Playing Games in Education - or, *Thank You Mario… But Our Princess Is In Another University!*

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Our Topics for this Morning…

What is a (Good) Videogame?

Elements of Game Design and Construction

Videogames and Education

What is a (Good) Videogame?

Zeroth-Order Readings

Huizinga, *Homo Ludens*

Salen & Zimmerman, *Rules of Play*

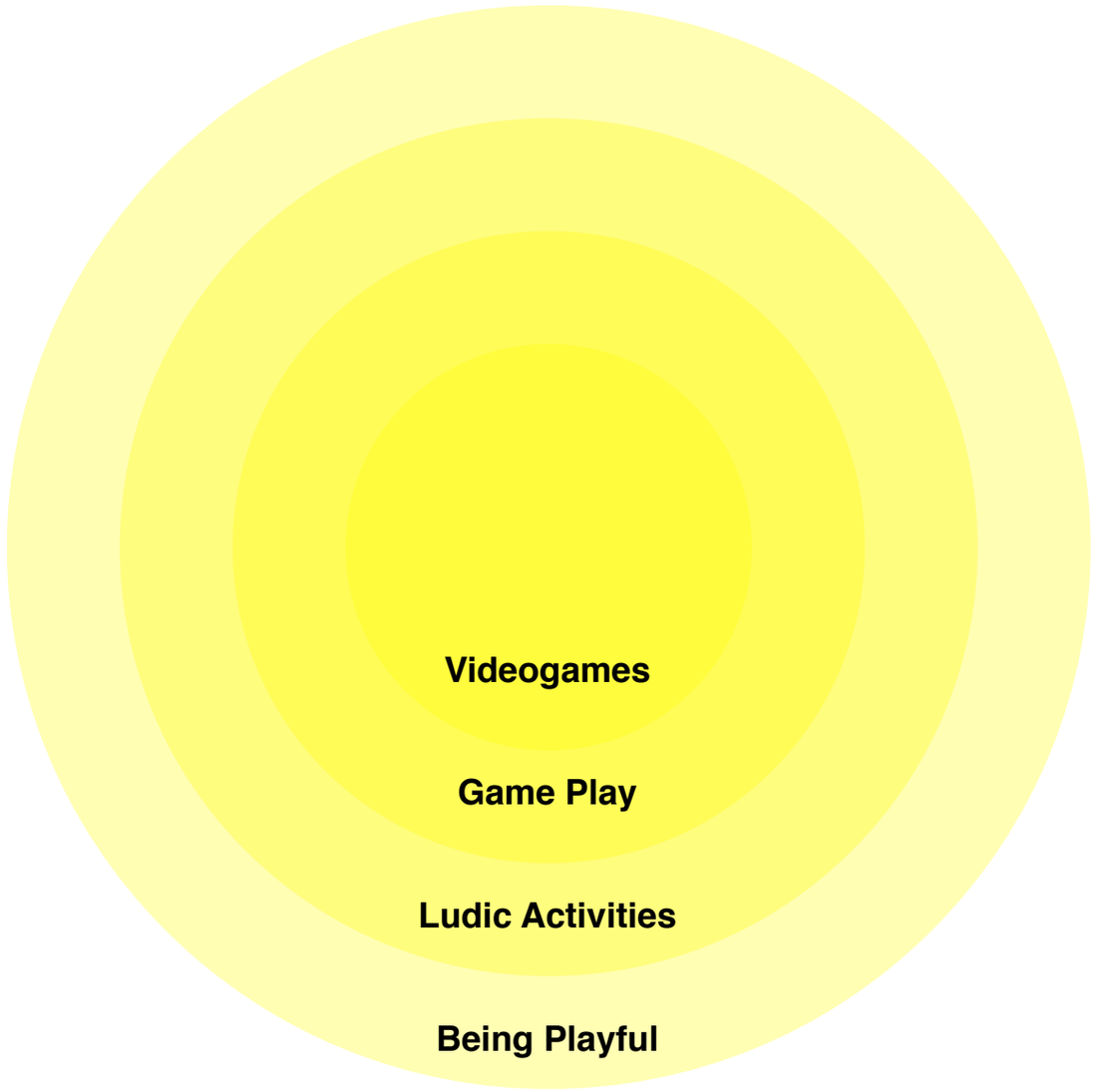
Formal Definitions of Play and Game (Salen & Zimmerman)

"Play is free movement within a more rigid structure."

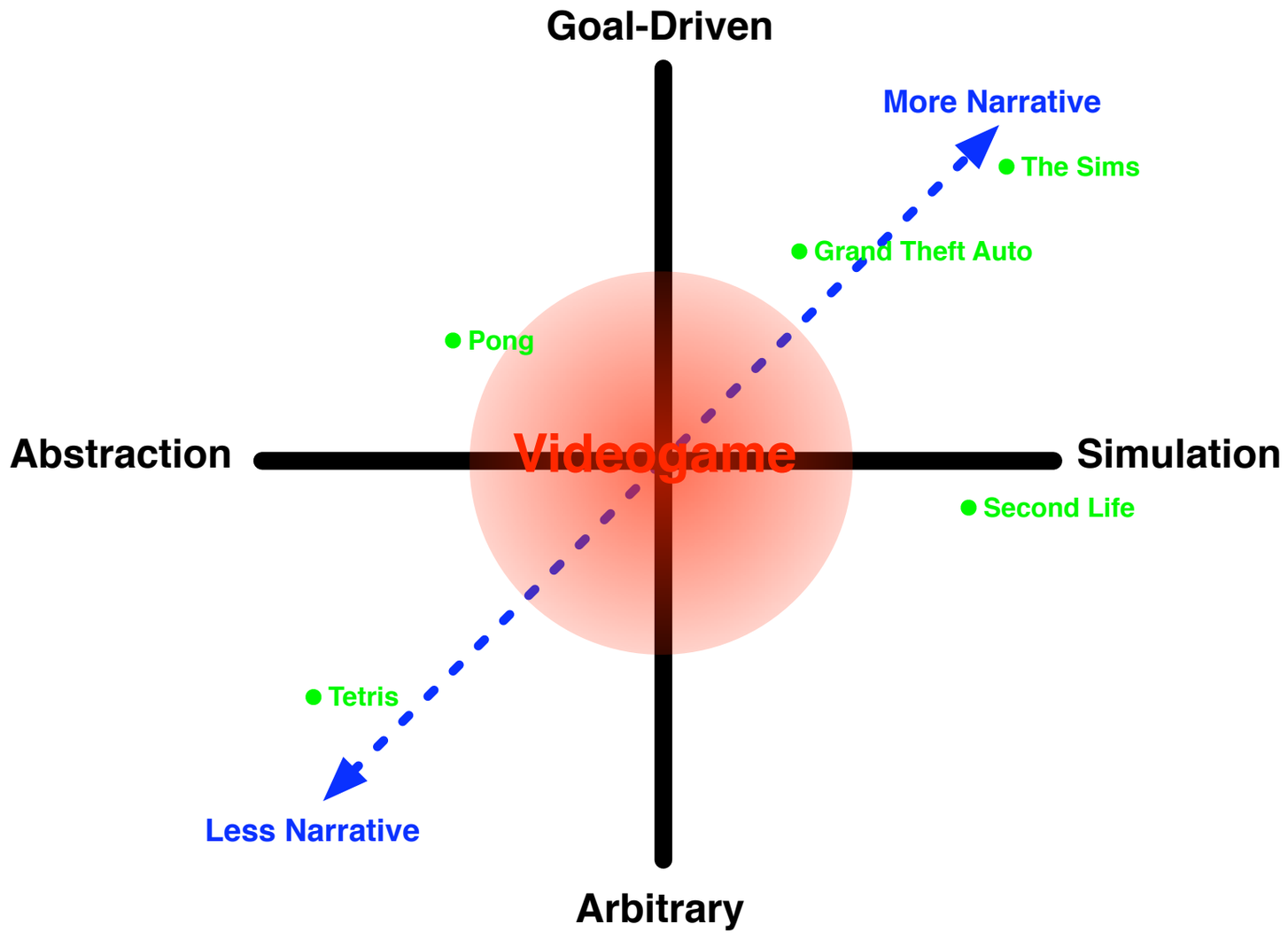
"A game is a system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome."

Salen, K. and E. Zimmerman, *Rules of Play : Game Design Fundamentals.* The MIT Press. (2003)

Relationship of Videogame Play to General Play



Game as Radial Category



Genres of Videogames 1 - Action

Shoot 'Em Ups (Space Invaders … Ikaruga)

Platformers (Donkey Kong … Super Mario Sunshine)

First-person Shooters (Doom … Half-Life 2)

Sports Games (Pong … World Soccer Winning Eleven 8 International)

Genres of Videogames 2 - Narrative

Interactive Fiction (Adventure … Curses)

Graphic Adventures (King's Quest … Myst series … Grim Fandango)

Action Adventures (Atari Adventure … Zelda series)

Role-Playing-Games (Wizardry … Neverwinter Nights … Final Fantasy Series)

MMORPGs (MUDs, MOOs, MUSHs … World of Warcraft)

Genres of Videogames 3 - Simulation

Sims (SimCity … The Sims)

Turn-based Strategy Games

- Military (Eastern Front 1941 … Final Fantasy Tactics Advance)
- World (Civilization … Europa Universalis II)

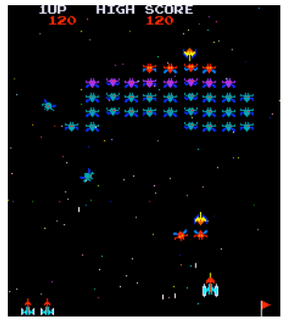
Real-time Strategy Games (Dune II … Starcraft series)

Genres of Videogames 4 - Puzzle and traditional

Puzzle Games (Tetris … PopCap Games)

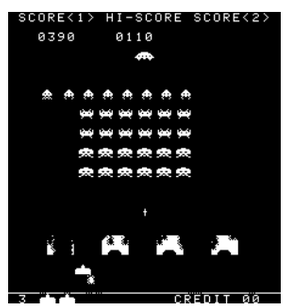
Traditional Games (Chess, Card Games)

Modification/Transformation



Galaxian - 1979

Xevious - 1982



Space Invaders - 1978

Gyruss - 1983

Scramble - 1981

Time Pilot - 1982

Millipede - 1982

R-Type - 1987

MODIFICATION → TRANSFORMATION → MODIFICATION

A False Dichotomy

Narratology

≠

Ludology?

Games and Boredom (Koster)

Game is too easy -> too simple patterns

Game is too involved -> uninterested in the info required to detect patterns

Game is too hard -> patterns are perceived as noise

Game becomes too repetitive -> new patterns are added too slowly

Game becomes too hard -> new patterns are added too fast

Game runs out of options -> all game patterns are exhausted

Raph Koster, *Theory of Fun for Game Design*. Paraglyph. (2004)

Successful Games Incorporate

Preparation before challenge ≠ game of pure chance

A sense of space ≠ trivial

A solid core mechanic ≠ no game there

A range of challenges ≠ game exhausted quickly

A range of required abilities ≠ simplistic

Skill in using these abilities ≠ tedious

Three More Key Items

Variable feedback

- Greater skill -> greater rewards

Ways of dealing with the "Mastery Problem"

- Don't let inexperienced players get clobbered, experienced players "bottom feed"

Failure must have a cost

Game Design as Narrative Architecture (Jenkins)

Evocative Spaces

Enacting Stories

- Broad goals/conflicts
- Localized incidents (micronarratives)

Embedded narratives

- Game as an information space discovered, structured, and restructured by the player

Emergent Narratives

- Constructed by the player

Jenkins, H., *Game Design as Narrative Architecture* - in Wardrip-Fruin,N. and P. Harrigan, *First Person : New Media as Story, Performance, and Game*. The MIT Press. (2004)

Typology of Ideological Levels in a Game (Frasca)

Level 1: representation and events ("what happens")

Level 2: manipulation modes ("what the player can do")

Level 3: goal rules ("what the player must do to win")

Level 4: meta-rules ("what player modifications to the other three levels are allowed")

Frasca, G., *Simulation versus Narrative: Introduction to Ludology* - in: Wolf, M.J.P. and B. Perron, *The Video Game Theory Reader*. Routledge. (2003)

Elements of Game Design and Construction

Components of Interactive Fiction (Montfort)

Inputs

- commands (in the world) -> diegetic or hypodiegetic (stories within stories)
- directives (about the program) -> extradiegetic

Outputs

- replies -> diegetic/hypodiegetic
- reports -> extradiegetic

Characters and Related Types

- Player(s)
- NPC
- Other Persons

N. Montfort, *Twisty Little Passages : An Approach to Interactive Fiction.* The MIT Press. (2003)

Ancestry of IF

Riddles

Puzzles

Literary machines

Dungeons & Dragons

AI Conversational Machines

Early Computer Games

Interactive Storytelling I (Crawford)

Things that don't work:

- Branching trees
- Foldback schemes without changing context
- "Constipated" stories
- Kill 'em if they stray
- Storified games

C. Crawford, *Chris Crawford on Interactive Storytelling*. New Riders Games. (2004)

Interactive Storytelling 2

Things that may work:

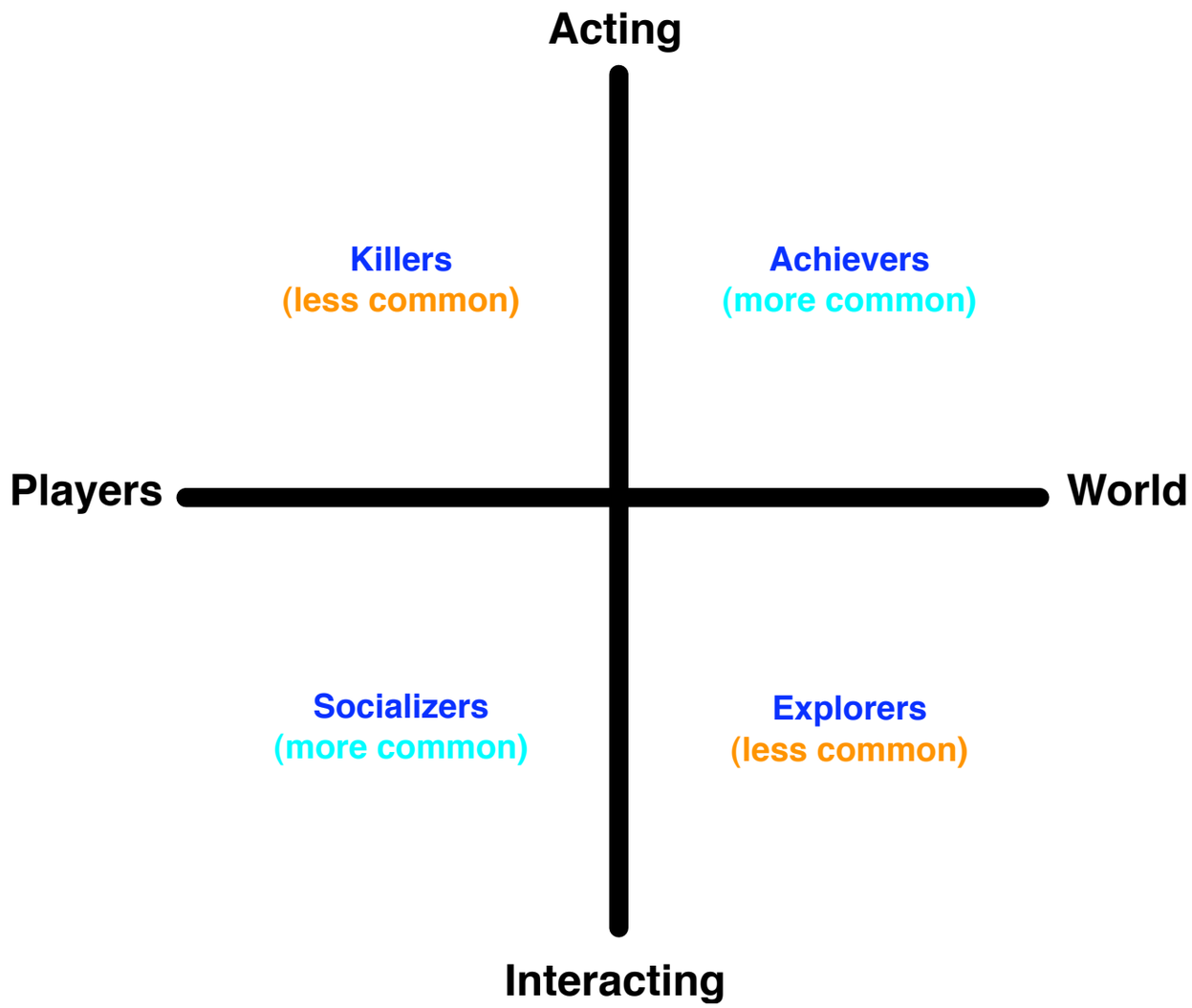
- Environmental approach
  - e.g. The Sims
- Data-driven approach
  - e.g., using formal schemes like Propp's
- Language-based approach
  - e.g., Trust and Betrayal: the Legacy of Siboot

Interactive Storytelling 3

Core Technologies Required:

- Personality model:
  - Intrinsic variables (e.g., pride)
  - Relationship variables (e.g., love)
  - Variables that denote changes in the other two
- Timeline manager:
  - Keep history and gossip records
  - Anticipate possible events
- Drama manager:
  - "Listen" = monitor story processes
  - "Think" = match these processes to a narrative model (e.g., Propp)
  - "Speak" = change variables to affect story development

MMORPG Player Types I (Bartle)



R. Bartle, *Designing Virtual Worlds*. New Riders Games. (2003)

MMORPG Player Types 2

4 Stable Game Configurations:

- Type 1: Killers and Achievers in equilibrium, with hardly any Socializers and Explorers
- Type 2: Socializers dominate, with everyone else only in bit parts
- Type 3: A balance between all four types, with enough Explorers to control the Killers
- Type 4: An empty world…

Type 3 is the most stable; types 1 and 2 eventually go to type 4

MMORPG Player Types 3

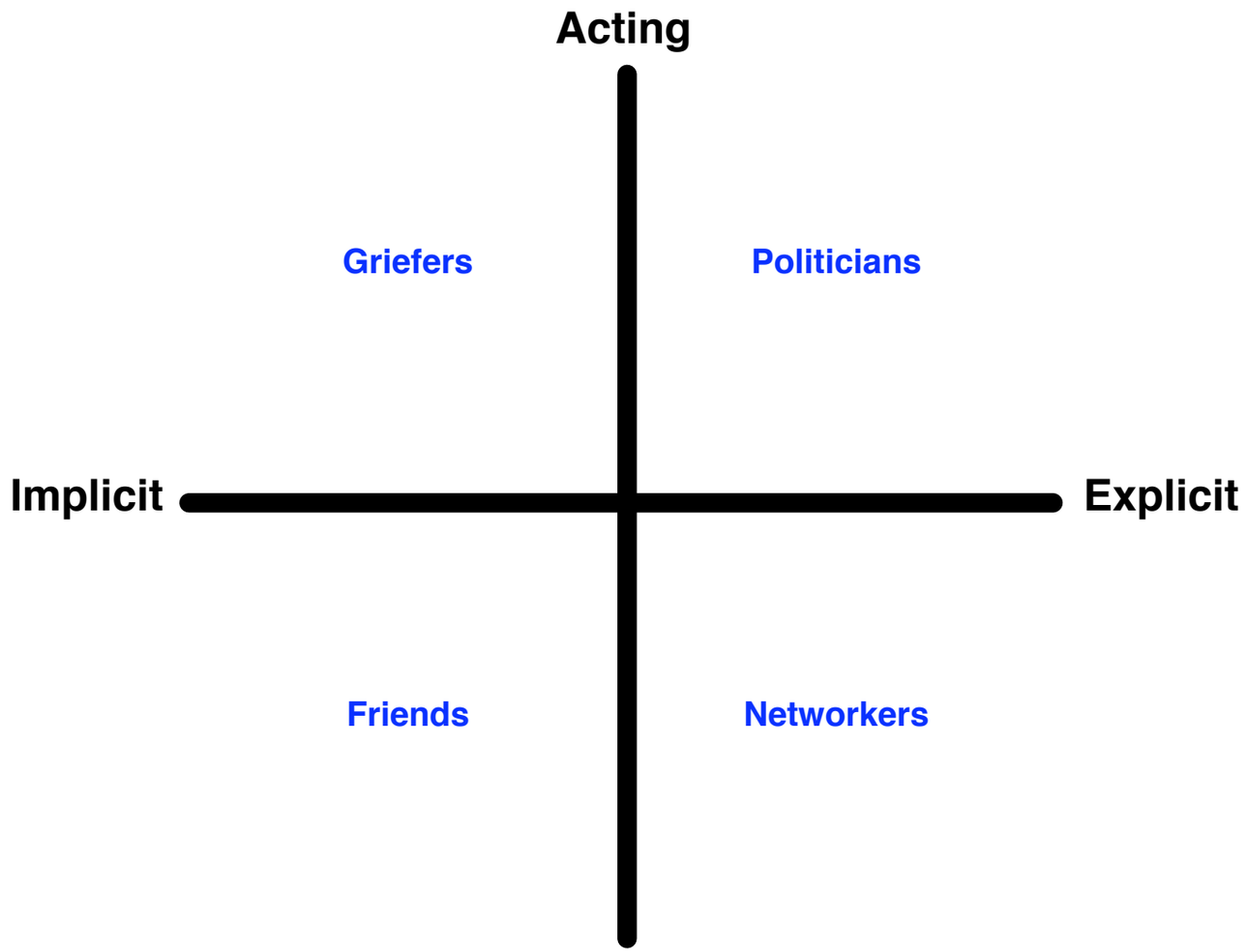
We notice that the sequence of player evolution tends to go:

- Killer -> Explorer -> Achiever -> Socializer

However, that's not quite a complete picture (e.g., for "wizzes")

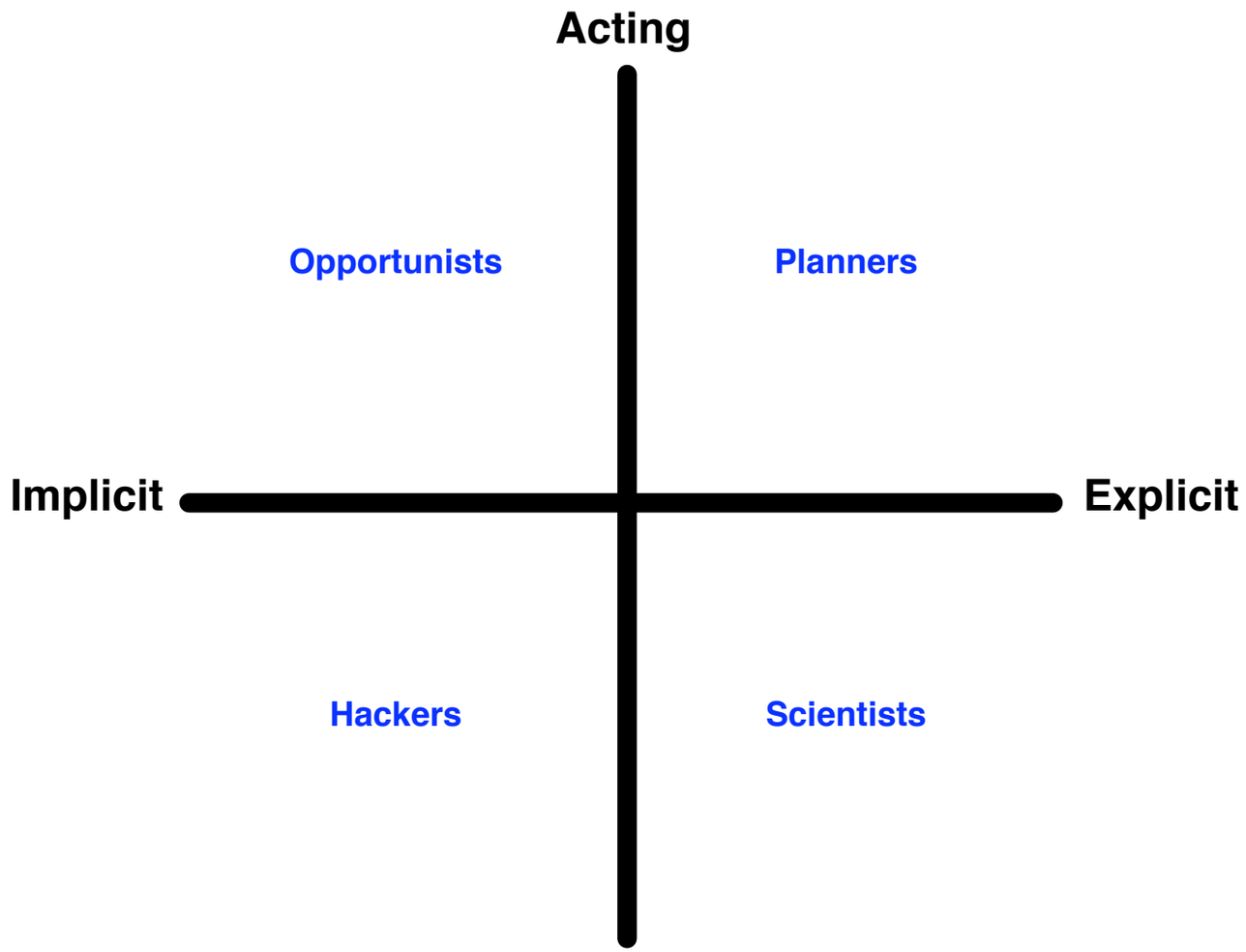
- A third axis can account for this:
  - IMPLICIT <-> EXPLICIT

MMORPG Player Types 4



(Player-side)

MMORPG Player Types 5



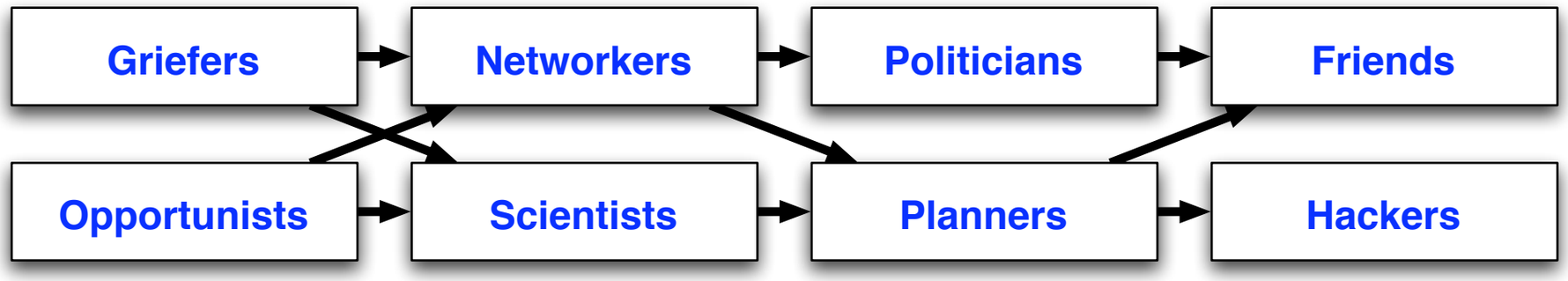
(World-side)

MMORPG Player Types 6

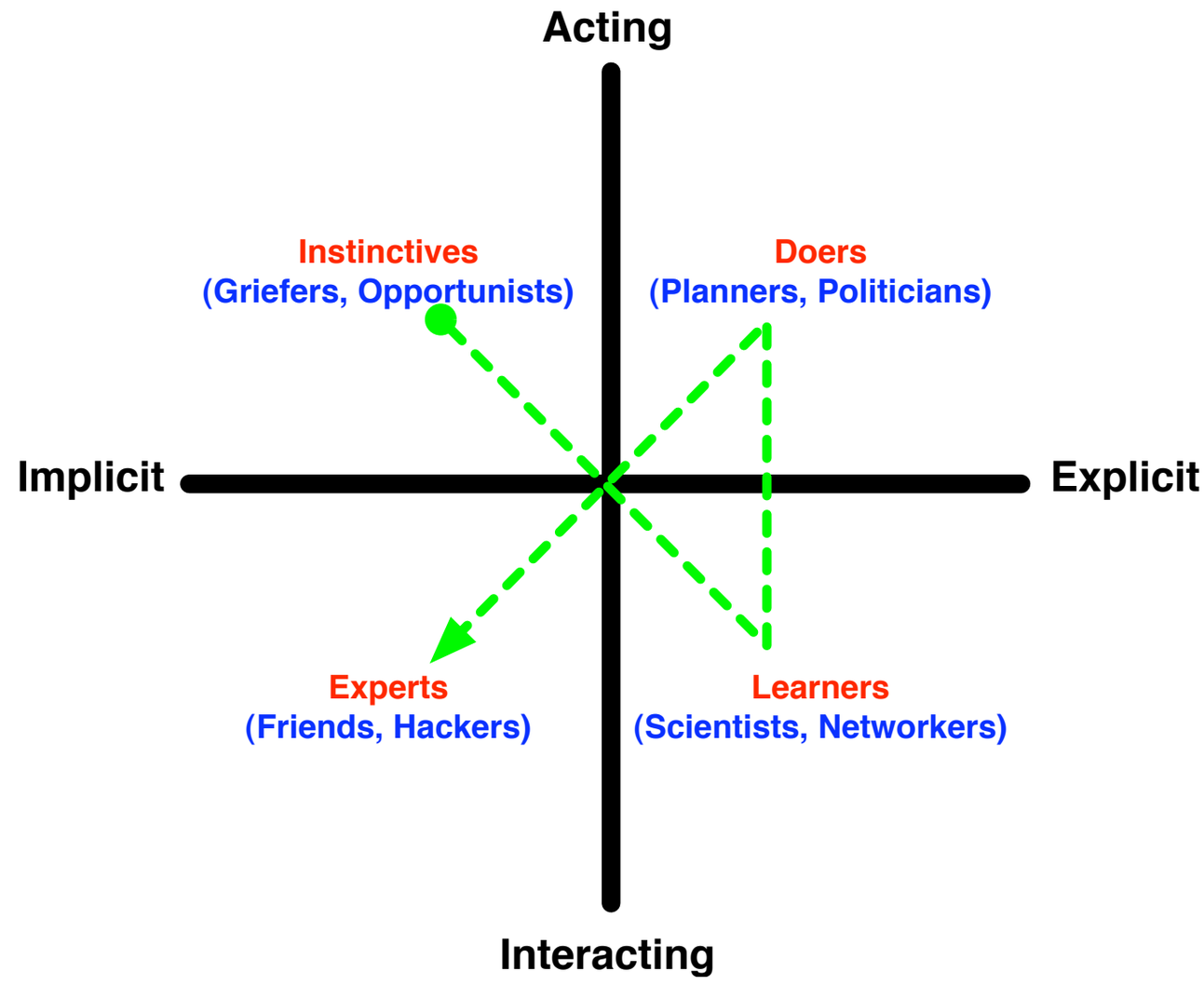
4 Primary sequences of player evolution:

- Main sequence: Griefer -> Scientist -> Planner -> Friend
- Minor sequence: Opportunist -> Networker -> Planner -> Friend
- Main socializer sequence: Griefer -> Networker -> Politician -> Friend
- Main explorer sequence: Opportunist -> Scientist -> Planner -> Hacker

MMORPG Player Types 7



MMORPG Player Types 8



An Interlude: Two Exhortations

1. Learn Some Calculus!

Not just for physics-based games!

Systems of coupled differential equations appear in almost every game…

2. Think of Space in Games Creatively!

The space through which movement is projected need not be traditionally physical!!!

Key AI Concepts 1 (Bourg & Seeman)

Individual Motion

- Patterns
- Chasing and evading (e.g., Breitenberg Vehicles)

Collective Motion

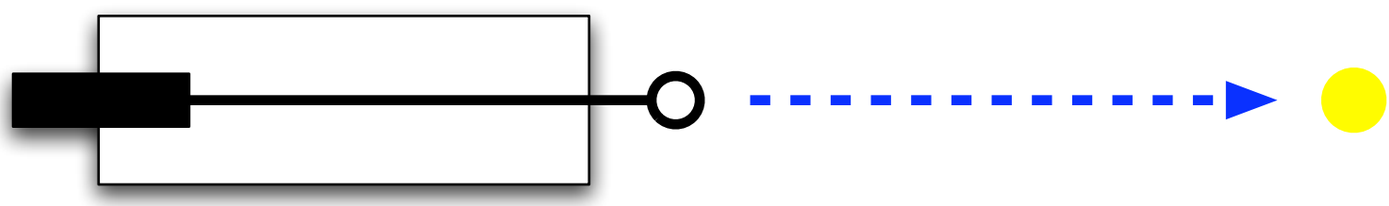
- Flocking (e.g., Boids)

Pathfinding

- Basic techniques (e.g., wall following)
- A* algorithm

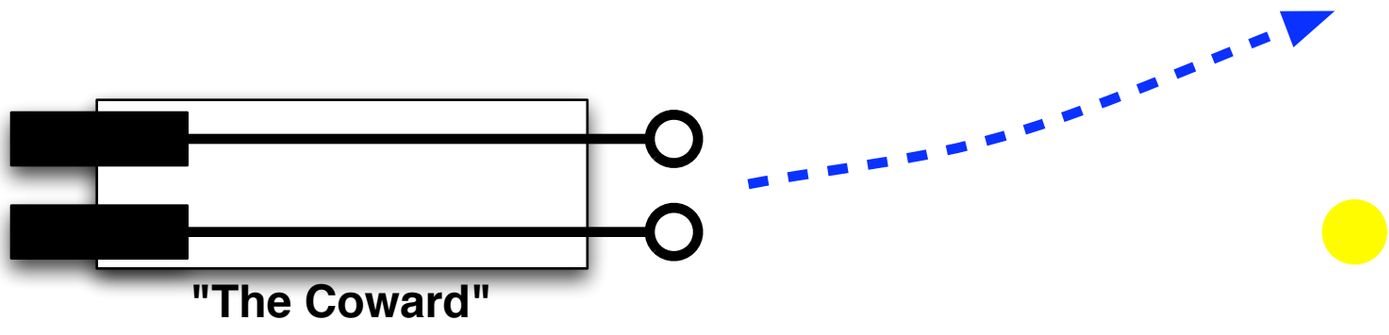
Bourg, D.M. and G. Seemann, *AI for Game Developers*. O'Reilly. (2004)

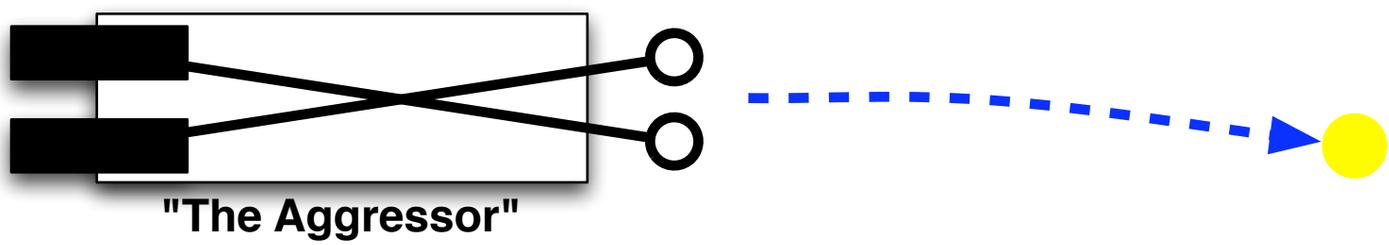
Chasing and Evading: Breitenberg Vehicles 1



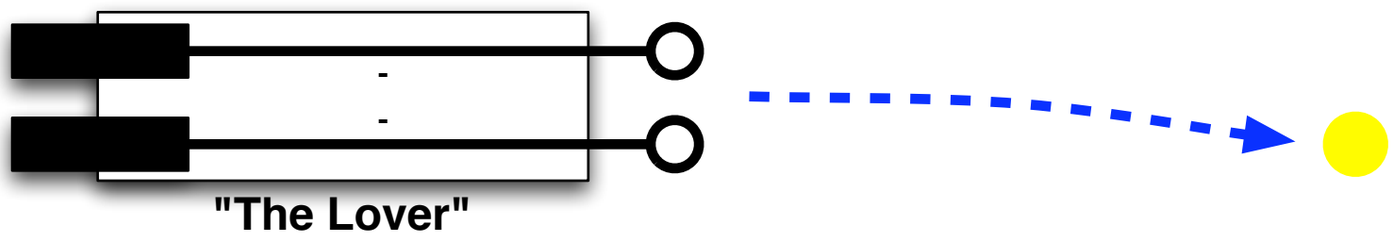
V. Braitenberg, *Vehicles: Experiments in Synthetic Psychology*. The MIT Press. (1986)

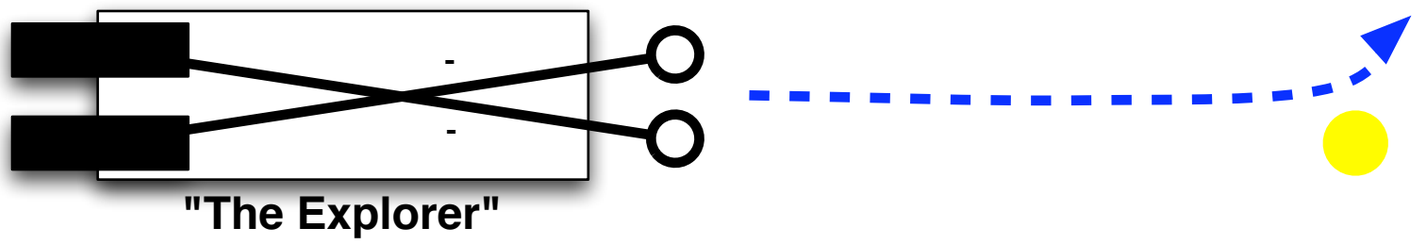
Breitenberg Vehicles 2





Breitenberg Vehicles 3



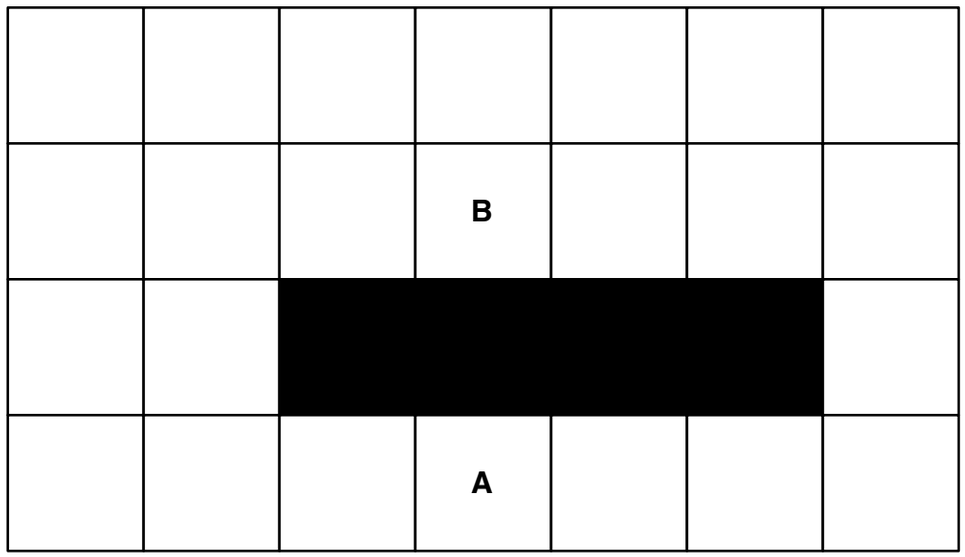


Flocking: Boids

Three basic rules

- Avoid collisions
- Match your speed with the birds you can see
- Orient yourself towards the birds you can see

Pathfinding: A* Algorithm - 1

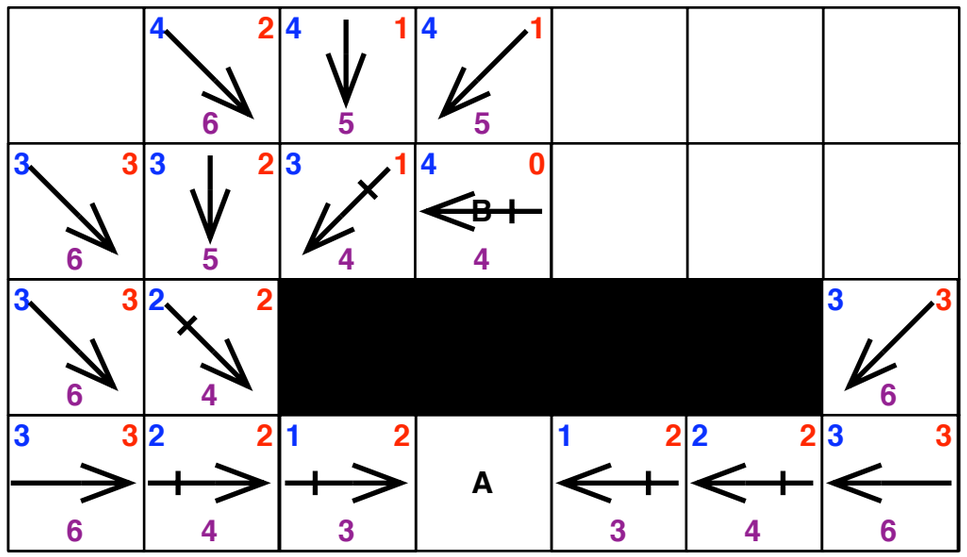


Pathfinding: A* Algorithm - 2

To get from A to B:

- At each neighboring location to A compute:
  - a cost = the number of steps from the start
  - a heuristic = a guess of how many more steps to the goal
  - score = cost + heuristic
- Mark each location with an arrow pointing at A, and designate them as "open"
- Designate A as "closed"
- Look at the "open" cells with the lowest score, and repeat for each the same process as for A
- The process ends when either:
  - B is reached - in this case the shortest path is given by following the arrows
  - B has not been reached, and there are no more "open" cells - in this case, there is no path going from A to B

Pathfinding: A* Algorithm - 3



Red: cost (number of steps from start)

Blue: heuristic (in this case, the "naive" shortest distance to the goal)

Purple: score (cost + heuristic)

"Closed" sites are designated with a crossed arrow

Key AI Concepts II

Behaviors:

- Scripting
- Finite State Machines
- Rule Systems

Non-determinism:

- Probability
- Fuzzy logic
- Bayesian Networks

Tools for Exploring Game Construction

Interactive Fiction: Inform

Interactive Worlds: Neverwinter Nights

- On Windows: Aurora Neverwinter Toolset
- On Mac OS X/Linux: neveredit

MMORPG Construction:

- Text-based; TinyMUSH
- Anyone designs: Second Life
- World builders design: Neverwinter Nights

Ground-up Game Construction: pygame

Videogames and Education

Effectiveness of Games in Education (Randel, Morris, Wetzel & Whitehill)

Meta-study of 68 studies from 1963-1991

- Social sciences; mathematics; language arts; logic; physics; biology

Most effective: language arts and mathematics

- 12 out of 14 studies showed positive results

Next most effective: social sciences

- 13 out of 46 showed positive results
- 33 out of 46 were as effective as traditional methods

Game learning overall showed better retention than traditional learning

Students showed greater interest in topics taught via games or simulations

Randel, J.M., B.A. Morris, C.D. Wetzel, and B.V. Whitehill. "The Effectiveness of Games for Educational Purposes: A Review of recent Research." *Simulation & Gaming* 1992 (Volume 23):261-276

Gee 1 - Active Learning

Gamers Learn From:

- 1. Doing and reflecting critically

Gee, J.P., *What Video Games Have to Teach Us About Learning and Literacy*. Palgrave Macmillan. (2003)
Prensky, M. "Escape from Planet Jar-Gon Or, What Video Games Have to Teach Academics About Teaching and Writing." *On The Horizon*, Volume 11, No. 3 (2003)

Gee 2 - Symbolic Systems

2. Appreciating good design and its principles
3. Seeing interrelations within and across symbolic systems
4. Mastering game symbolic systems
5. Relating the game world to other worlds

Gee 3 - Worlds and Identities

6. Taking risks in a space with reduced consequences
7. Committing to participating in a compelling virtual world
8. Assuming multiple identities in and across worlds

Gee 4 - Development of Capabilities

9. Observing the evolution of their own capabilities
10. Getting more out than they put in
11. Being rewarded for achievement at every level of expertise
12. Extensive practice in a rewarding context
13. Learning new skills at each level of expertise
14. Operating at the outer edge of their capabilities at each level of expertise

Gee 5 - Experiential Learning

15. Interacting experimentally with the game world
16. Finding multiple approaches to a solution
17. Discovering meaning from experience
18. Understanding texts experientially and contextually
19. Understanding the interconnections among texts that define them as a family
20. Constructing meaning from the intersection of multiple media
21. Understanding how information and knowledge are stored in the game environment
22. Leveraging intuitive and tacit knowledge

Gee 6 - Developing Skills

23. Practicing in simplified game subdomains
24. Tackling later problems via generalizations of earlier ones
25. Seeing early on concentrated samples of generalizable skill sets
26. Acquiring basic skills that apply to a range of games
27. Receiving information on-demand and just-in-time
28. Experimenting with only a minimum of explicit instruction
29. Transferring, modifying, and adapting earlier learning to later problems

Gee 7 - Cultural Models

30. Reflecting safely about their cultural models and assumptions about the world

31. Reflecting safely about their cultural models and assumptions about their learning processes

32. Reflecting safely about their cultural models and assumptions about the workings of a symbolic domain

33. Searching for knowledge in all aspects of the game, in themselves, and in their interaction with the game

Gee 8 - Community

34. Sharing their knowledge with other players
35. Forming a distinct community via shared interests in the gaming world
36. Teaching others and modifying the game experience

Case Study: Games to Teach (Holland, Jenkins & Squire)

MMP Games

- Hephaestus, Periodista, Revolution, Daedalus' End, Dream Trackers

Action Sims

- Supercharged!, Replicate!, Cuckoo Time, XTreme Sports

Narrative Games

- Biohazard, Sole Survivor, La Jungla de Optica, Dreamhaus

Physical/Game World Interaction

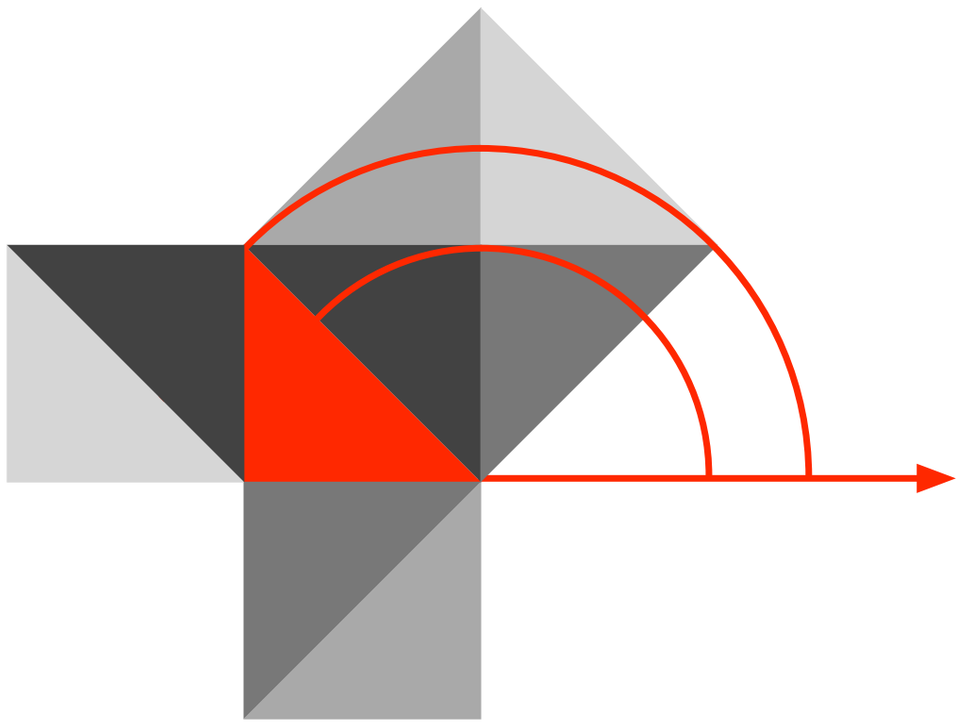
- Environmental Detectives

Meta Gaming Games

- Game Maven

Holland, W., H. Jenkins, and K. Squire, *Theory by Design* - in: Wolf, M.J.P. and B. Perron, *The Video Game Theory Reader*. Routledge. (2003)

Hippasus



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