

Carnegie Mellon University

Entertainment Technology Center

Educational Games: Transformational, or Befuddling?

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Talk Outline

- Intro to ETC and “transformational”
- ETC educational game case studies
 - *Invasion!!* with Chicago Field Museum
 - Biomes in the classroom
 - Walk-around “games for change”
- “Befuddling”: Dampening the hype
- Two more examples drawn from ETC work
- Wrap-up (with invite to a summit April 30)



ETC: Technology + Art

2-year graduate degree: MET



ETC: See Us April 30!

- tes.etc.cmu.edu
- For educators, developers, and subject matter experts interested in how experiences can be designed and developed to positively transform and improve society



Power of Stories

- ETC core courses: *Building Virtual Worlds* (BVW), *Visual Story*, *Improvisation*
- Games can “hook” users with story; increase interest in educational content



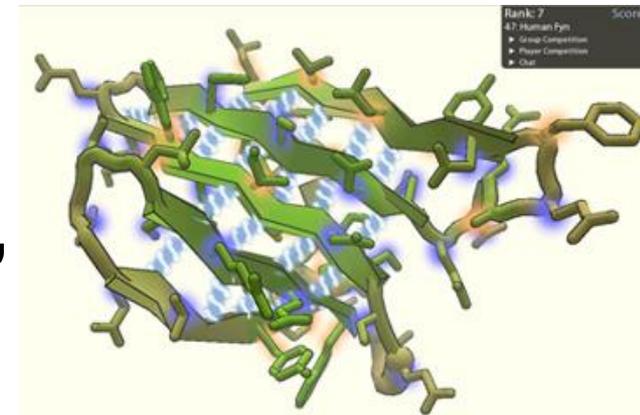
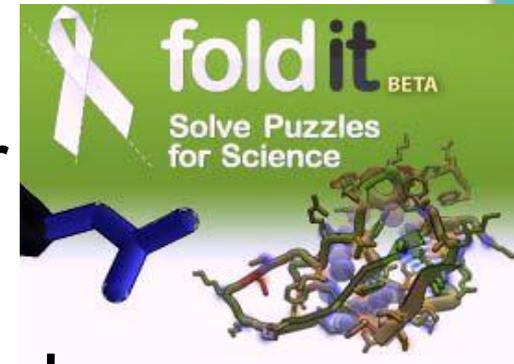
Games with a Purpose

- “GWAP” – popularized by Louis von Ahn at Carnegie Mellon
- *ESP Game*
- Licensed by Google, *Image Labeler*
- Metadata generation as by-product of play
- von Ahn & Dabbish
CACM 2008 paper, DOI
10.1145/1378704.1378719



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](https://doi.org/10.1038/nsmb.2119)



GWAP and the Player

- GWAP can generate metadata for information repositories
- GWAP can generate new scientific data
- I will delve into another purpose for games: changing the player rather than capitalizing on “human computation”
- What can games do for the player?



Transformational Games

- Jesse Schell, fellow ETC faculty member
- *The Art of Game Design*
- “Games that change the player....”
 - Educational
 - Behavior
- Some examples follow...



Chicago USA: Invasive Species

ETC project: *Invasion!!* (at *BrainPop* games pages – <http://www.brainpop.com/games/invasion!!/>)

The Field Museum

The Field Times

NEW CARP CZAR APPOINTED!

MIKE

PLEASE ENTER YOUR NAME

CLICK HERE TO CONTINUE

CARP DIRECTION

CHICAGO

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.

MIKE

PUBLIC APPROVAL

YOU HAVE 3 ACTIONS LEFT THIS TURN
CHOOSE AN ACTION

BUILD

DRAW/PLAY CARD

STATUS:

INDUSTRIES TOURISM - RECREATION SURROUNDING STATES ADVOCACY

LAKE MICHIGAN

CHICAGO

More on *Invasion!!*

Invasive Species Lesson Plan: The Invasion Game

Grade Levels: 3-5, 6-8, 9-12

In this lesson plan which is adaptable for students in grades 3-12, students will explore the effects of invasive species. They will participate in a game simulation in which they must stop carp (a non-native species) from progressing through the waterways to Lake Michigan.

Preparation and Game Background Information for the Teacher:

Invasion!! is a free online game created by a Carnegie Mellon University Entertainment Technology Center (ETC) student project called "Bridges," sponsored by the MacArthur Foundation. Working in partnership with the Field Museum of Chicago, the game explores the goal of preventing Asian carp from invading the waters of Lake Michigan. Portions of the background information provided in this lesson plan have been adapted from the game developer's website.

The game has two parts. The first part is an introductory game appropriate for students in grades 3-12. The player controls an Asian carp which can swim, eat, and jump out of the water. The carp eats plankton to gain energy, and at a certain point, can jump up to try to hit boaters and birds (as occurs in the real world). The purpose of this game is to draw the player into the world of Asian carp.

The second and primary portion of the game is a simulation where the player is introduced to the complex global dilemma of managing invasive species. This portion of the game targets high school students, as it requires some advanced reading skills and an appropriate level of systems thinking to appreciate the socio-political aspects of the game. The objective is to stop carp from progressing through the waterways to Lake Michigan. The style of game play is a mix of a turn-based tower defense game and a simple card game to gain resources to build more towers. To win the game, the player needs to keep the carp out of the lake for 25 turns. There are random events that affect the system each turn, so the player will have to often adjust strategies.



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 YETI: Arctic Biome

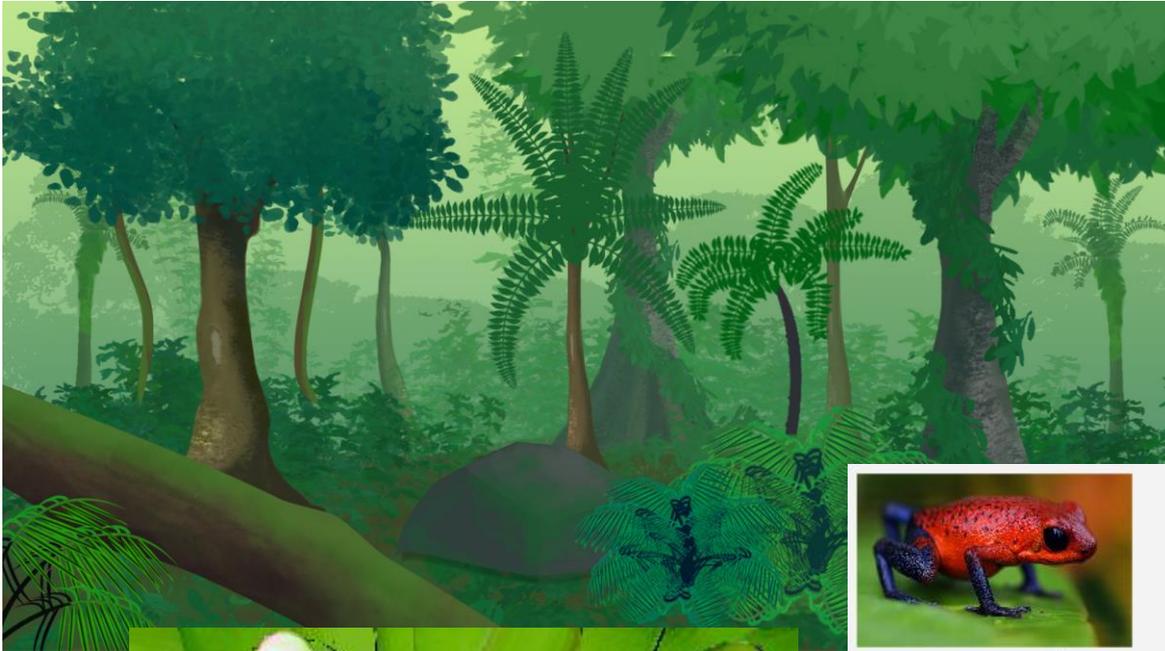


Arctic Stars: The Far North

- Available as free app (Google play) as *Arctic Stars: The Far North* by Xuyan Ke
- James Inglis, Eric Kron, Shashank Kairamkonda, Christian Karrs, Xinghu Lu, Xuyan Ke



ETC Gaia: Rainforests



Spring 2015
Bing Liu, Melody Lee,
Brentt Kasmiskie, Jake
Ahn, Jerry John, Tiffa
Cheng, Vivek Sangubhotia



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



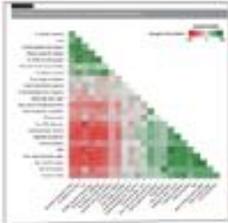
Research Behind *Feed*

GIVING
what we can



RIISING FOOD PRICES, SOCIAL MOBILIZATIONS,
AND VIOLENCE: CONCEPTUAL ISSUES IN
UNDERSTANDING AND RESPONDING TO THE
CONNECTIONS LINKING HUNGER AND CONFLICT

SILVIA MALALA
Professor, School of Nutrition Science and Policy, Tufts University, Boston, MA



CONFLICT: A CAUSE AND EFFECT OF HUNGER

By Ellen Mottet, Mark J. Cohen, and Thomas Robinson

FAO
Statistical
Yearbook
2012

INTERNATIONAL FOOD
POLICY RESEARCH INSTITUTE
empirical solutions for ending hunger and poverty
Supported by the World Bank

Corruption

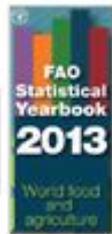
Conflict

World Wide Maze
Spaceship Pilot
Multiplayer OSMOS
Cookie Clicker
Node.js

Web-based Games

WAY, Climate Defense, Half the Sky
Bioharmonious, Inside the Haiti Earthquake
Ayiti: The Cost of Life
Thirst, NeoColonialism
Nation States, NarcoGuerra
Superbetter

Games for Change



Distribution

Isle of Ture Mobile
Neopets, Bear Hunter, Faria, Ghent
Turn Yourself into Pixels
Smugglers and Spies, Blind Bell
Cytus, Capture the Flag, Pokemon
Wow Name Tags, Enemy Defender, Arathi Basin
Red Light Green Light, Sunny Day, Shadow Tag
Go Tutorial, Games Three, Sudio Fish, Project Assassin
Flight Simulator, Barthol Games
Quarter Football, Parallelweb

Large / Outdoor Games



“Befuddlers”

- Does learning happen?
 - Pittsburgh science of learning
 - ETC collaborations with HCII
 - Some online notes at <http://workingexamples.org>
- Can educators find the “good stuff”
 - Parent guides, teacher guides can help
 - Great educator portals could help more
- Platform: Flash? PC/Mac? Apps?
- Game polish for educational vs. entertaining
- Other hurdles.... (will revisit in Q/A)....



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



Go!
The Electric Company

Parents Home

Activities

- Tips for Everyday Literacy
- Electric Racer
- Prankster Planet

Electric Racer

Download and Drive!

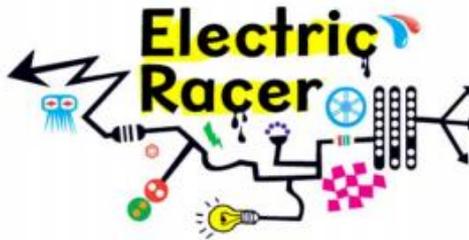
In this exciting two-player driving game for kids and adults, players work together as a team to drive through a race track filled with words. Whether you're the driver or the passenger, you'll need to work together to collect and unscramble words!

More on *Electric Racer*

Parent Guide

Sesame Workshop views digital play as an important opportunity for intergenerational interaction around young children's literacy development. Just as *Sesame Street* introduced children and their families to the potential of television two generations ago, the *Electric Racer* game continues this tradition of learning and fun in a digital age. Video games based on literacy challenges can provide opportunities for parents and children to engage with language together, which supports the development of children's literacy skills and their motivation to learn.

Electric Racer is a two-player downloadable driving game targeted for 6-9 year olds. One player acts as the driver, and the second as the passenger. The goal of the game is to work together as a team to drive through words on the track with a particular phonics goal. It is the driver's job to use the arrow keys to drive through the words on the track, engaging the player in reading and identifying target words. The passenger player is responsible for then unscrambling the words, acting in a supporting role to help the driver complete the race. Co-play with a parent or caregiver is not critical to win, but it provides additional learning opportunities and makes game play more fun.



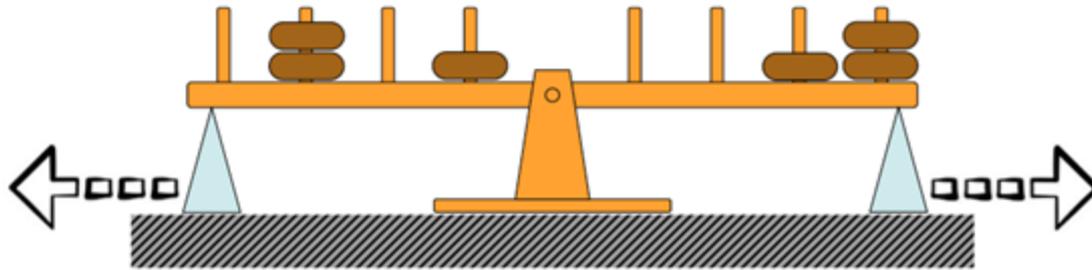
ETC Projects: ENGAGE

- DARPA ENGAGE program promoted scientific literacy for children ages 4-12
- Many ETC projects involved, many games produced: <http://www.etc.cmu.edu/engage/>



Science Content in 3 Games

- Balance scale and sum of cross products
- Determine whether a scale will balance, given a particular configuration of weights on each side of the fulcrum



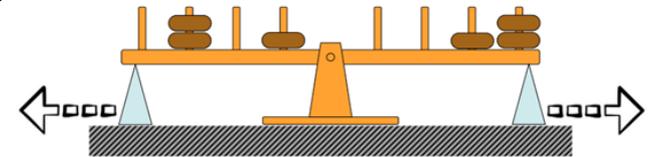
Siegler, R. S. (1976). Three aspects of cognitive development. *Cognitive Psychology*, 8, 481-520



Objectives for Balance Games

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

1. Learners only pay attention to weight, not distance.
2. Learners also consider distance, but only when the weight is equal on both sides.
3. Learners consider both weight and distance, but when the cues suggest different outcomes, they guess.
4. Learners 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.



PuppyBot Rescue

- Developed in concert with Sesame Workshop
- Uses HTML5, optimized for touch
- Adapt game level progression (ages 5-11)

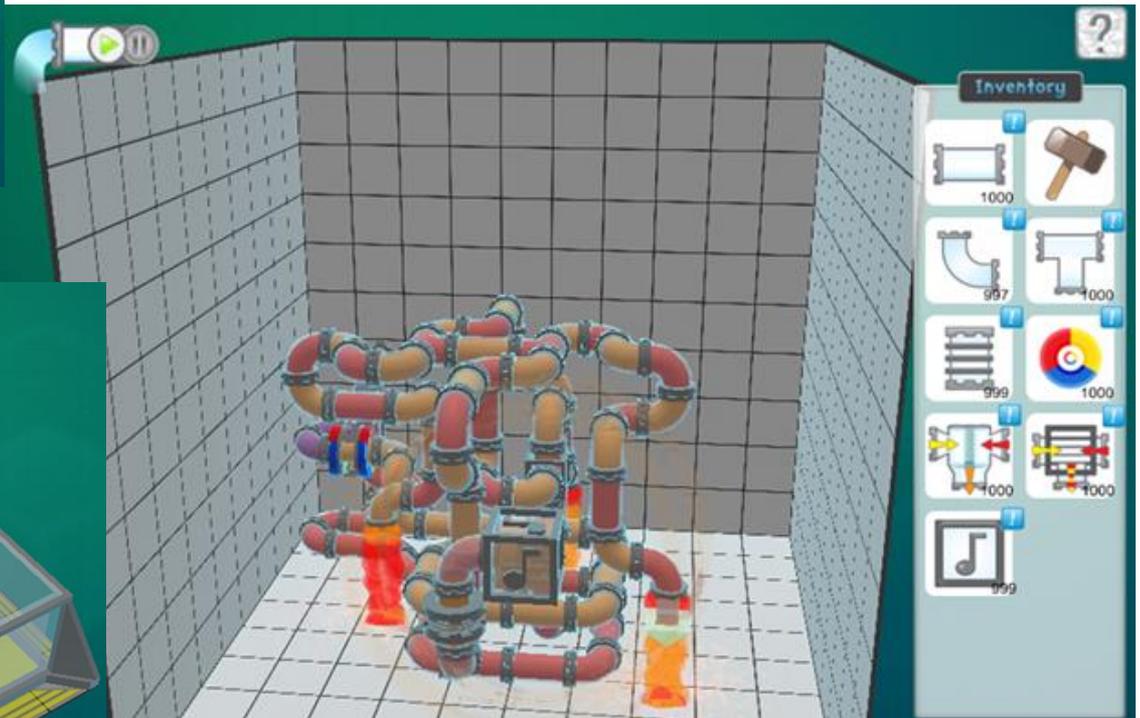
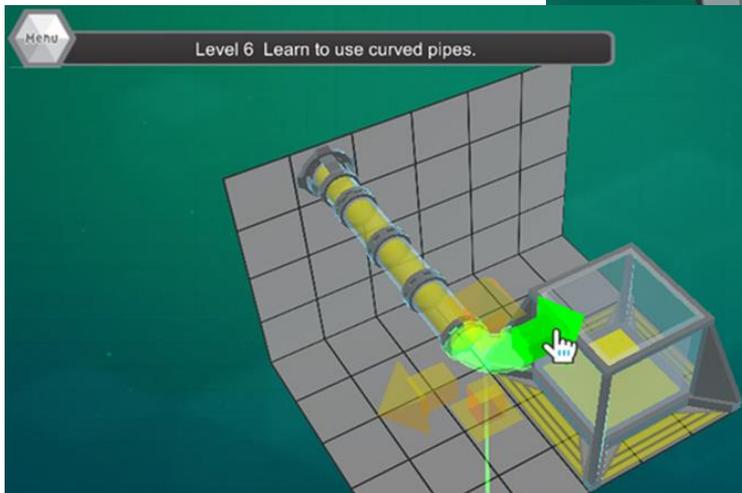
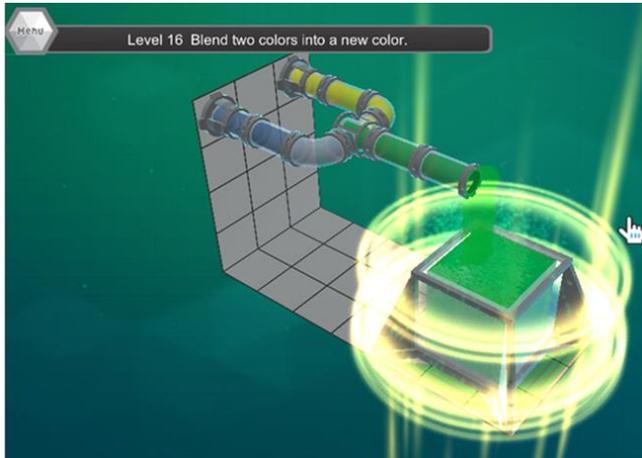


Promoting Systems Thinking

- GameGrid ETC team, Fall 2013
- Worked 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/>



Water+ from ETC GameGrid



GameGrid → Water Bears

- GameGrid work extended by Schell Games
- Published as Water Bears (iPad; see <http://www.nextpittsburgh.com/business-tech-news/schell-games-brings-education-life-three-new-steam-based-games/>)



Schell Games making STEAM-based games “to change the world”

Deb Smit March 26, 2015 Business & Tech News, Kidsburgh Pittsburgh



ETC: Many Projects, Many Experiences



Thanks to:

- MacArthur Foundation
- Claude Worthington Benedum Foundation
- DARPA ENGAGE program
- Dedicated ETC students delivering on projects with transformational goals
- ETC and HCII faculty and staff
- Numerous educators who helped in iterative design, testing, and refinement



Summary

- Games can be transformational teaching tools
- Games can inspire people to learn more:
 - *Hello Ocean, Arctic Stars, ...*
 - *Ursa (Feed)*
- Games can introduce topics (*Invasion!!*)
- Games can be a “head fake” (*Water Bears*)
- Further information
 - www.etc.cmu.edu for ETC and its projects
 - www.workingexamples.org for digital media and learning developer insights (seed, sprout, bloom)
 - Mike Christel, christel@cmu.edu



Other Resources

- BrainPop, www.brainpop.com
- GlassLab, glasslabgames.org
- PBS Kids, pbskids.org
- ...connections are “Befuddling” – educational game validation, educational game distribution, connecting educators, developers, distributors...



For more on “Transformational”

- Register at tes.etc.cmu.edu (getting close to full...)



**TRANSFORMATIONAL
EXPERIENCES
SUMMIT**

a Summit on Making Media that Matters

April 30th, 2015 in Pittsburgh, PA



Carnegie Mellon University
Entertainment Technology Center