Game-Based Learning: An Introduction

Michael Yacci, PhD

Professor, Information Technology

may@it.rit.edu

The Buzz

- Edutainment, game-based learning, goal-based scenarios, educational games
- Combining aspects of entertainment technologies with instruction
- Away from "stand-up" and into games, movies, media, interactivity, etc.
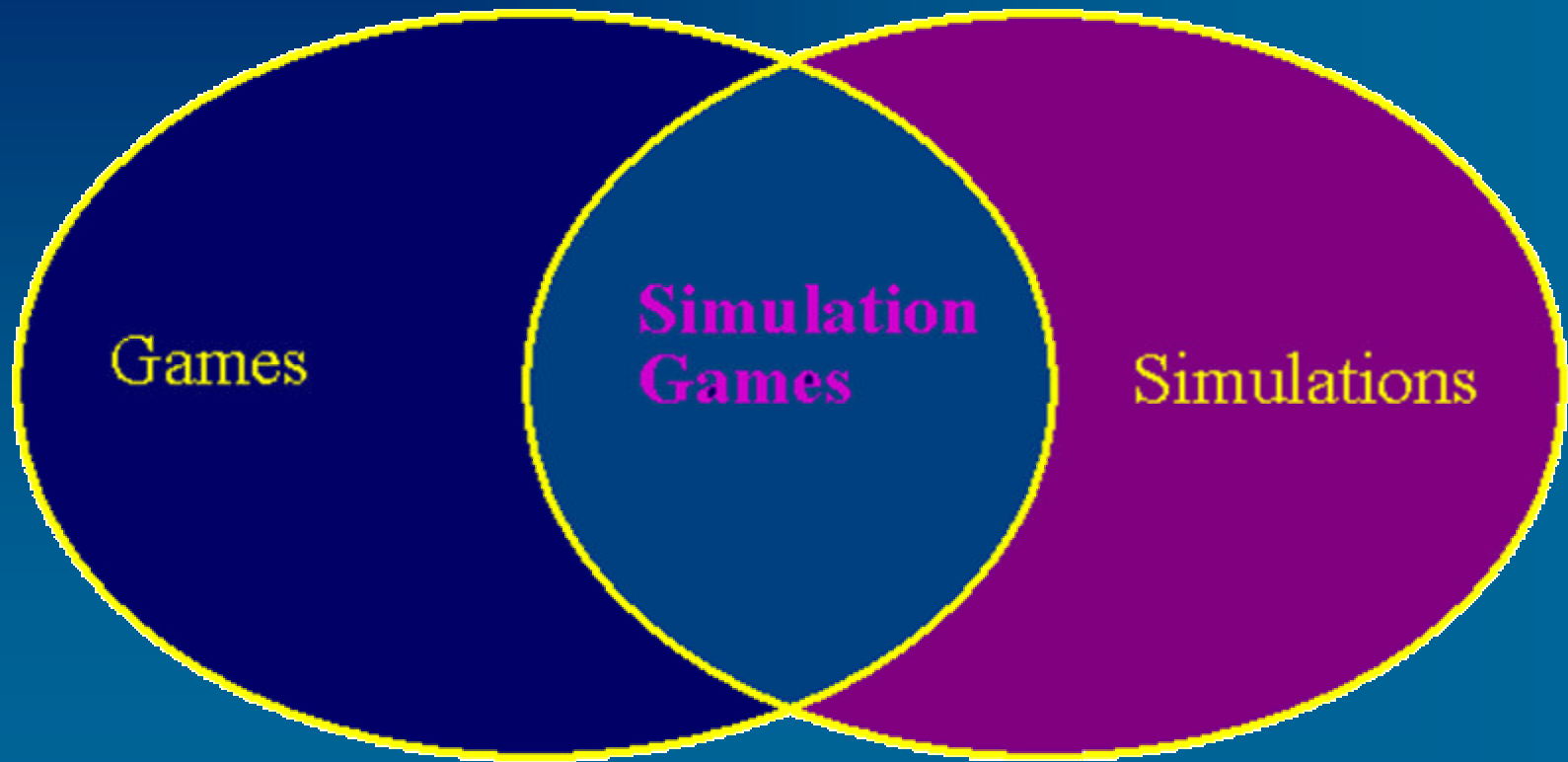- "Classroom teacher in a box" is a limited vision

Program

- What are the structures and attributes of game based learning?
- What can be taught with game based learning?
- How do we *use* them in the classroom?
- How do students react?

Pre Game Issues:

- Learning (or "my course") is *hard* – my work is *serious*! How can it be fun?

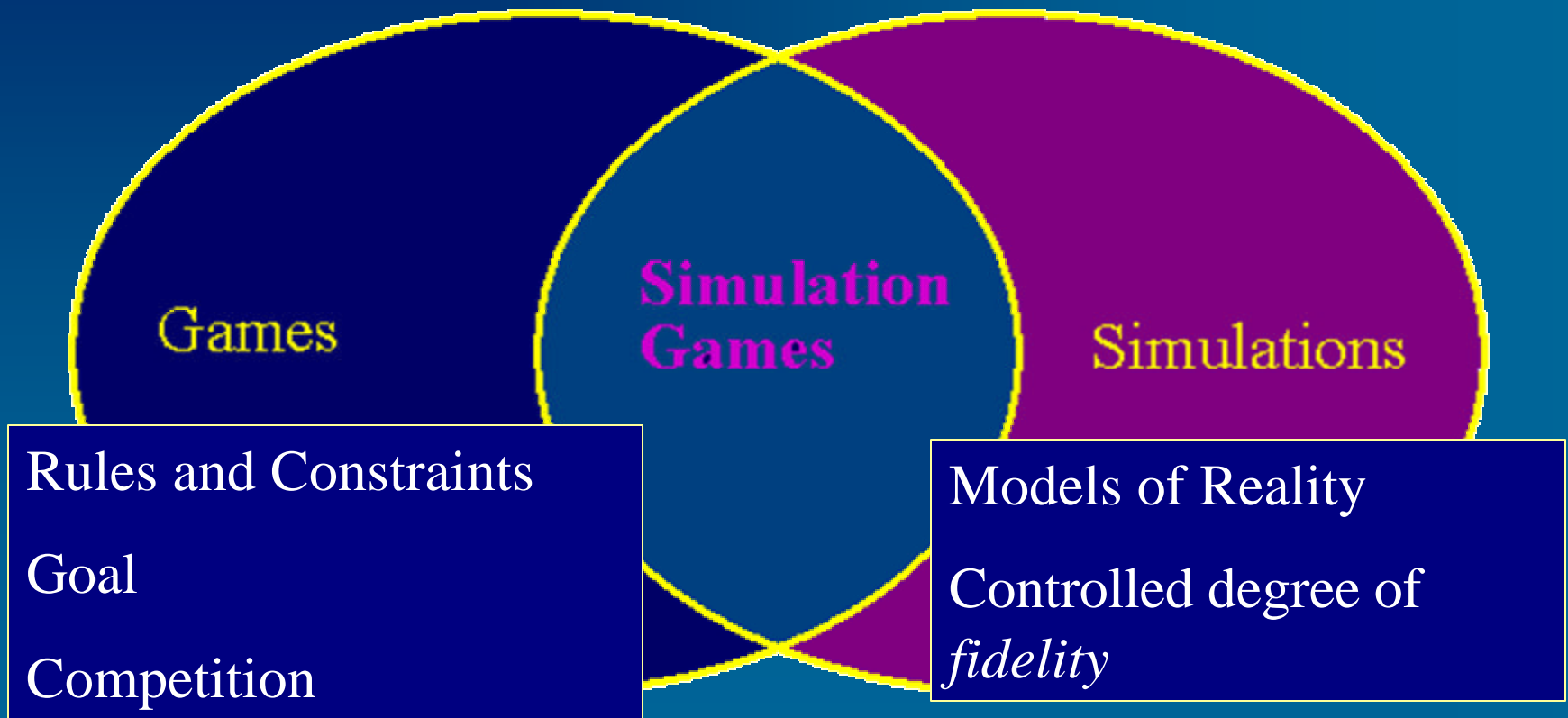- Do games teach better than "traditional" techniques?
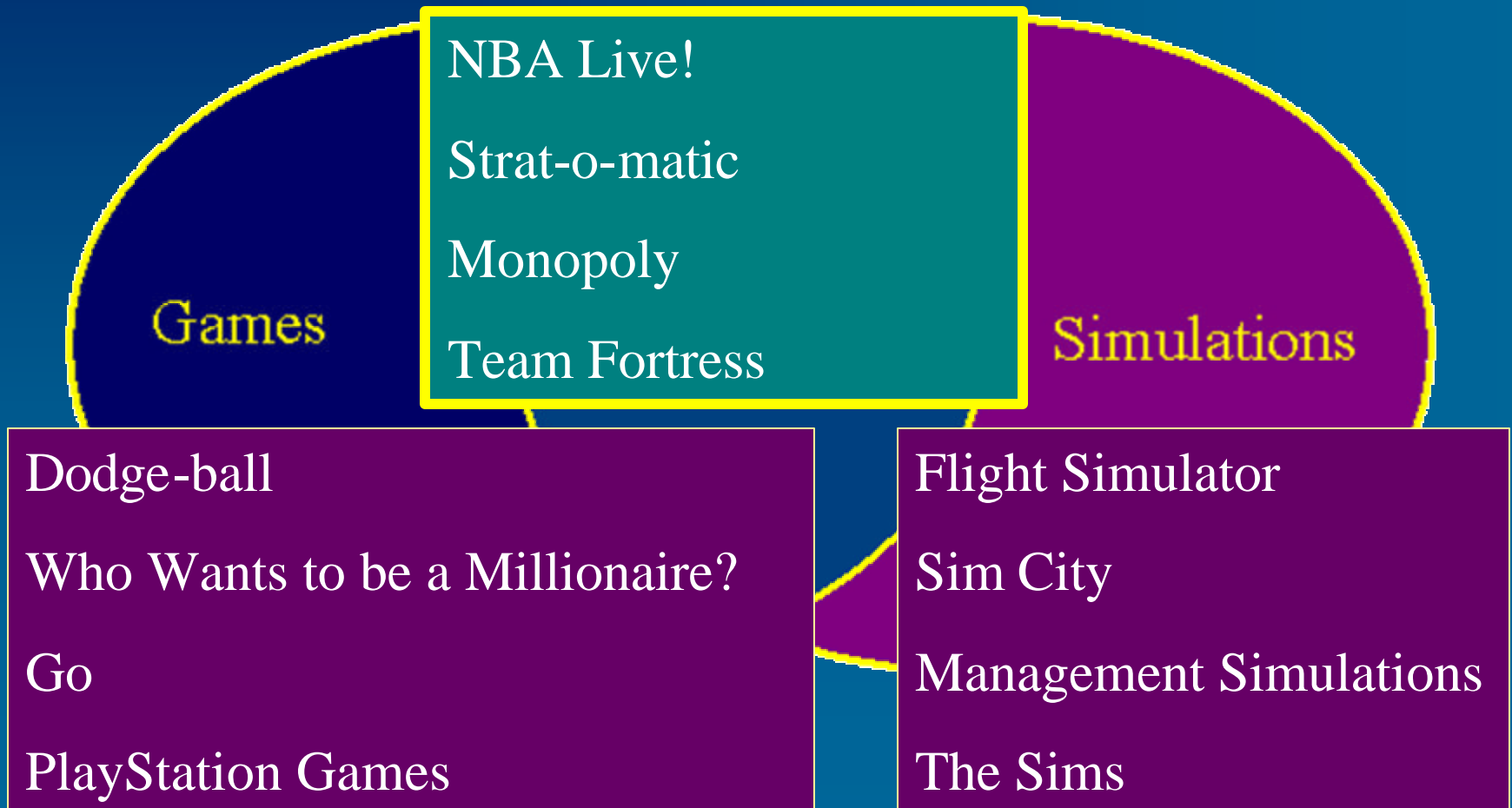
Games and Simulations and Simulation Games

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Games

Simulation Games

Simulations

Rules and Constraints

Goal

Competition

Models of Reality

Controlled degree of *fidelity*

Games and Simulations and Simulation Games

Games

Simulations

NBA Live!

Strat-o-matic

Monopoly

Team Fortress

Dodge-ball

Who Wants to be a Millionaire?

Go

PlayStation Games

Flight Simulator

Sim City

Management Simulations

The Sims

But the purpose…

- Not pure fun
- Educational and instructional outcomes
- Even at the expense of "fun"

What's fun about games and simulations?

- People get "into" them for long periods of time
- Competition and collaboration are fun
- Failure is tolerable – after all, it's not *real*
- Often willing to learn a lot of irrelevant stuff in the name of fun: "Go to the Head of the Class!"
- Point of view: makes work into fun

Types of Games

- **Intrinsic Games**: the content is tightly coupled to the game play
- **Extrinsic Games**: the content is "bolted on" to the game structure
- **Self-paced/Reflective Games**: time can be stopped, planning is essential
- **Externally-paced/"Twitch" Games**: speed is essential to the game or the task

Extrinsic Games

- **Jeopardy** – substitute any content
- Trivial pursuit
- You don't know Jack

Intrinsic Games

- Flight Simulator – also a twitch game
- Management games -- reflective
- Department of Justice: Quandaries
- Ethics simulation – to get people to read and recognize what is otherwise incredibly dull rules and requirements

Stock Market Simulation(s)

- Many available (*Ameritrade*)
- The "game" is to make as much money as you can
- Allow you to mess up and learn fearlessly
- SmartStocks.com
- Requires you to use real support pages

Simulated Experiments

- Duplicates what can be done in a "lab" with less hassle, resources, danger, and more control

- [Battery simulation](#) / Genetics

- Massive network experimentation

Axis and Allies

- Board Game set in the middle of WWII
- Players can "change history"

An Alternative to Creative Writing?

- American Girls: Premiere

What Can be Taught?

- **Facts:** knowledge level, recall, rote learning, memorization, labels
- **Principles:** cause and effect relationships (what if…?)
- **Complex problem solving:** when simple procedures and algorithms don't work
- **Examples of concepts, rules:** what does this thing really look like?
- **Creativity:** form, style,

How do they map?

- Extrinsic Games: useful for facts
- Intrinsic Games: precision skills, problem solving, cause and effect (principles)

- *Transfer*: generally better facilitated by intrinsic games and *discovery* situations

Intrinsic Games

LOS ANGELES, California (Reuters)

    -- The U.S. Army has found a powerful new weapon in training soldiers for the dirty and dangerous business of urban warfare: video games.

For the past year, the Army has been handing out free games as part of its recruiting efforts, but in the coming months it will also turn to a video game to train squad leaders in real-life combat tactics.
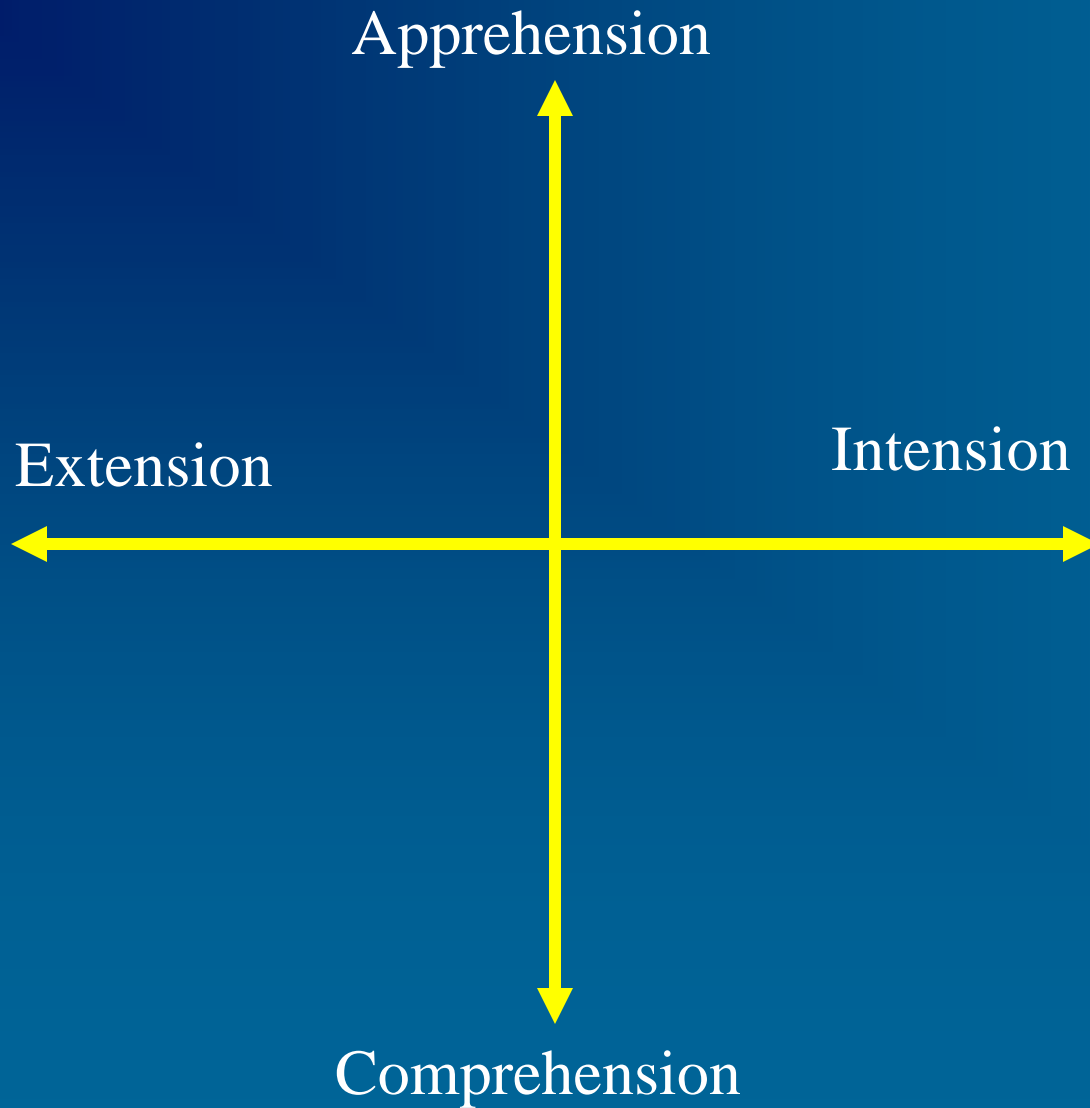
  (May 2003)

Full Spectrum Warrior
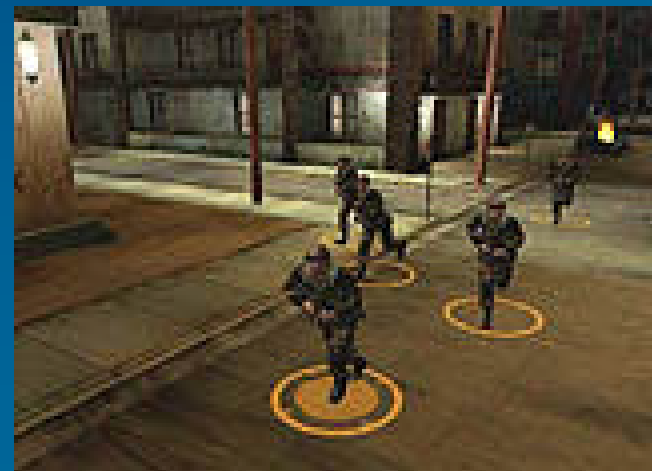
Kolb's *Experiential Learning* Model

- Students don't learn just from playing games or experimenting with simulations (Pea & Kurland, 1984)

- …Unless the context is "well-engineered and targeted at well-defined learning objectives." (Lehrer, et al., 1989, 1991; Miller, Lehman, Koedinger, 1999)

- Kolb's model is a reasonable place to start

The Basic Model

- Two dimensions: people grasp information and transform it
- "prehension"
  - Apprehension
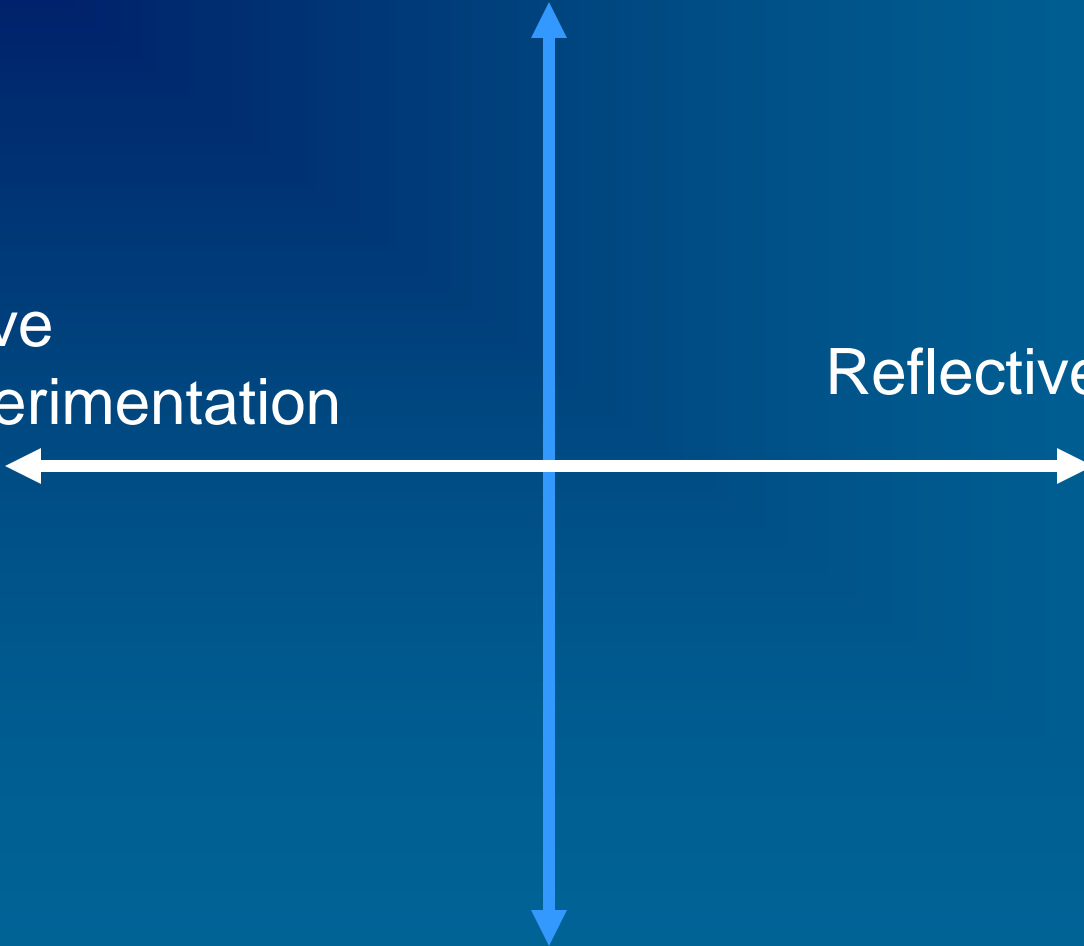 - Comprehension
- "transforming"
  - Intention
  - Extension

Concrete Experience

Reflective Observation

Abstract Conceptualization

Active Experimentation
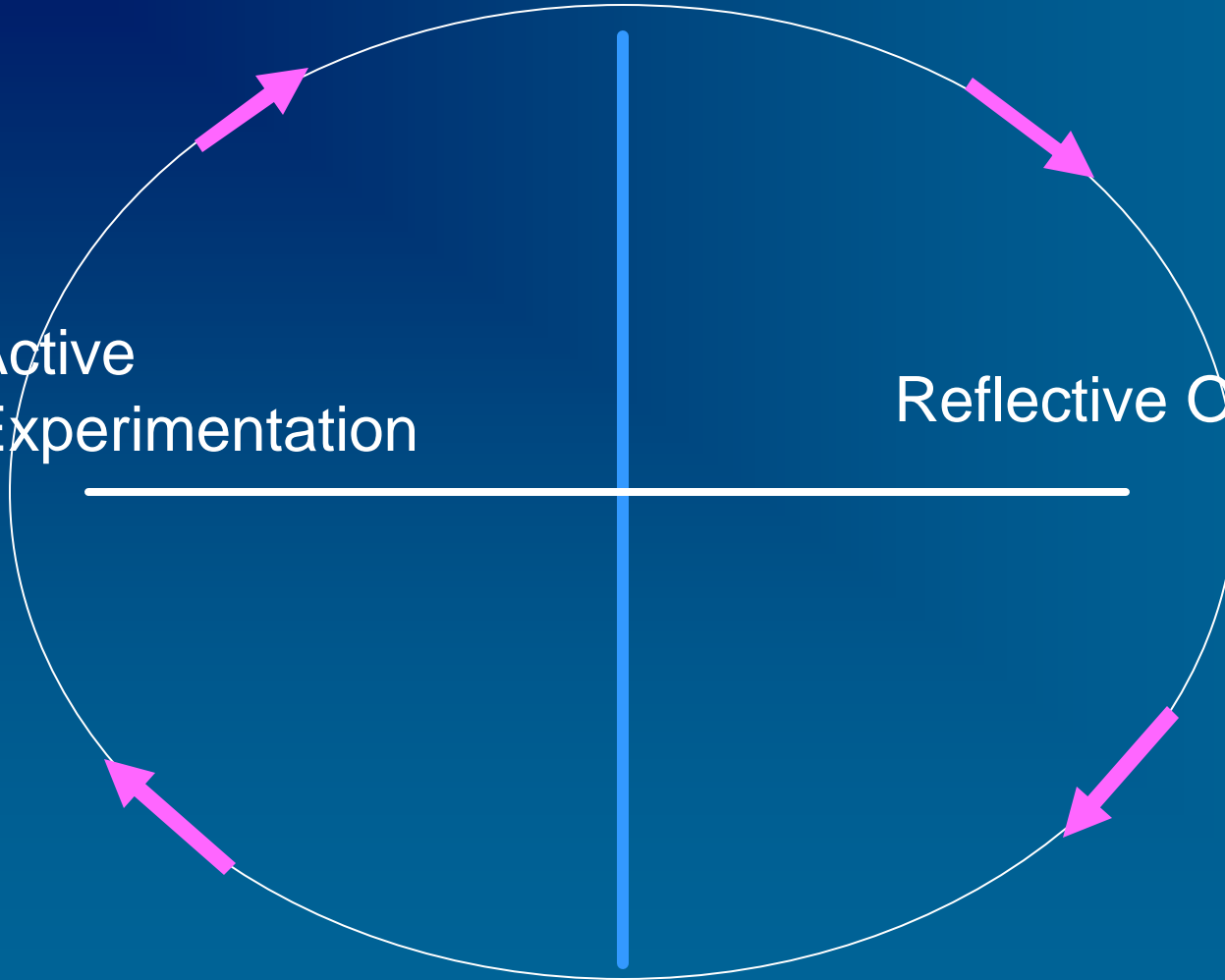
A Learning Experience

- Tends to follow the sequence in order
- Can start anywhere
- May spend different amounts of time in each quadrant, but should touch on them all
- Learners have a *preferred* quadrant, but benefit from exposure to all styles
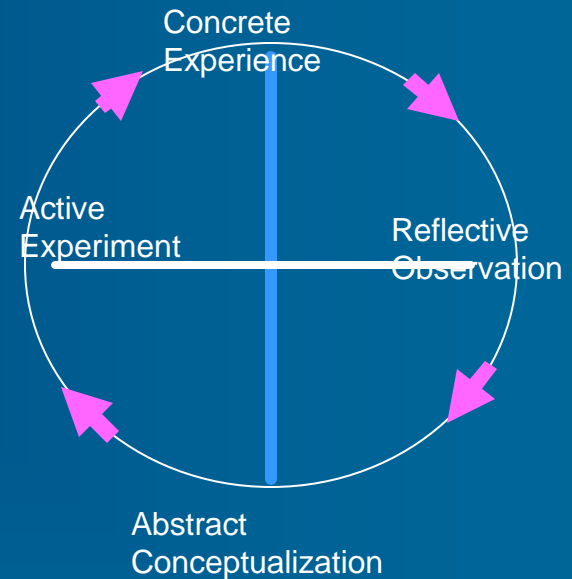
A "within game" Cycle

1. Experience something discordant: student "makes a move"

2. Reflect and observe the phenomenon: what happened in the game

3. Relate reality to theory – look for a model: *why* did that happen

4. Construct a hypothesis: Plan for next move: this should happen, let's do it
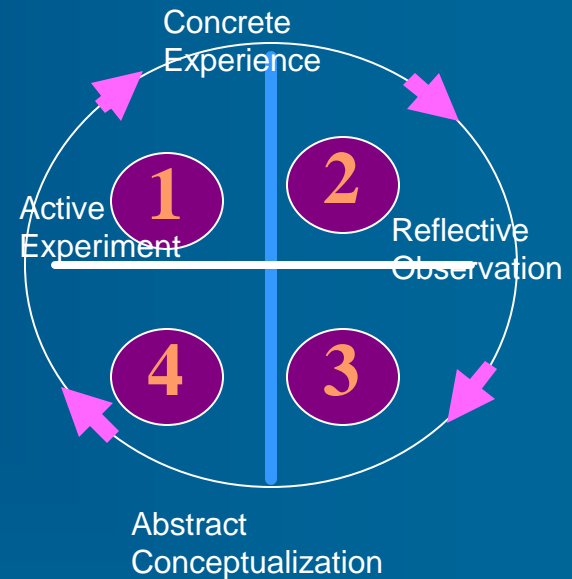
A Full Game Cycle

1. Experience something discordant: student got beaten in game

2. Reflect and observe the phenomenon: what happened at various key points

3. Create a model or hypothesis: is there a known relationship

4. Test it: if we replay, is it different?

Concrete Experience

Active Experiment

Reflective Observation

Abstract Conceptualization

What is usually not built into a game

- Reflection and observation
- Prediction and theory building

"Debriefing" the activity

Additional Pieces

- Lab reports (what did you do, when , to whom, with what results)
- Business reports (weekly planning)
- Presentations to "Board of Directors"
- Graphing of data
- Scorekeeping by students

General Uses in Education

- Low threat discovery (no explanation – just try it!)
- Stimulus for discussion (ethics, attitude change)
- Use as practice
- Use as assessment

"Therapeutic" Uses

- De-sensitizing speakers to crowds
- Dealing with post-traumatic stress disorders

Use of Teams

- Many minds, one character
  - Three players seems to be common
- Assigned roles (sales, manufacturing, etc.)

- *Teamwork* can learned as byproduct, but must be debriefed as well

What Needs Fidelity

- Everything can't be real
- What is most important to learning task
- What is most *fun*
- Physical/Process
  - model fidelity
- Situational/Procedural
  - user interaction fidelity

Who Needs Fidelity?
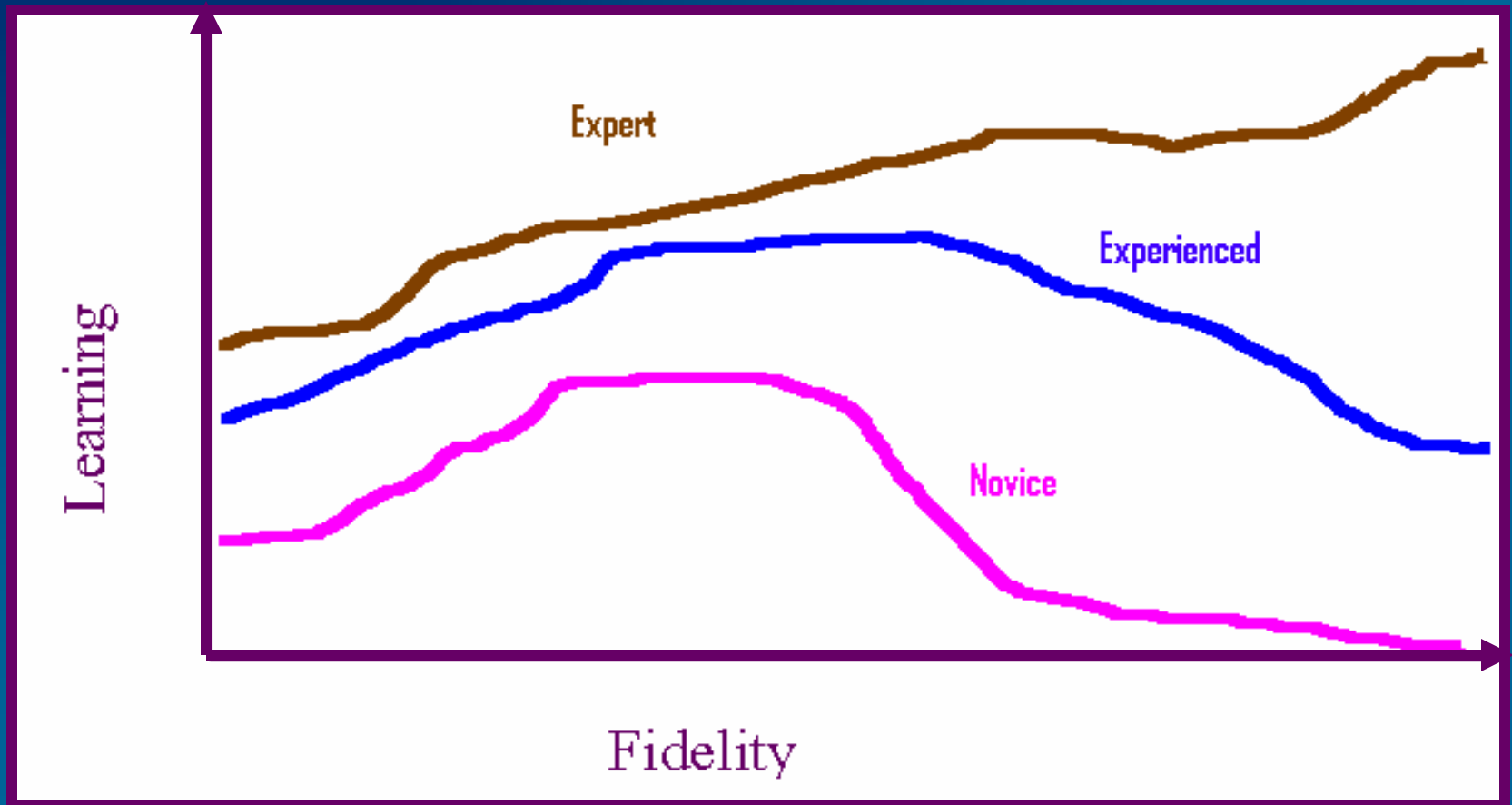
High Fidelity

**Mission Rehearsal Exercise**

- (MRE), being developed by a contractor for the U.S. military to help train soldiers heading for combat, peacekeeping and humanitarian missions.

"150-degree movie screen, complete with 10.2-channel audio that creates floor-shaking sound effects. To enhance the sense of reality, smells including burned charcoal can be pumped into the room. Participants can gesture and touch objects and elicit responses in the simulator. The machine also uses voice-recognition technology and different languages to allow participants to converse with the characters they encounter."

Extremely High Fidelity

- **Tank Driver Trainer** in Ft. Knox KY.
- The typical Training Tank costs $155/mile to operate whereas the Tank Driver Trainers cost $5.44/simulated mile. (About 100K training miles per year.)
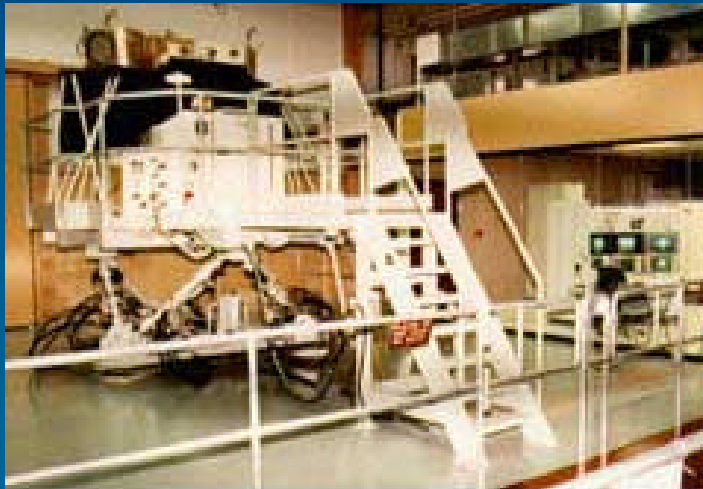
M1 Drivers Cab

Learners

- Multi-modality
  - Rich simulations may help students who have trouble with lectures, auditory learning, motivation
  - Evidence by Mayer that suggests an additive effect for multi-modality presentations that "agree"

Only kids like games, not adults?

- Adults are just as likely to benefit from games, once they get past the interface
  - Business people like complex business simulations *better* than college students (Patz, 1990).
- My Own Experience
  - Students: "this is so unreal"
  - Experienced adults: "this is so much like real life"

What Can You Do?

- Buy an already developed simulation
- Use an extrinsic game (Jeopardy, Trivial Pursuit)
- Develop paper and pencil simulations – humans as "brains"
- Develop simple computer based games
- Work with professionals/grad students

Diffusion of Planned Change
(1991-1993)

- You are the Minister of Diffusion in a Third World Country (Montoga)

- You need to save the country from economic ruin

- By *selecting* an innovation and *diffusing* it to all the farms in the country

Low Fidelity

(for 2003 – high fidelity in its day!)

Change 7.0

FARM 5: Hacienda Valle Fecund

Lutas per year (millions): 3.4875

Employees: 900 Lutaneros

Environment: Businesslike atmosphere

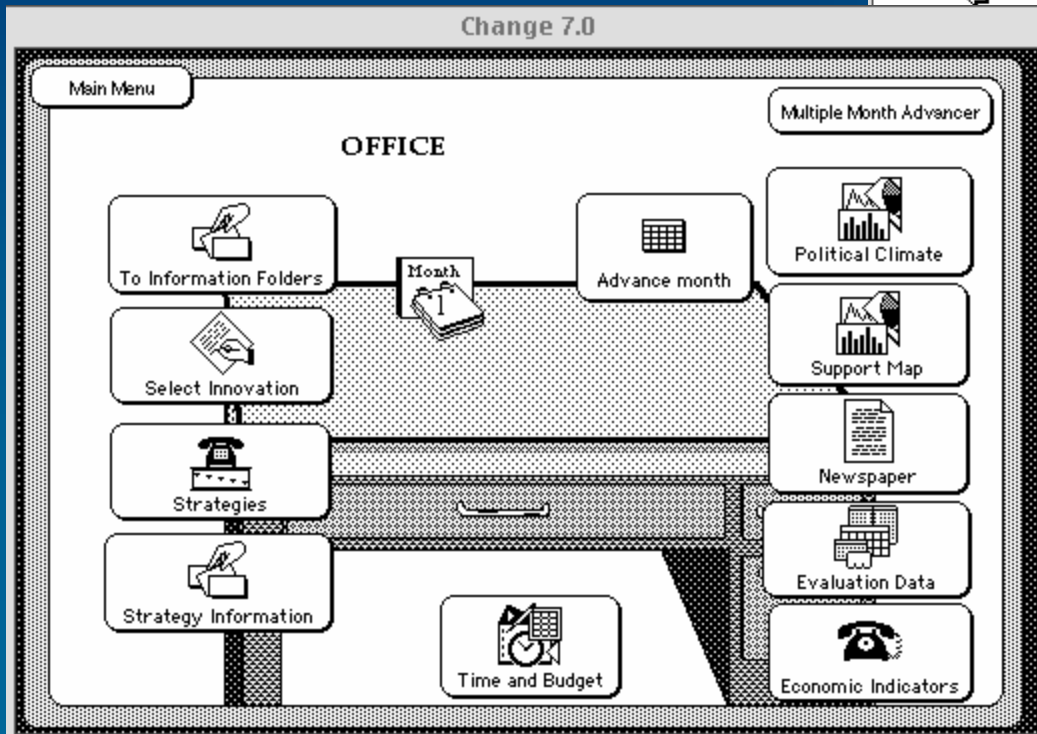Average Monthly Wage: 219

Productivity: 46%

Style: Slow to change

Background: The management is very deliberate. They are not eager to upset what they have, even though it is only average. Relatively harmonious group, and they see no reason to gamble on something new unless it is "proven" to be good.

Info Map   Status Map   Office

Change 7.0

Main Menu   Multiple Month Advancer

OFFICE

To Information Folders   Month   Advance month   Political Climate

Select Innovation   Support Map

Strategies   Newspaper

Strategy Information   Evaluation Data

Time and Budget   Economic Indicators

But a very complex process model operating "under the hood"

More Low Fidelity

INNOVATION: Hard-Skinned Luta

- ○ print (flyers)
- ○ tv
- ○ speaker
- ○ print (brochures)
- ○ personal visit
- ○ demonstration
- ○ training
- ○ telephone
- ○ try-out (limited)
- ○ try-out (extensive)

Amount Pending

farm 1
farm 2
farm 3
farm 4
farm 5
farm 6
farm 7
farm 8
farm 9
farm 10
farm 11

Considering:

demonstration for:farm3

show pending strategies

Office

Enact

There are a few more things I can tell you about the **Hard-Skinned Lut**a idea. First of all, you will be purchasing some biologically treated Luta seeds, which have been bio-engineered to have a hard skin. That means that they can be picked easily by a machine. Second, it entails purchasing several large picking machines. They are easy to operate, and training is available. The hard-skinned lutas are plucked from their vines automatically by the machine.

Overall, this system will cost you slightly more than the manual way that you currently pick lutas. But, this increased cost will be offset by the ability to pick lutas more efficiently. You'll probably see an improvement in luta production of about 20%.

I am not completely sure about what might happen when the new hard-skinned lutas hit the market. I imagine that a few people will dislike the tough skin, but that shouldn't make much difference.

To Folders

The Game's purpose:

- Can students diffuse a new idea?
- Generally "yes" by this point of the quarter
- Can students predict the long term effect of the innovation?
- No – it is often unpredictable and frequently bad

The Future?

- Simple templates: generic simulations such as business models, teamwork
- Will still largely be custom made
- Techniques for measuring "expenses" of game-based learning
- Pre-games era of computer-based learning is creating "a mechanical horse to pull the wagon…"

The End?

Questions?

Questions?

Questions?