

# **Game-Based Learning Theory**

**by**

**Daniel Laughlin**



# Game-Based Learning Theory

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NASA Learning Technologies

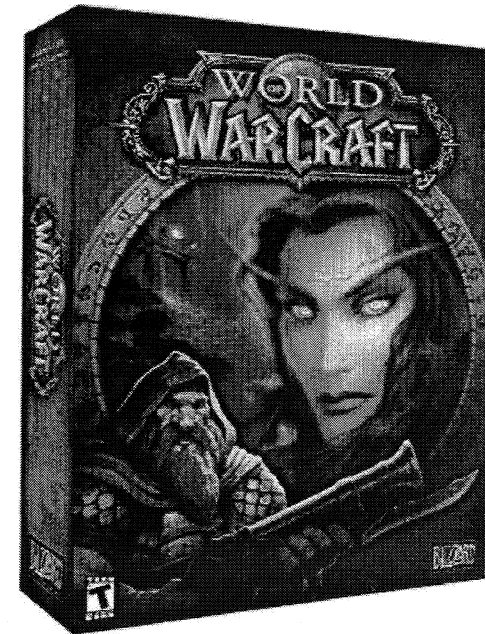
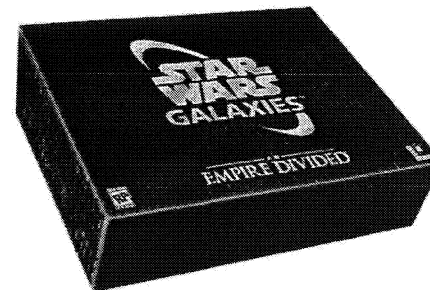
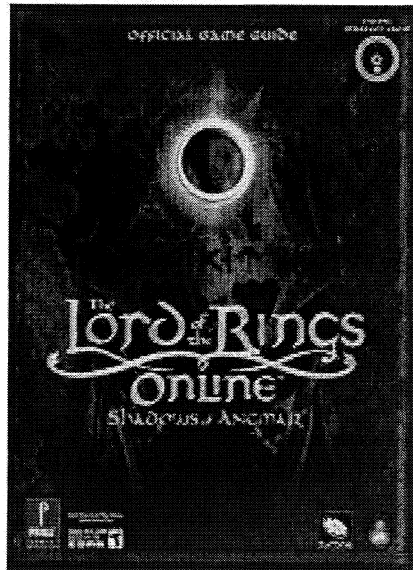
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# Persistent Immersive Synthetic Environments

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# PISE Statistics

- World of Warcraft: 9 million
- Second Life: 8.5 million
- Average MMO: 125K-500K
- Club Penguin: 700K

The latest industry estimates are that between 20 and 30 million Americans currently participate in persistent immersive synthetic environments. For comparison 26 million Americans golf.

# The Concept and Planning Documents

“NASA eEducation Roadmap: Research Challenges in the Design of Persistent Immersive Synthetic Environments for Education & Training”

Federation of American Scientists and NASA Learning Technologies: 2007

<http://learners.gsfc.nasa.gov/NLT/road.html>

“Harnessing the Power of Video Games for Learning”

Federation of American Scientists:2006

<http://www.fas.org/gamesummit/>

“A Guide to Educational Uses of Games for NASA”

NASA Learning Technologies: 2005

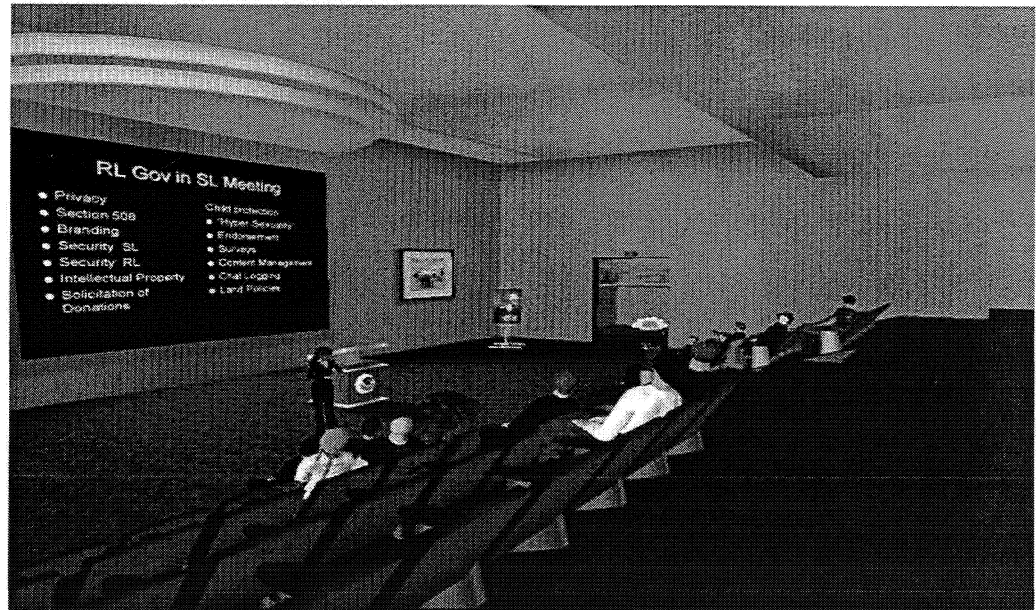
<http://learners.gsfc.nasa.gov/NLT/road.html>

# Third Spaces

PISE are not just connection points, they are meeting places.

PISE are the new public squares, village centers, malt shops, malls and pubs all rolled into one.

PISE come with a sense of 'thereness' that engages the mind like a real place does.



# Learning Theory

- Pierce and James
- Dewey
- Johnson-Laird and Anderson

What makes learning work?



# It starts as real code...

```
// Entity 0
// worldspawn
{
  "classname" "worldspawn"
  "detail_number" "0"
  "min_pixels" "250"
  "geometry_scale" "32.0"
  "light_geometry_scale" "32.0"
  "ambient_color" "0 0 0"
  "emergency_ambient_color" "0 0 0"
  "mapversion" "220"
  // Brush 0
  // sample_group:g[1] -> regular_polys:g[1] -> poly:p[1]
  {
    (-352 -288 0) (368 -288 0) (368 -272 0) concrete [ 1.0 0.0 0.0 -32.0 ] [ 0.0 -1.0 0.0 224.0 ] 0 1.0 -1.0
    (-352 -272 144) (368 -272 144) (368 -288 144) concrete [ 1.0 0.0 0.0 -32.0 ] [ 0.0 1.0 0.0 -224.0 ] 0 1.0 -1.0
    (-352 -288 144) (368 -288 144) (368 -288 0) concrete [ 1.0 0.0 0.0 -32.0 ] [ 0.0 0.0 1.0 64.0 ] 0 1.0 -1.0
    (-352 -272 0) (368 -272 0) (368 -272 144) concrete [ -1.0 0.0 0.0 32.0 ] [ 0.0 0.0 1.0 64.0 ] 0 1.0 -1.0
    (-352 -288 0) (-352 -272 0) (-352 -272 144) concrete [ 0.0 -1.0 0.0 -224.0 ] [ 0.0 0.0 1.0 64.0 ] 0 1.0 -1.0
    (368 -288 144) (368 -272 144) (368 -272 0) concrete [ 0.0 1.0 0.0 224.0 ] [ 0.0 0.0 1.0 64.0 ] 0 1.0 -1.0
  }
  // Brush 1
  // sample_group:g[1] -> regular_polys:g[1] -> poly:p[2]
  {
    (-352 272 0) (368 272 0) (368 288 0) concrete [ 1.0 0.0 0.0 -32.0 ] [ 0.0 -1.0 0.0 -336.0 ] 0 1.0 -1.0
    (-352 288 144) (368 288 144) (368 272 144) concrete [ 1.0 0.0 0.0 -32.0 ] [ 0.0 1.0 0.0 336.0 ] 0 1.0 -1.0
    (-352 272 144) (368 272 144) (368 272 0) concrete [ 1.0 0.0 0.0 -32.0 ] [ 0.0 0.0 1.0 64.0 ] 0 1.0 -1.0
    (-352 288 0) (368 288 0) (368 288 144) concrete [ -1.0 0.0 0.0 32.0 ] [ 0.0 0.0 1.0 64.0 ] 0 1.0 -1.0
    (-352 272 0) (-352 288 0) (-352 288 144) concrete [ 0.0 -1.0 0.0 336.0 ] [ 0.0 0.0 1.0 64.0 ] 0 1.0 -1.0
    (368 272 144) (368 288 144) (368 288 0) concrete [ 0.0 1.0 0.0 -336.0 ] [ 0.0 0.0 1.0 64.0 ] 0 1.0 -1.0
  }
}

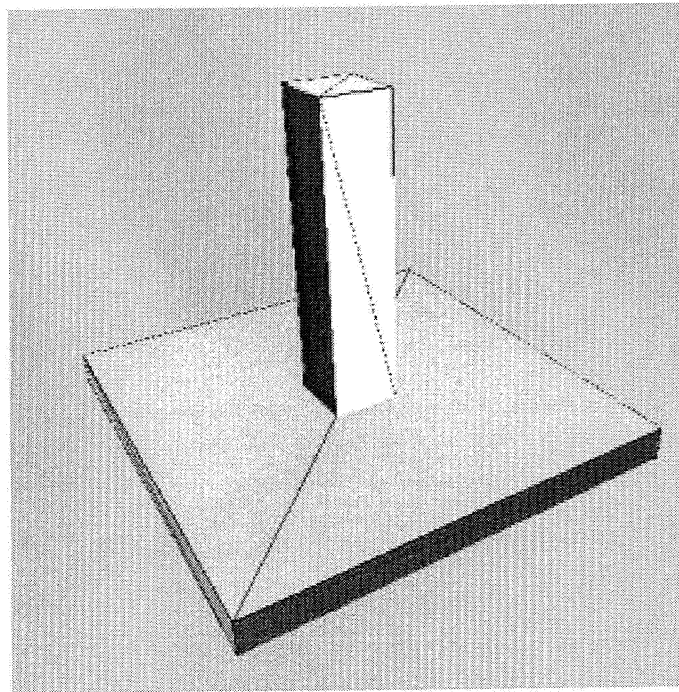
// Entity 1
// sample_group:g[1] -> portals:g[2] -> portal:b[1]
{
  "classname" "portal"
  "ambient_light" "0"
  // Brush 0
  // sample_group:g[1] -> portals:g[2] -> portal:b[1] -> poly:p[1]
  {
    (-362 -66 -2) (-360 -66 -2) (-360 66 -2) NULL [ 1.0 0.0 0.0 298.0 ] [ 0.0 -1.0 0.0 -8.0 ] 0 1.0 -1.0
    (-362 66 130) (-360 66 130) (-360 -66 130) NULL [ 1.0 0.0 0.0 298.0 ] [ 0.0 1.0 0.0 8.0 ] 0 1.0 -1.0
    (-352 -66 130) (-360 -66 130) (-360 -66 -2) NULL [ 1.0 0.0 0.0 298.0 ] [ 0.0 0.0 1.0 64.0 ] 0 1.0 -1.0
    (-362 66 -2) (-360 66 -2) (-360 66 130) NULL [ -1.0 0.0 0.0 -298.0 ] [ 0.0 0.0 1.0 64.0 ] 0 1.0 -1.0
    (-362 -66 -2) (-362 66 -2) (-362 66 130) NULL [ 0.0 -1.0 0.0 8.0 ] [ 0.0 0.0 1.0 64.0 ] 0 1.0 -1.0
    (-360 -66 130) (-360 66 130) (-360 66 -2) NULL [ 0.0 1.0 0.0 -8.0 ] [ 0.0 0.0 1.0 64.0 ] 0 1.0 -1.0
  }
}
```

lots of code!

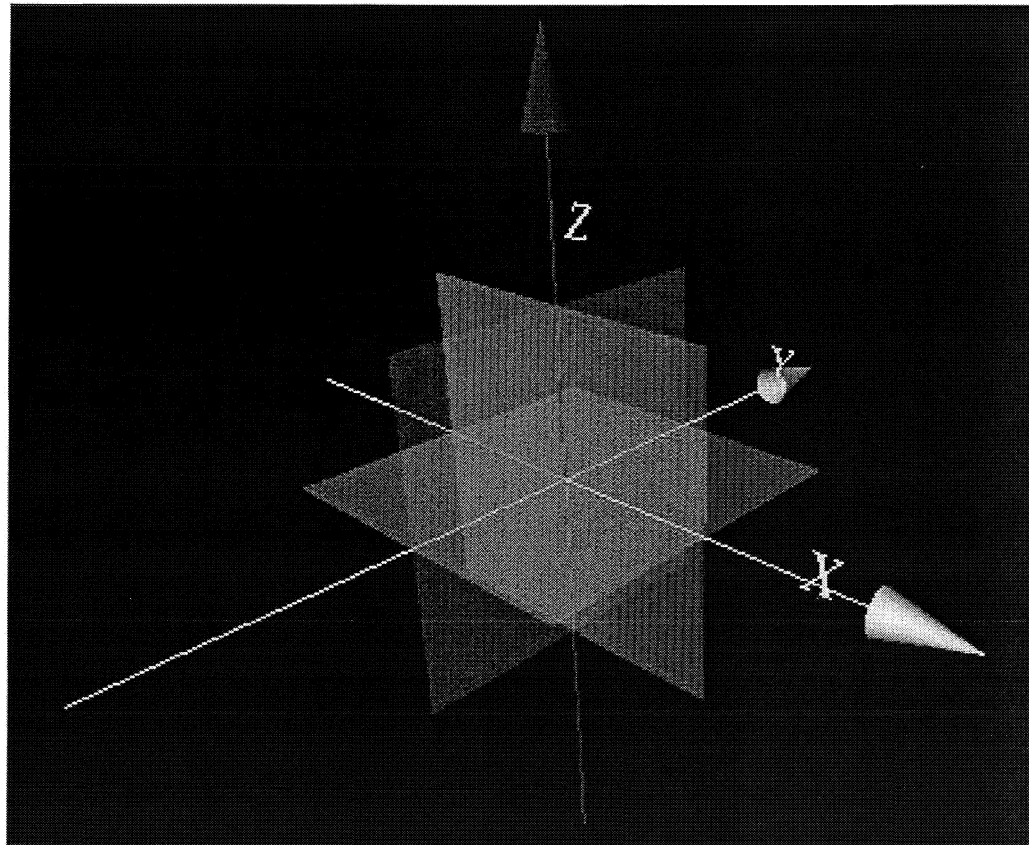
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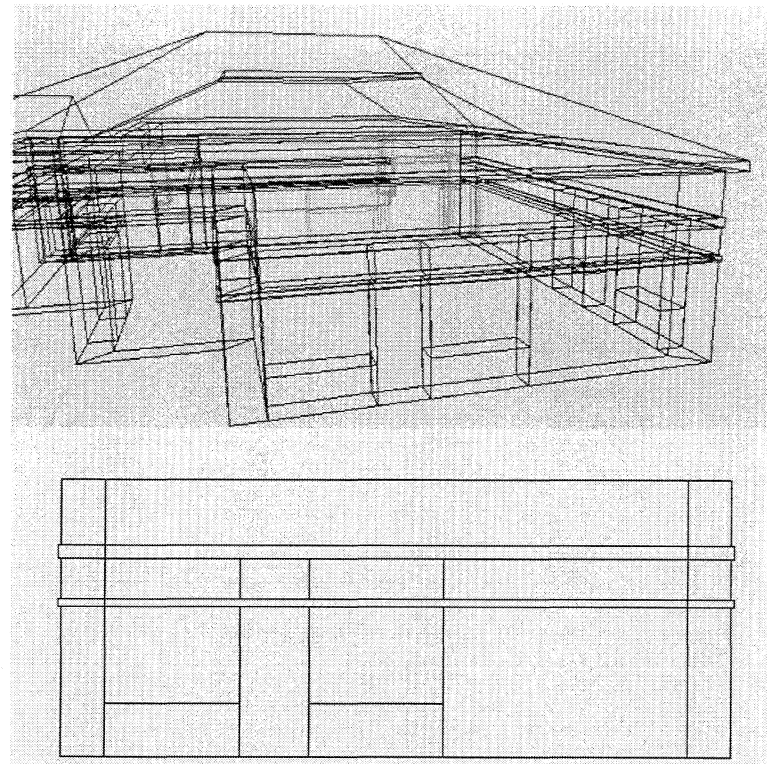
# The code defines “objects”



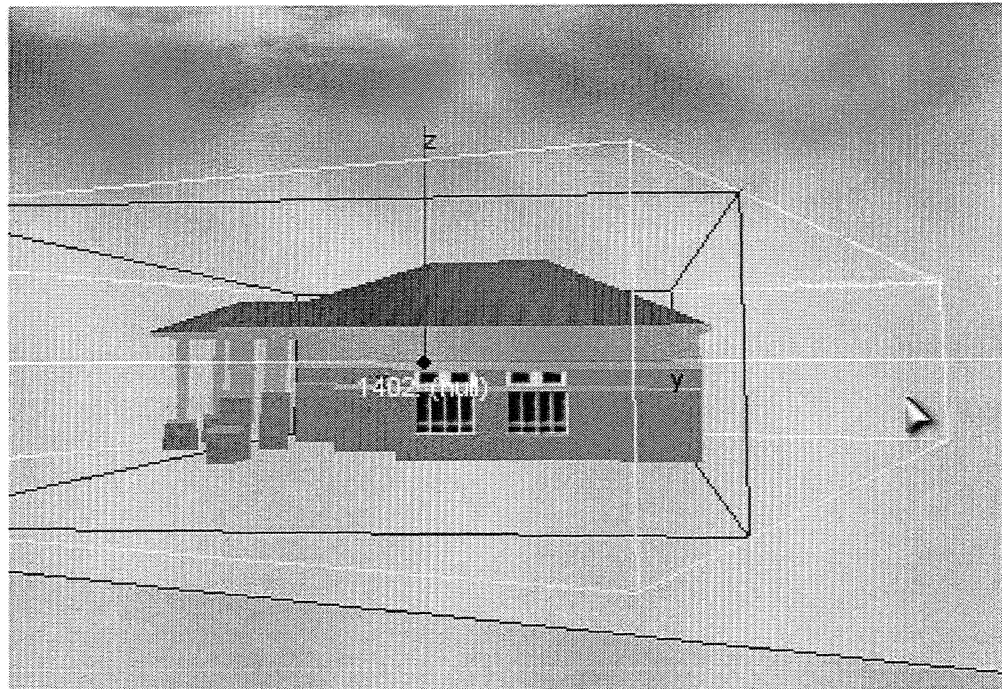
The objects exist in computer space, known as the “grid”



# The objects and space combine



# A “place” is created



# A “world” is created

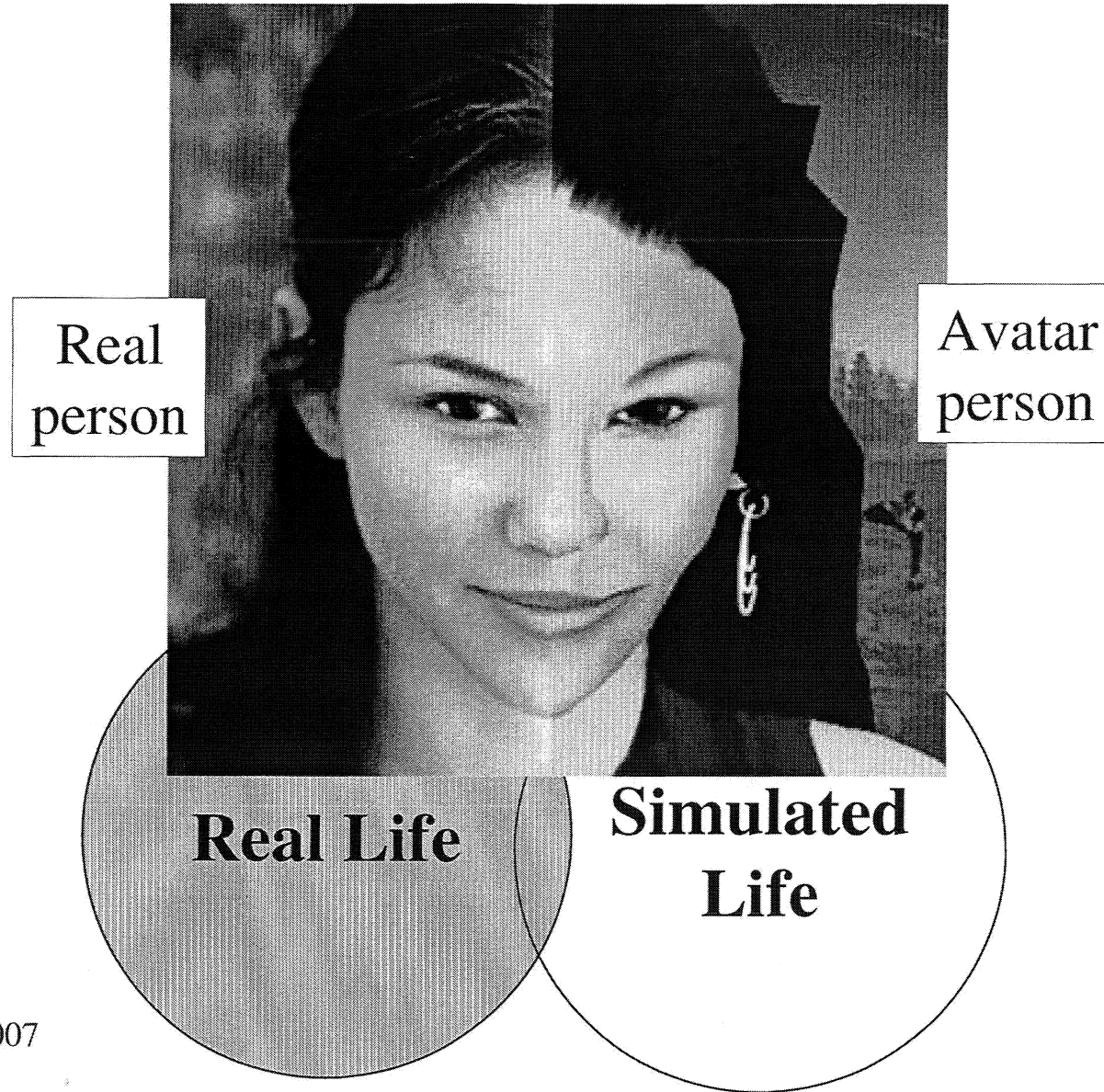


After awhile, the grid and code becomes obscure,  
and the “world” maintains focus



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# Real/Simulated Overlap





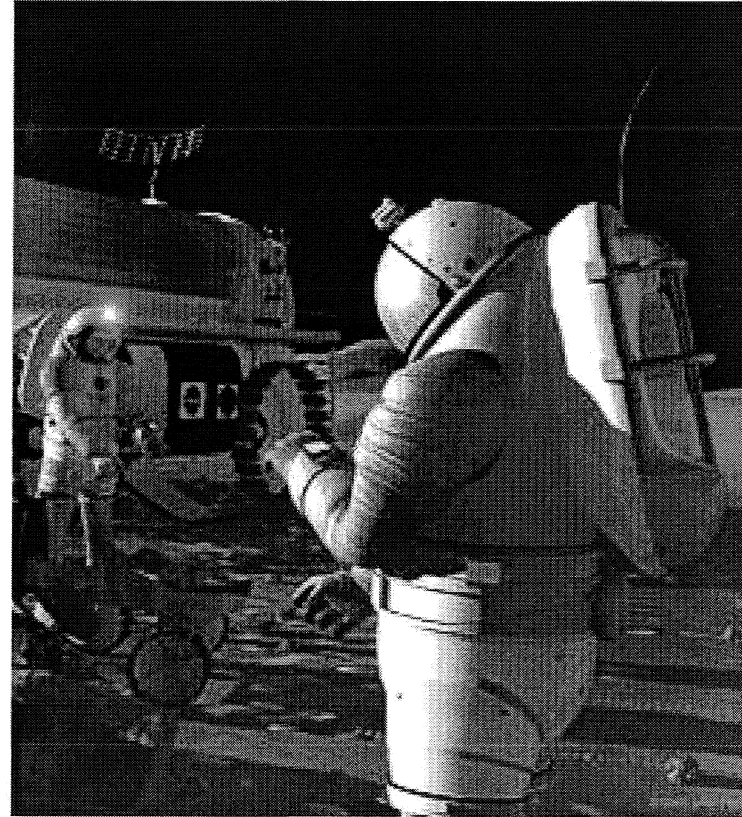
# Learning Practice

- Exposure to new ideas
- Exposure to new experiences
- Exposure to more intricate models

What makes learning work?

# A 21<sup>st</sup> Century Way of Sharing

When NASA returns to the moon in 2020, the people of Earth will be able to share that experience. Not just through the passive medium of television like the last time we went to the moon, but through the virtual experience of a persistent immersive synthetic environment. Kids are starting to use PISE at a very early age already. Nickelodeon and Disney each run their own online worlds. The children who play in those worlds are going to expect more from both their work and play as adults than 2D interactivity. They will expect 3D the same way people today expect cable television and those in the 1970s expected color television.



# Why games?

- Easy repetition
- Fast feedback
- Easy repetition
- Cognitive offloading
- Improved ‘telepathy’
- Built in motivation
- Easy repetition

# Choice of Approach

- Stealth learning (fooling the student)
- Informed learning (fooling the brain)
- Accidental learning (no fooling)

# Contact Information

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