

Making Discovery Visible

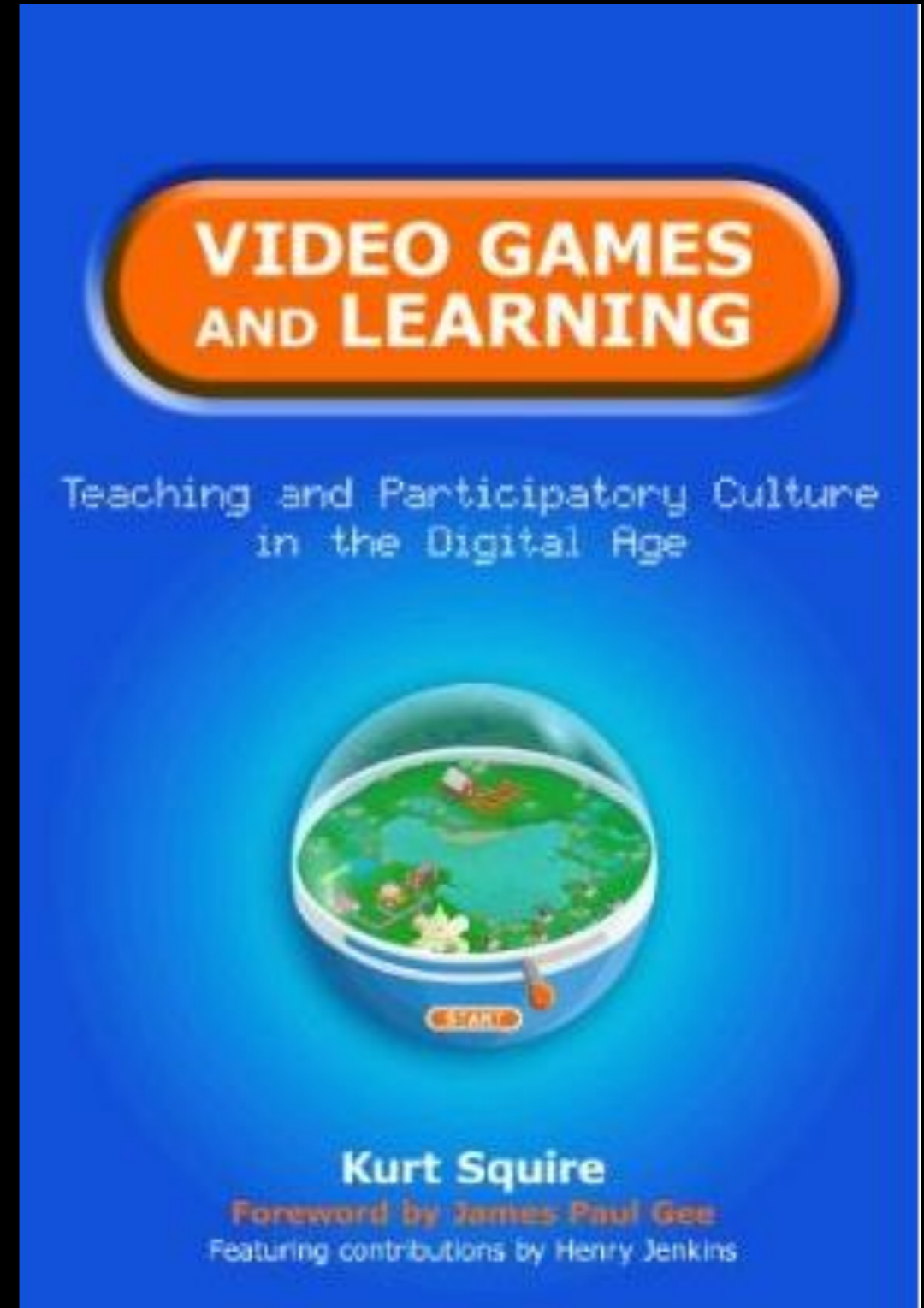


WISCONSIN INSTITUTES FOR
DISCOVERY

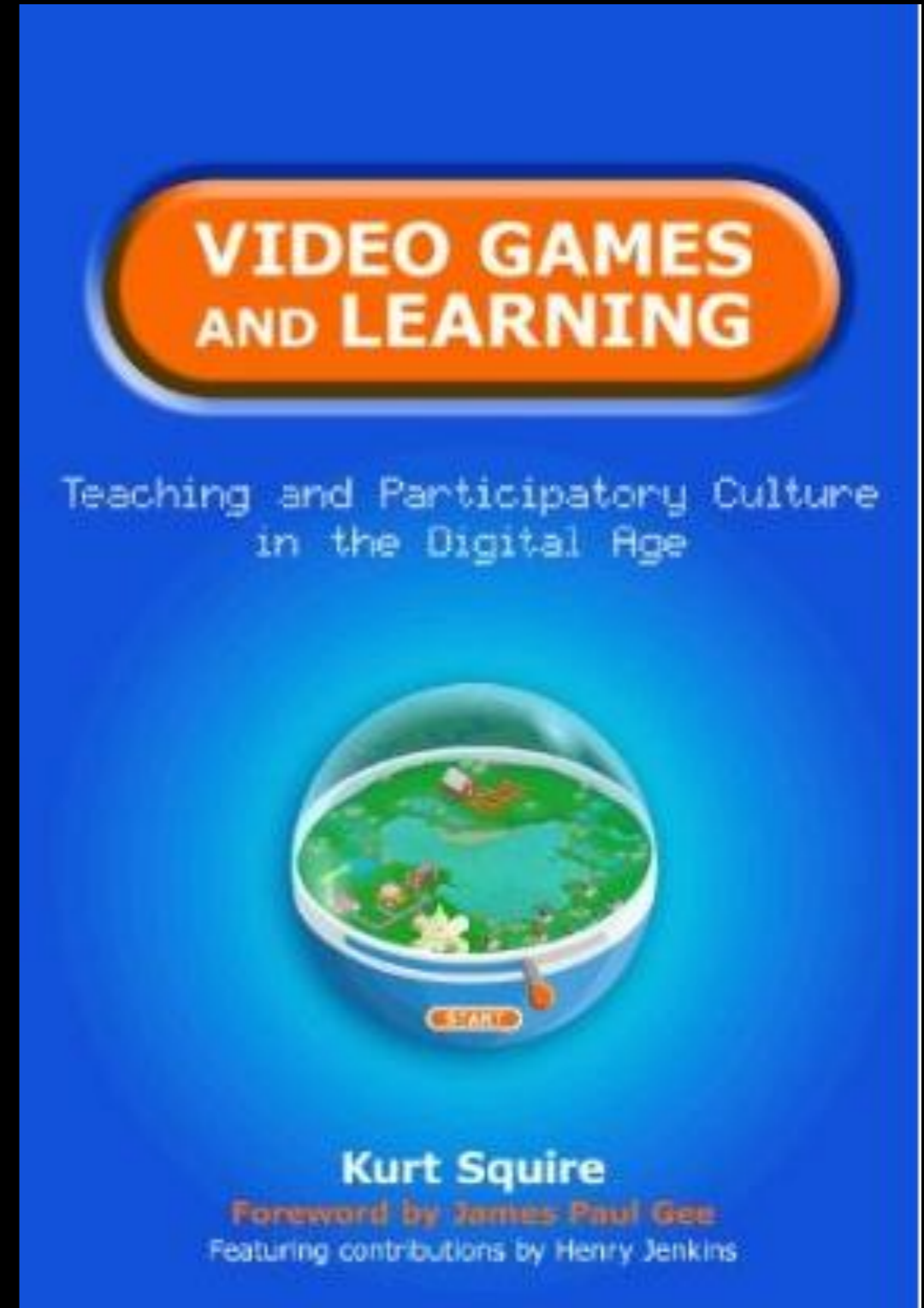
MORGRIDGE INSTITUTE FOR RESEARCH
WISCONSIN INSTITUTE FOR DISCOVERY

Kurt Squire
Senior Investigator, Creative Director

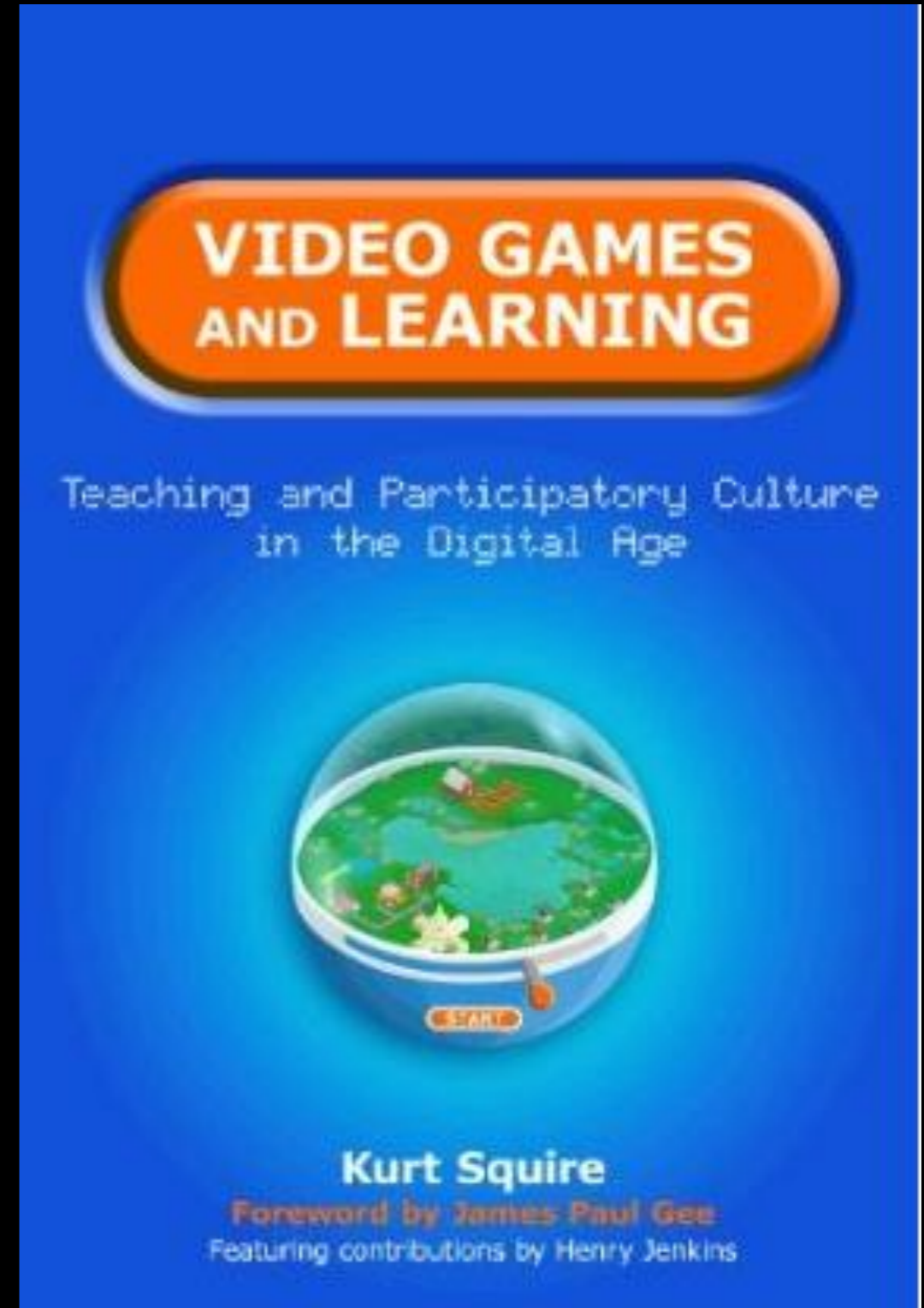
Games are models
that represent ideas
as interactive worlds.



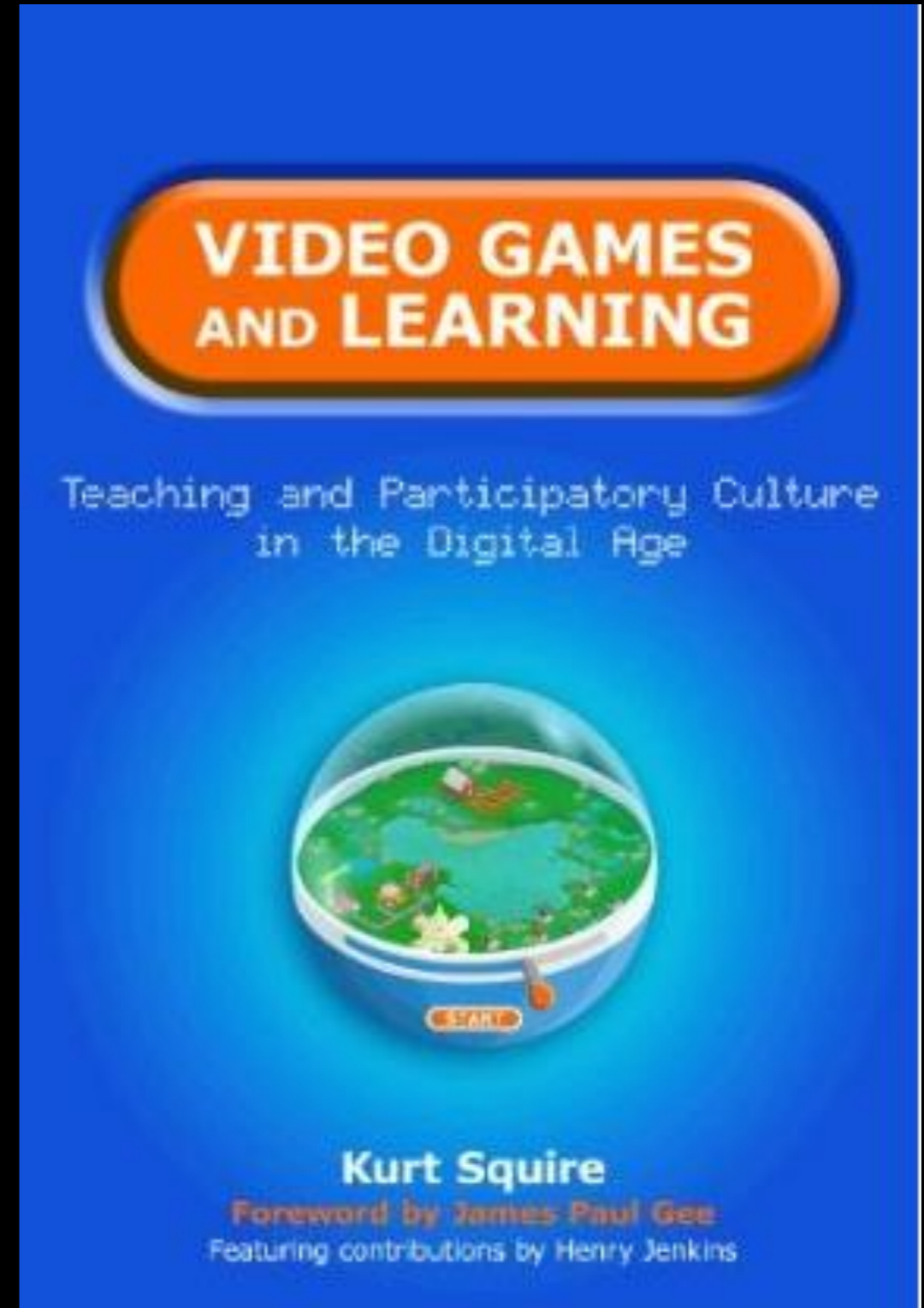
We build more robust models of scientific ideas through cycles of perceiving and doing.



But unlike sims & models, games pique our interest in new domains & embrace the aesthetics of experience.



This is especially important in an attention economy.



- big bird & kid watching tv

Games are about solving **problems**.
Through game play,
we develop skills.

VIDEO GAMES AND LEARNING

Teaching and Participatory Culture
in the Digital Age

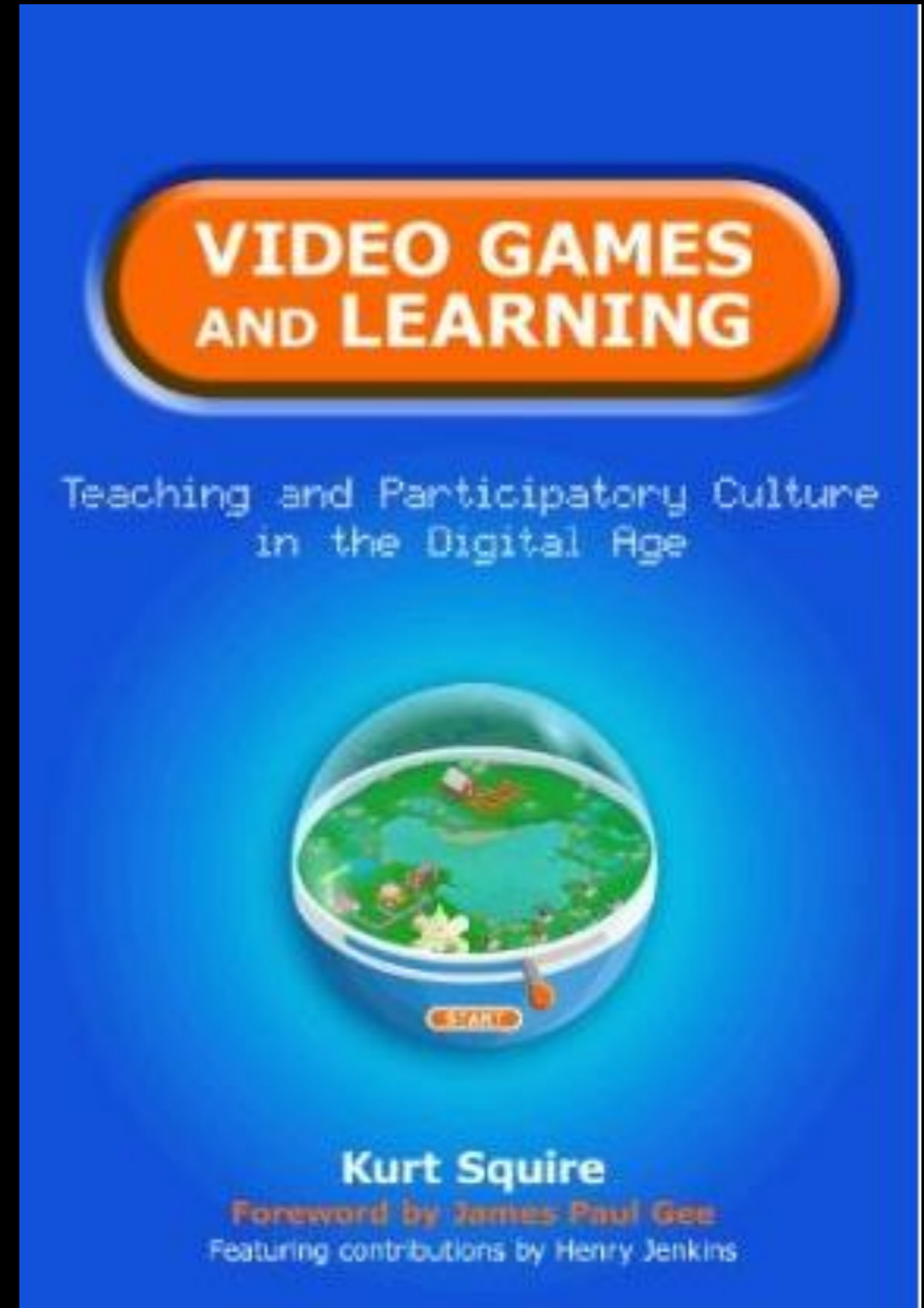


Kurt Squire

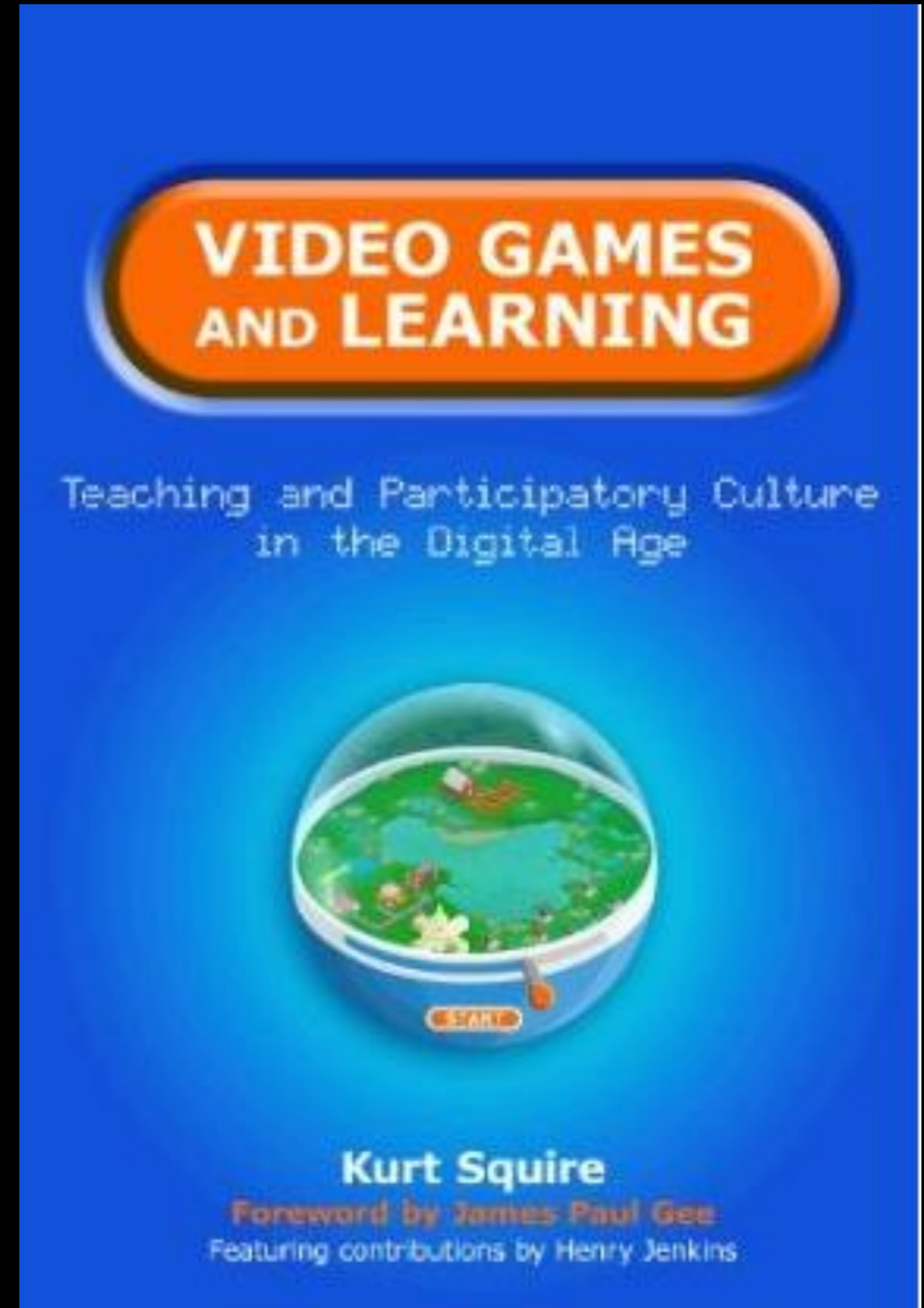
Foreword by James Paul Gee

Featuring contributions by Henry Jenkins

We develop those skills in communities that assess our performance.

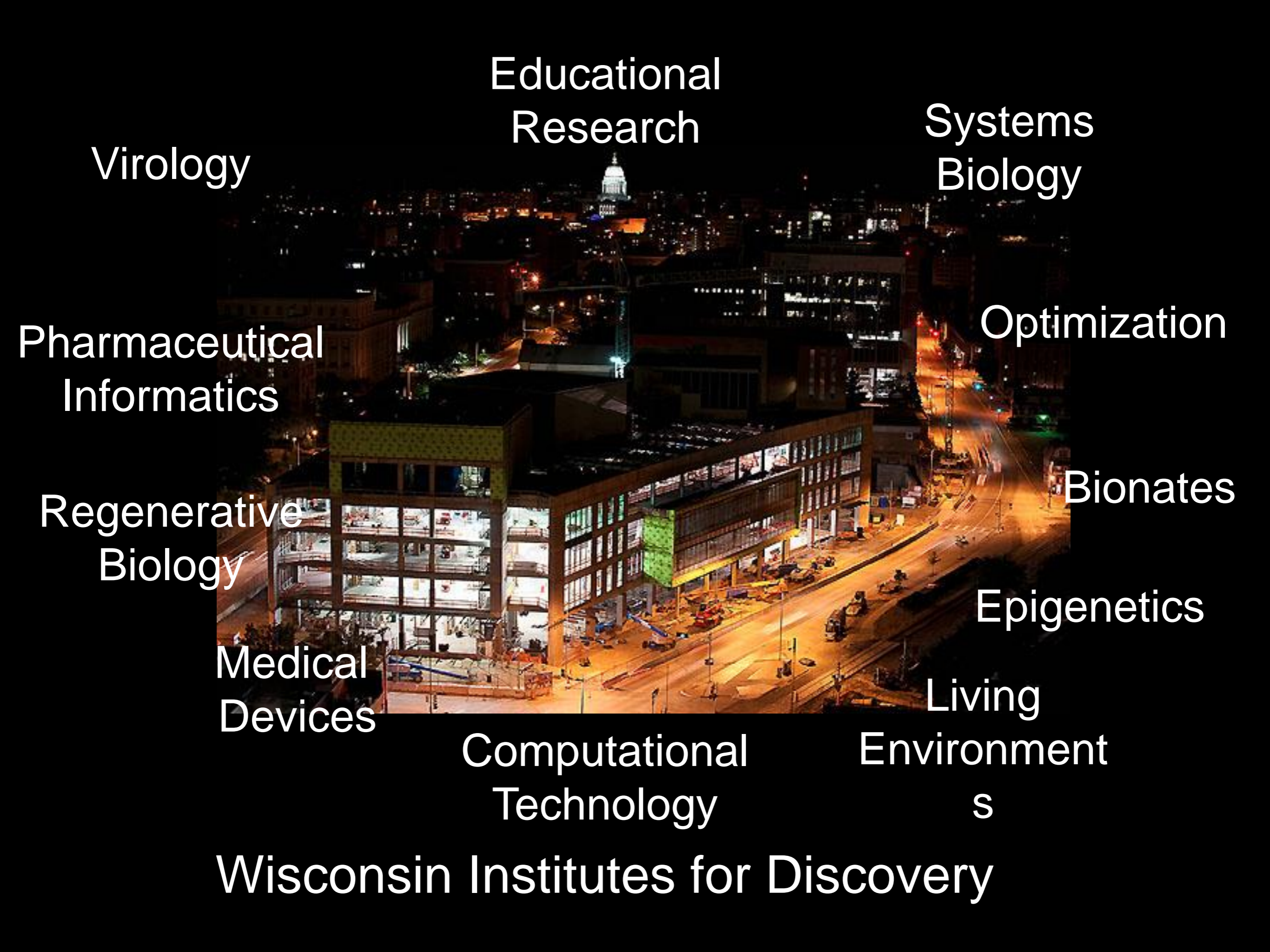


Through participating in these communities we can become new kinds of people.





Wisconsin Institutes for Discovery



Virology

Educational
Research

Systems
Biology

Pharmaceutical
Informatics

Optimization

Regenerative
Biology

Bionates

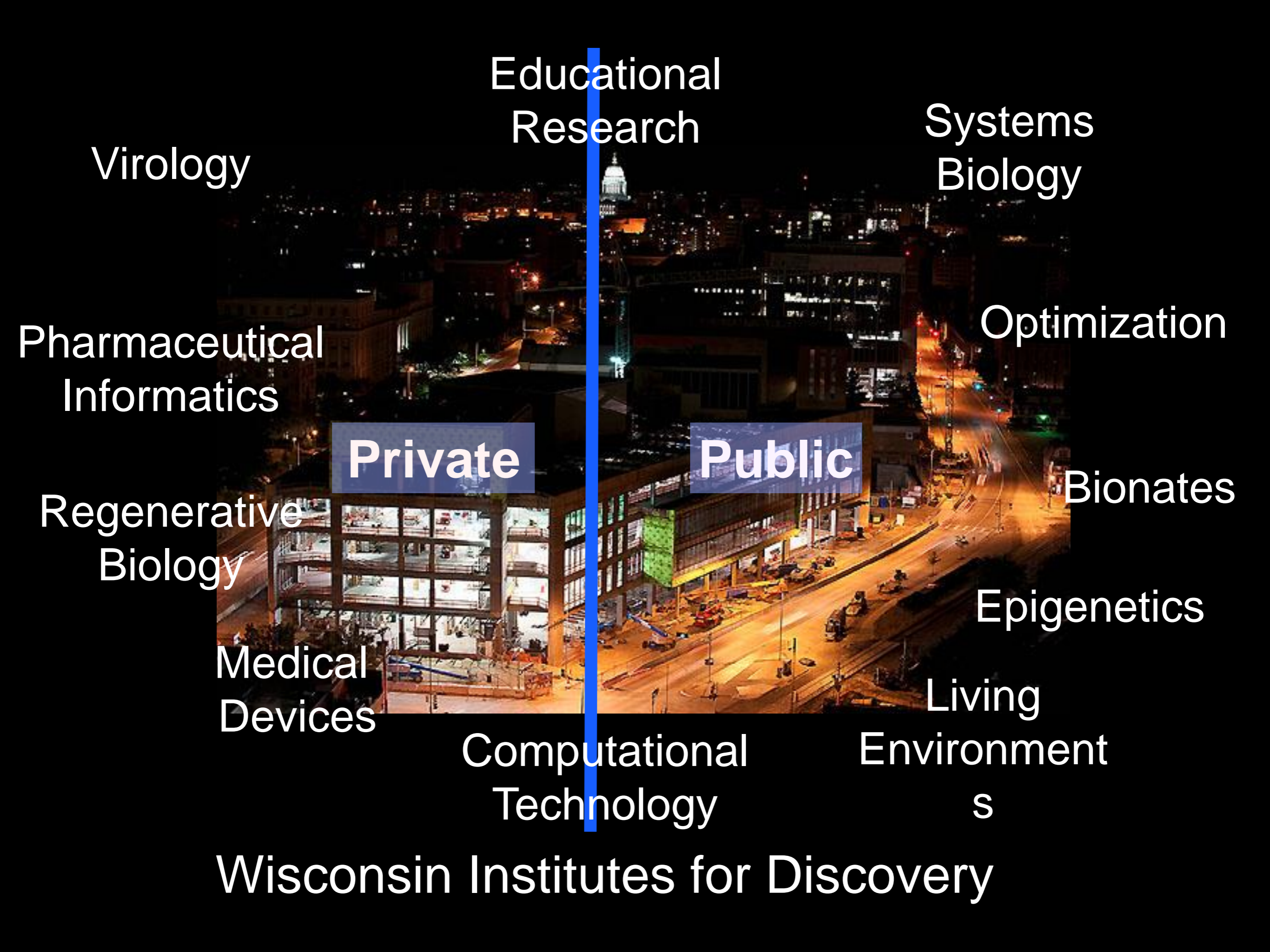
Medical
Devices

Epigenetics

Computational
Technology

Living
Environment
s

Wisconsin Institutes for Discovery



Virology

Educational
Research

Systems
Biology

Pharmaceutical
Informatics

Optimization

Private

Public

Regenerative
Biology

Bionates

Medical
Devices

Epigenetics

Computational
Technology

Living
Environment
s

Wisconsin Institutes for Discovery



Educational Games that Make Discovery Visible



Experience the thrill of scientific
discovery.



Participate in the Making of Science



PLAN

Genetic factors in several symptoms of anxiety

YEAR 1: WINTER



RESEARCH COMPLETE

49

56

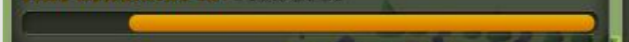
Where: Dock
When: Present

Data Lenses C S



Welcome to Madison, Wisconsin!

TIME REMAINING IN: YEAR 2033



PLOTS

Displays t

****ENDANGERED SPECIES SIGHTING****

An endangered *Harpy Eagle* sighting has been reported at a neighboring plot of land. The witness has remained anonymous so the credibility of the report is not something that can be verified as this time.

Would you like to travel to this plot of land and investigate this report?

INVESTIGATE

IGNORE



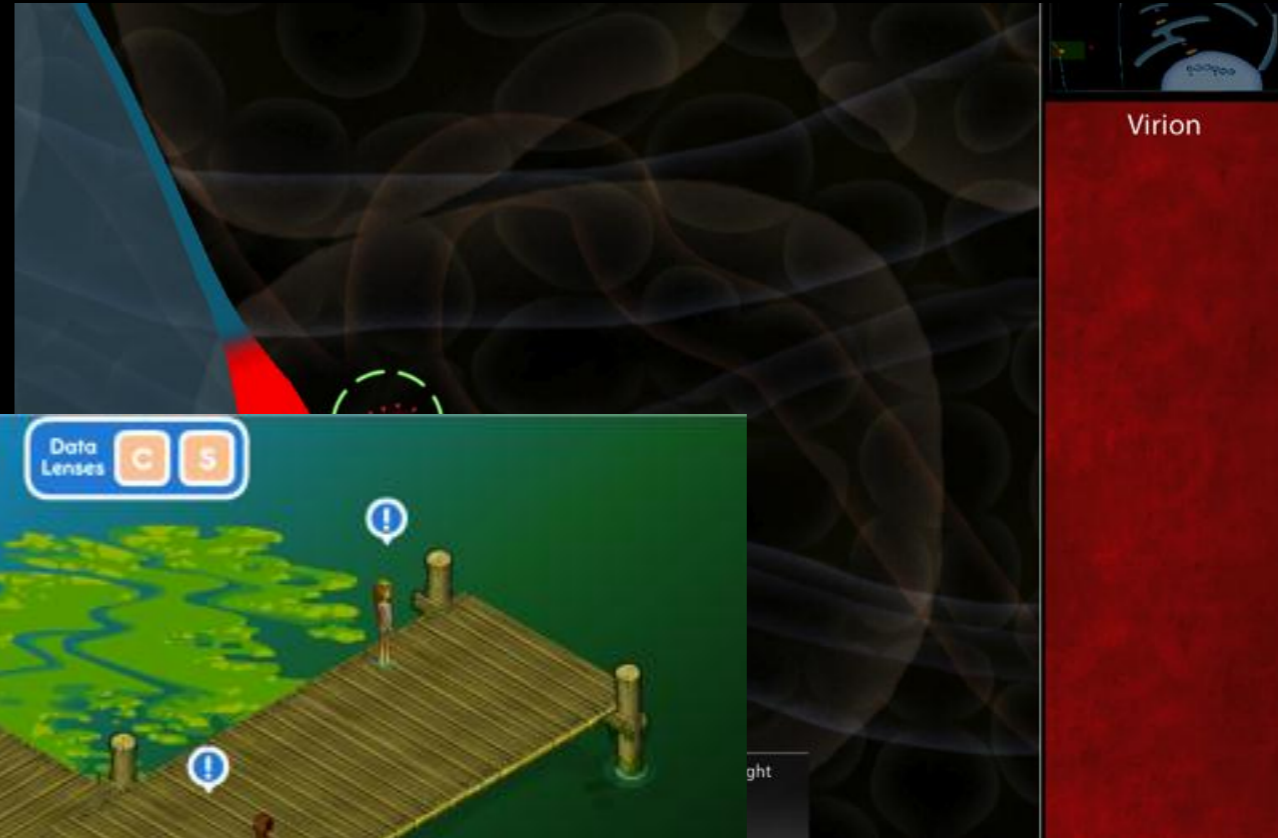
COMMON ACTIONS

This button accesses a set of common global actions all players can use.

- COMMON ACTIONS
- ENACT POLICIES
- BUILD PARKS
- BUILD PARK
- IMPORT WILDLIFE
- ADD CAMPING
- CREATE TOURIST EVENTS

UNMANAGED PROPERTY | \$3277

RESOURCES	QUALITY	CURRENT BID	PLACE BID
25%	63%	\$3277	PLACE BID



Virion



Help ?

Patient ID: Mr. Rey

Lg Nv C S

Cancer Proximity

Target Marker

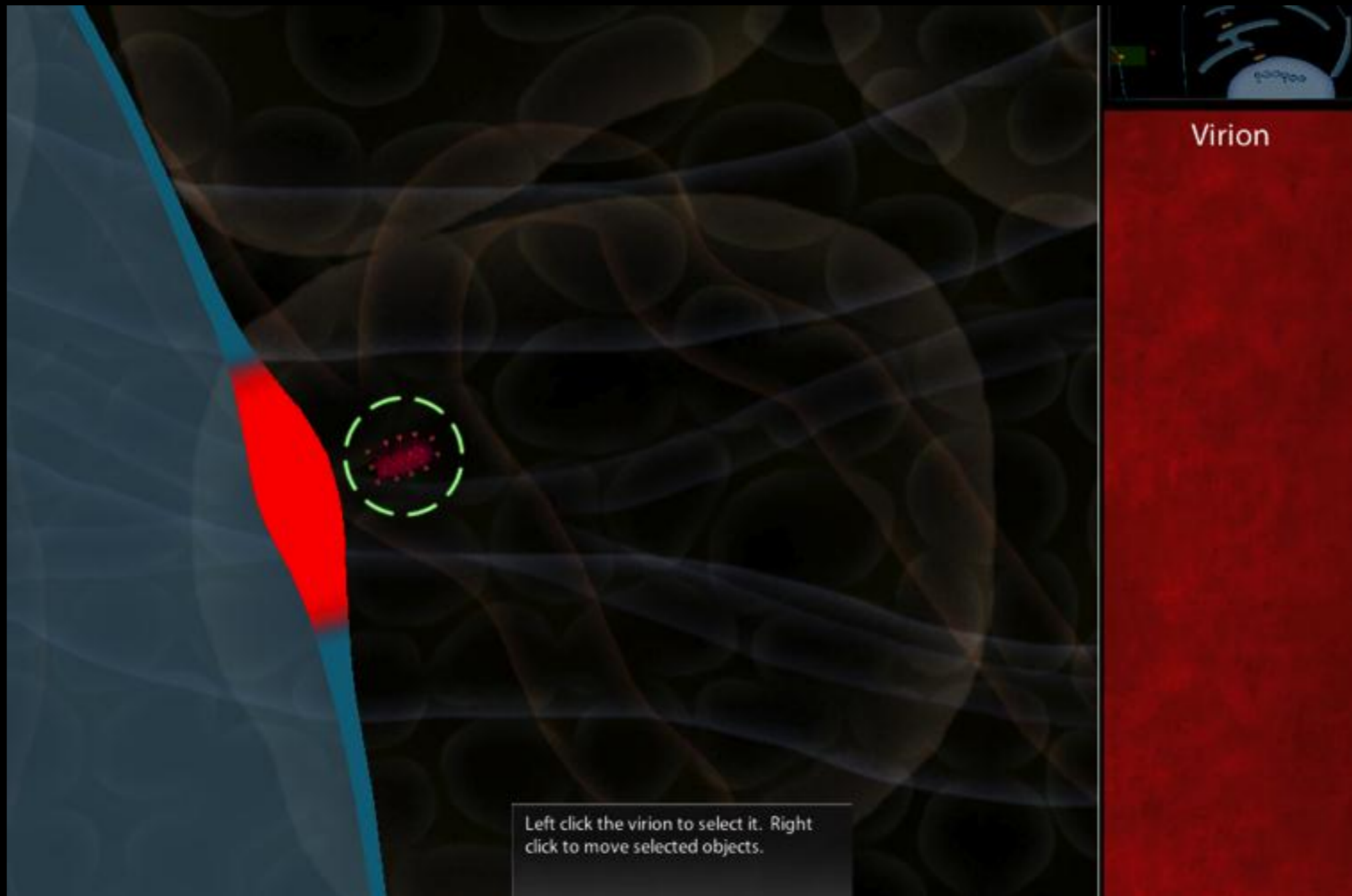
Target Eraser

Standard View

Enhanced View

Submit

Touchmark - Quantisys FBL



Games based on cutting-edge discoveries

Virulent iPad





1 month, 1,000 downloads

More of Us have arrived. Fight off the last wave of
Slivers...

VIRULENT



- Initial Findings
 - High interest in content
 - Players use images to scaffold material
 - Context for interdisciplinary collaboration



TIME REMAINING IN: YEAR 2033

LEVEL 4 | CONSERVATION AGENT

15 4,000 4,000 4,000

PLOTS

Displays the number of land plots you control.

ENDANGERED SPECIES SIGHTING

An endangered Harpy Eagle sighting has been reported at a neighboring plot of land. The witness has asked to remain anonymous so the credibility of the report is not something that can be varified as this time.



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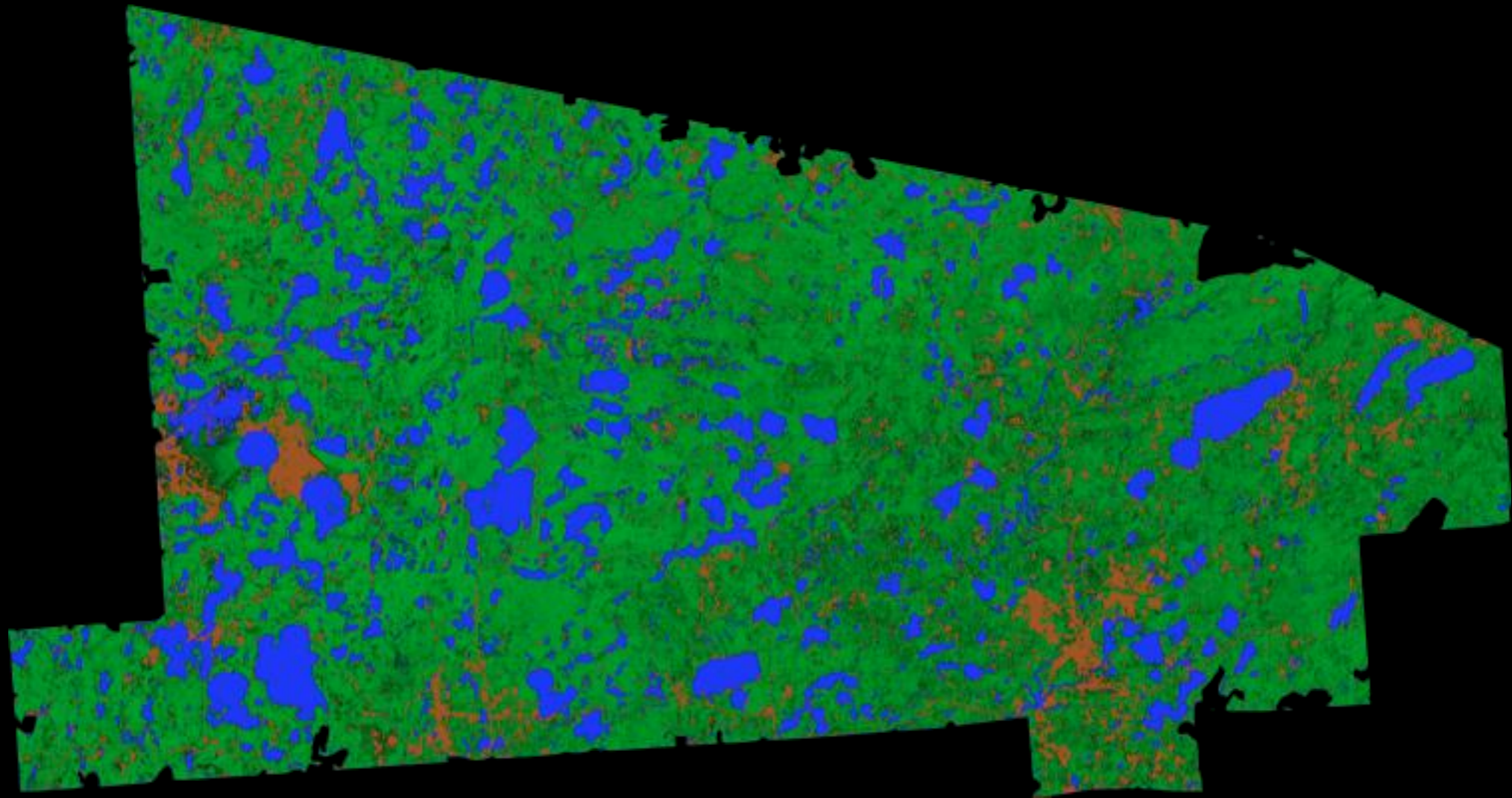
- COMMON ACTIONS
- ENACT POLICIES
- BUILD PARKS
- BUILD PARK
- IMPORT WILDLIFE
- ADD CAMPING
- CREATE TOURIST EVENTS

UNMANAGED PROPERTY | \$3277

RESOURCES	QUALITY	CURRENT BID	PLACE BID
25%	63%	\$3277	

Trails Forward





Game World

Vilas County, WI

963,976 square single acre tiles

(1,352 x 713 grid)

TRAILS FORWARD GAME CONCEPTS ROLES

Ranger

Developer

Timber Co.

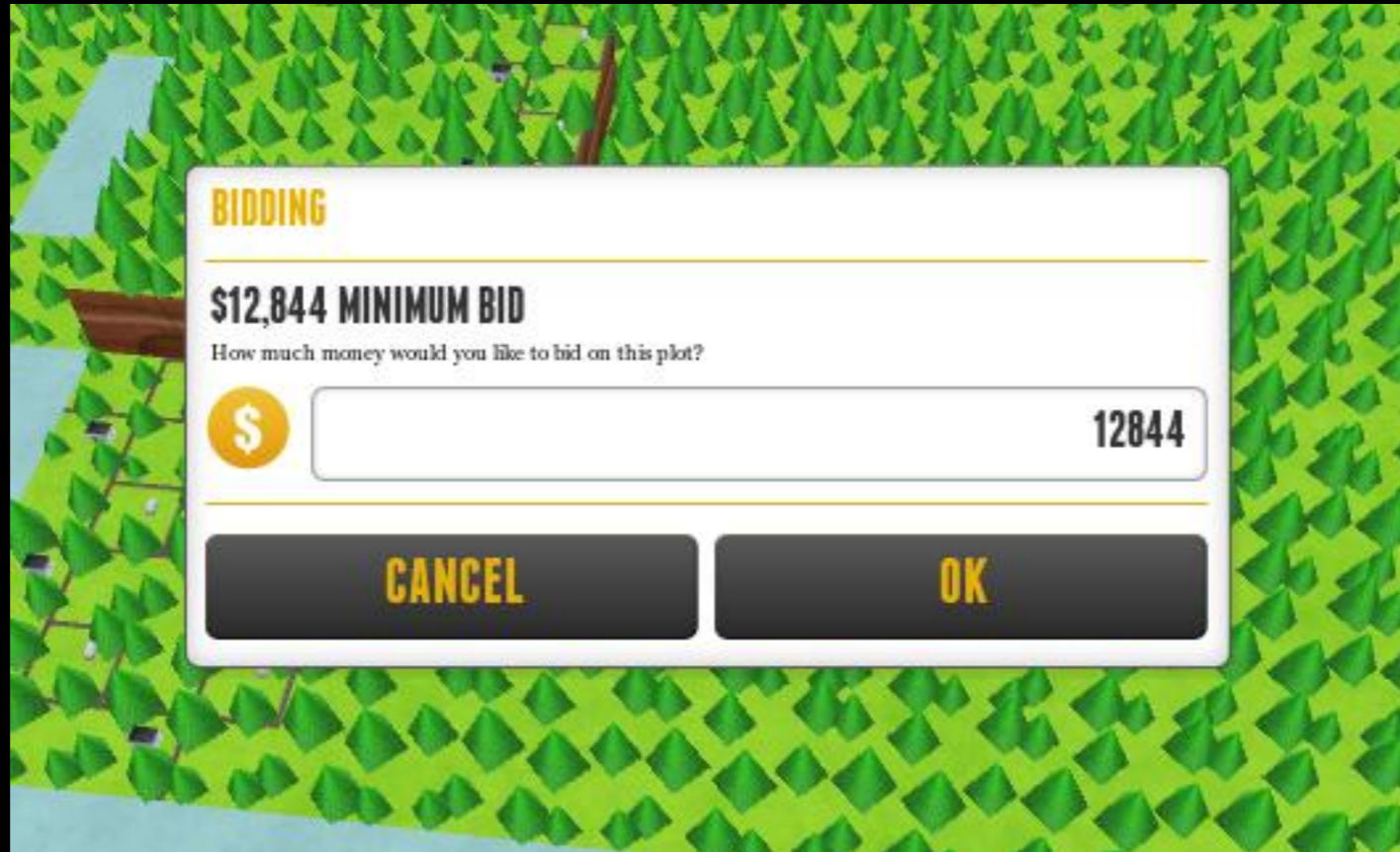


Enforces Law

Builds Properties

Harvests Forest

Cares for the Land



CORE GAME CYCLE

Buy & Sell Property
Lobby the State for Roads
Lobby the State for Zoning Changes



****ENDANGERED SPECIES SIGHTING****

An endangered **Harpy Eagle** sighting has been reported at a neighboring plot of land. The witness has asked to remain anonymous so the credibility of the report is not something that can be varified as this time.

.....

Would you like to travel to this plot of land and investigate this report?

INVESTIGATE **IGNORE**



Rangers

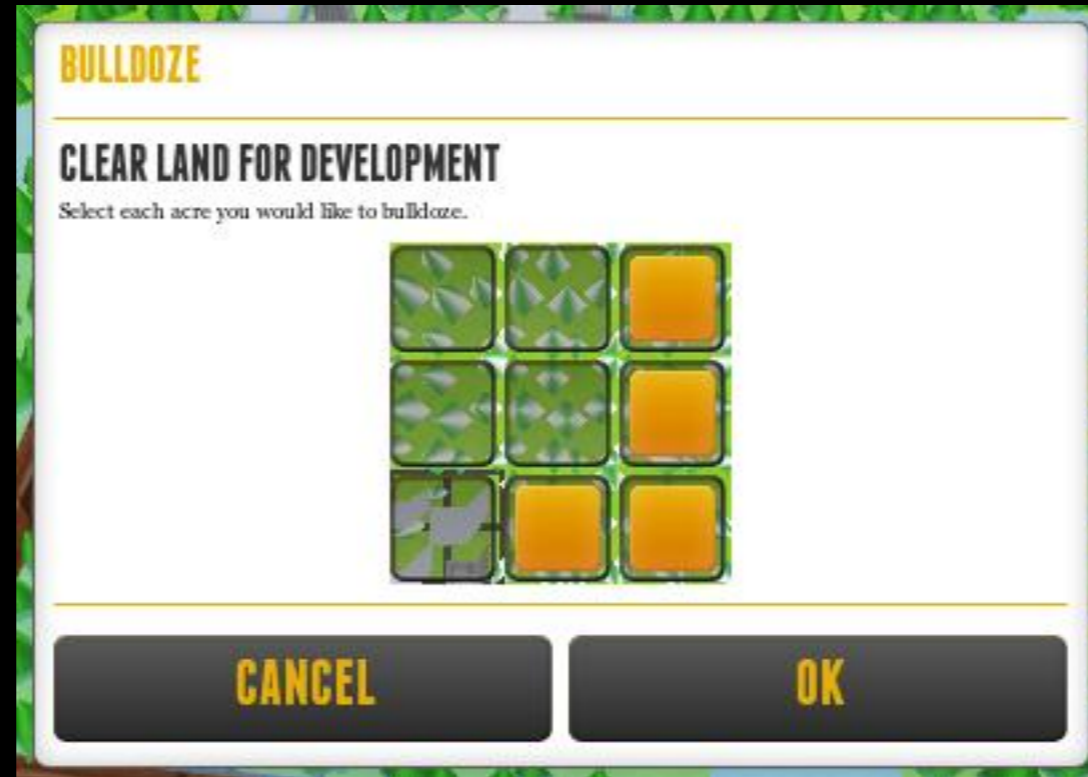
Build Parks

Open Land for Hunting/Birdwatching

Import Wildlife

Check for Endangered Species





Developers

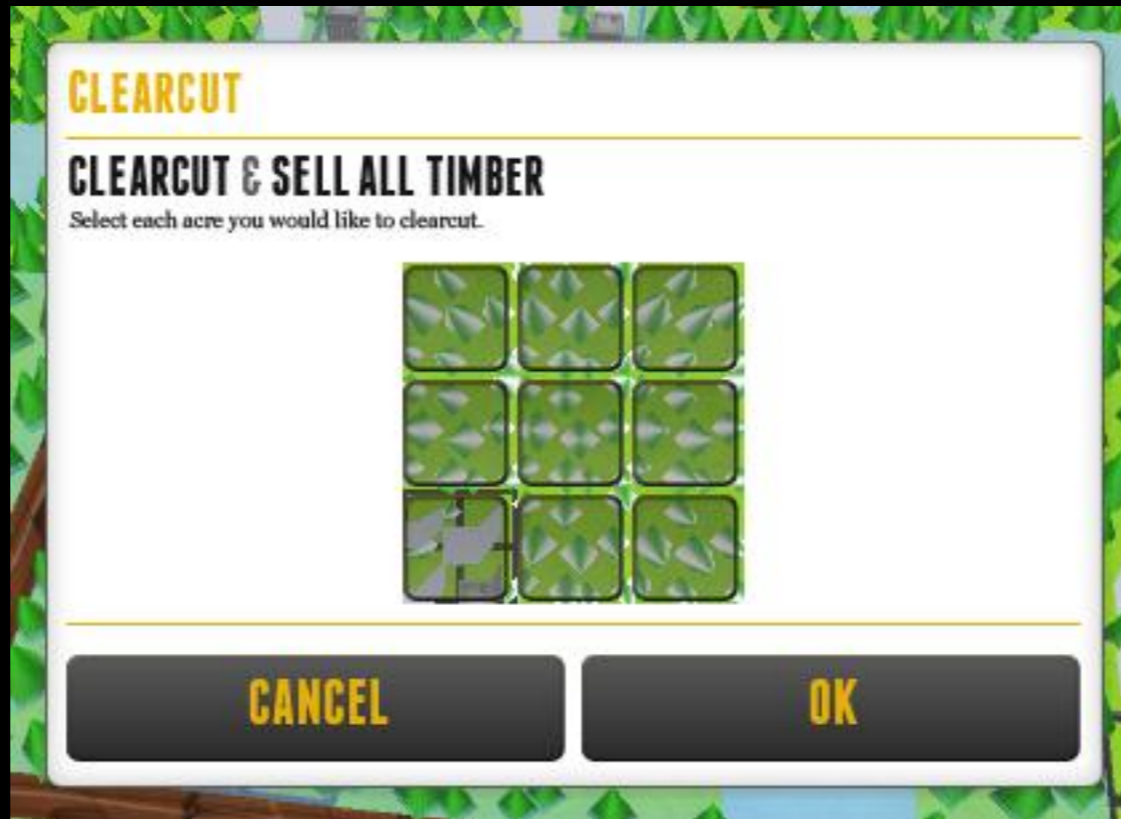
Bulldoze land

Build Homes

Build Factories

Enhance Properties (e.g., Solar Panels)





Loggers

Clearcut Forest

Plant Seeds

Selectively Harvest Wood

Open Land for Hunting/Birdwatching



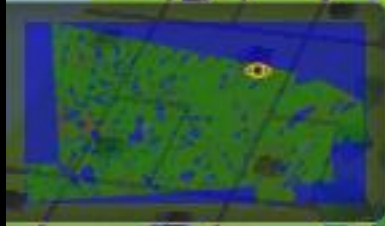
BEN SHAPIRO | LOGGER

0

\$ 1,000

20,000

140,000



UNMANAGED PROPERTY

\$500

COMMON ACTIONS

USE FOREST

LOBBY ROADS

LOBBY ZONING

LOBBY SALE

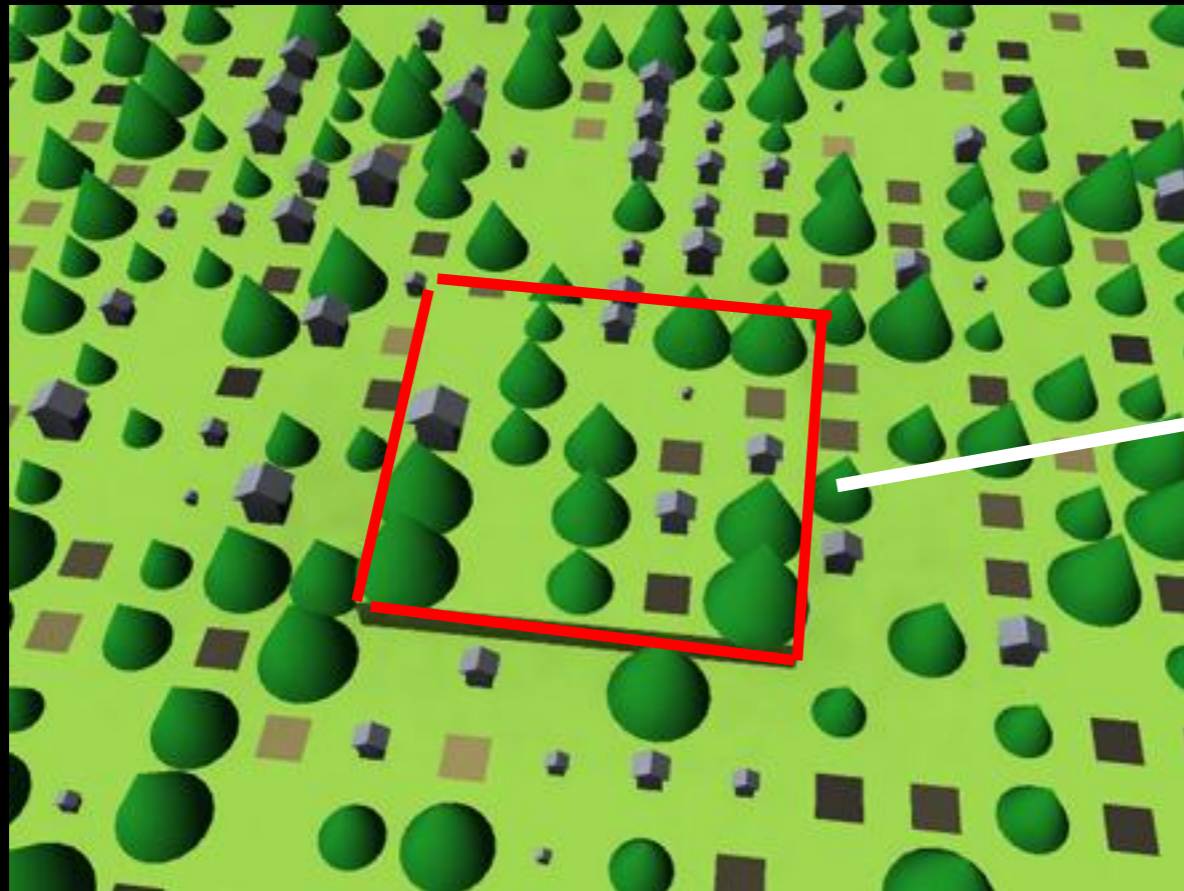
BID ON PLOT

SHOW BIDS

Building Density: 11%
Development Intensity: 0%
Tree Density: 15%
Tree Size: 0%

For educational use only

TRAILS FORWARD GAME CONCEPTS LAND MODEL



3x3 acres

1 Megatile

TRAILS FORWARD Architecture



Game Client

http



Game Server

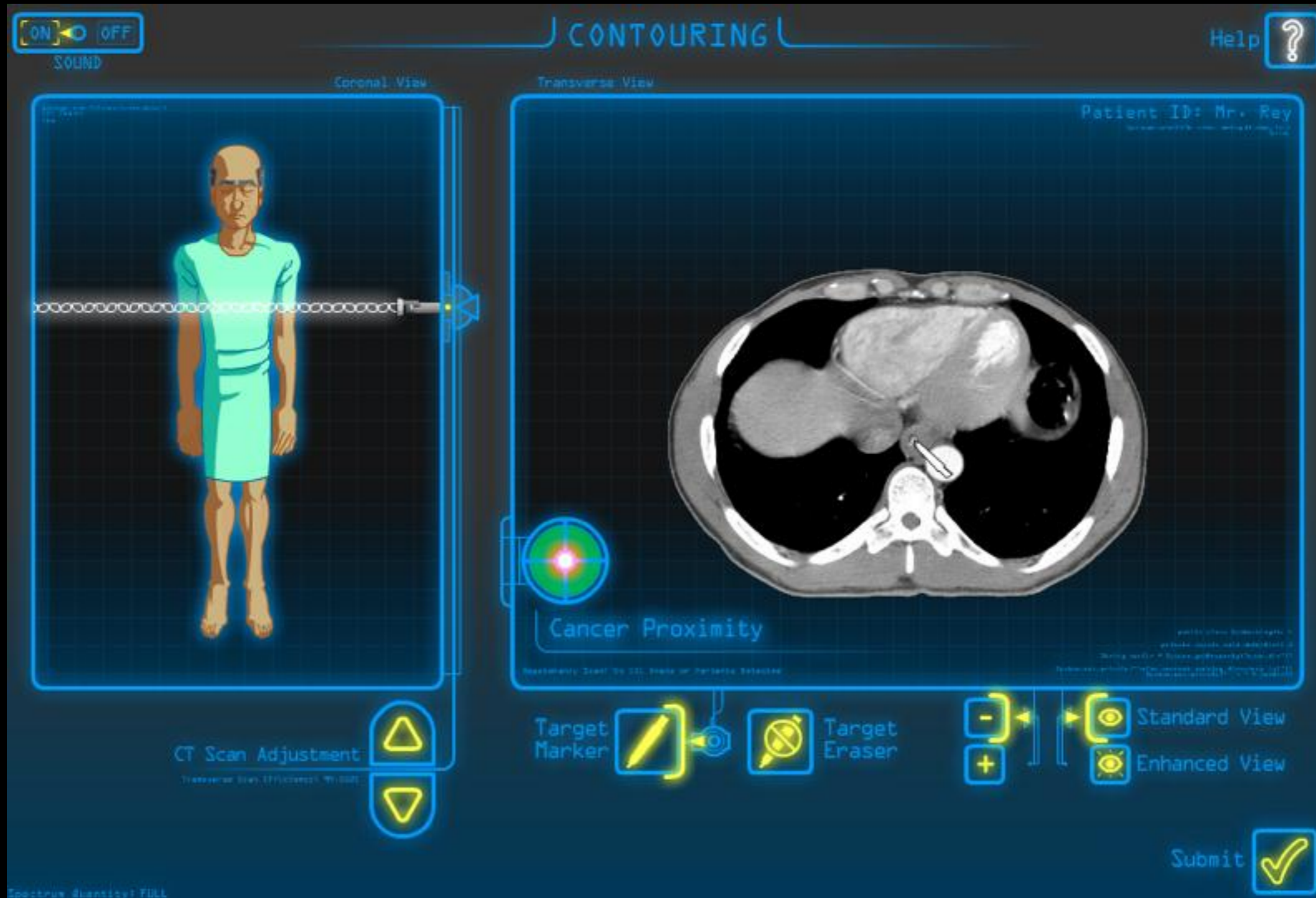


Database

http



New Clients & Bots



Games that let you discovery the joy in helping someone.

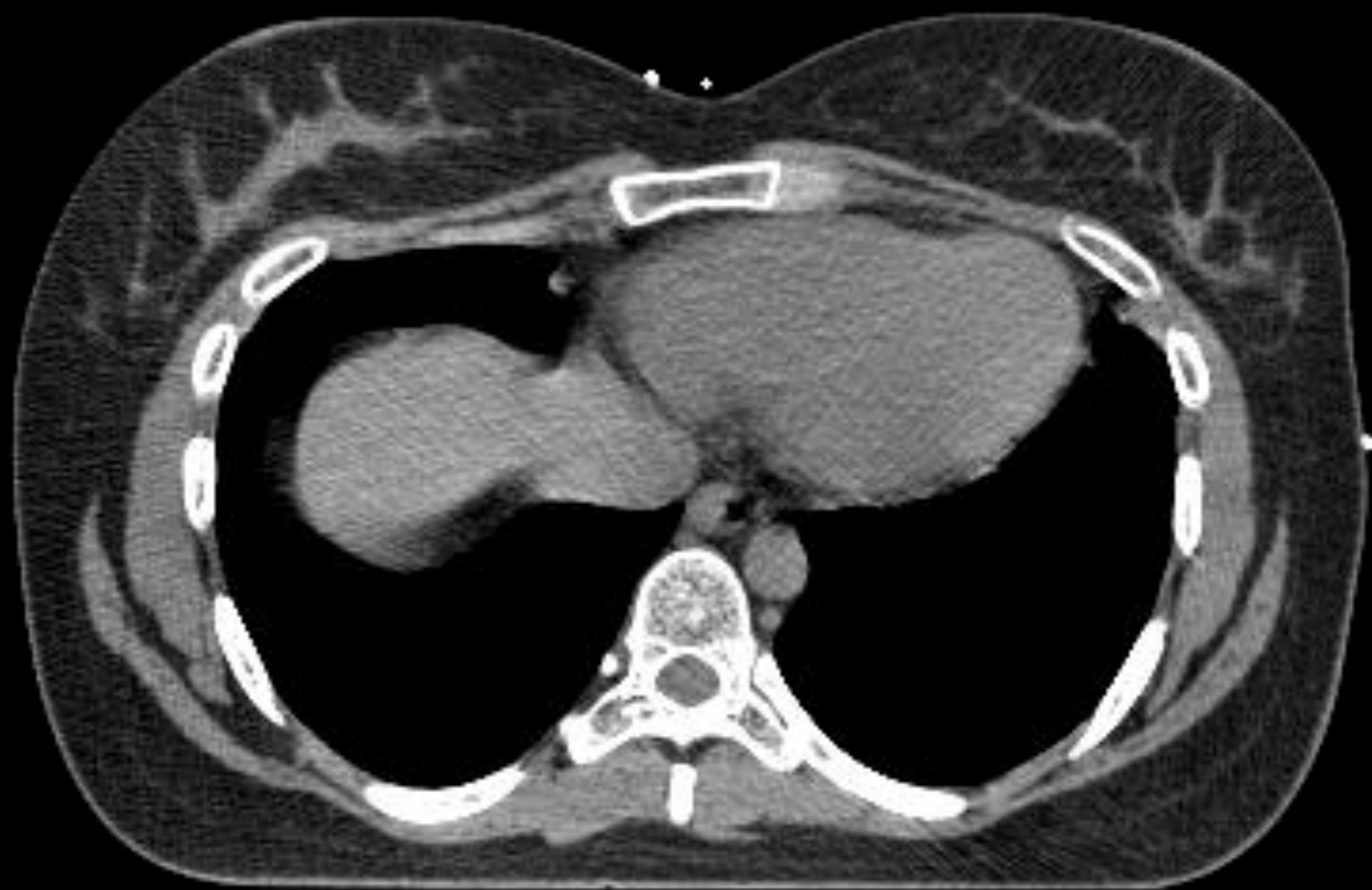
What if You Had Cancer?

Symptoms
Imaging
Diagnosis
Treatment
“Cut Poison Burn”

Imaging

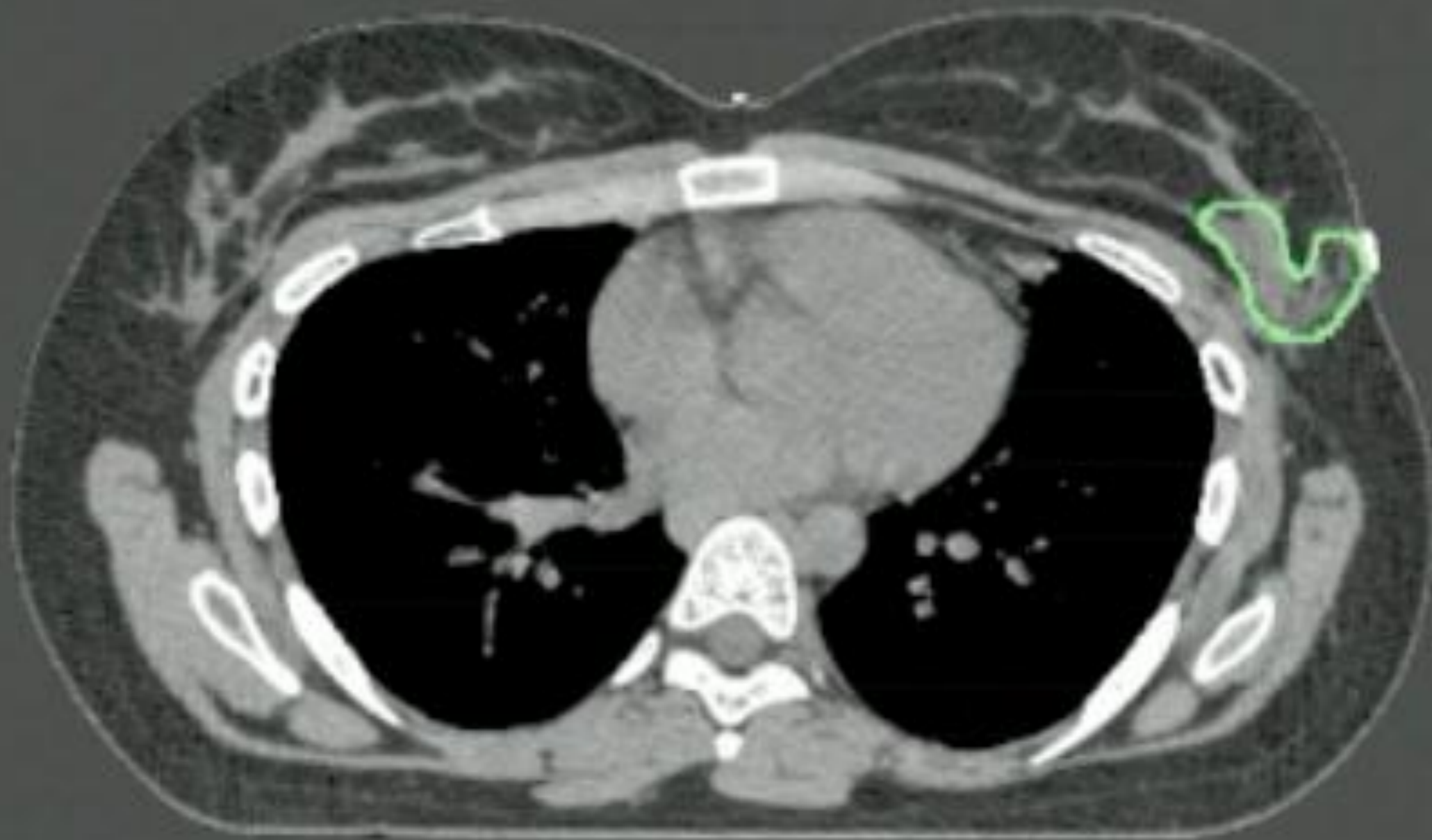




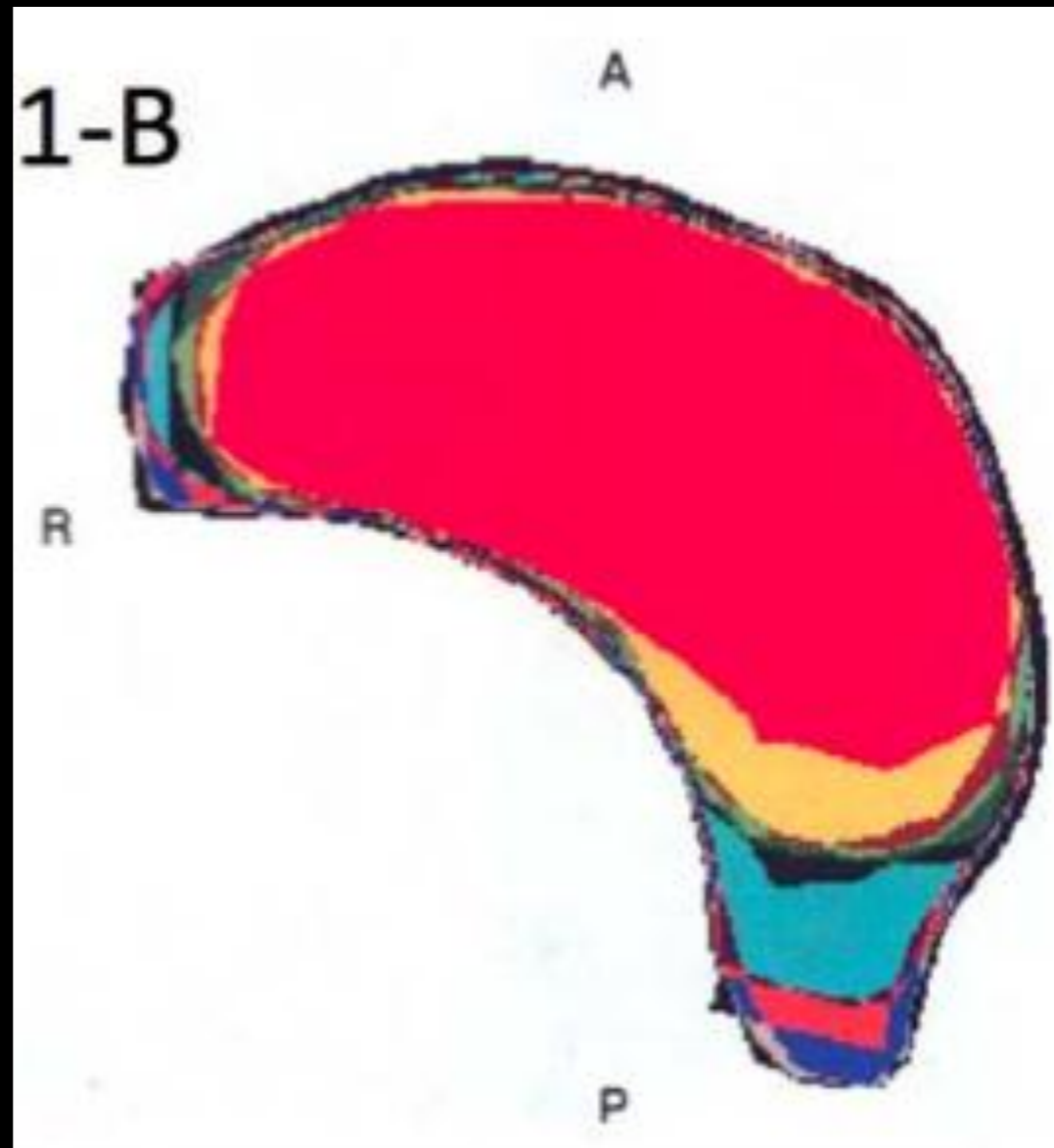




Diagnosis



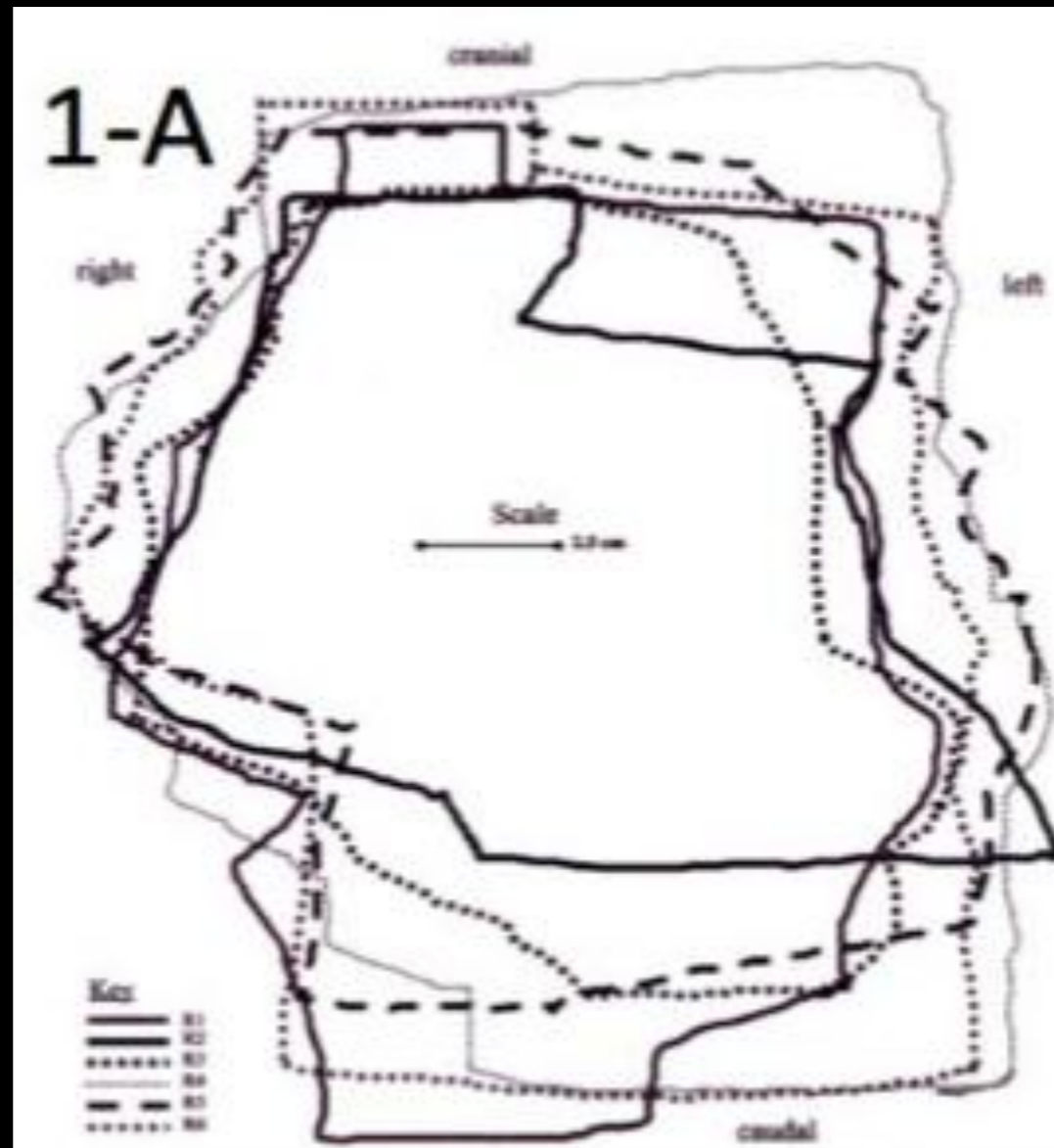
Breast Cancer



17.5% variation

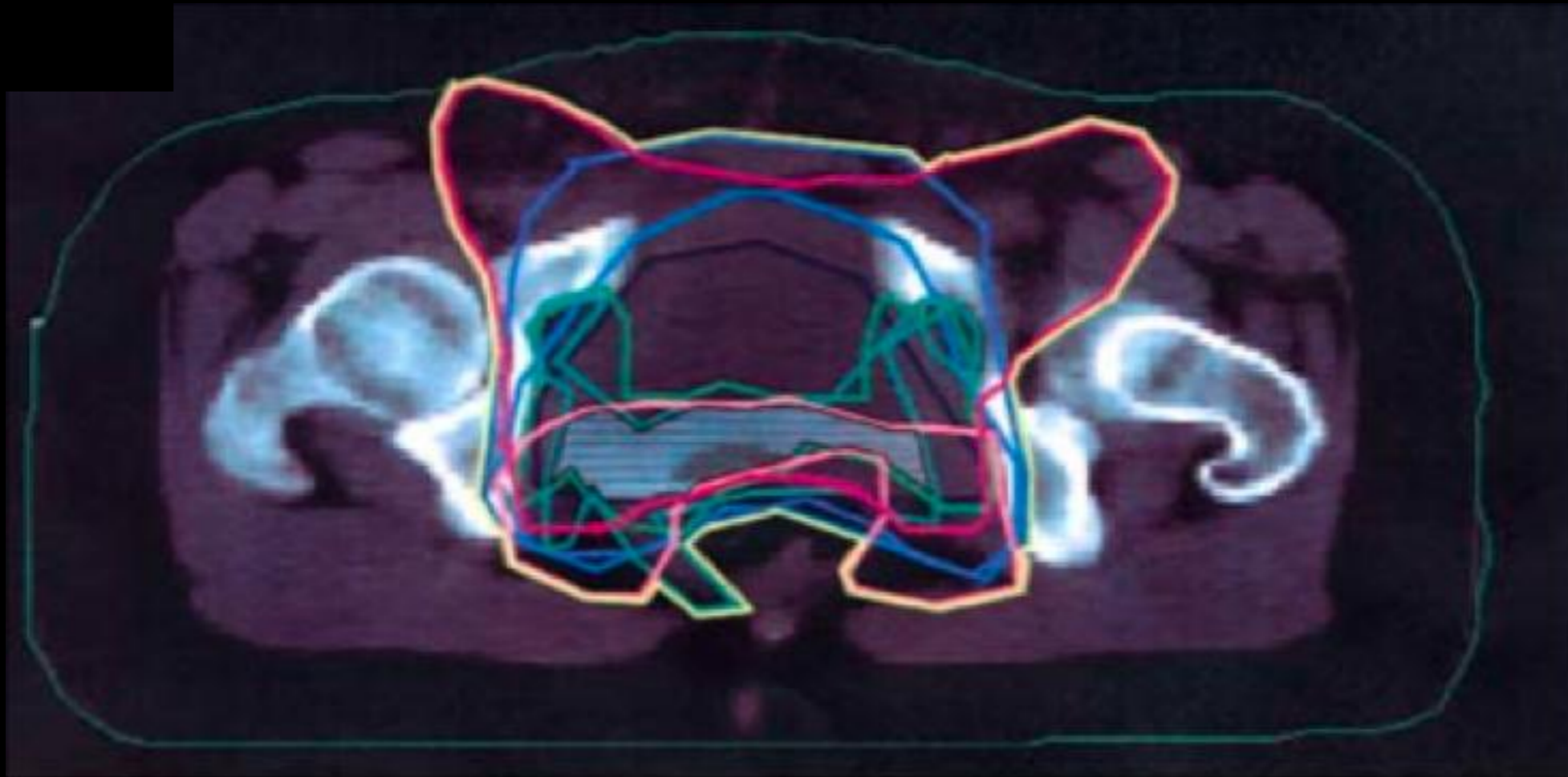
Hurkmans et al.
(2001)

Lung Cancer



Factor of 2

Cervical



3-4x variation

Weiss & Hess (2003)

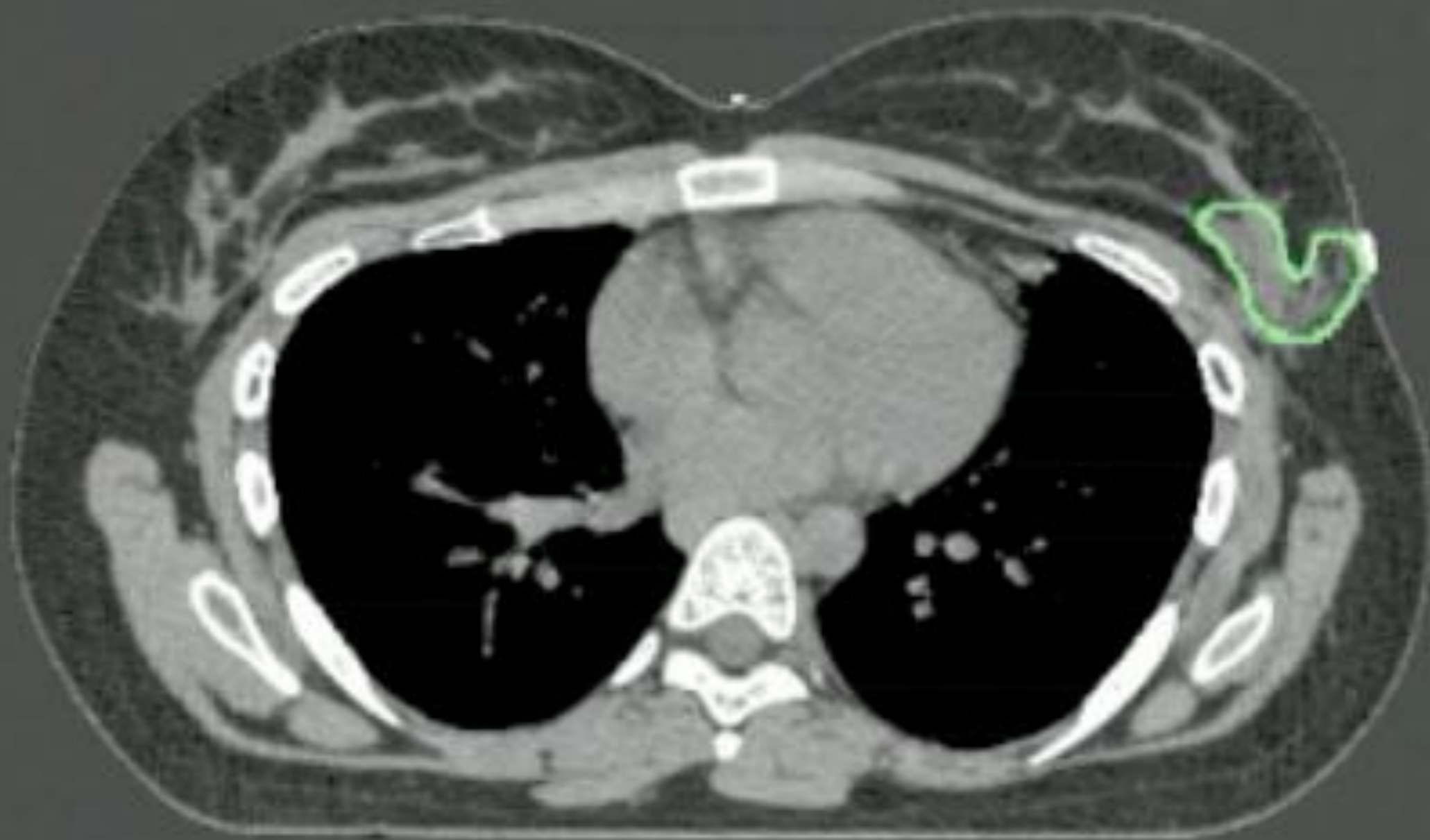
Treatment



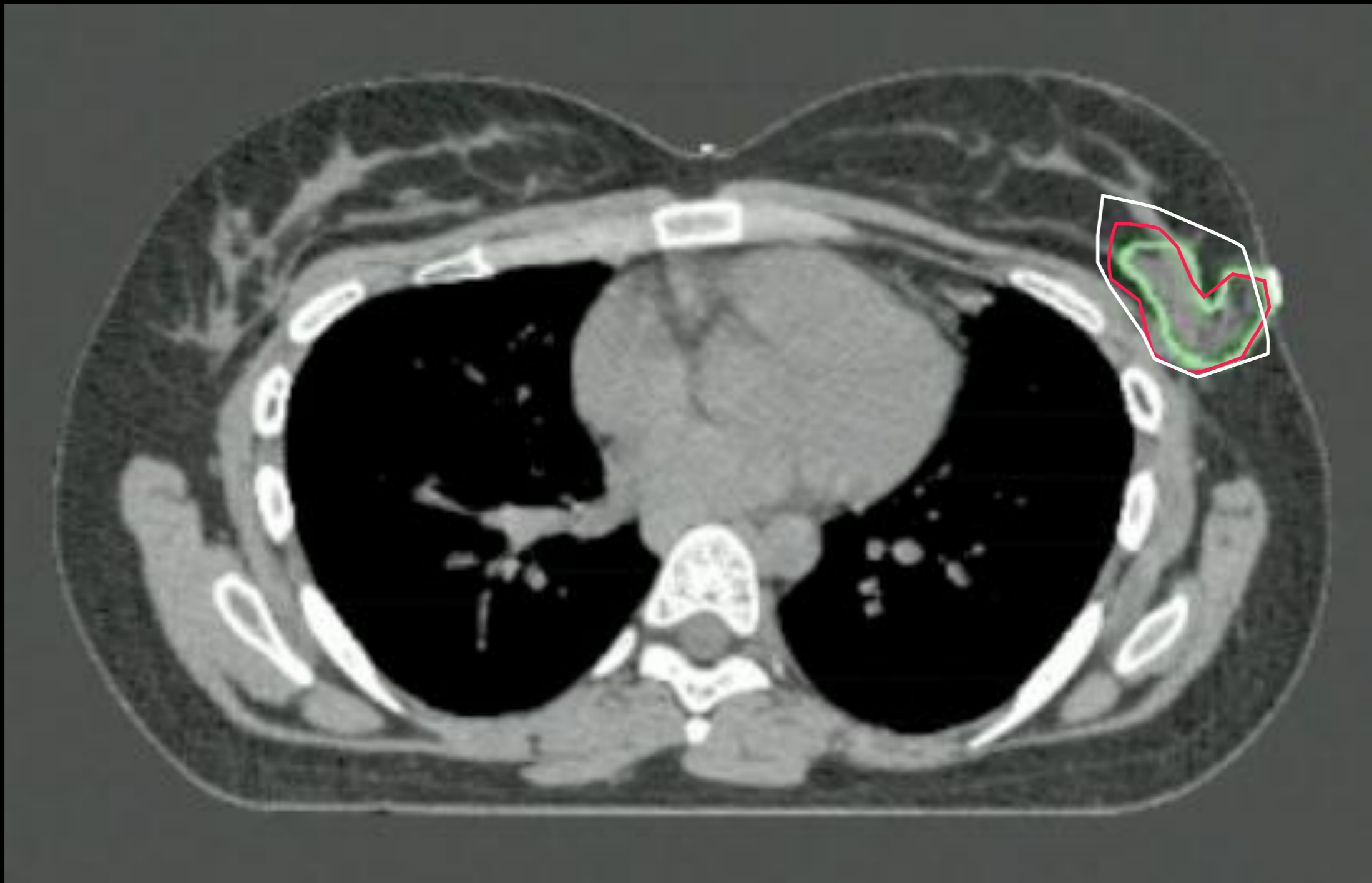
This is not good for patients.

Imagine instead....

Diagnosis



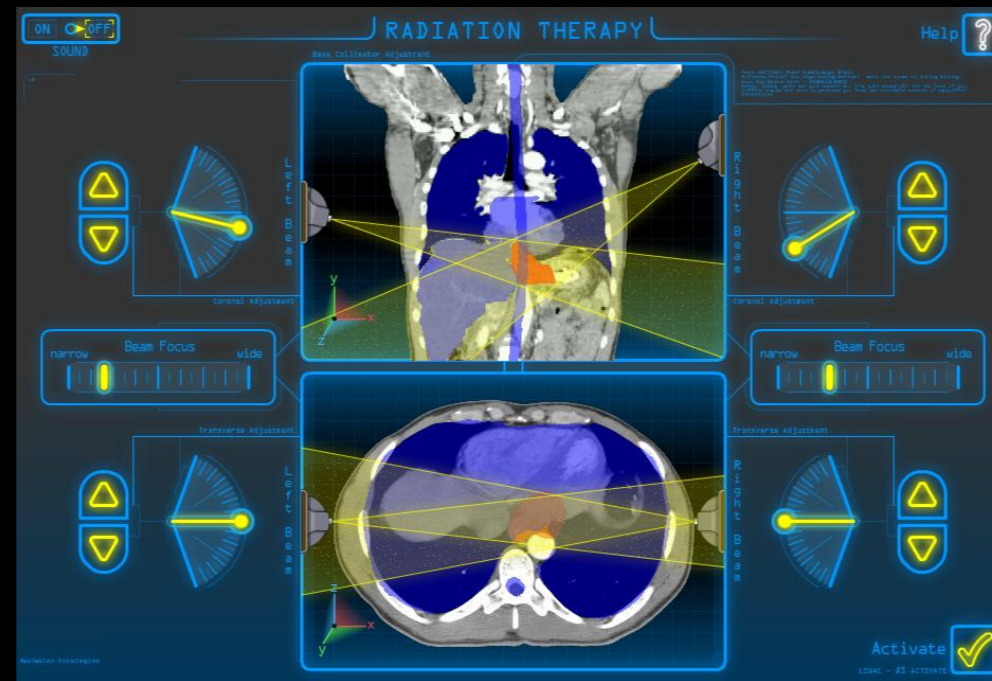
Diagnosis



Imagine getting not a second
or third opinion, but a doctor
working with 2 million
opinions.

Radiologists
& Doctors

General
Public



Medical
Training

Children
& Youth

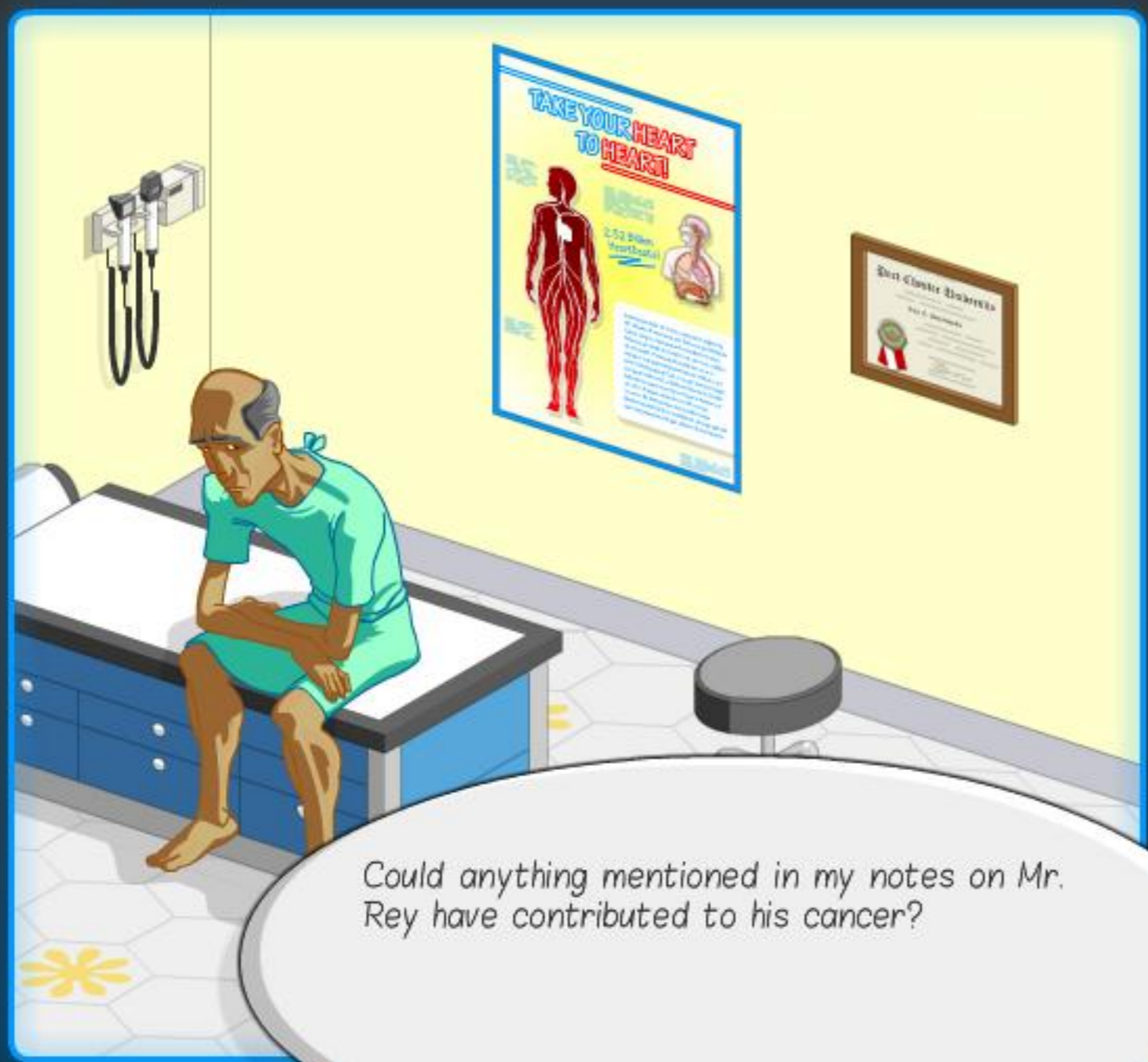
SINGLE PLAYER PROTOTYPE



Symptoms
Imaging
Diagnosis
Treatment

ON OFF
SOUND

PATIENT CONSULTATION



Could anything mentioned in my notes on Mr. Rey have contributed to his cancer?

Navigation: MEDICAL HISTORY • PHYSI...

Has suffered from reflux discomfort for 10 years

- Hypertension
- Treated for prostate cancer 10 years ago

OK

ON OFF

SOUND

CONTOURING

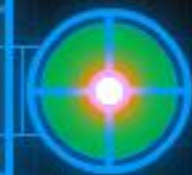
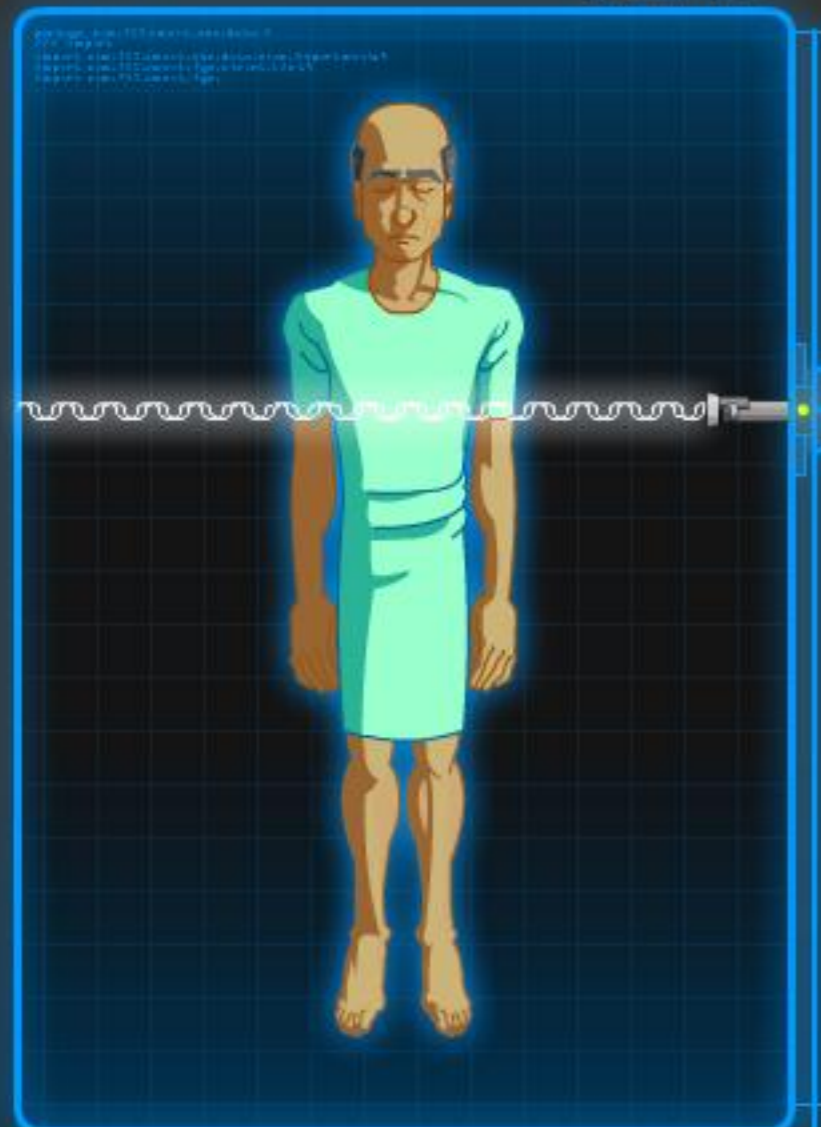
Help



Coronal View

Transverse View

Patient ID: Mr. Rey



Cancer Proximity

Repetitively Scan! No T11, T12, or T13. Repeated

Small illegible text in the bottom right corner of the transverse view panel.

CT Scan Adjustment:



Transverse Scan Efficiency: 99.00%

Target Marker



Target Eraser



Standard View

Enhanced View



Submit



ON OFF

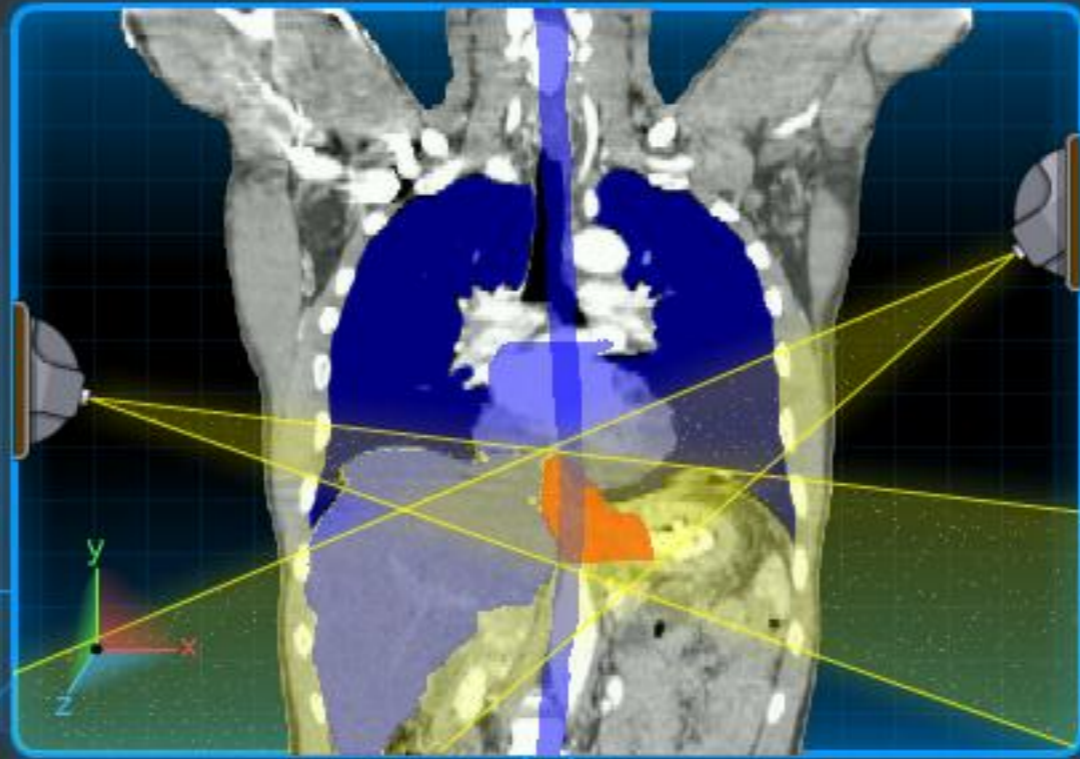
SOUND

RADIATION THERAPY

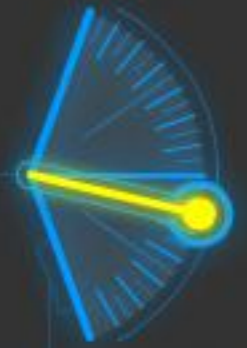
Help



Beam Collimator Adjustment



This software must always be used in accordance with the instructions for use. It is not intended for use in the treatment of patients with severe or life-threatening conditions. The user must be aware of the risks associated with the use of this software. The user must be aware of the risks associated with the use of this software. The user must be aware of the risks associated with the use of this software.



Coronal Adjustment



Coronal Adjustment

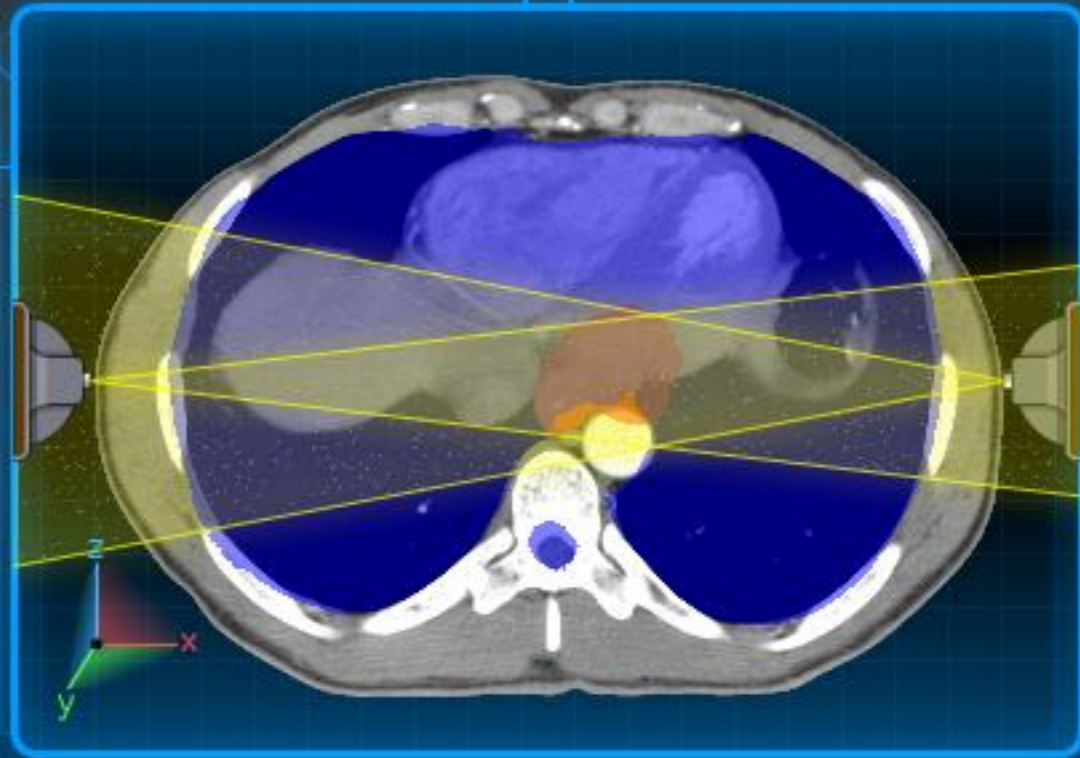
Beam Focus

narrow wide

Beam Focus

narrow wide

Transverse Adjustment



Transverse Adjustment

Activate



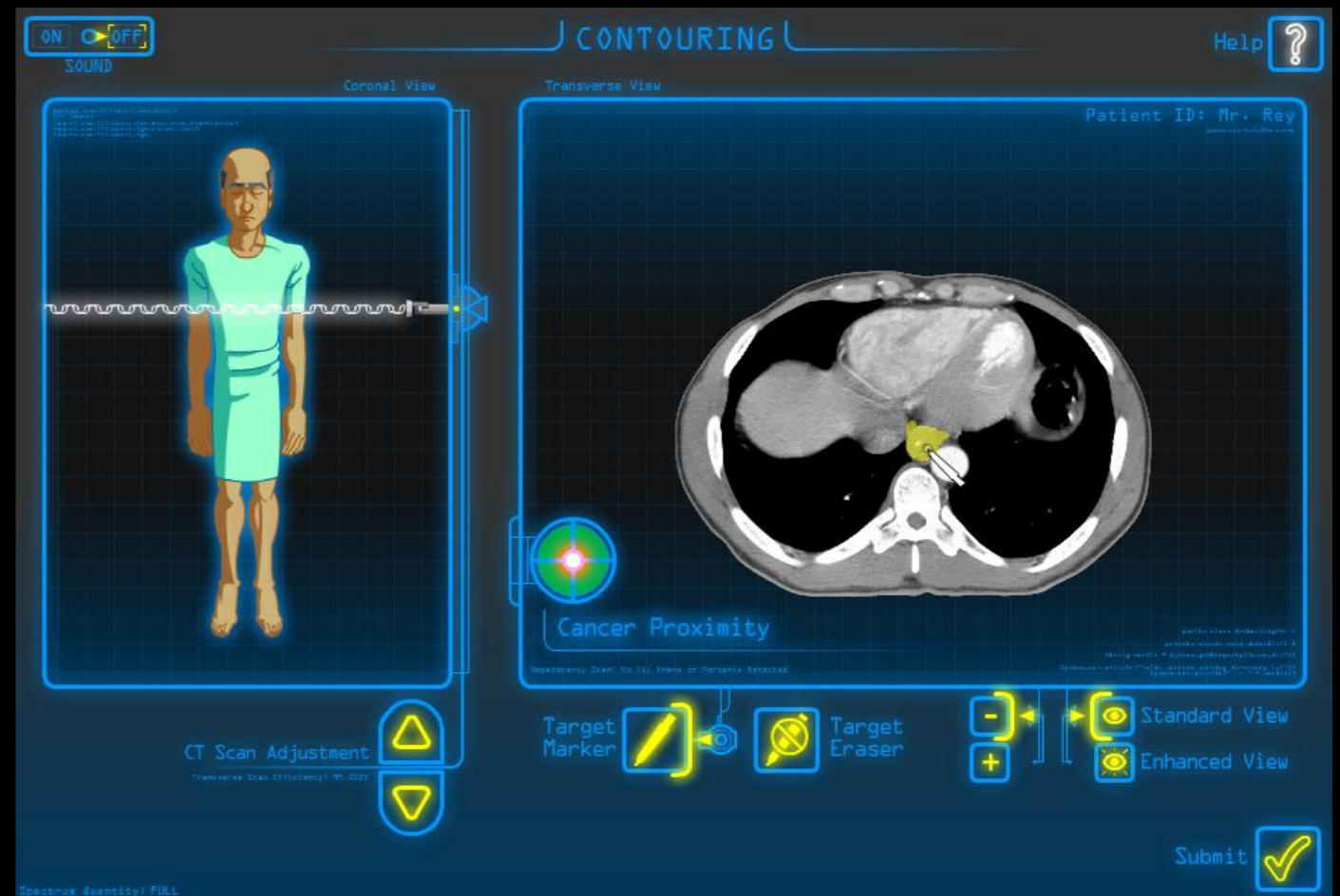
LINAC - 45 ACTIVATE

Would kids play this?

Will they learn anything?

Exploratory Study

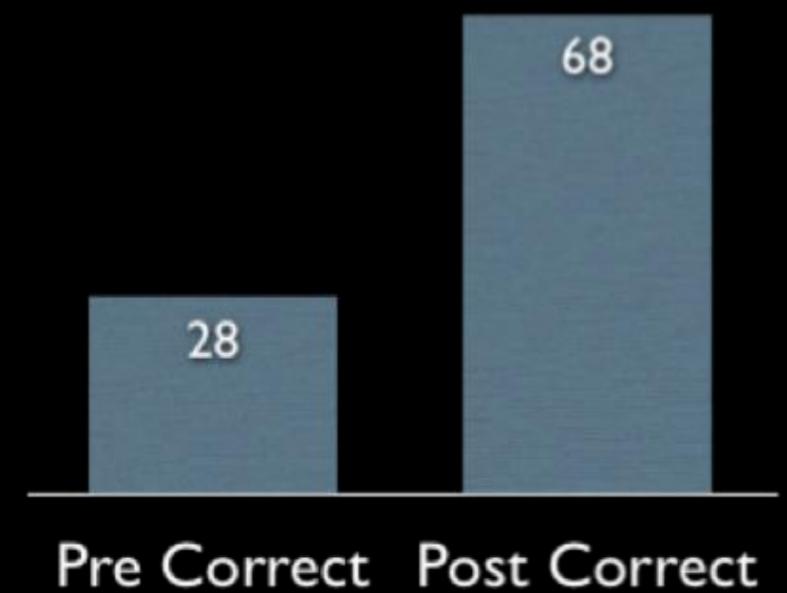
- Participants:
- 69 students (12 to 20)
- Format:
 1. Pre-test
 2. Oncology
 3. Post-test



What does a radiologist do?

Open-ended, $\chi^2 (1, N = 69) = 38.03, p < .001$

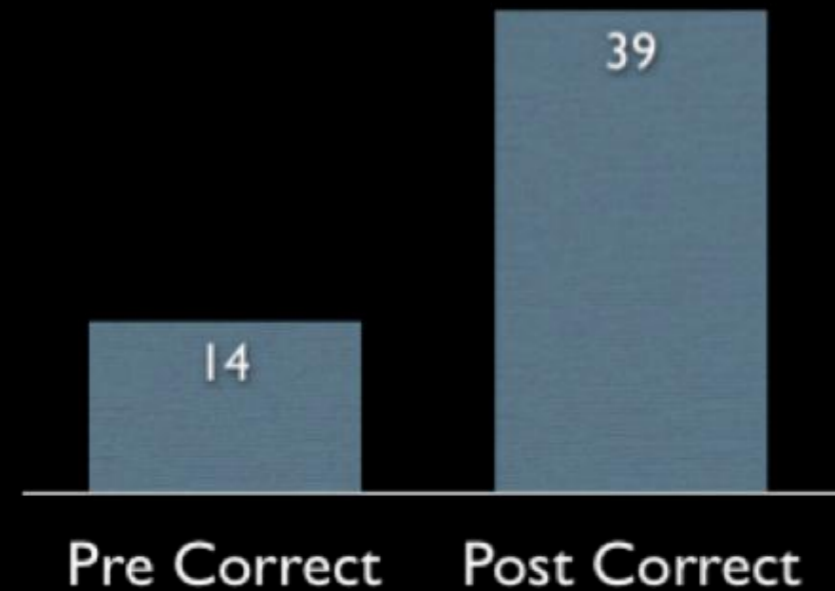
Pre Correct: 28, Post Correct: 68



Contouring a cancerous tumor

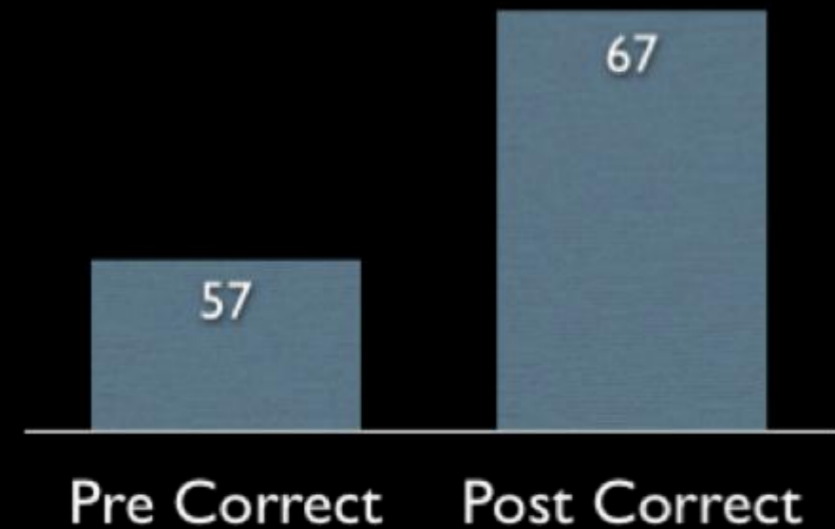
$\chi^2 (1, N = 69) = 17.46, p < .001$

Pre Correct: 14, Post Correct: 39



What is difficult about radiotherapy?

$\chi^2 (1, N = 69) = 9.03, p < .001$

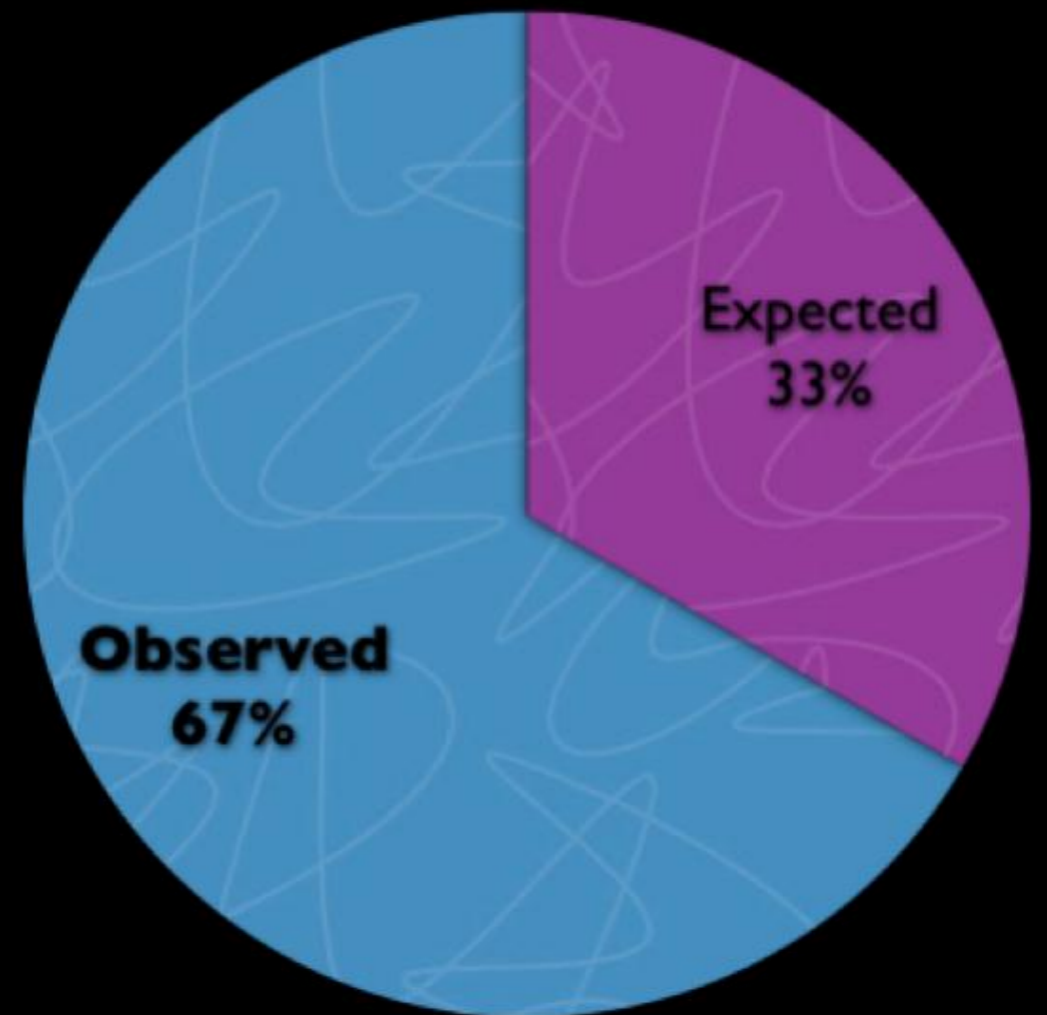


“It is hard to keep from exposing healthy tissue to radiation beams”

Playing APA taught me about treating cancer

$\chi^2 (2, N = 69) = 38.17, p < .001$

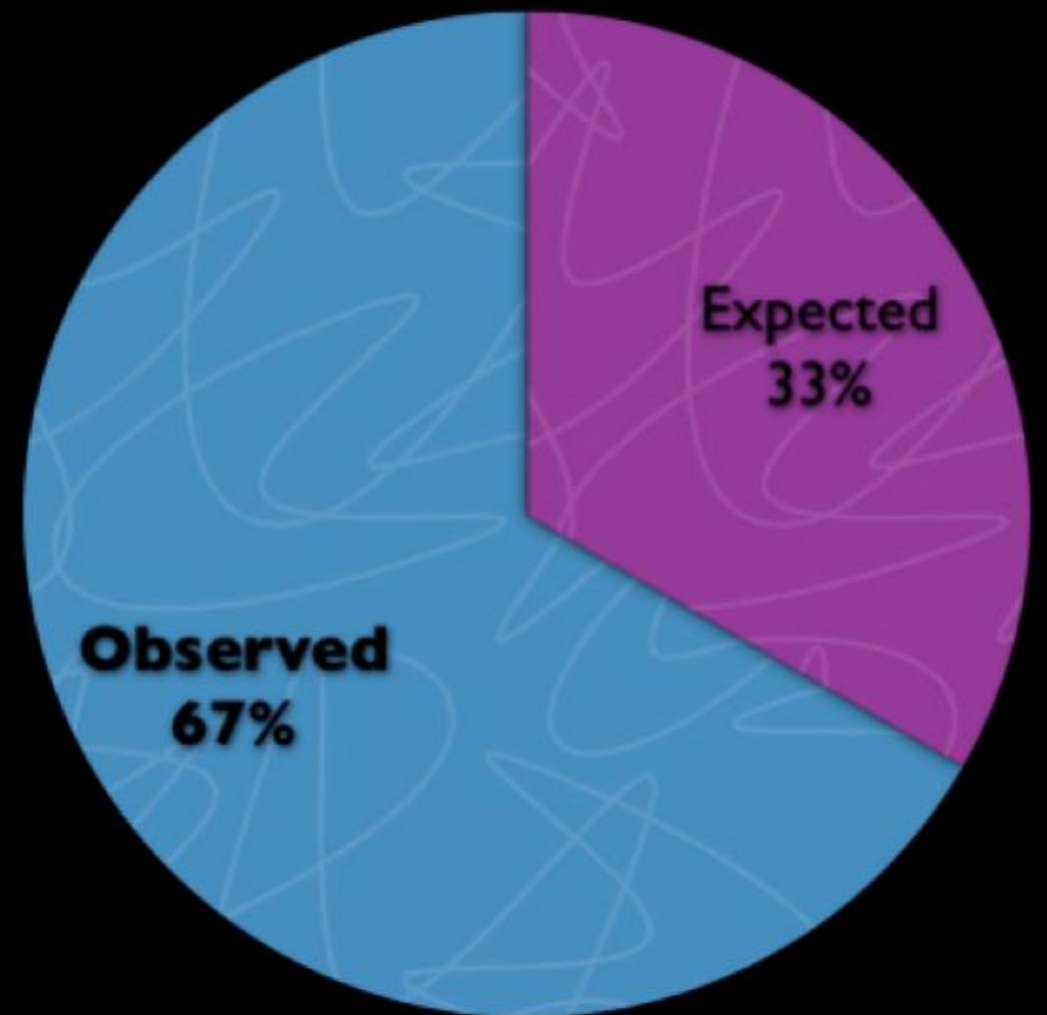
Observed: 46, Expected: 23



Playing APA taught me about contouring cancerous tumors

$\chi^2 (2, N = 69) = 37.13, p < .001$

Observed: 46, Expected: 23



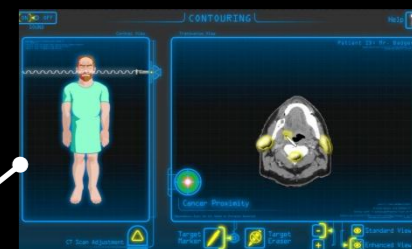
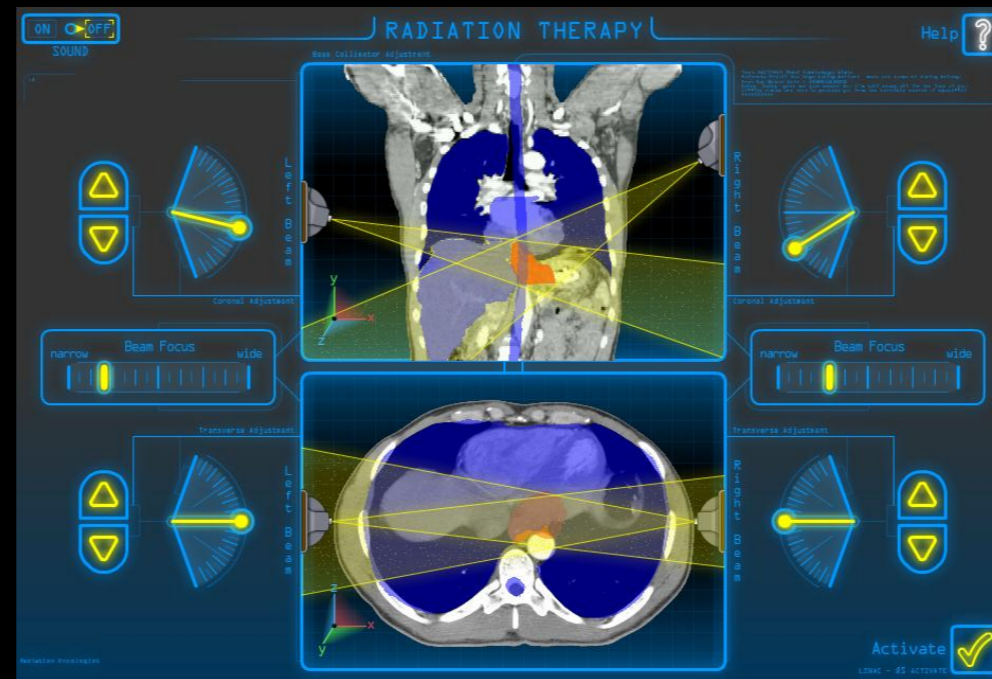
Students indicated a **highly significant increase in interest medical professions** ($M = 2.93$, $SD = 1.38$) compared to pre-gameplay ($M = 2.58$, $SD = 1.25$), $t(69) = 4.11$, $p < .001$

With training, I could be a good doctor.

Females' indicated a **significant increase in future medical/professional confidence** ($M = 3.89$, $SD = 1.16$) as compared to pre-game-play ($M = 3.48$, $SD = 1.37$), $t(27) = 2.28$, $p < .0125$

Radiologists
& Doctors

General
Public

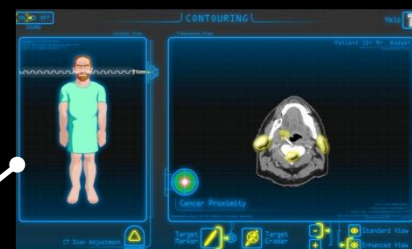
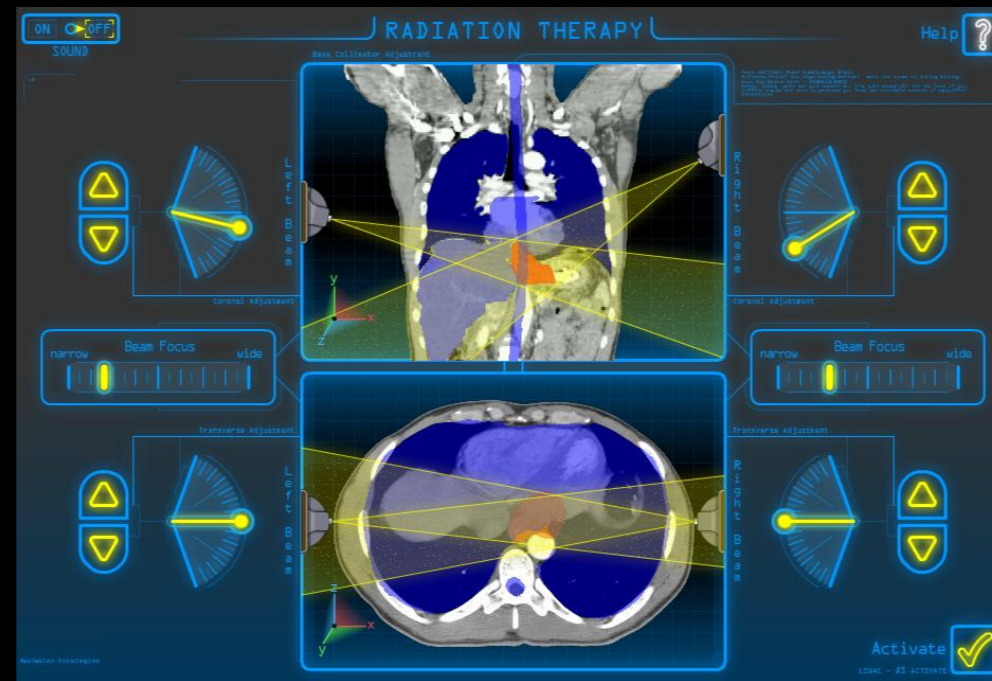


Medical
Training

Children
& Youth

Radiologists & Doctors

General Public



Children & Youth

Medical Training

COMPUTER

v0.01

TOOLS

Current image: #3



I'M DONE

TEMPORARY BADGE

Nathan
Liam
Sarah
Morgan

CURRENT ROOM

OFFICE

BACK

0 credits - Get info
Your free credits expire soon

Games
More

Sponsored Story

Danielle Elizabeth likes Battlefield.



Battlefield
Like

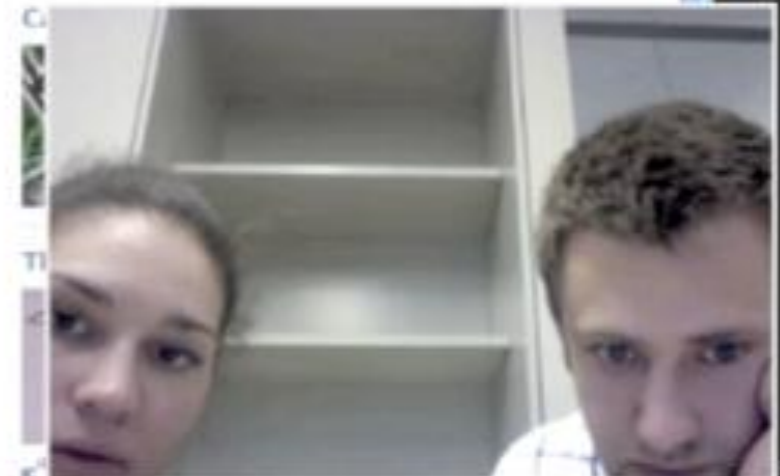
Sponsored

Create an Ad

Levi's® WaterTank



Tweet. Check in. Pledge. Complete simple challenges and unlock water for communities in need. Play the Levi's® Watertank Game Now!



BACK TO CASES



CURRENT CASE INFO

- Games
- apa_beta
- J-Anat
- More +

Sponsored Stor



Sponsored

Chalmers Jewe



Like · 542 peo

Play Zynga's Ne

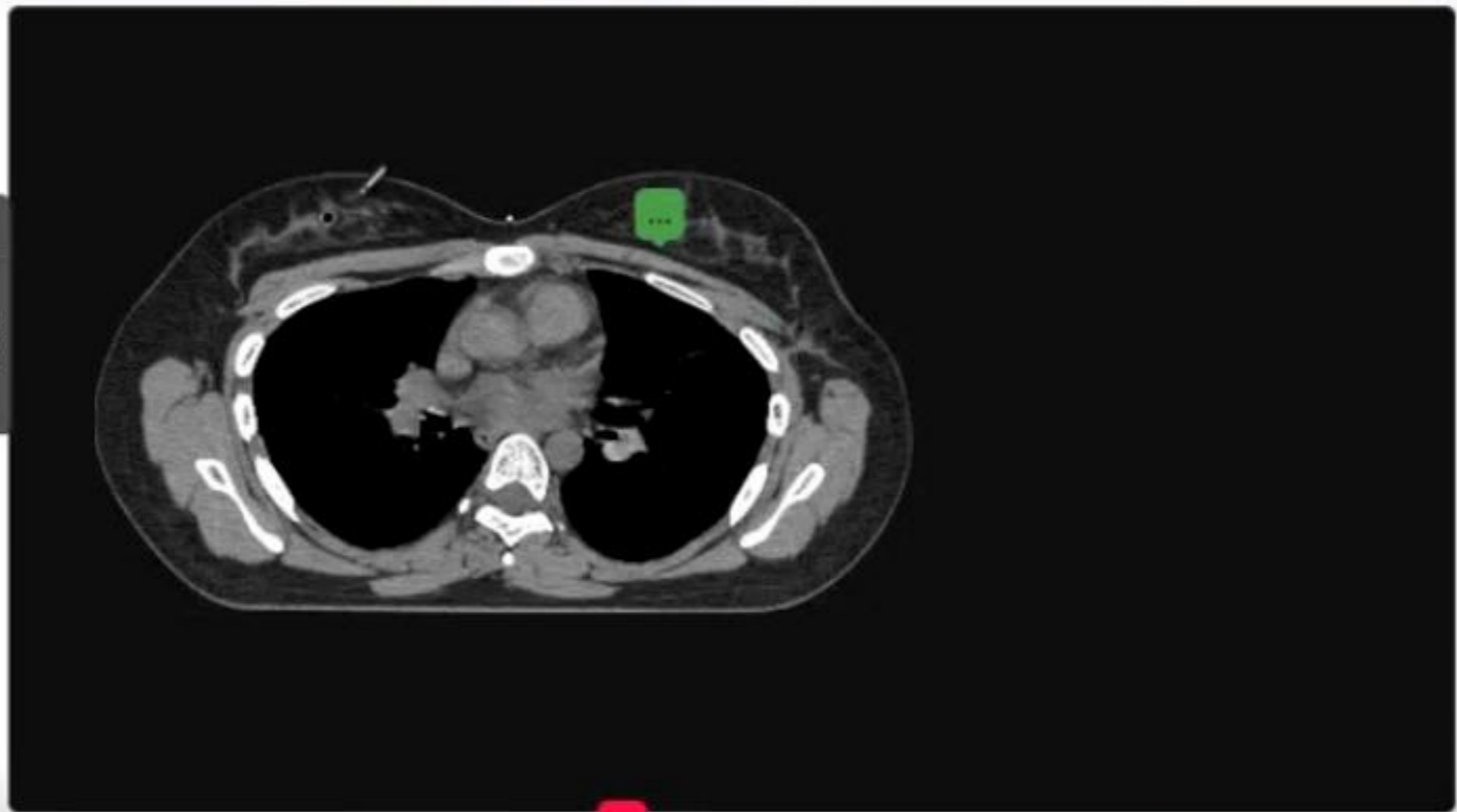


Ultimate Tower



Rebecca Hafema

CHAT



TEAM (4)

ONLINE (0)

FRIENDS (0)

LAYER: 1 2 3 4

I'M DONE

SCORE IT!



INVITE FRIENDS

HIDE DRAWINGS

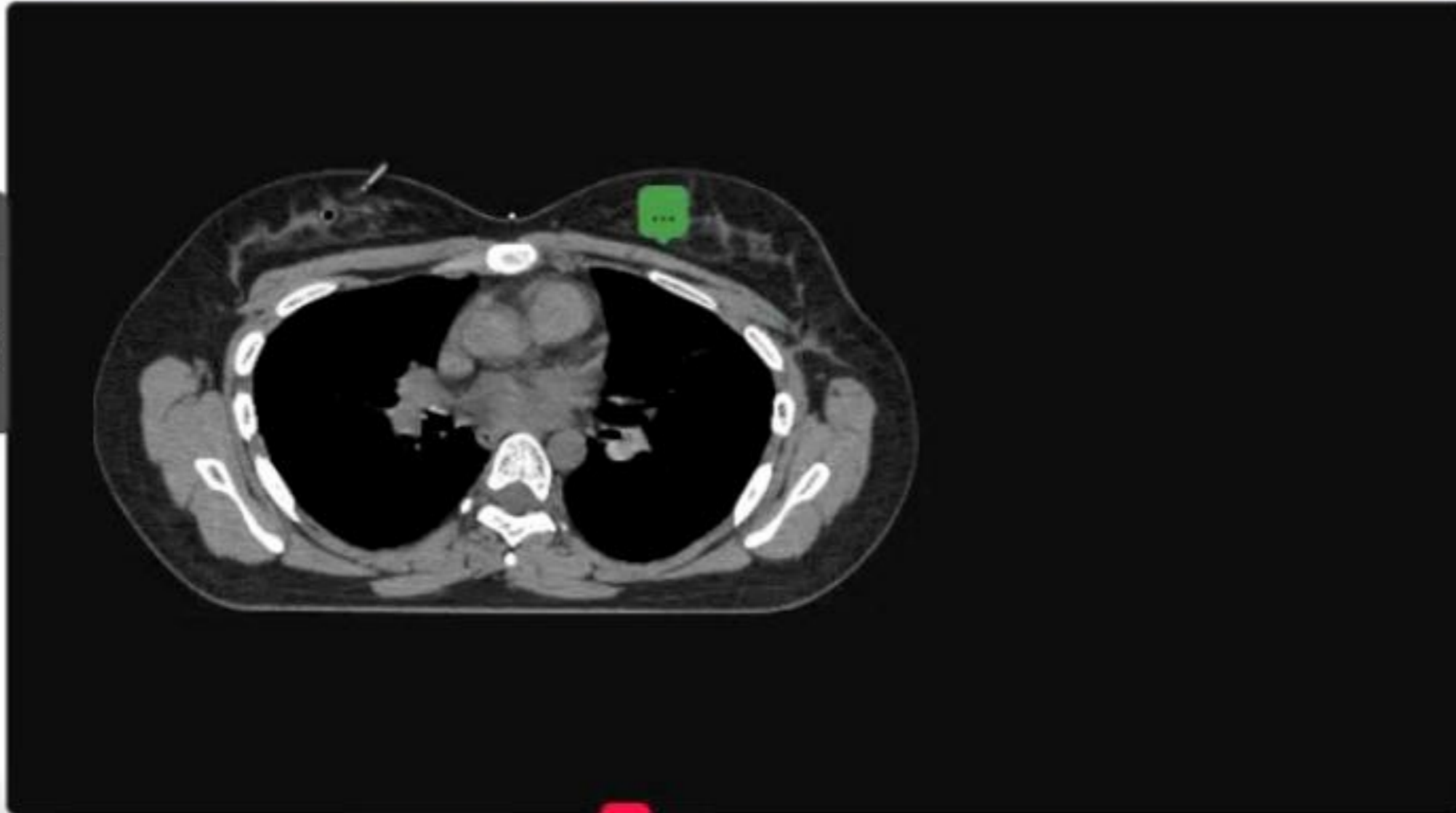
RESET DRAWING

BACK TO CASES



CURRENT CASE INFO

CHAT



TEAM (4)

ONLINE (0)

FRIENDS (0)

LAYER: 1 2 3 4

I'M DONE

SCORE IT!



INVITE FRIENDS

HIDE DRAWINGS

RESET DRAWING

- Games
- apa_beta
- J-Anat
- More +

Sponsored Stor



Sponsored

Chalmers Jewe



Like · 542 peo

Play Zynga's Ne



Ultimate Tower



Rebecca Hafema

COMPUTER

v0.01

TOOLS

Current image: #3



I'M DONE

TEMPORARY BADGE

Navigation icons for other rooms: Nathan, Sarah, Morgan

CURRENT ROOM
OFFICE **BACK**

0 credits - Get info
Your free credits expire soon

Games
More

Sponsored Story

Danielle Elizabeth likes Battlefield.



Battlefield
Like

Sponsored

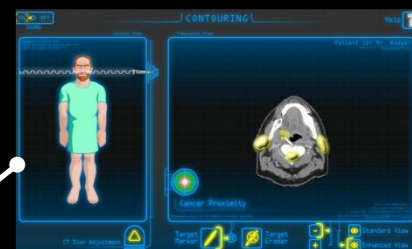
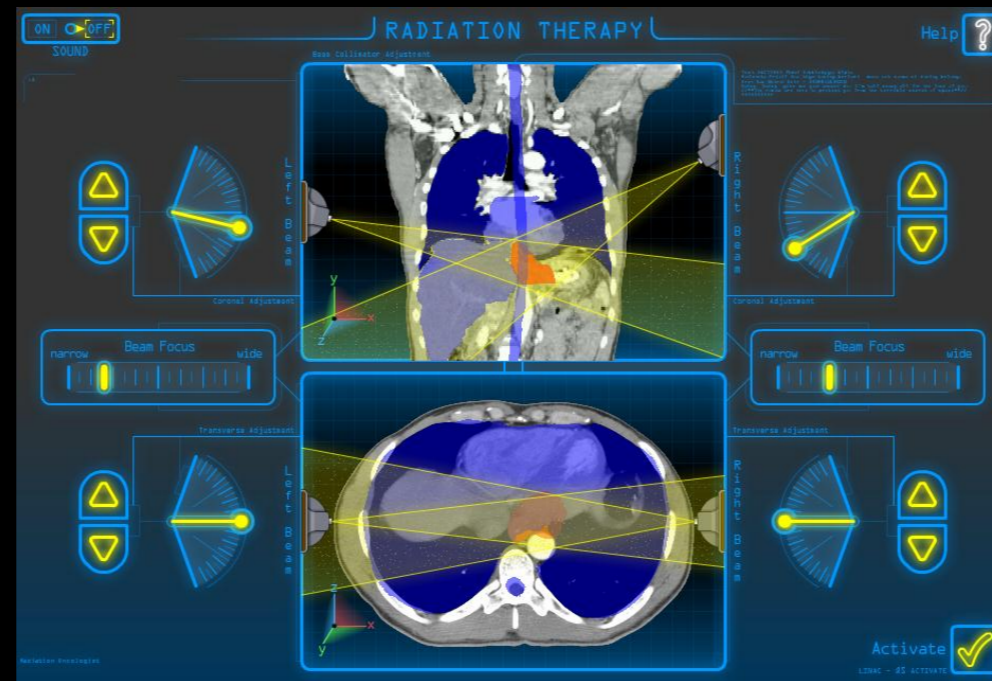
Create an Ad



Dr. Lonie Salkowski

Radiologists & Doctors

General Public

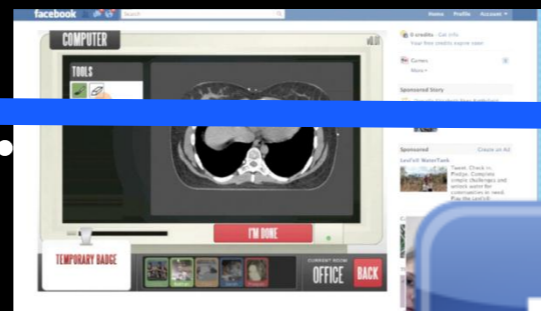
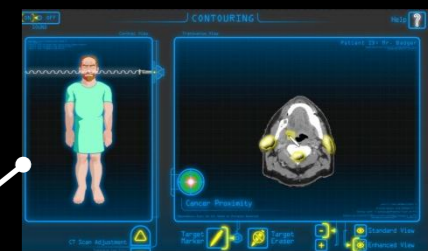
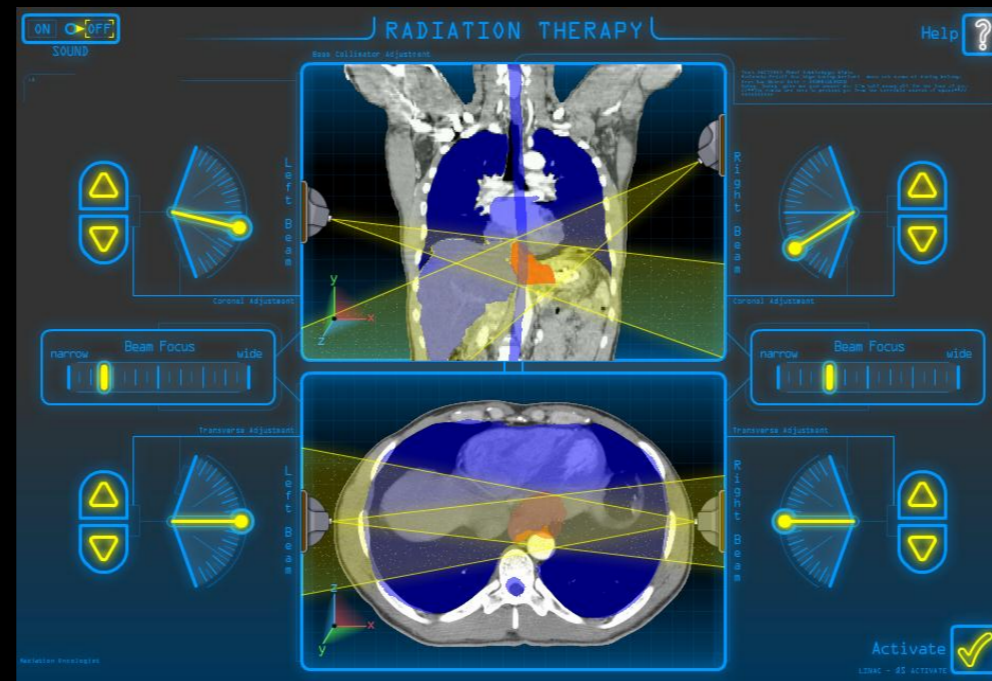


Medical Training

Children & Youth

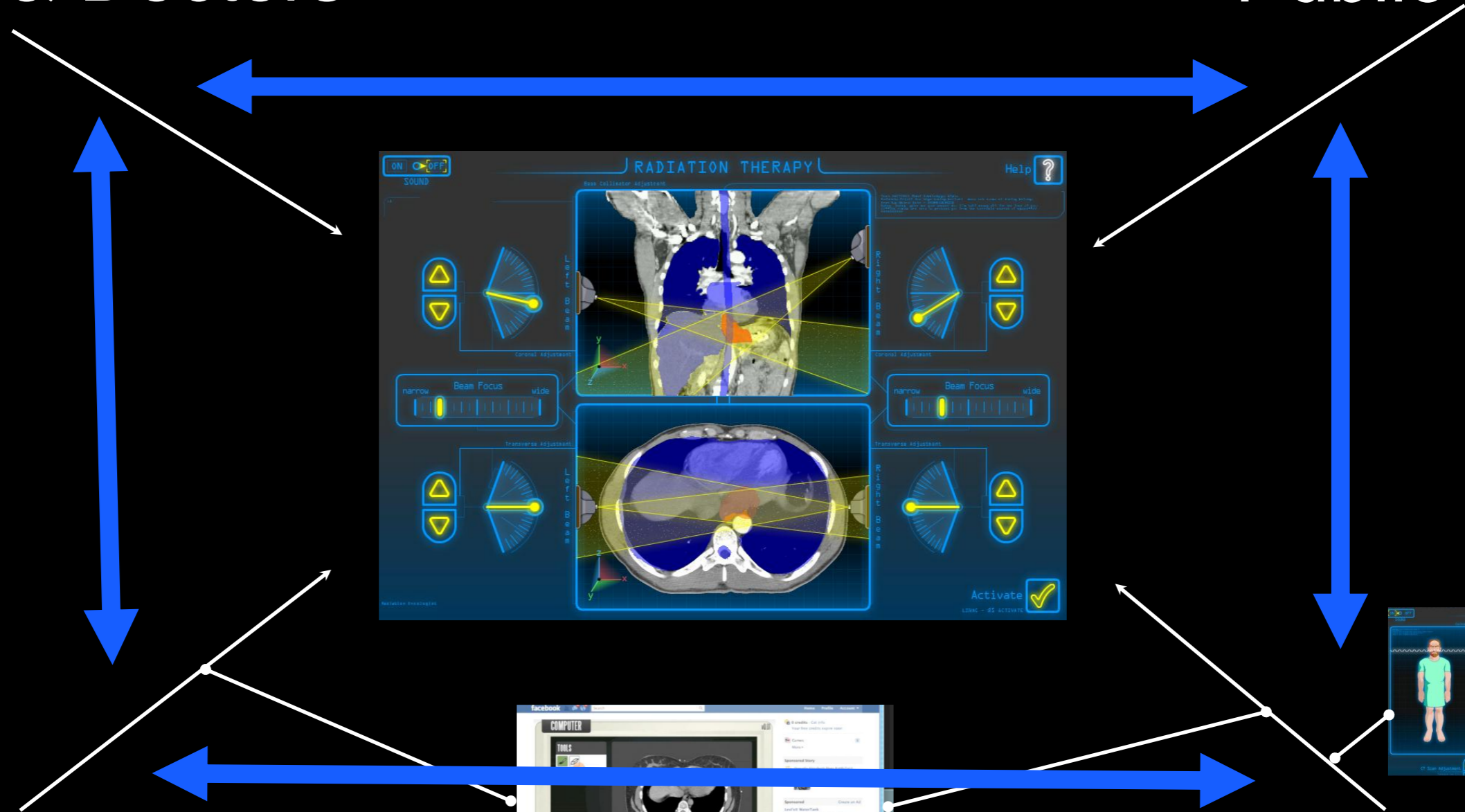
Radiologists
& Doctors

General
Public

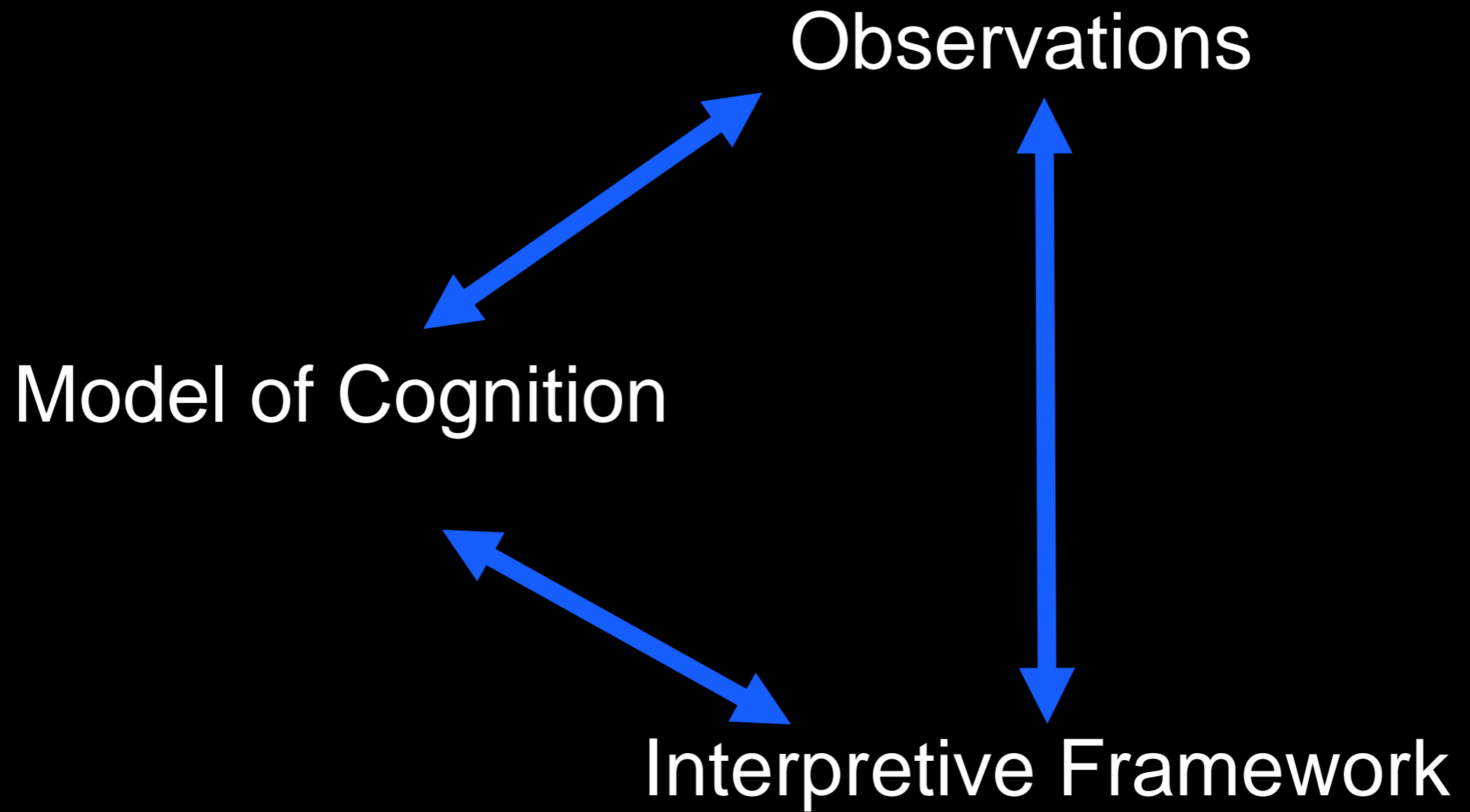


Medical
Training

Children
& Youth



- How might we assess learning?





100 Year's WAR Background QUIZ
(Get try to give your best answer, it's okay if you do not know the answer)

Name Jack

1. Who were the main countries involved in fighting the Hundred Years' War?
 - a. England and Germany
 - b. France and the Holy Roman Empire
 - c. Sweden and Denmark
 - d. America and England
 - e. France and England
2. Who was the King who was the main reason for the war?
 - a. King Henry VIII
 - b. Queen Isabella
 - c. King William I
 - d. King Edward III
 - e. There was no King involved.
3. When did the Hundred Years' wars take place approximately?
 - a. In the 1700's
 - b. After the Middle Ages
 - c. During the 14th and 15th Century
 - d. In the 16th and 17th Century
 - e. In the 18th and 19th Century
 - f. Never, Levi made them up
4. What was the Black death?

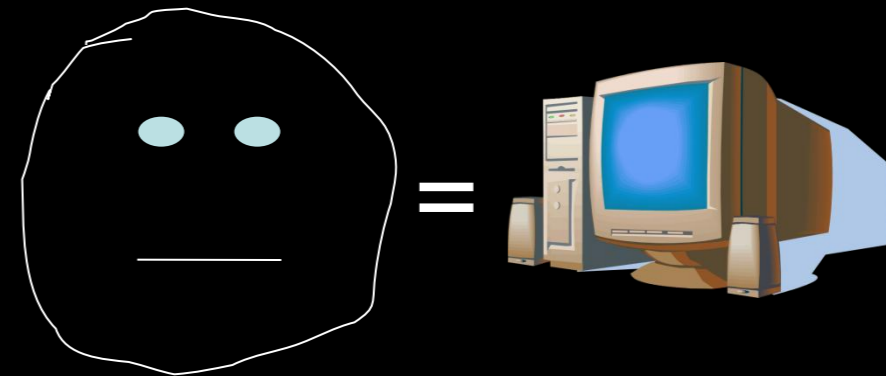
A Horse
5. What was the union of Kalmar?

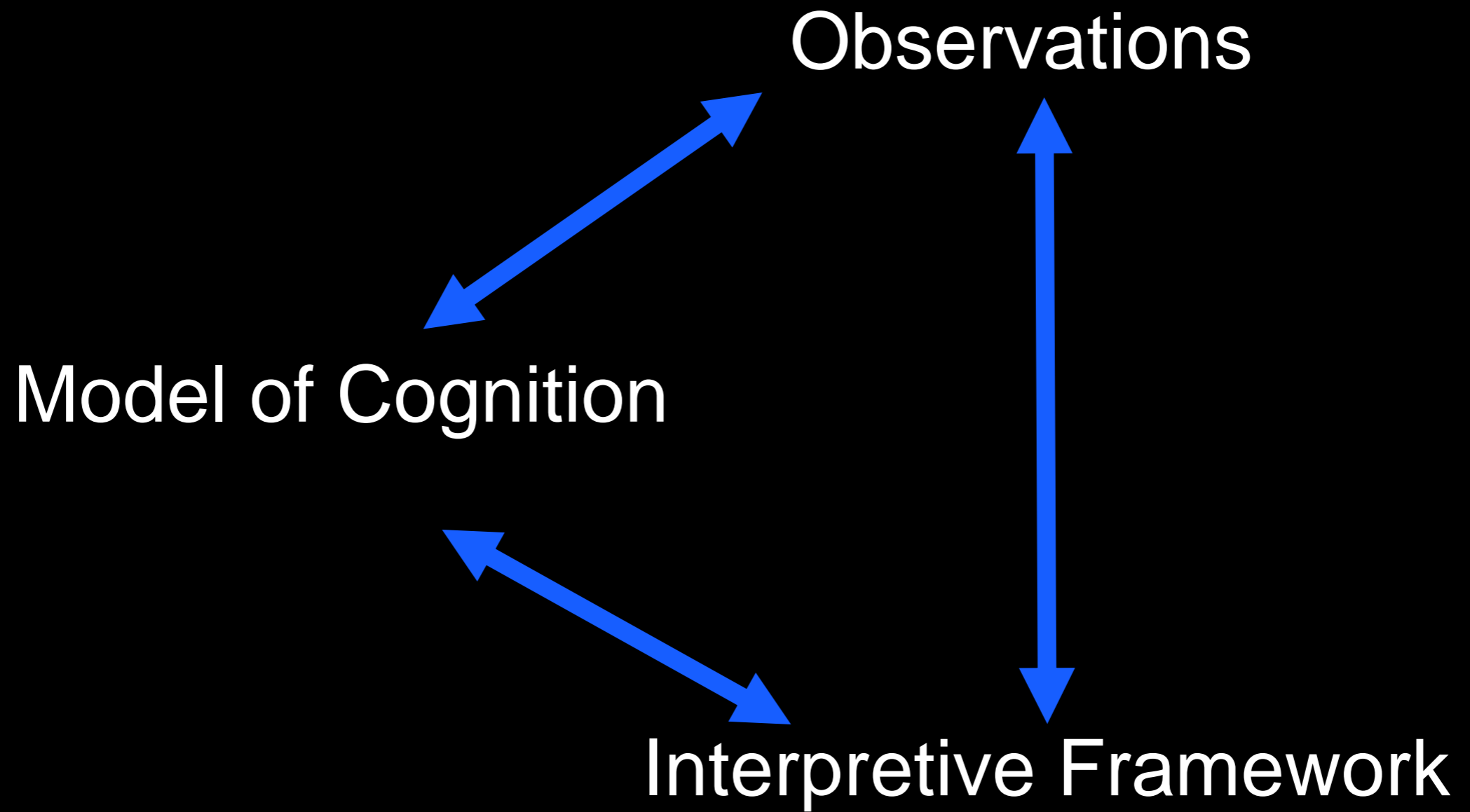
Don't know
6. Why did the 100 years' war begin?

people hated people
7. What were each sides' advantages in the Hundred Years' war? Why?

1 side had good warriors, one did not
8. How was the Holy Roman Empire in the middle ages different from the ancient Roman Empire?

The Holy Roman Empire
was to involved in "Romance"
and the Roman Empire was not.





- What assumptions are in this model?



100 Year's WAR Background QUIZ
(Get try to give your best answer, it's okay if you do not know the answer)

Name Jack

1. Who were the main countries involved in fighting the Hundred Years' War?
a. England and Germany
b. France and the Holy Roman Empire
c. Sweden and Denmark
d. America and England
e. France and England

2. Who was the King who was the main reason for the war?
a. King Henry VIII
b. Queen Isabella
c. King William I
d. King Edward III
e. There was no King involved.

3. When did the Hundred Years' wars take place approximately?
a. In the 1700's
b. After the Middle Ages
c. During the 14th and 15th Century
d. In the 16th and 17th Century
e. In the 18th and 19th Century
f. Never, Levi made them up

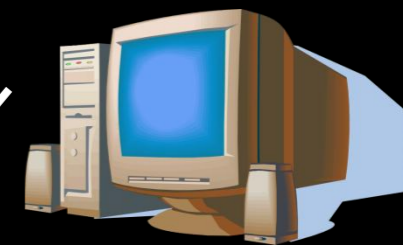
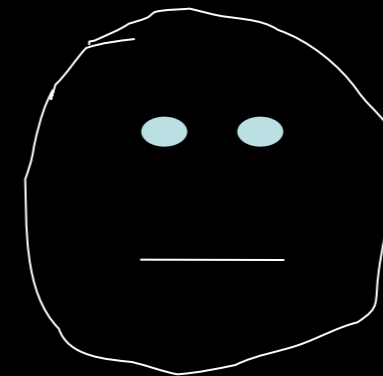
4. What was the Black death?
A Horse

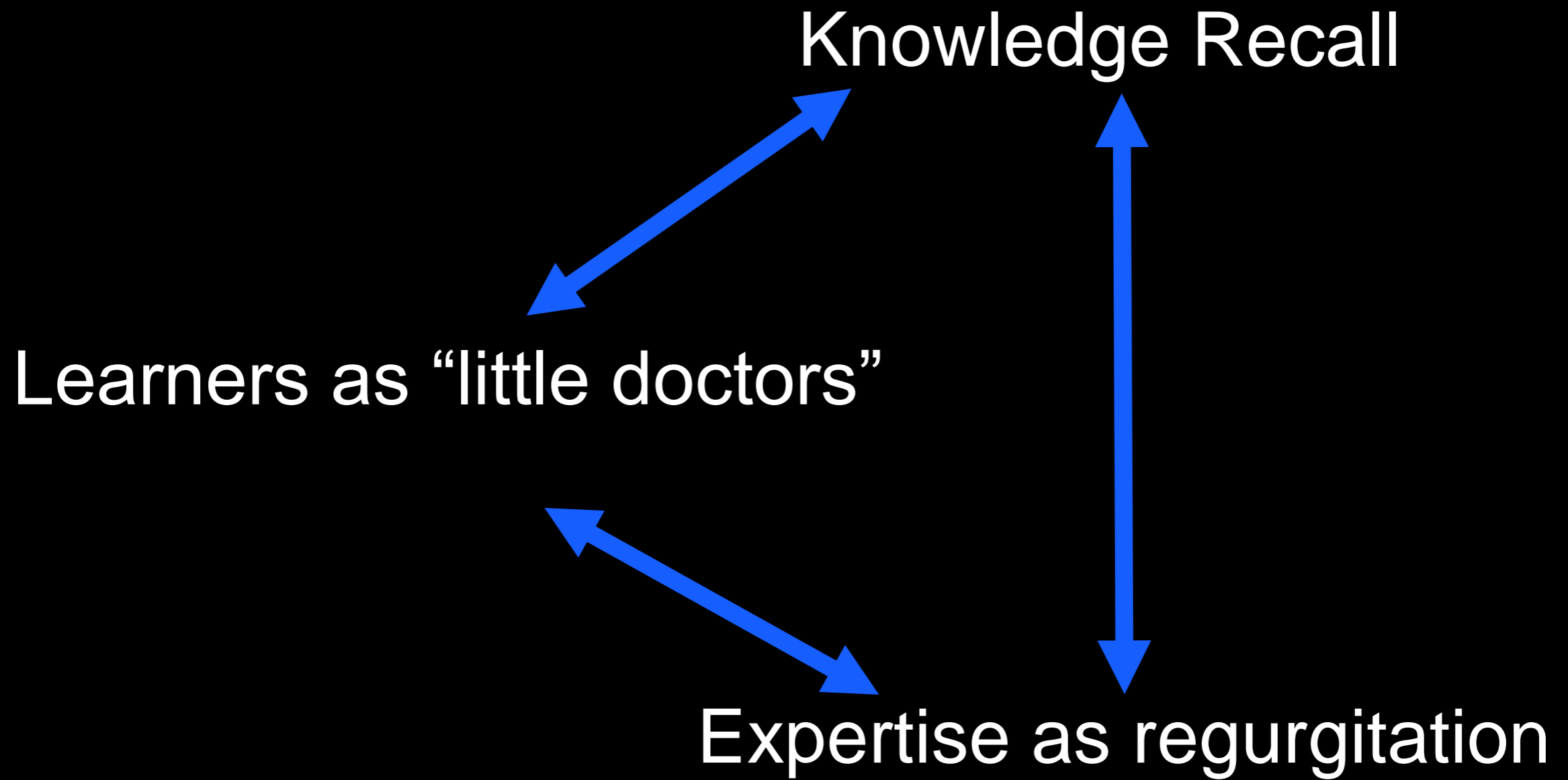
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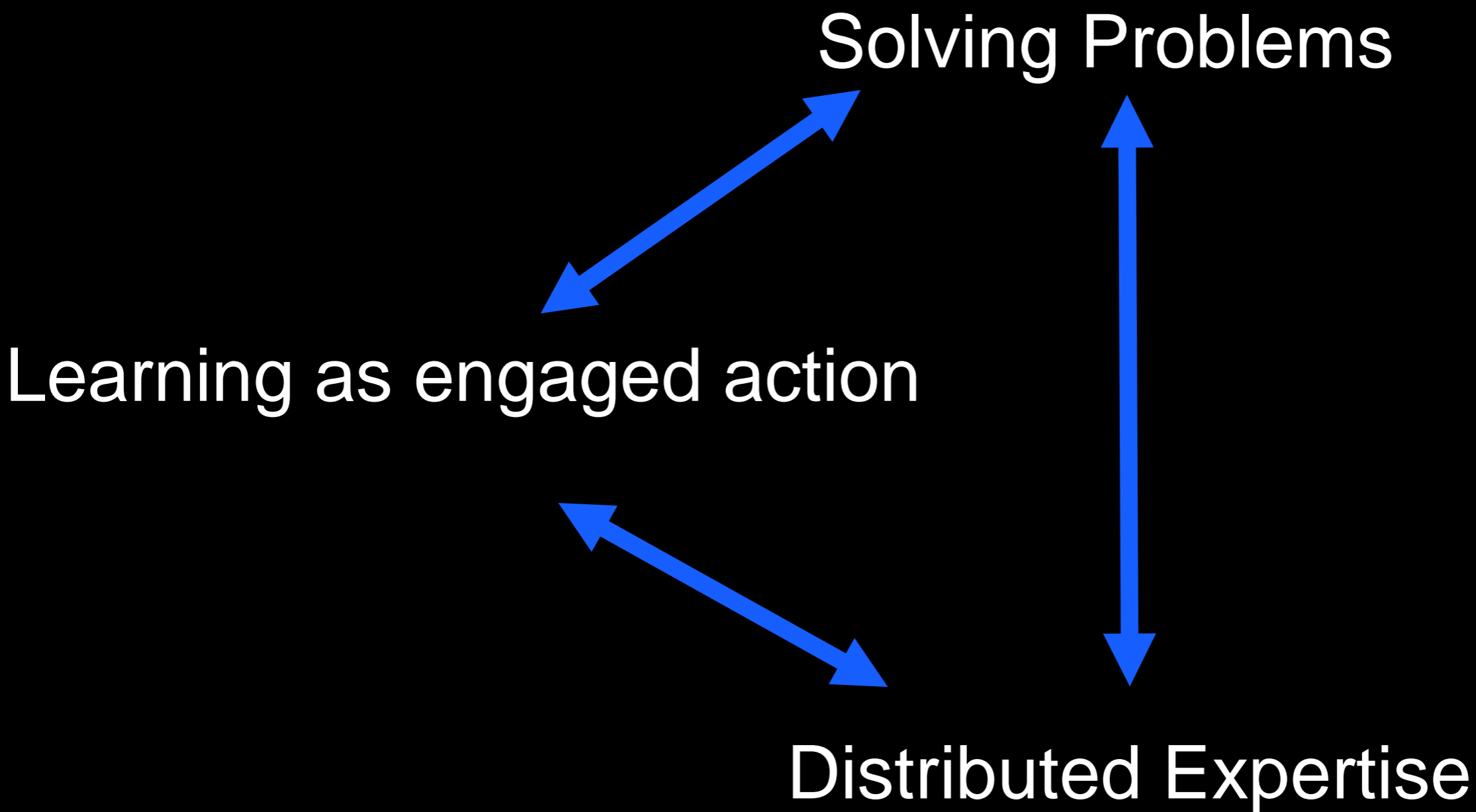
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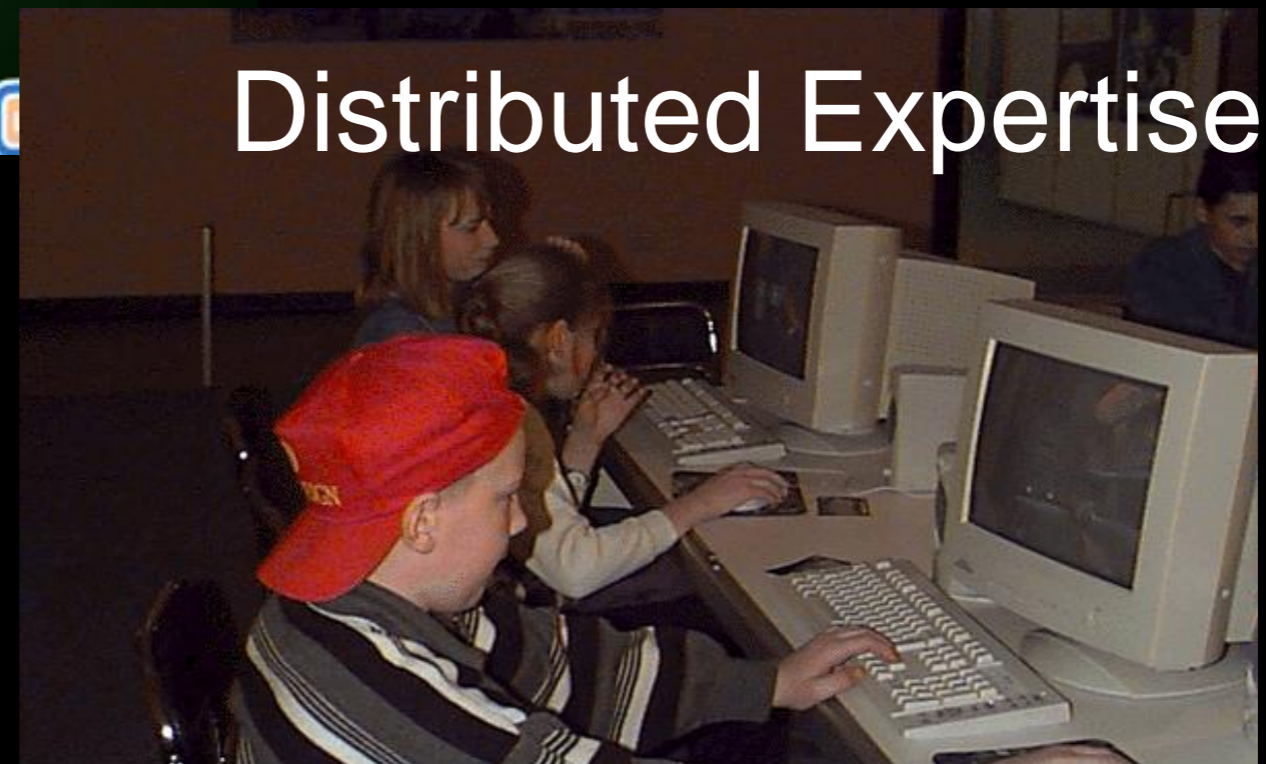
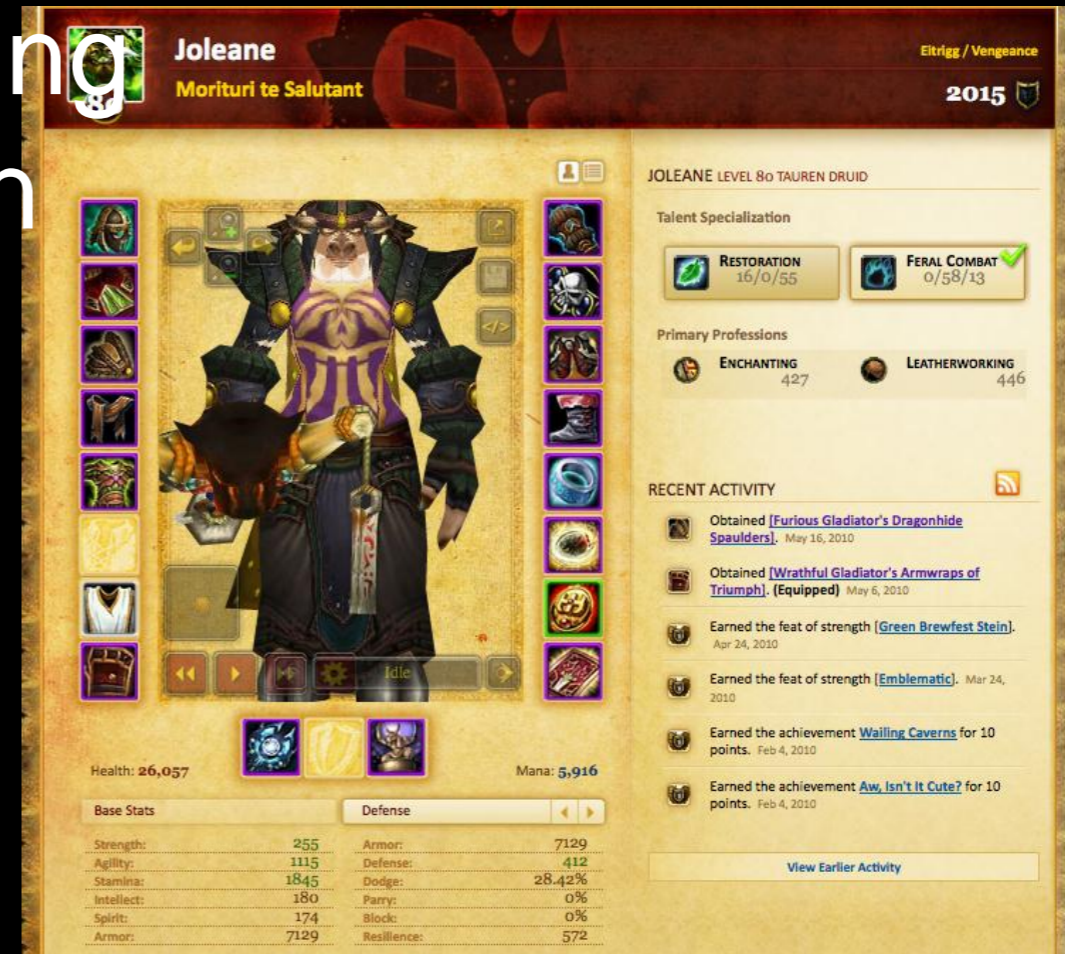
8. How was the Holy Roman Empire in the middle ages different from the ancient Roman Empire?
The Holy Roman Empire was to involved in "Romance" and the Roman Empire was not.







Problem solving Participation



- How do we do this?



Joleane

Morituri te Salutant

Eitrigg / Vengeance

2015



Health: 26,057

Mana: 5,916

Base Stats		Defense	
Strength:	255	Armor:	7129
Agility:	1115	Defense:	412
Stamina:	1845	Dodge:	28.42%
Intellect:	180	Parry:	0%
Spirit:	174	Block:	0%
Armor:	7129	Resilience:	572

JOLEANE LEVEL 80 TAUREN DRUID

Talent Specialization

RESTORATION
16/0/55

FERAL COMBAT
0/58/13

Primary Professions

ENCHANTING
427

LEATHERWORKING
446

RECENT ACTIVITY

- Obtained [\[Furious Gladiator's Dragonhide Spaulders\]](#). May 16, 2010
- Obtained [\[Wrathful Gladiator's Armwraps of Triumph\]](#). (Equipped) May 6, 2010
- Earned the feat of strength [\[Green Brewfest Stein\]](#). Apr 24, 2010
- Earned the feat of strength [\[Emblematic\]](#). Mar 24, 2010
- Earned the achievement [Wailing Caverns](#) for 10 points. Feb 4, 2010
- Earned the achievement [Aw, Isn't It Cute?](#) for 10 points. Feb 4, 2010

[View Earlier Activity](#)

1. Technical
“Achievements”

II. Records of
Decisions

III. Peer ratings



Joleane

Morituri te Salutant

Eitrigg / Vengeance

2015



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[View Earlier Activity](#)

What did they do?

What choices did they make?

How did others view their work?



Joleane

Morituri te Salutant

Eitrigg / Vengeance

2015



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What did they do?

427

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[View Earlier Activity](#)

What did they do?



SINGLE
PLAYER



MULTI
PLAYER

STARCRRAFT

WINGS OF LIBERTY



Enoyls
9001



Enoyls.slyone

9001

Summary

Achievements

Statistics

Match History

Avatars/Decals

Player Maps

STATISTICS - Multiplayer 1v1

CAREER WINS
132

MOST SUCCESSFUL MAP
Lost Temple

MOST WINS AS
Zerg

MOST WINS AGAINST
Protoss

HIGHEST RANK ACHIEVED
D16 13TH

CURRENT HIGHEST
24TH
D94

MATCH HISTORY

1v1 Defense of the Ancients
MATCH DATE: 05/25/2009

2v2 Lost Temple
MATCH DATE: 05/25/2009

1v1 Char Broiled
MATCH DATE: 05/25/2009

1v1 Char Broiled
MATCH DATE: 05/25/2009

ACHIEVEMENTS

OVERALL PROGRESS [390/670]

CAMPAIGN [51/55]

SKIRMISH [53/72]

CHALLENGE [18/95]

MULTIPLAYER [72/80]

MODS [6/42]

COMBAT [75/200]

RECENT ACHIEVEMENTS



MENU

Korey

DreamX

Flywheel

12



08:23 AM

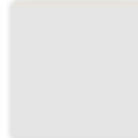
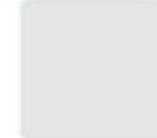
- Choices are chokepoints to test understanding

Where: The Terrace
When: Past

Data Lenses



Inventory



Yeah?



Drop your argument item here:



NEVERMIND

CONFIRM



Turbidity: Limnology Building 1969

Turbidity at the Limnology Building in 1969

DISCARD

Hey again... So, about your boat...

The ... of the z...



- What evidence do players choose for arguments?
- Which characters do they talk to?
- Is there a difference between experts & novices?
- Do players make different choices after playing?



What decisions do players make in authentic contexts?



Performance data is used for formative feedback all the time.

Name	Type	Rank	Equipped	Base Score
VanCleef's Helmet of Triumph (Heroic)	Helm	Helm 1	0	1042.434
Bloodfang Hood	Helm	Helm 2	0	968.3842
Hood of Lethal Intent	Helm	Helm 11	1	906.4137
VanCleef's Helmet of Triumph	Helm	Helm 3	0	940.1124
VanCleef's Helmet of Conquest	Helm	Helm 5	0	850.1788
Conqueror's Terrorblade Helmet	Helm	Helm 6	0	832.9348
Mimiron's Flight Goggles	Helm	Helm 7	0	827.6415
Bloodfang Mask	Helm	Helm 4	0	876.9221
Guise of the Midgard Serpent	Helm	Helm 9	0	804.7361
Garona's Guise	Helm	Helm 8	0	815.9734
Valorous Terrorblade Helmet	Helm	Helm 10	0	787.41

Players can model their own learning

- Assessment is social



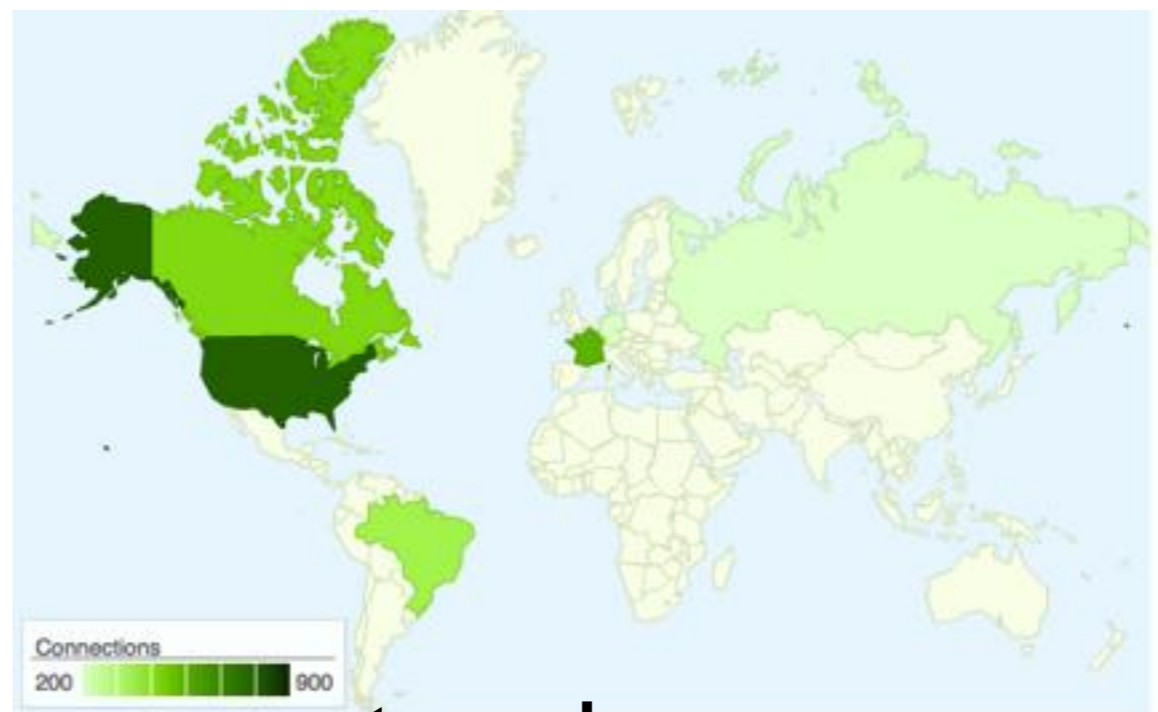
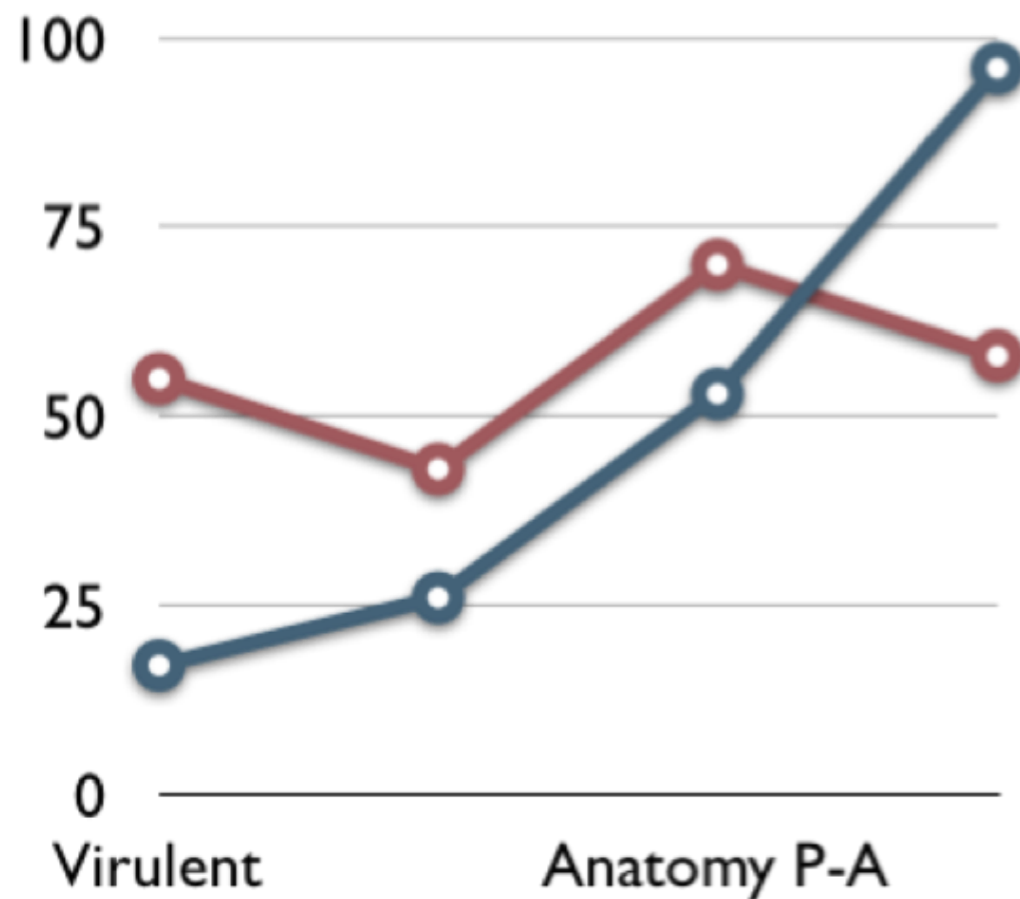
Jolene, Level 19, American, Female



physician ratings



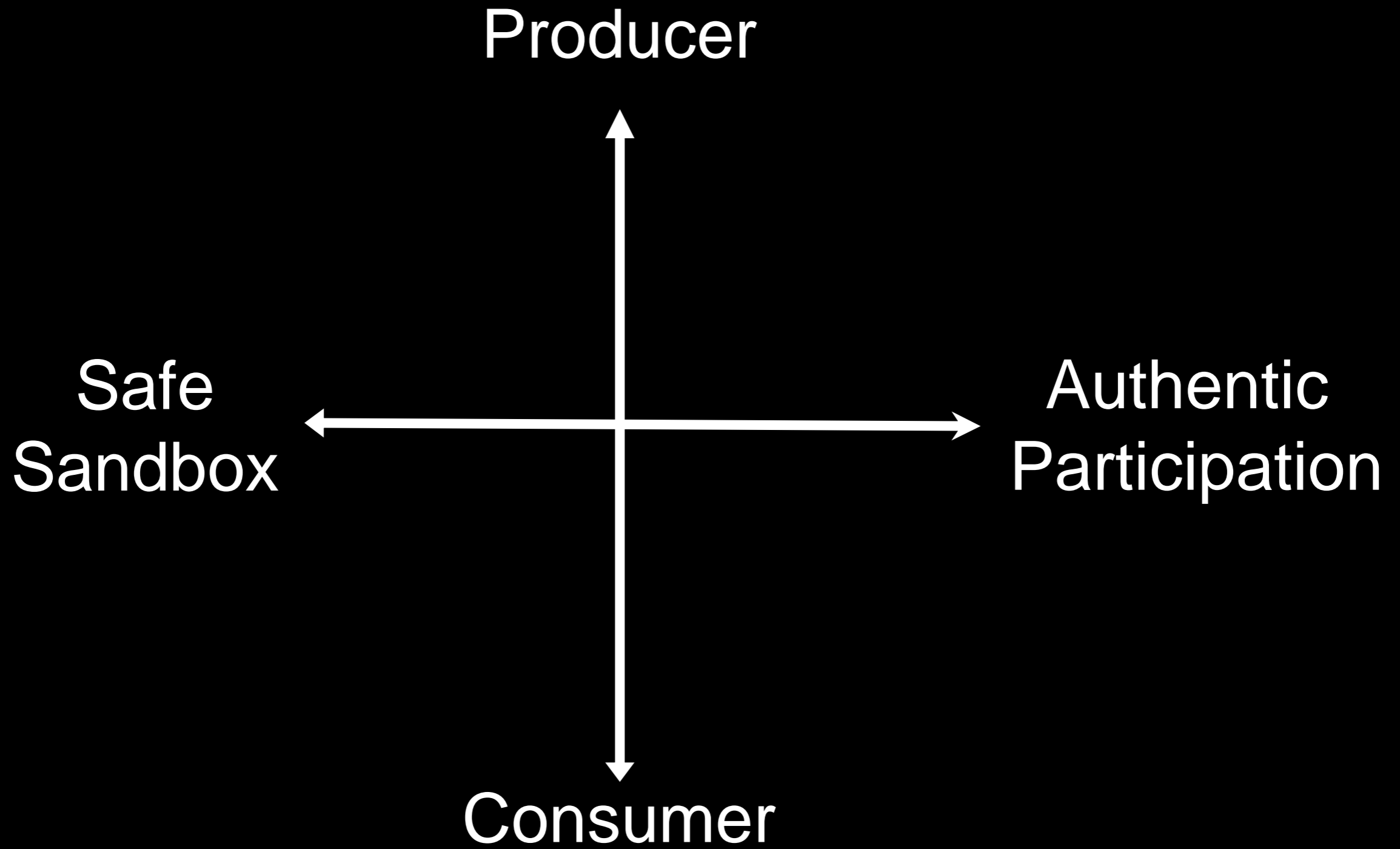
composite scores



network map


- cross institutional
- embedded diagnostics
- social & technical assessments





Transforming public participation in science.



- 
- Sangtae Kim, Director, Morgridge Institute of Research
 - Susan Millar, Director, Educational Research & Development
 - Richard Halverson, Associate Co-Director
 - Post - Docs
 - Nathan Patterson
 - Ben Shapiro
 - Graduate Students
 - Matt Gaydos
 - Sarah Chu
 - Kevin Harris
 - Adam Mechtley
 - Dennis Paiz-Rameriz
 - Belinda Guiterrez

Developers

- Allison Salmons
- Mike Beall
- Erin Robinson
- Jake Ruesch
- Greg Vaghan

Educational Research Integration Area

virtual schools

home schools

charter schools

shrinking
state
funding

new
hardware

HIRE ONE POSTDOCTORAL STUDENT

FINISHED



JAMAL

I hope to make a difference at your lab.

INTERVIEW THIS CANDIDATE



NEIL

Nice to meet you!

INTERVIEW THIS CANDIDATE



GRANTS

Please pick a Grant to apply for.

Heart Disease Prevention

Award Amount: \$10000

Depression and Anxiety

Award Amount: \$10000

Treating the Aging Population

Reputation needed: 2



WRITING THE GRANT PROPOSAL



PAGES
3

CITATIONS
2

"I CAN'T WAIT TO SHOW MY BOSS!"



JAMAL

Nice! Your latest study spearheaded by Jamal is getting all sorts of circulation. Word of your increasing reputation has already traveled through the department.

A PA from a neighboring lab steps in to congratulate you. "Who wrote the proposal for this?" she asks, and Jamal smiles and says he did. Then she laughs and says, "No, who really wrote it?" When you assure her that it really was Jamal, her smile falls and she quickly excuses herself from the lab.



Genetic factors in several symptoms of anxiety



YEAR 1: AUTUMN

REPUTATION: 1



Genetic factors in several symptoms of anxiety

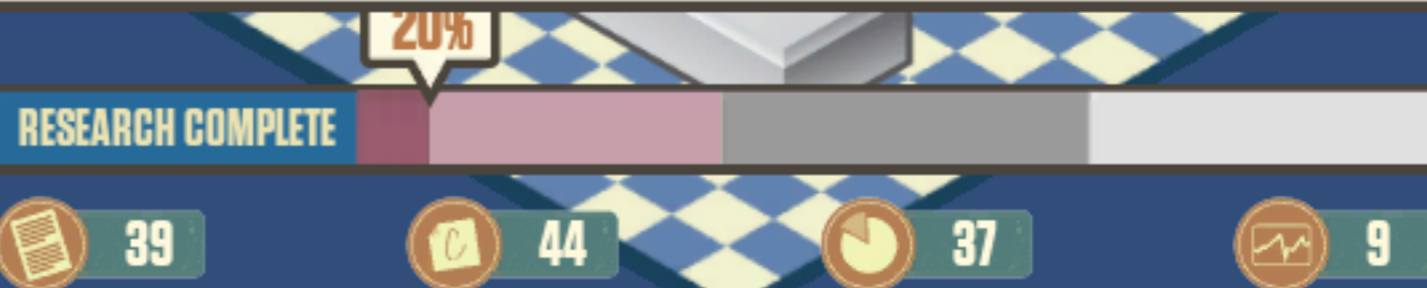


Mistaken Identity

Jamal was in the building's mail room when he ran into the mail deliveryman. "Morning Darnell," he said. Before Jamal had a chance to correct him, he said, "You better do something about those overdue tuition notices - there's a new one every week." And then he handed him a letter. Finally Jamal said, "I'm not Darnell..." to which the mailman quickly replied, "Don't worry, I'll make sure he gets the letter, okay?"

You find this out when Jamal hands you the letter, knowing what to do.

OK





Genetic factors in
several symptoms
of anxiety

Mistaken Identity

What would you like to do?

Talk to Darnell

Talk to Jamal

Do Nothing

RESEARCH COMPLETE





Genetic factors in several symptoms of anxiety

Mistaken Identity

You Selected: Talk to Darnell

What would you like to do?

Give Darnell his letter

Talk to Darnell about his overdue tuition

BACK

DONE

RESEARCH COMPLETE



39



44



37

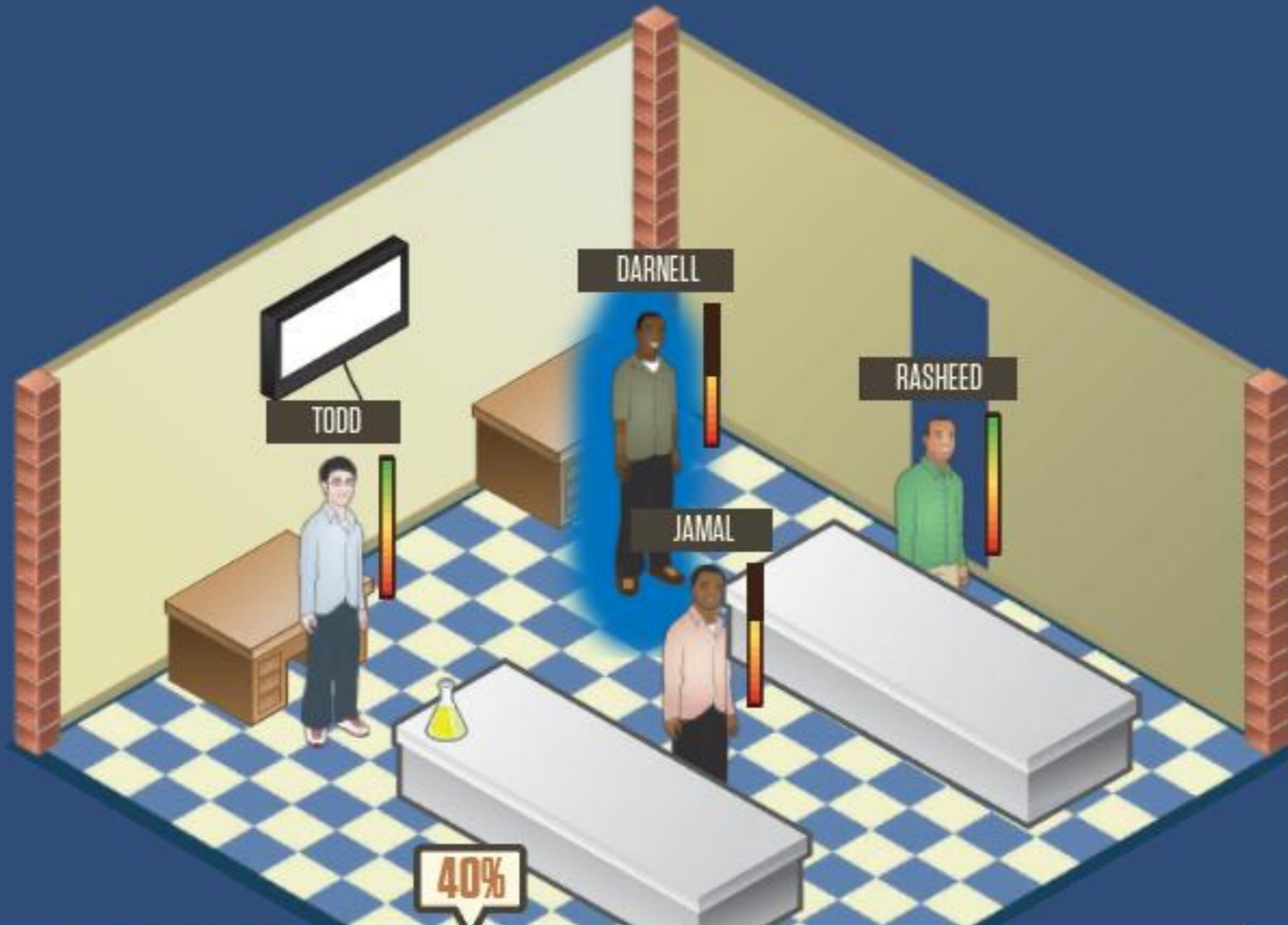


9



Genetic factors in several symptoms of anxiety

YEAR 1: WINTER



REPUTATION: 1