Helios: An HTML5 Game about Balance

Arseniy Klishin, Neerav Mehta, Yilin Fan, Mu Ni, Sakar Khattar
Sean Brice, Matt Champer, Sam Collier
Mike Christel, Scott Stevens, Bryan Maher

christel@cmu.edu
Talk Outline

• Background about ETC and *Helios* Team
• *Helios* Overview Video
• *Helios* Development
  – Goals
  – Value of iterative playtesting
  – One specific formative playtest
• *Helios*: A Lead-in to *Puppybot Rescue*
• Other ETC Educational Game Efforts
IMPACT!

SEAN BRICE MATT CHAMPER SAM COLLIER YILIN FAN
SAKAR KHATTAR ARSENIY KLYSHIN NEERAV MEHTA NI MU
SCOTT STEVENS MIKE CHRISTEL BRYAN MAHER
ETC Project IMPACT!

• http://www.etc.cmu.edu/projects/impact/
• Arseniy Klishin
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• Yilin Fan
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• Sean Brice, Matt Champer, Sam Collier
ETC Projects: ENGAGE

• DARPA ENGAGE program includes promoting scientific literacy, ages 4-12
• Many ETC projects involved, many games produced: http://www.etc.cmu.edu/engage/
ETC: Technology + Art

2-year graduate degree: MET
ETC: Founded in 1999

• Don Marinelli and Randy Pausch, first co-directors (Drama and Computer Science)
• Drew Davidson, current ETC Director
Power of Stories

• ETC core courses: *Building Virtual Worlds* (BVW), *Visual Story*, *Improvisation*

• Games can “hook” users with story

• Proven to be true with children’s games developed by ETC for ENGAGE, e.g., *RumbleBlocks*
Helios Development

- Refine a prior game about the balance scale, with input from Sesame Workshop
- Prepare game for in-depth testing by professionals (Pittsburgh Science of Learning Center, CMU HCII)
- Validate that game is playable by children
- Allow for configurability by teachers
- Use iterative development process
Proportional Reasoning

• Via Siegler* paper: science content is to understand the principles governing the balance scale and the sum of cross products rule that can be used to determine whether a scale will balance, given a particular configuration of weights on each side of the fulcrum

Science Learning Objective

Help children progress through 4 increasingly sophisticated mental models identified by Siegler:

1. Children only pay attention to weight, not distance.
2. Children also consider distance, but only when the weight is equal on both sides.
3. Children consider both weight and distance, but when the cues suggest different outcomes, they guess.
4. Children consider both the amount of weight and distance of weights from the fulcrum; if the cues suggest different outcomes, they use the sum of cross products rule.
Inquiry Reasoning and SEL

- From National Research Council framework, Scientific and Engineering Practices: construct explanations
- Socio-Emotional Learning (SEL) goals are to measure and support learners to:
  - “Ask for help” – Seek and/or accept assistance from others when encountering a problem
  - “Cooperate” – Cooperate with others to accomplish a joint task
  - “Discuss” – Solve problems through interactions and discussions with peers
Game Design and Learning

Michelle Dickey* suggests:

– Narrative can set up exploration, collaboration, challenge
– Narrative serves as organizational framework for interactive space
– Intrinsic motivation via: Choice, Control, Collaboration, Challenge, and Achievement

Teeter Totter Go! → Helios
SEL Features in TTG

• Sharing made an explicit part of the game
• Fellow “player” more a peer than a coach
TTG: Example Playtest Iteration

• 11 children. 7 1\textsuperscript{st} graders. 4 2\textsuperscript{nd} Graders
• User interface was unclear
• Turn making was not clear
• Sharing is difficult (some children resisted, emphatically)
• Fatigued from confusion in UI
TTG Shortfalls Leading to Helios

• Choice was limited (one side of fulcrum, just actions above head of avatar)
• Choice could be deadlocked
• Choice was repetitive and too focused, stifling curiosity

• ...Helios grew out from these lessons, informed by Sesame Workshop designers and playtests
“Helios”

- Ages 6-10
- New player interaction and narrative
“Helios”

• New level approach
“Helios”

- Uses XML for easy configurability

total_nuts: 3
slot_nuts: 0000_0120
slots_off: 1101_0110
level_type: circuit
Playtests!

- Feb. 27th
- 8 Pre-K Students

- 4 boys, 4 girls
- Most players asked for more levels to play
Playtests!

- Mar. 13th
- 21 2nd grade students, 7-8 years old
Iterative Feedback

• Nice sound effects and music
• Great art, nice variety
• Good story
May 2013 Formative Playtest

- 17 Playtesters, K-3rd grade
- Player enthusiasm strong through 25 min.
- Level sequences should be tuned to grade (or better, to demonstrated skill)
- SEL integration into science game difficult, too shallow here to measure well
Summary

- Developed “Helios” for science learning, inquiry, and SEL:
  - Predecessor game TTG lacked player motivation
  - Helios Choice via male/female avatar, placement on beam, predictions and hypotheses, tone to use in communication with peer (SEL)
  - Helios Control in changing the environment
  - Collaboration via working with peer to beat “Boss”
  - Challenge in beam problems, Achievement in progressing through space station
Links

- http://www.etc.cmu.edu/projects/impact/ (within, you’ll see Demo: Helios page)
- http://www.etc.cmu.edu/engage/ (old/new games)
Flow

Mihaly Csikszentmihalyi* and “Flow Theory”:

– Being completely absorbed in an activity
– For *Helios*, level complexity increasing ideally to let the child player enjoy rewarding experience to remain engaged and feel a sense of achievement without undue frustration

Flow, in More Detail

Jeremy Gibson*:

– Player must be “out of flow” a bit at times to feel skillful
– Playtesting can help test for player boredom/frustration

Importance of Iteration

• *Helios* one example of learning from your players

• See also Schell’s *Art of Game Design*, Gibson’s *Introduction to Game Design, Prototyping, and Development* (1st Ed. 2008)

Building from Helios

• Better flow through adaptive learning strategies
• Improved “stickiness” through touch interfaces, fast play-through
• Emphasize one thing: Siegler Rules
• New game is PuppyBot Rescue (HTML 5 game as well, but built with CreateJS library): http://www.etc.cmu.edu/engage/
Games with a Purpose

- “GWAP” – popularized by Louis von Ahn at Carnegie Mellon
- ESP Game
- Licensed by Google, Image Labeler
- Metadata generation as by-product of play
GWAP: Benefitting Science

- *Foldit*, Univ. Washington Center for Game Science, 2008
- Protein-folding game leveraging human spatial reasoning
- Scientific publications with Foldit players as co-authors, e.g., 2011 article with DOI 10.1038/nsmb.2119
Transformational Games

• Jesse Schell, fellow ETC faculty member
• *The Art of Game Design*
• “Games that change the player….”
  – Educational
  – Behavior
• Some examples from ETC follow…
Chicago USA: Invasive Species


The Field Museum

**NEW CARP CZAR APPOINTED!**

**MIKE**

Please enter your name

**CLICK HERE TO CONTINUE**

Your job is to stop the Asian carp from reaching Lake Michigan. To WIN, collect 10 GOLD STARS. You get 1 GOLD STAR each turn if the Asian carp do not advance. You lose 1 gold star if the Asian carp advance during your turn.
ETC Imagica: Biomes for Children
Imagica: 1 Semester, 6 Students

Producer, UX designer, 2D/3D artist, animator, interaction & tech programmer
Iterative Playtesting with Imagica

- Tablet-driven experience for 8-11 year olds
- Marine biologist validates content
- Child-testing confirms appeal of experience
ETC Project Ursa: World Hunger

• Created *Feed*, played at Games for Change
• Outdoor, many-player game

Jack Koo
Art

Yan Jin
Game Designer

Tim Rosko
Sound Designer / Writer

Xuyan Ke
Programmer

Alex Hu
Programmer

Lisa Elkin
Producer

Janet Lin
Producer

Carnegie Mellon University
Entertainment Technology Center
Research Behind Feed

- Corruption
- Conflict
- Web-based Games
- Games for Change
- Distribution
- Large / Outdoor Games

Carnegie Mellon University
Entertainment Technology Center
ETC Project: Electric 4 Education

• Produce intergenerational literacy game for 6-9 year olds and their parents

• Fielded at Public Broadcasting System activities website:

www.pbs.org/parents/electriccompany/electric-racer.html
Promoting Systems Thinking

- GameGrid ETC team, Fall 2013
- Work with Creativity Labs, Indiana Univ.
- Produced a game to give children practice with and stimulate interest in systems thinking: *Water+*
- Game uses Unity Web Player: http://www.etc.cmu.edu/projects/gamegrid/
Educational Games: Community

workingexamples.org

Many ETC projects detailed there as “Seed-Sprout-Bloom”:
• GameGrid (Water+)
• RumbleBlocks
• Beanstalk
• PuppyBot Rescue
ETC: Many Projects, Many Experiences
“Extended” Summary

• Games can be transformational, including literacy, science literacy, world hunger, etc.

• Games can drive people to learn more:
  – *Invasion!!* (for Field Museum; invasive species)
  – Imagica [www.etc.cmu.edu/projects/imagica/](http://www.etc.cmu.edu/projects/imagica/)
  – Ursa (*Feed*) […projects/ursa/](http://…projects/ursa/)

• Further information
  – [www.workingexamples.org](http://www.workingexamples.org)
  – [www.etc.cmu.edu](http://www.etc.cmu.edu) for ETC and its projects