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2011 — 2031

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Foldit, Refraction, and Changing the Game of Education

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Computer Science and Engineering
University of Washington

FUTURE/WORLD 2011 2031

Center for Game Science

- Newly formed at UW
- Using video games to solve hard problems
- Combine science + game design

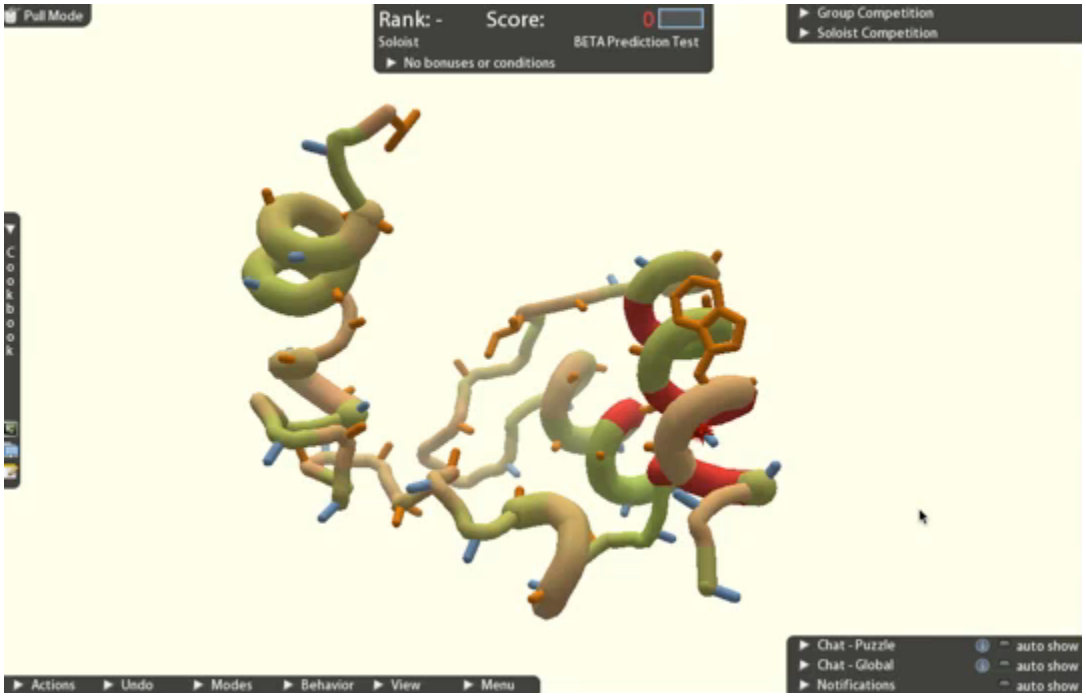
Center for Game Science

- Team
  - graduate students, undergraduate students, developers, and artists (~30 people)
- Working with:
  - world class game designers (ex-Bungie), learning scientists (John Bransford), biochemists (David Baker)

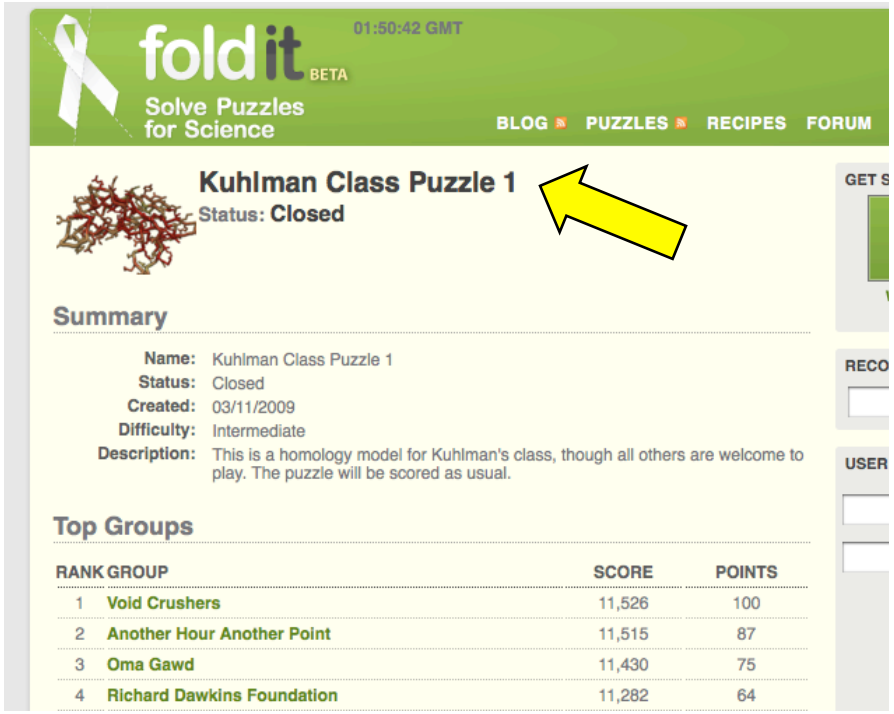
The Challenge:

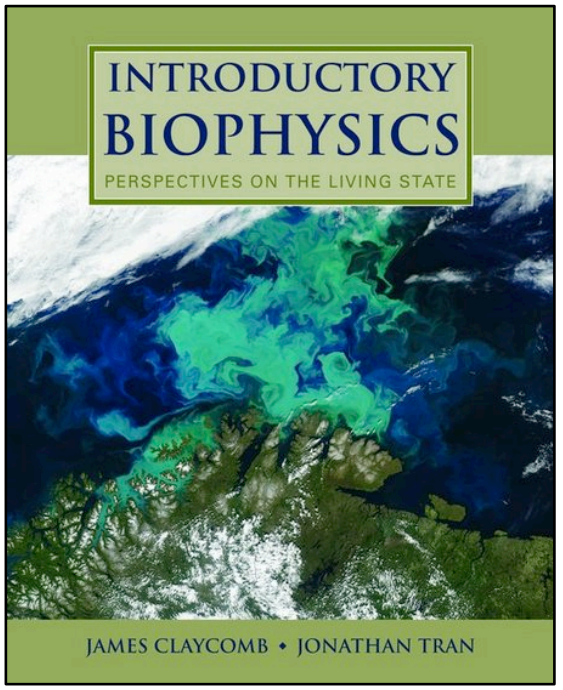
- hard to make an entertaining game
- even harder to do this and solve a problem
  - constraints on game design
  - do real biochemistry, really learn something
- cannot separate the two objectives

Foldit


Pull Mode
Rank: -
Score:
0
Soloist
BETA Prediction Test
No bonuses or conditions
Group Competition
Soloist Competition
Cookbook
Chat - Puzzle
auto show
Chat - Global
auto show
Notifications
auto show
Actions
Undo
Modes
Behavior
View
Menu

Education

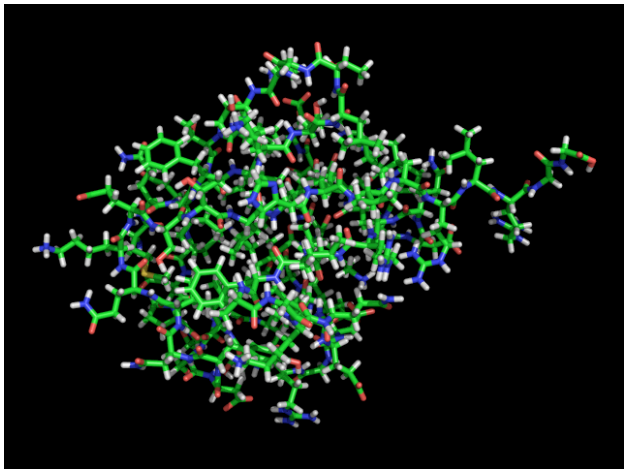

fold it BETA
01:50:42 GMT
Solve Puzzles for Science
BLOG PUZZLES RECIPES FORUM
Kuhlman Class Puzzle 1
Status: Closed
Summary
Name: Kuhlman Class Puzzle 1
Status: Closed
Created: 03/11/2009
Difficulty: Intermediate
Description: This is a homology model for Kuhlman's class, though all others are welcome to play. The puzzle will be scored as usual.
Top Groups
RANK GROUP SCORE POINTS
1 Void Crushers 11,526 100
2 Another Hour Another Point 11,515 87
3 Oma Gawd 11,430 75
4 Richard Dawkins Foundation 11,282 64

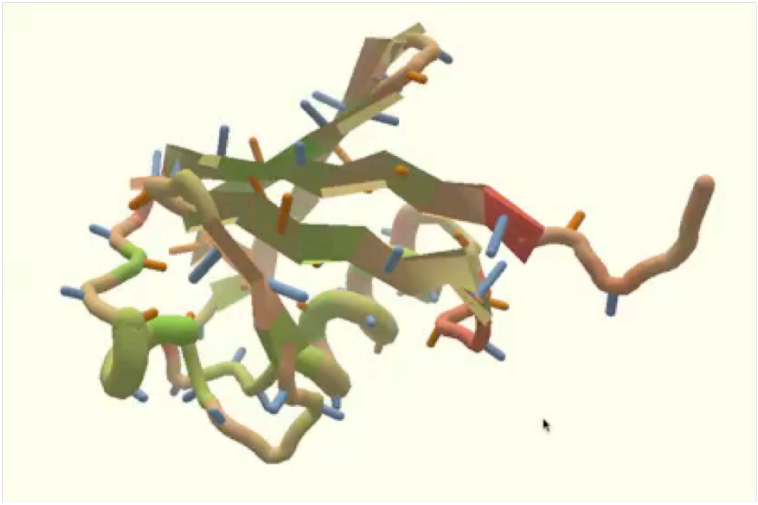

INTRODUCTORY
BIOPHYSICS
PERSPECTIVES ON THE LIVING STATE
JAMES CLAYCOMB • JONATHAN TRAN

Find the Core Problem

- problem solving is fun
- let players know what they are working on
- abstract away details
  - but give access

Find the Core Problem

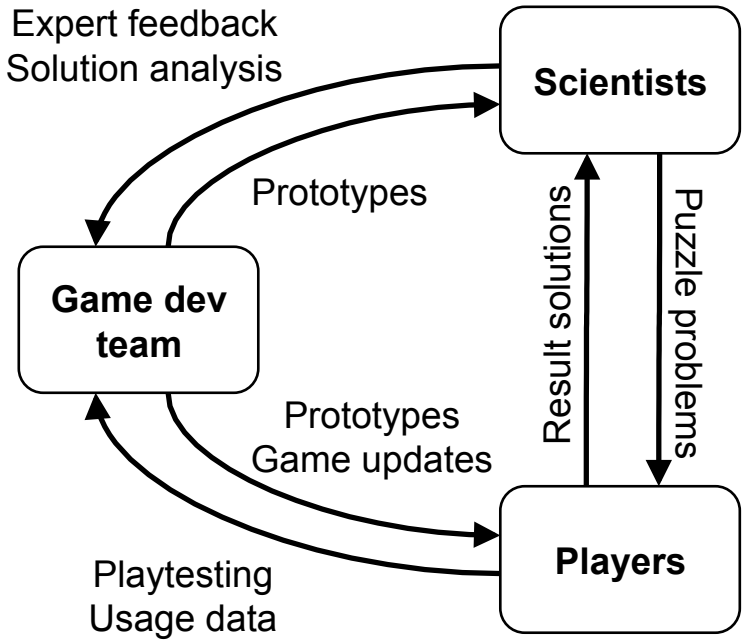




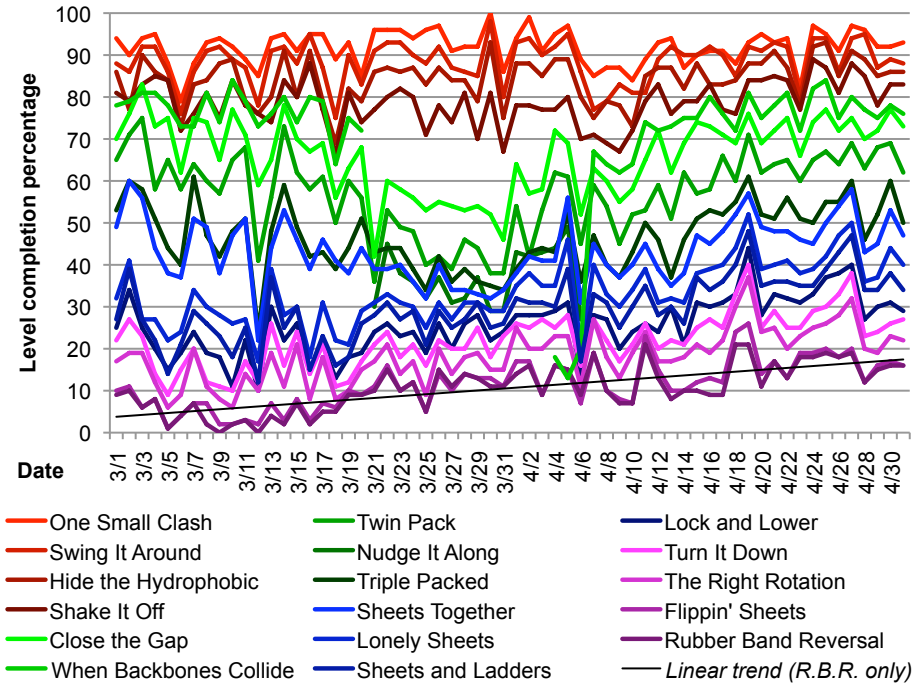
Iterate and Experiment

- not going to get it right first time
- performed design as an experiment
- game evolves as players do

Iterate and Experiment



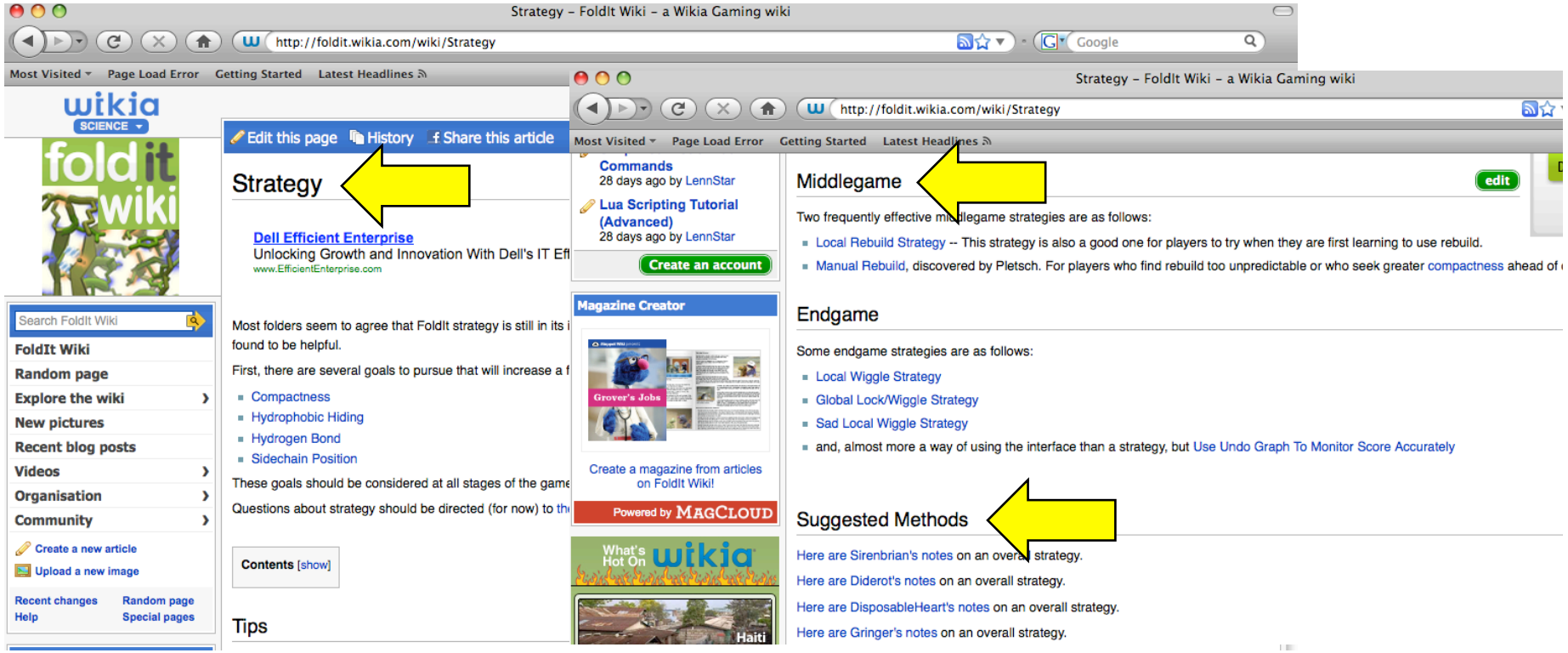
Iterate and Experiment



Develop Community Expertise

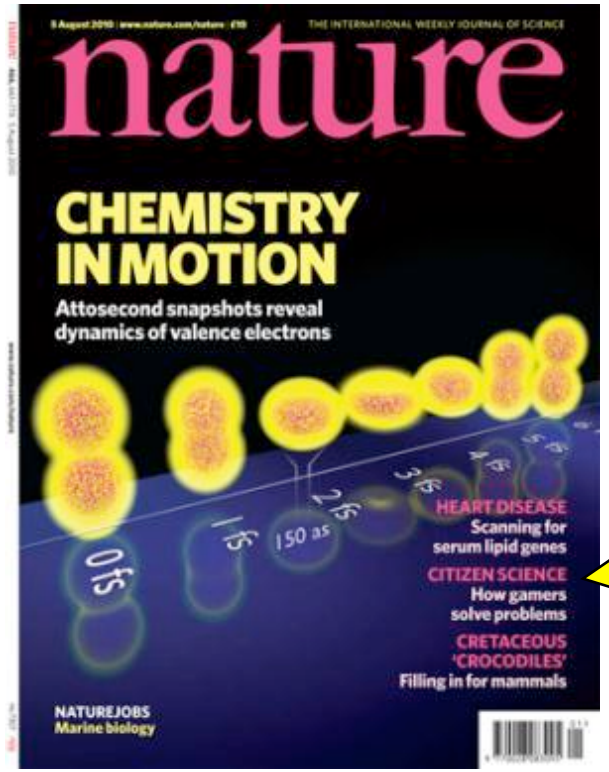
- from knowing nothing to being an expert
- engaged an involved for an extended period of time
- support community, collaboration, competition, social elements
  - chat, forums; leaderboard; groups

Develop Community Expertise



Develop Community Expertise

Evaluation



- Foldit players can solve problems
- Even when computers can't

Foldit + Kinect

Solving Hard Problems with Human-Computer Symbiosis

Coadaptation:

1. People → Experts
2. Programs/Games → Optimal problem tools

Games are an ideal vehicle of coadaptation

Transforming Educational Research: Optimal Learning Pathways to Expertise

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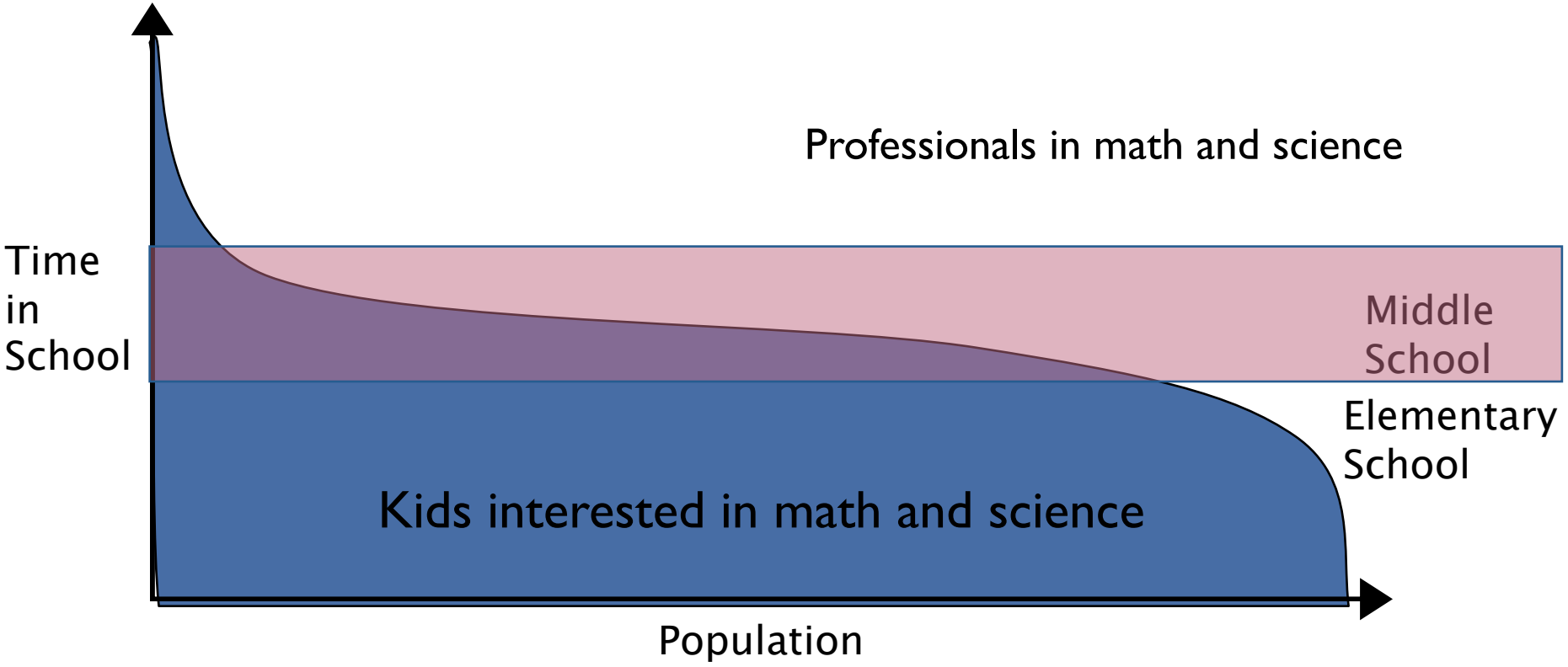
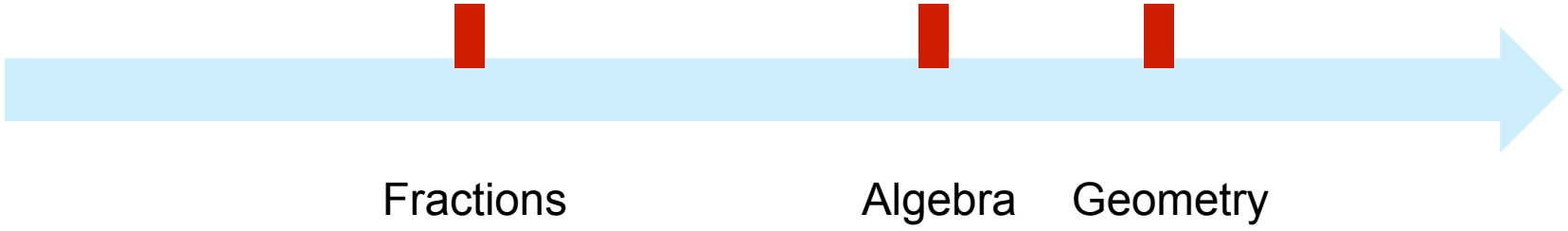
Target Young Kids



Math Bottlenecks

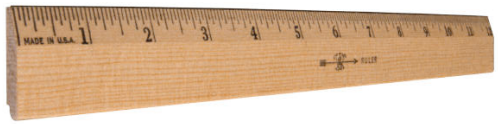


"Difficulty with fractions… is **pervasive** and is a **major obstacle to further progress** in mathematics."

- US National Mathematics Advisory Panel final report, 2006, 2008

Approaches to Teaching Fractions

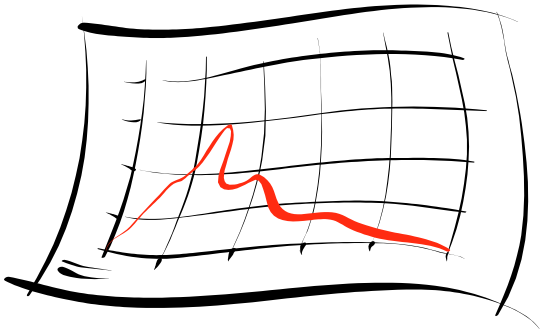
$$\frac{1}{4} = 0.25$$



- Educators argue about which is the best

Crisis in Evidence

- Many fields drowning in data
- Education research – opposite problem



- No rigorous studies
  - To inform instructional practice
  - To understand learning process

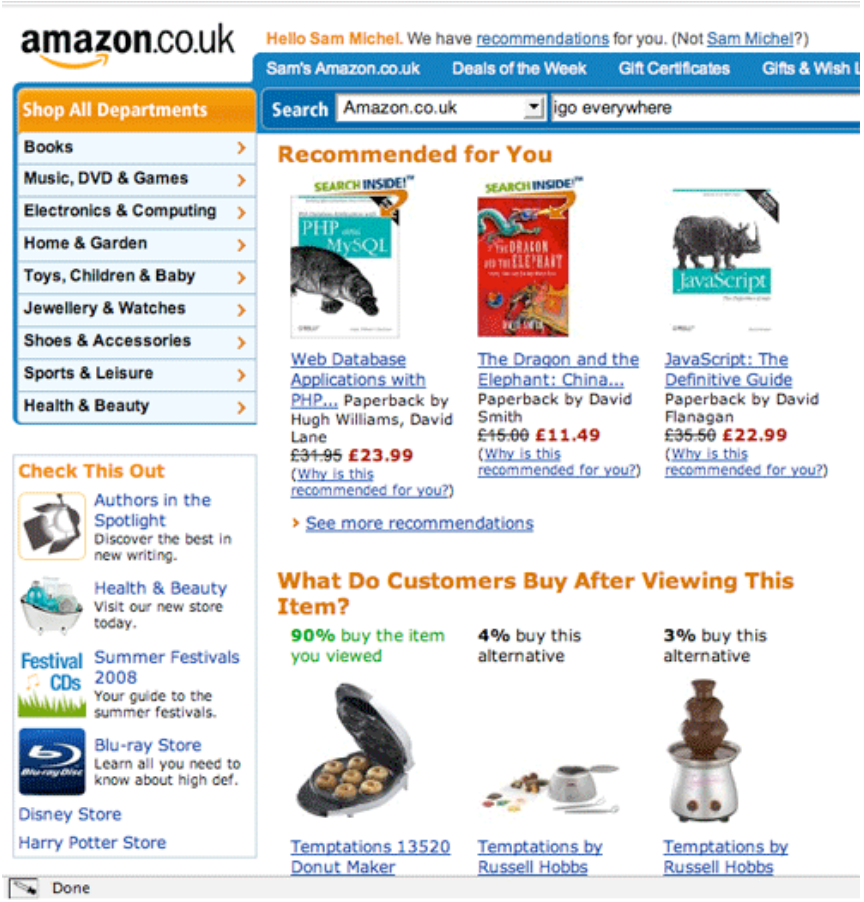
To make an effective fractions game

Need to find:

- optimal pathways
- student-specific adaptations

Games for Learning

Games for Massive Data-gathering to Optimize Learning Pathways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Hello Sam Michel. We have recommendations for you. (Not Sam Michel?)
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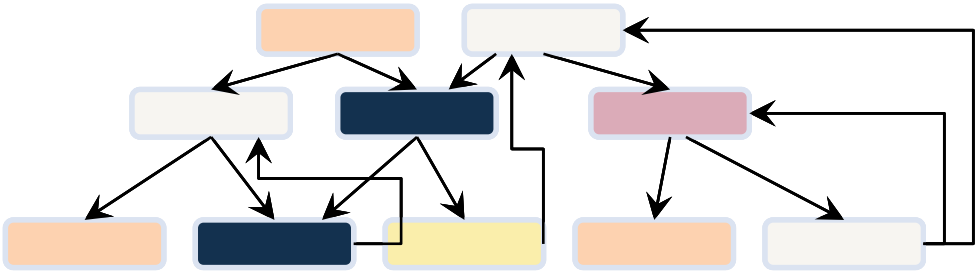
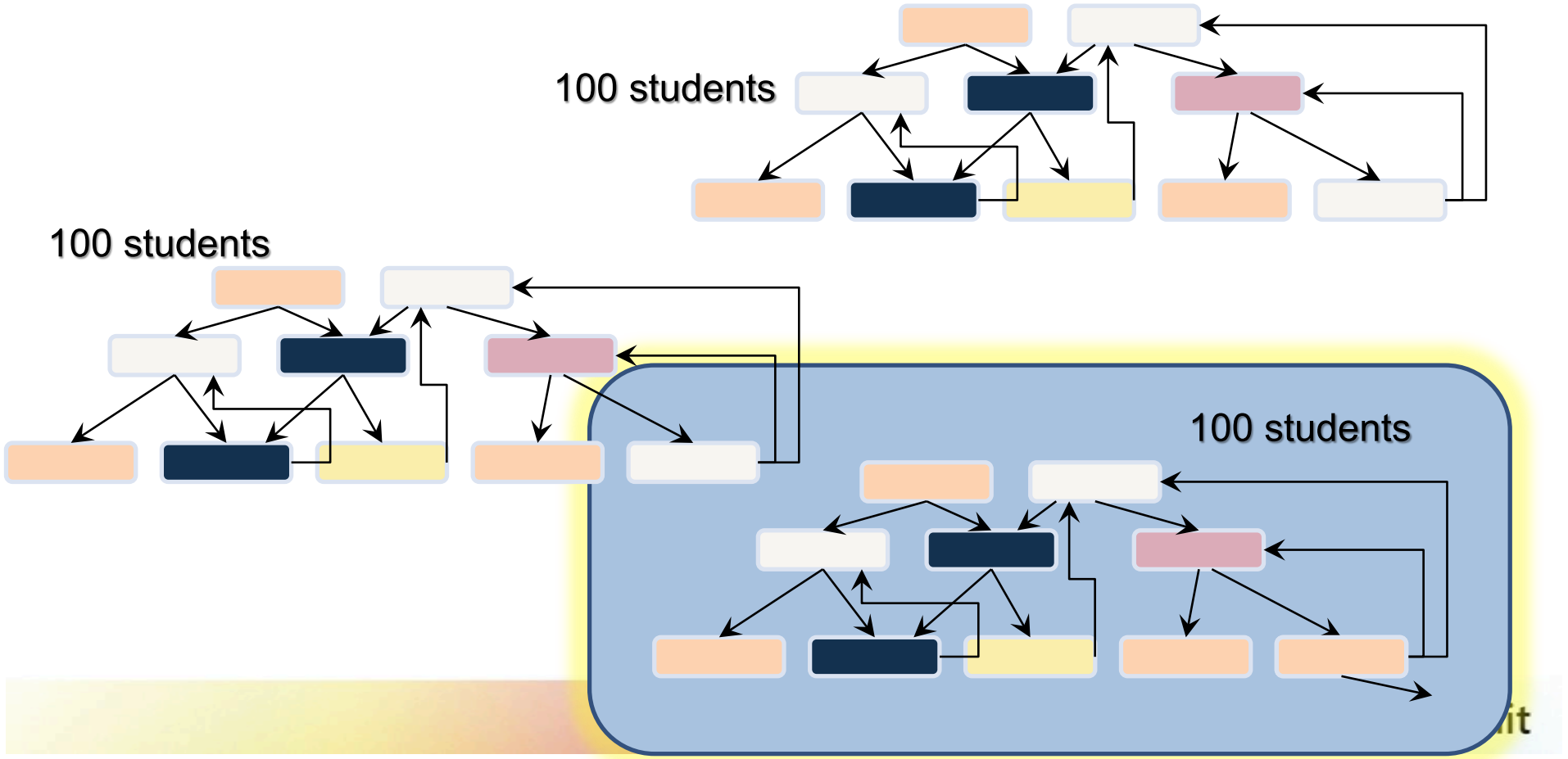
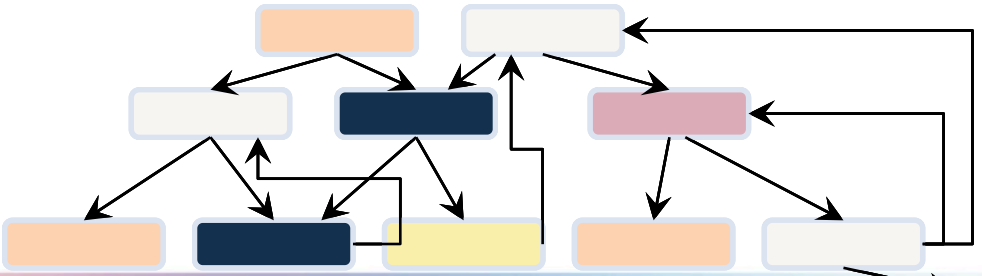
Visit our new store today.
Festival CDs
Summer Festivals 2008
Your guide to the summer festivals.
Blu-ray Store
Learn all you need to know about high def.
Disney Store
Harry Potter Store
What Do Customers Buy After Viewing This Item?
90% buy the item you viewed
4% buy this alternative
3% buy this alternative
Temptations 13520 Donut Maker
Temptations by Russell Hobbs
Temptations by Russell Hobbs
Done

In-game assessment and refinement



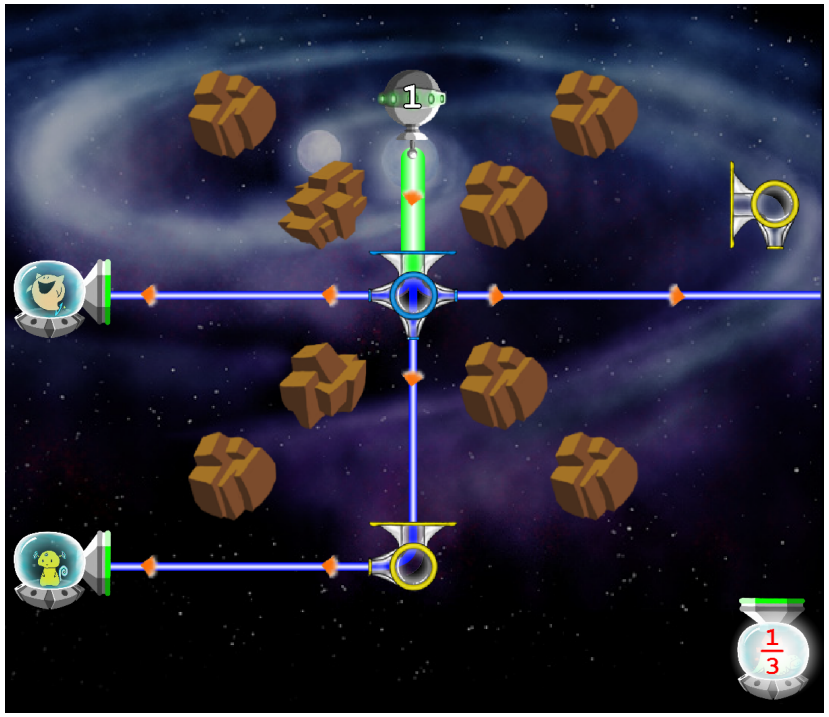

100 students
100 students
100 students

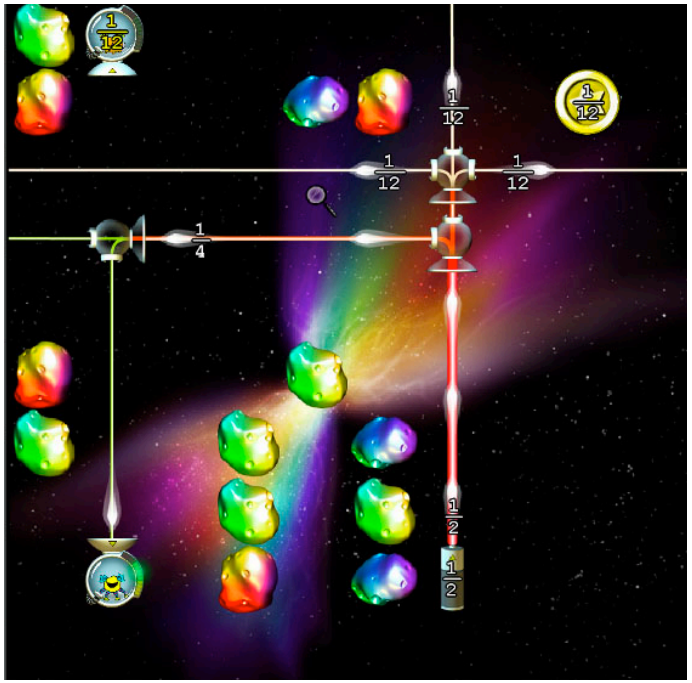


Students

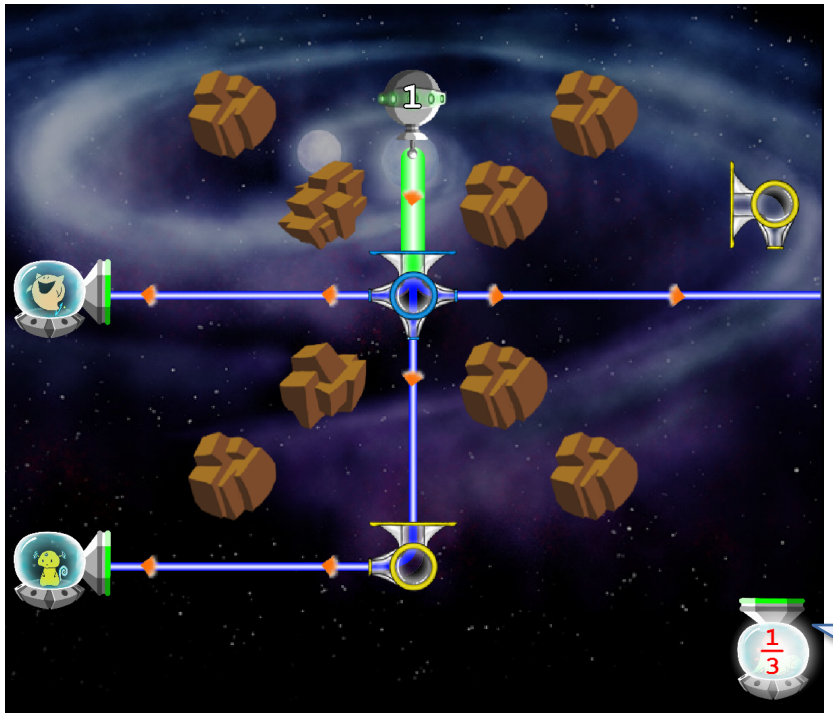
- Online game world
- Accessible to any child with a web browser
- K12 Virtual Academies
- Public school Systems
  - Washington
  - Texas

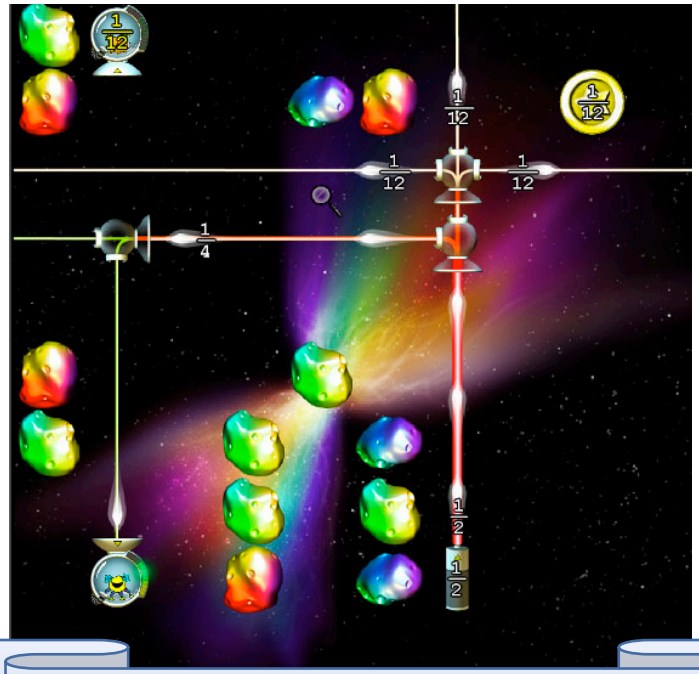
Refraction





Refraction





Disney Learning Challenge
Grand Prize

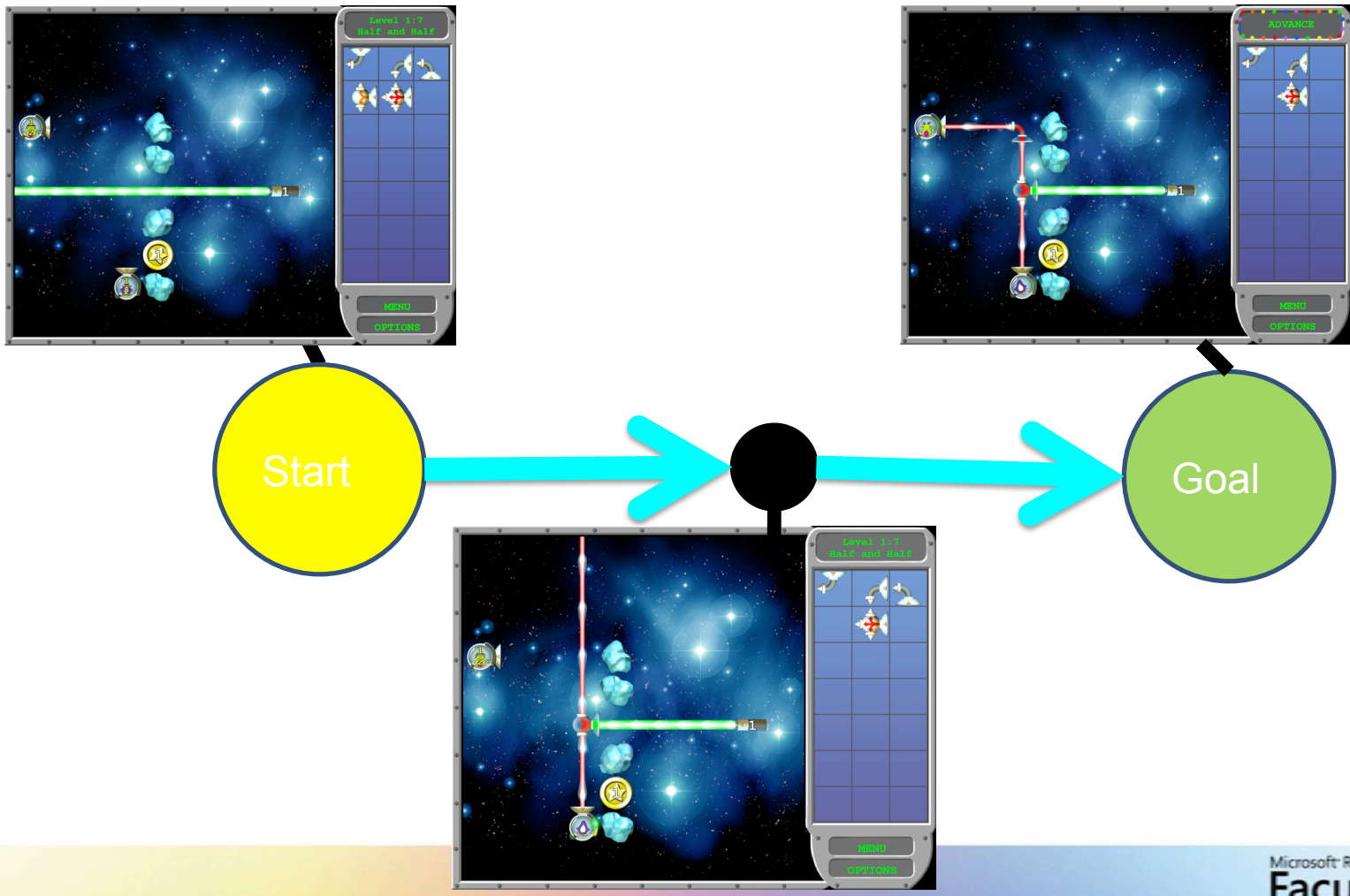
Answer Interesting Questions

- What pathways do kids take to learn?
- What is the partial ordering of concepts that must follow one another?
- How do we modify the game for a specific subset of students?
- What's the best thing to do at specific point of confusion?
- What's the best level to present at any point?

Visual Analysis

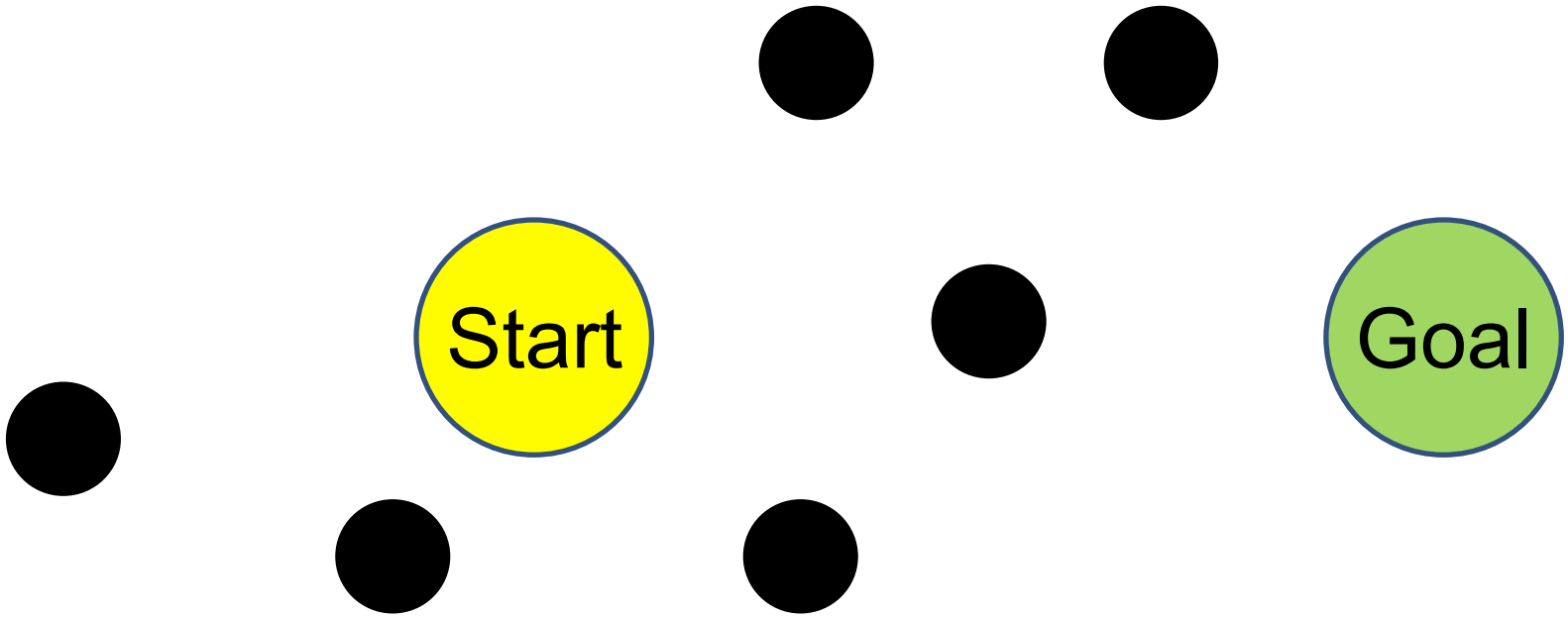
How can we see patterns in the massive high-dimensional data from gameplay?

Developing visual data analytics tools for all educators and learning scientists

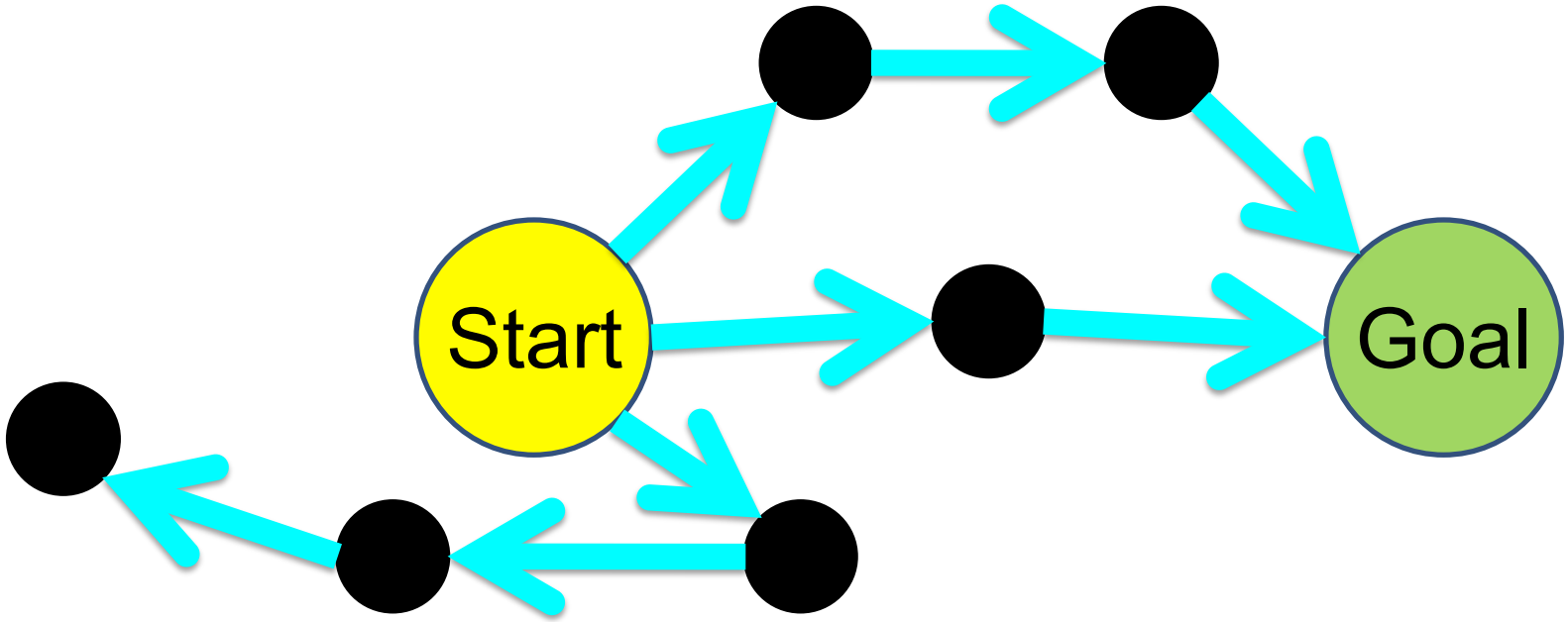

Start
Goal

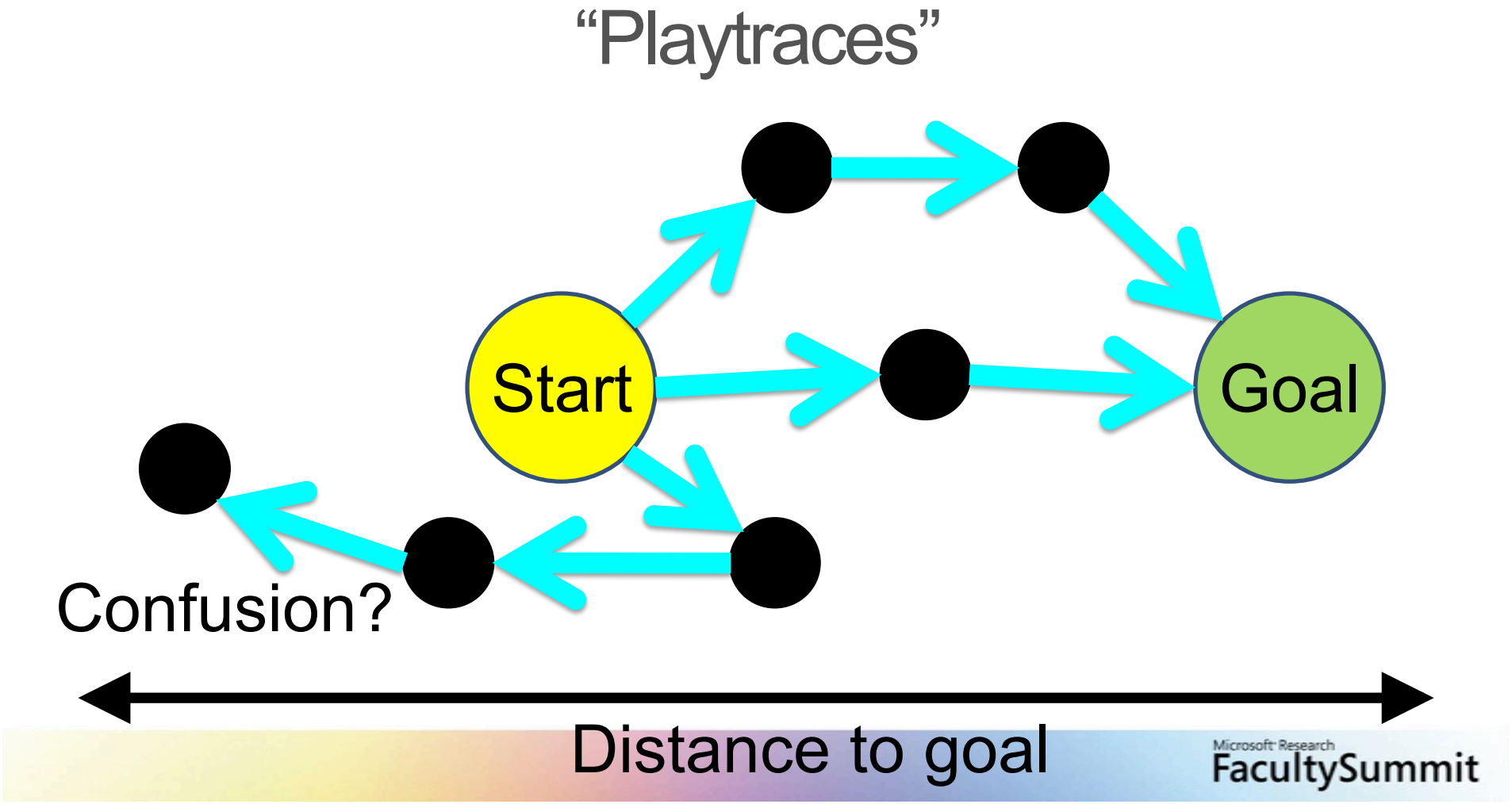
“Playtraces”

“Playtraces”



“Playtraces”




"Playtraces"
Start
Goal
Confusion?
Distance to goal
Microsoft Research
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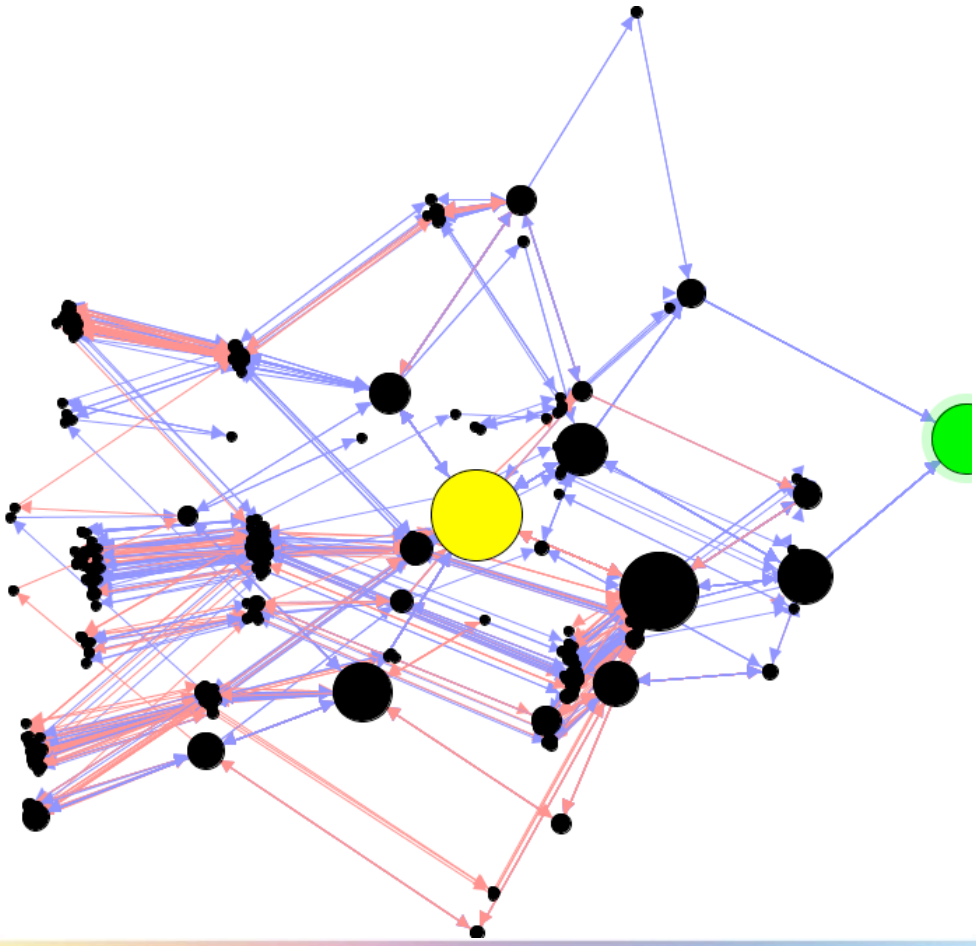
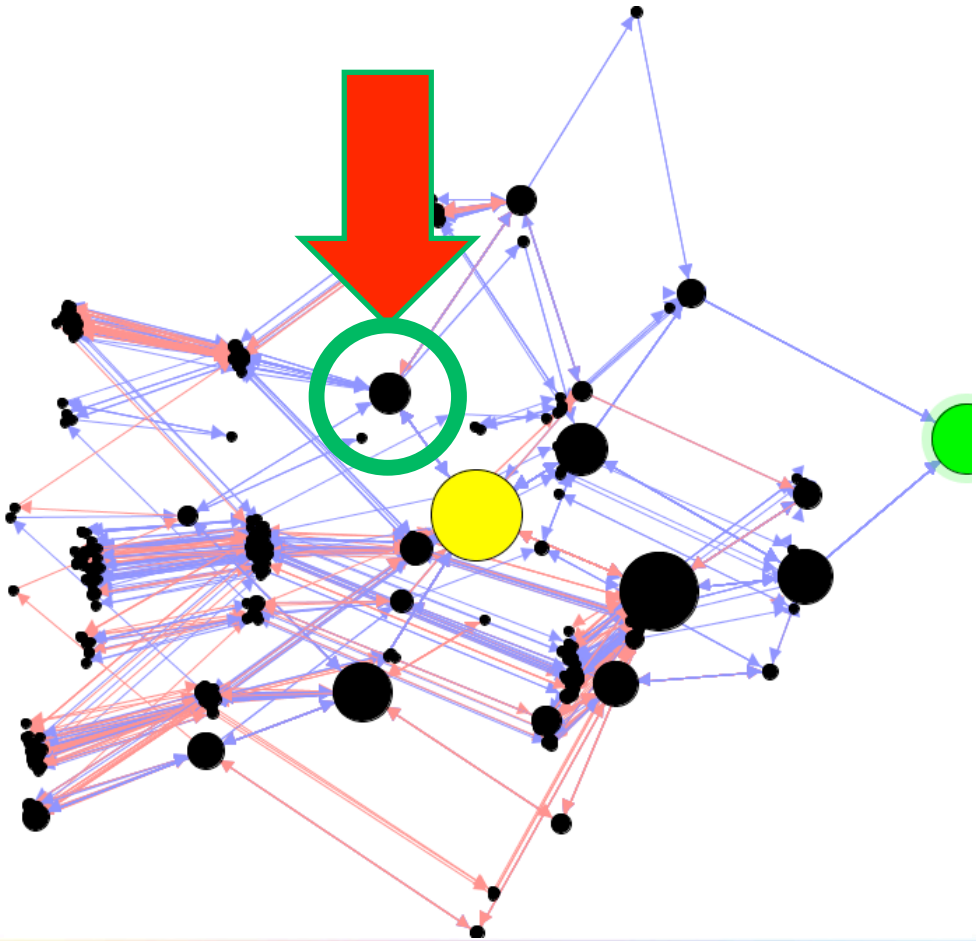
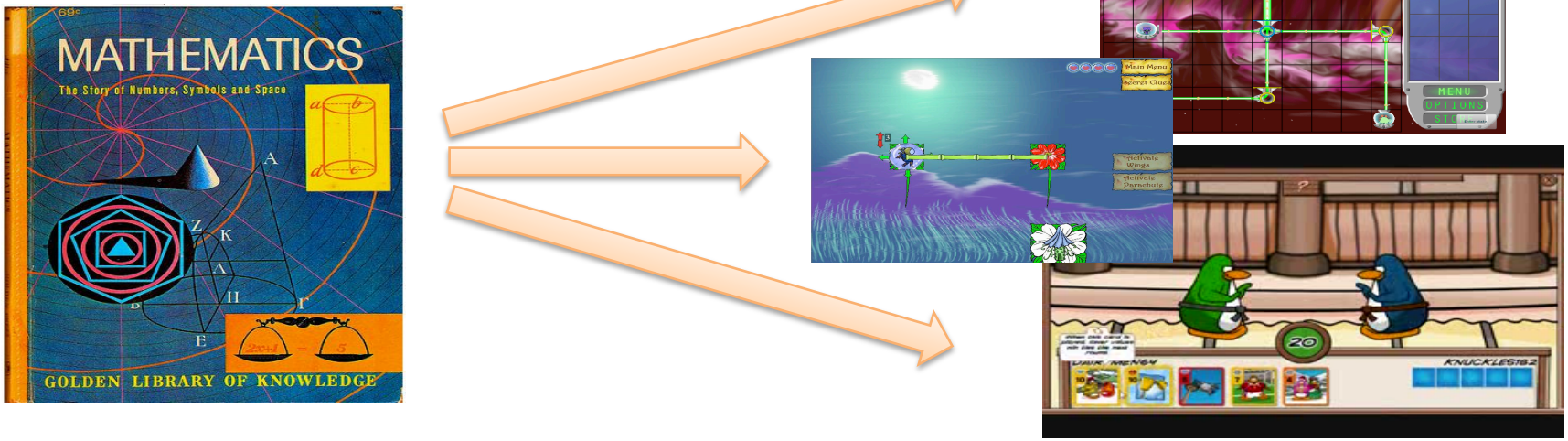


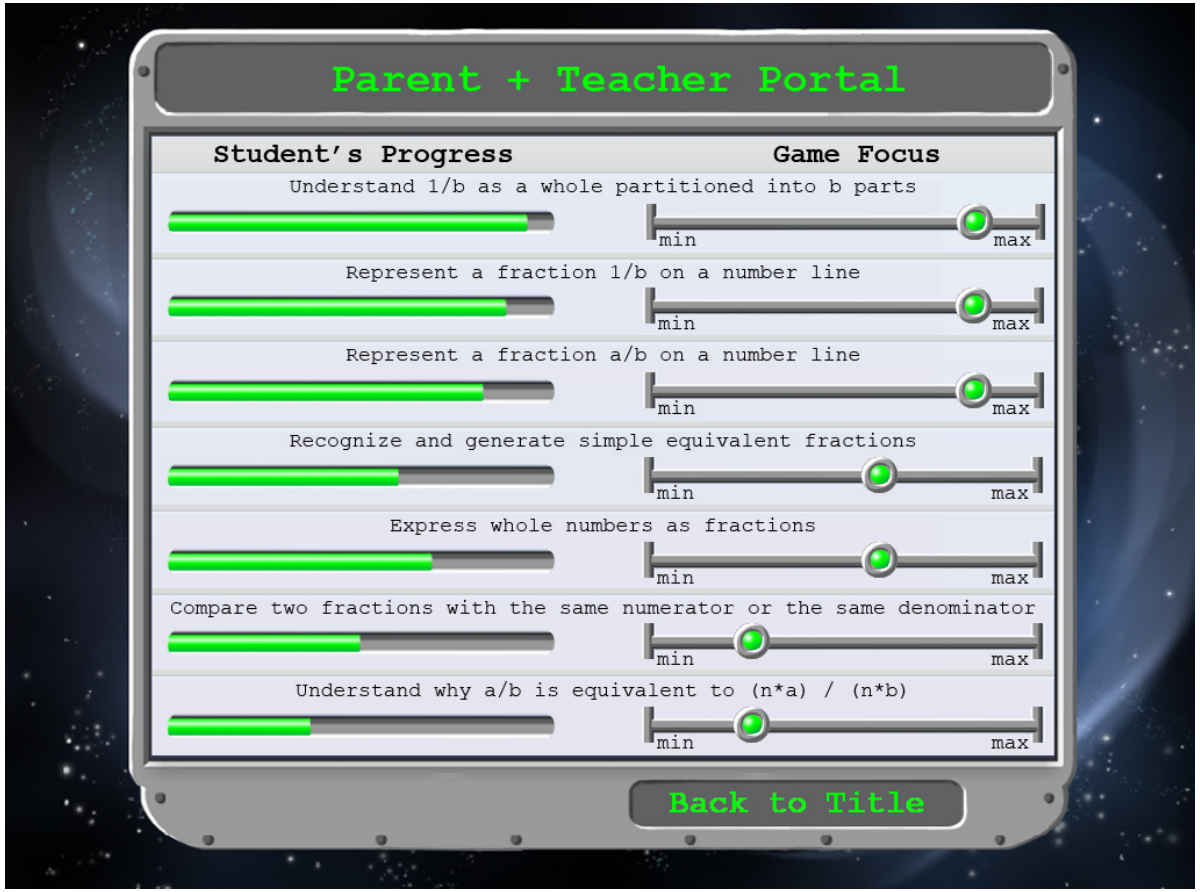


Level 5:0
Custom Level
1
2
1
MENU
OPTIONS

Textbooks -> Games



Textbooks -> Games


Parent + Teacher Portal
Student's Progress
Game Focus
Understand 1/b as a whole partitioned into b parts
min
max
Represent a fraction 1/b on a number line
min
max
Represent a fraction a/b on a number line
min
max
Recognize and generate simple equivalent fractions
min
max
Express whole numbers as fractions
min
max
Compare two fractions with the same numerator or the same denominator
min
max
Understand why a/b is equivalent to (n*a) / (n*b)
min
max
Back to Title

- Fun and engaging games
- Massive data gathering
- Continually adapting
- Optimal pathways for novices -> experts

http://fold.it

http://www.kongregate.com/games/gamescience/refraction

Contact me:

scooper@cs.washington.edu

http://www.cs.washington.edu/homes/scooper/