Wonderland Design Goals**

- Focus on social interaction, formal and informal
  - Emotionally salient
  - Strong sense of social presence, allowing for discussion of sensitive topics
  - Spontaneous, unplanned interactions, particularly socializing before and after planned events to build trust
  - Enhance communication during formal interactions
- Design for collaboration
  - Seamless document and media sharing--no need to switch contexts
- Extreme extensibility
  - Allow developers to add any sort of new behaviour

## **MiRTLE video**



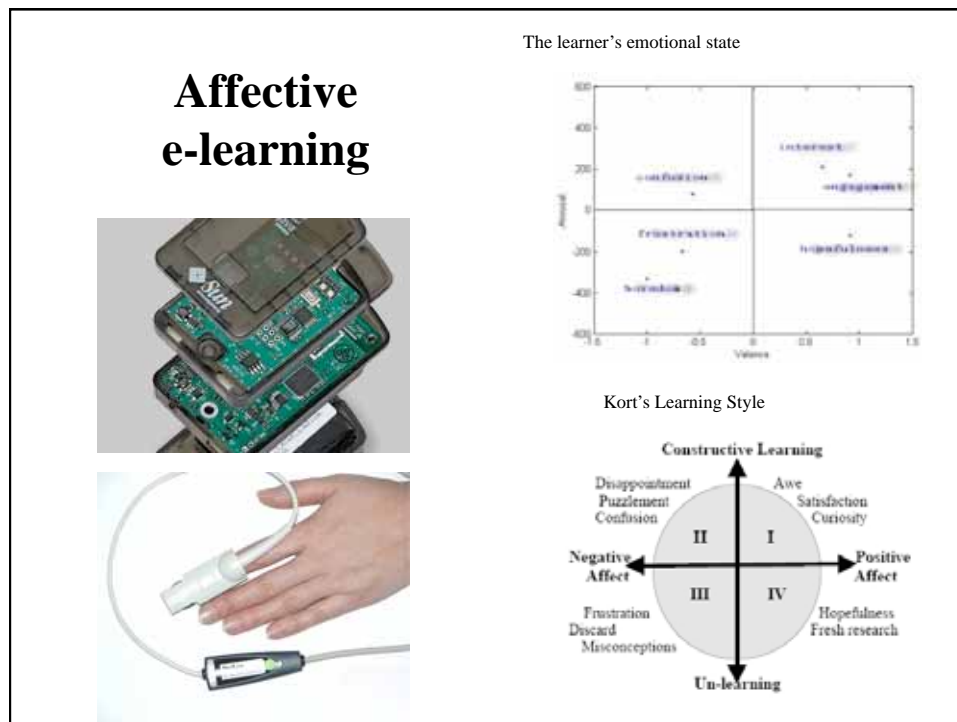
## Some eLearning Issues

### *Multicultural Facets*

- eLearning has a global reach
- Global reach infers multicultural audiences
- Culture affects how students present themselves cognitively, socially and emotively
- Mirtle customisation tools allows cultural differences to be studied and better understood (eg differing avatar design, differing interaction modalities etc)

*Minjuan did you want to add something here, and maybe present this page, or should we scrub this?*

- Emotions have been identified as a useful indicator of students response to learning teaching material (eg difficulties may be indicated by frustration, stress etc)
- Lack of emotion feedback in eLearning and virtual reality is a disadvantage
- Emotions can be sensed via interpreting video, audio, neurological or physiological data



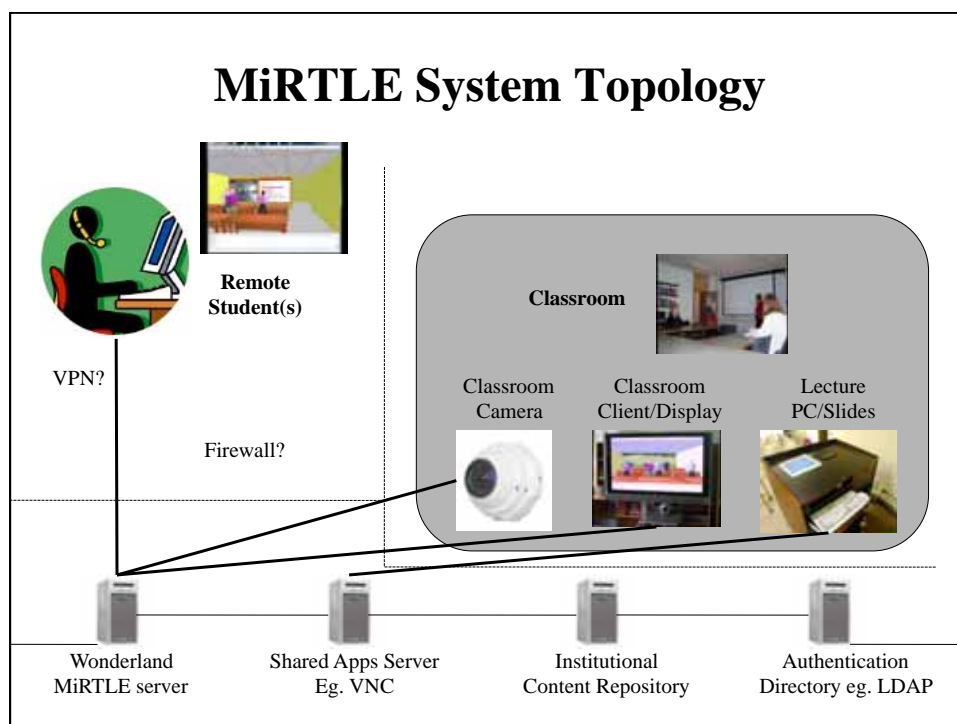
## Some eLearning Issues

### *Meta Teaching Affordances*

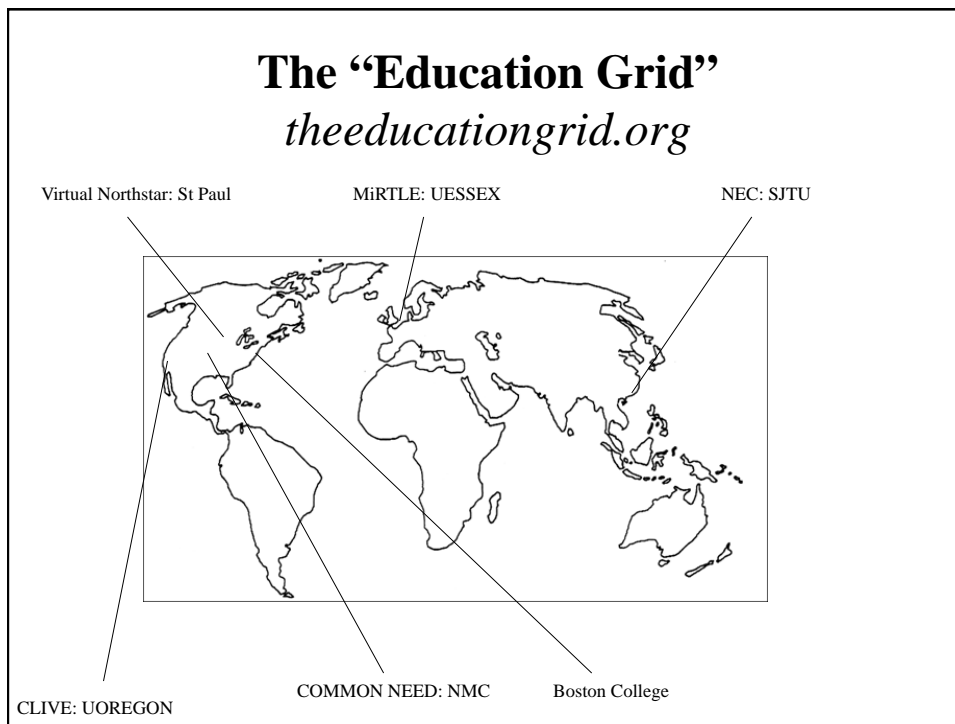
- Virtual Worlds open up new possibilities such as:
  - Translating learning content and knowledge into tangible virtual objects that student can manipulate and explore in new ways
  - Altering the physical laws to allow students to interact and explore the physical world in new ways
  - Providing a social setting for isolated learners
- Virtual Worlds offer technological advantages such as:
  - Lower bandwidth requirements
  - Richer interactivity (and increased learner engagement)

## Key issues for Wonderland

- Build on its strengths
  - Audio
  - Collaboration
  - Customisability
- We are using (or plan to use): audio, live lecture video feed, shared apps (VNC), SunSPOTs
- We need better functionality in key areas:
  - Avatar customisation
  - Avatar gestures
  - World-building tools







## Some issues with privacy and integrity in collaborative virtual environments

An increasing need to protect data and resources available within virtual worlds

- spatial access (i.e., who can move their avatar where)
- media access (who can view which images or hear what sounds)
- object use/mutability (who can use and change which VR objects)

Wonderland can potentially provide much greater control of privacy and integrity in CVEs

Example: WonderDAC – Wonderland with discretionary access control



Courtesy: Timothy Wright from University of Notre Dame

## Differentiators

### Wonderland:

- Live application sharing
- Integration with business data
- Internal or external deployment
- Darkstar scalability
  - very large to very small
- Open and extensible
  - 100% Java
  - Open source, open art path
- Audio (spatial) as core feature
- Extensive telephony integration

### Second Life:

Privacy/security issues?  
 Suitability for institutional deployment?  
 Commercial platform  
 Very large community  
 Rich scripting and world building  
 Online economy

### Opensim:

OpenSim - a SL compatible server (SL has already open sourced their client)  
 Not as platform-agnostic as Wonderland (relies on Mono/.Net)  
 OpenSim Grids enable worlds to be linked

## Conclusions

- We have described “*work in progress*” aimed at delivering a mixed reality environment for eLearning
- Environment allows students to inhabit a mixed virtual and real classroom (with local and remote students interacting with each other in a similar way to a real campus).
- Have explained how it can:
  - Provide a richer form of interactivity (and increased learner engagement)
  - Providing a social setting for isolated learners
  - Translate learning content and knowledge into tangible virtual objects that student can manipulate and explore in new ways
  - Alter physical laws to allow students to interact and explore the physical world in new ways
  - Lead to lower bandwidth requirements
  - Provide a means of exploring multicultural issues.

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## Questions

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