GDC EDUCATION SUMMIT

Teaching the Social Science-y \ Bits of Games

Edward Castronova
Professor
BS in Game Design
Indiana University

Motivation

- Diversity of expertise in game design education: Artists, coders, designers
- But social science elements appear frequently
- If you’re an artist teaching the intro design course, how do you teach about...

Social science-y things

- How prices work
- Why do crowds show up where they do
- Why Barrens chat

1.

barrens chat

the eternal home of chuck norris in **WoW**,as well as a hangout spot for twelve year olds. many times, after getting a character out of the barrens, they create a new one, just to go back there.

example of barrens chat

barrens resident 1: hey guys
helpful passerby: yes?
barrens resident 1: THATS WHAT SHE SAID!
barrens resident 2: reported
barrens resident 3:reported for reporting.

by toxicwhirl July 03, 2006

A method

What’s worked for me...

1. Read and review the theory yourself
2. Translate into system language
3. Express the key idea in English
4. Demonstrate with a board game

Three examples, maybe four

- Prices (economics)
- Tipping points (sociology)
- Arms races (international affairs)
- Wisdom of crowds (sociology)

But first, PRIZES!!!

1. How tall is Castronova, in inches?
2. Submit a number between 0 and 100, inclusive. The winning number is the one closest to 2/3 of the average of submitted numbers.

First example: Markets in games

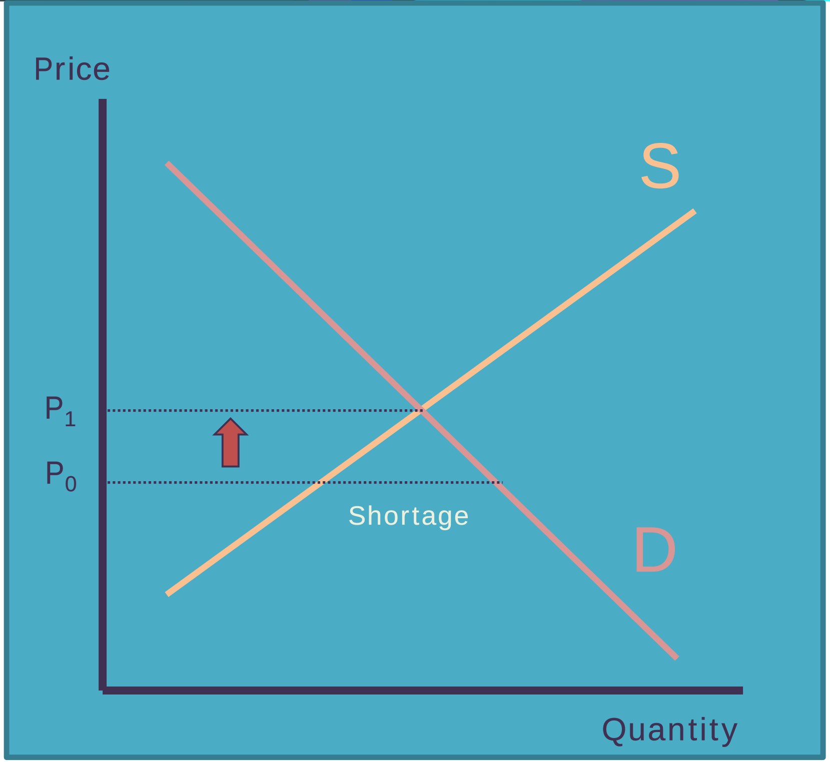
1. “The theory of supply and demand”

(Disclaimer: This is microeconomics, which has a good track record. This is not about unemployment, inequality, Wall Street, or any of that. This is about simple markets, which are the nuisance elements of many designs. Designers just want the price of bread to be player-driven but stable. Microeconomics can do that.)

1. How tall is Castronova, in inches? 2. Submit a number between 0 and 100, inclusive. The winning number is the one closest to 2/3 of the average of submitted numbers.

"When demand exceeds supply, prices rise. This brings out additional supply and dampens demand, until supply equals demand again."

The key insight is, there will be slight shifting, not a runaway in price or a collapse of the market.



1. How tall is Castronova, in inches? 2. Submit a number between 0 and 100, inclusive. The winning number is the one closest to 2/3 of the average of submitted numbers.

Theory to Systems to English

2. In systems talk: “A market system has an internal stable state. When the system gets out of balance, it has internal pressure to re-balance.”
3. In English: “Prices adjust to the availability and demand for things.”

1. How tall is Castronova, in inches? 2. Submit a number between 0 and 100, inclusive. The winning number is the one closest to 2/3 of the average of submitted numbers.

4. Demonstrate

The resource market in Power Grid

1. How tall is Castronova, in inches? 2. Submit a number between 0 and 100, inclusive. The winning number is the one closest to 2/3 of the average of submitted numbers.

Price

	1	2	3	4	5
Coal	x x x	x x x	x x x	x x x	x x x
Oil		o o	o o o	o o o	o o o

Resources in the market establish the price

1. How tall is Castronova, in inches? 2. Submit a number between 0 and 100, inclusive. The winning number is the one closest to 2/3 of the average of submitted numbers.

Costs 3

Price

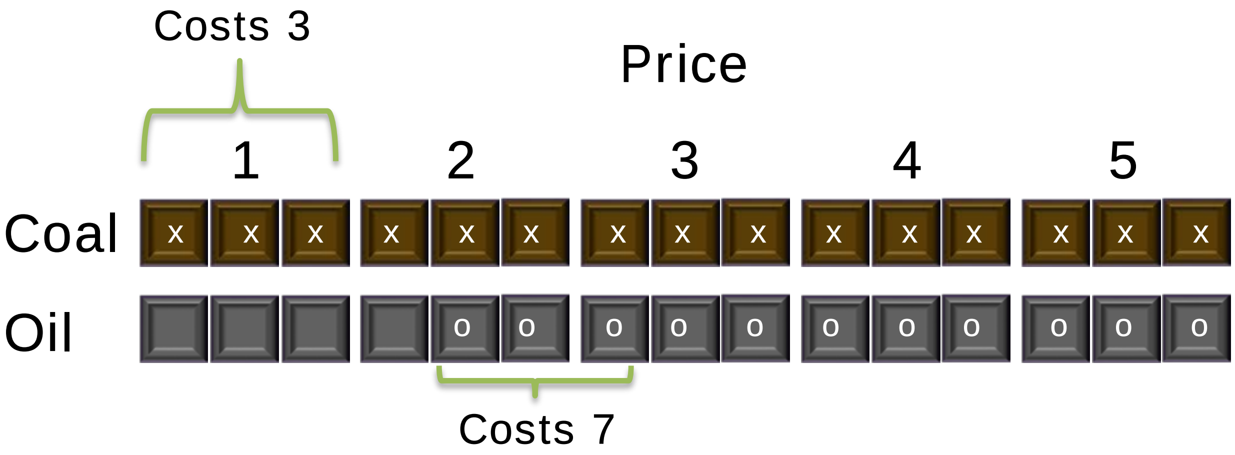
	1			2			3			4			5		
Coal	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Oil					o	o	o	o	o	o	o	o	o	o	o

Resources in the market establish the price

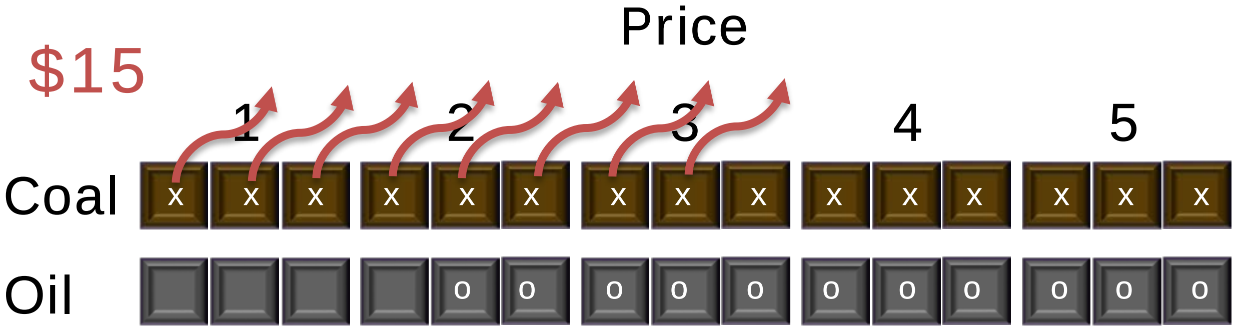
1. How tall is Castronova, in inches? 2. Submit a number between 0 and 100, inclusive. The winning number is the one closest to 2/3 of the average of submitted numbers.

Resources in the market establish the price

1. How tall is Castronova, in inches? 2. Submit a number between 0 and 100, inclusive. The winning number is the one closest to 2/3 of the average of submitted numbers.



1. How tall is Castronova, in inches? 2. Submit a number between 0 and 100, inclusive. The winning number is the one closest to 2/3 of the average of submitted numbers.



Player buys increase the price

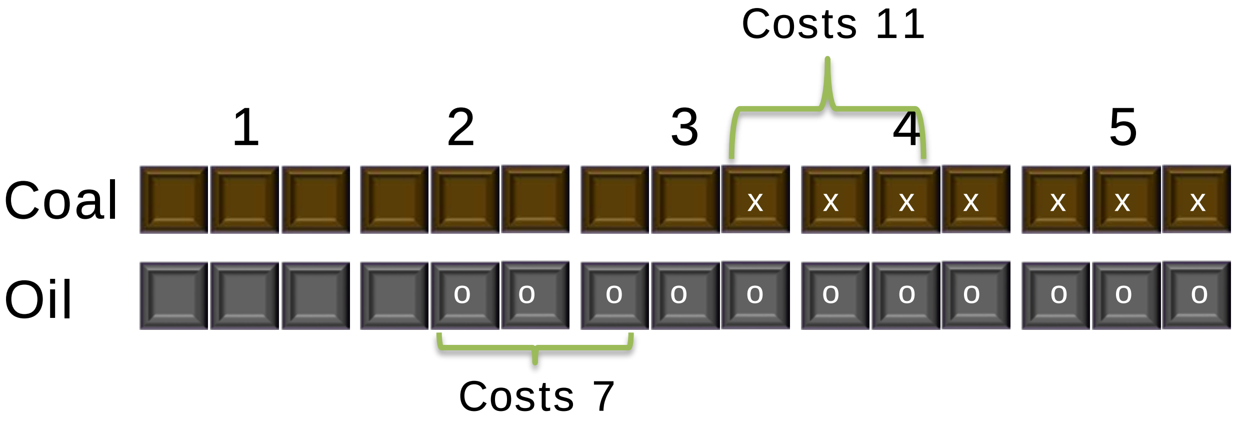
1. How tall is Castronova, in inches? 2. Submit a number between 0 and 100, inclusive. The winning number is the one closest to 2/3 of the average of submitted numbers.

Price

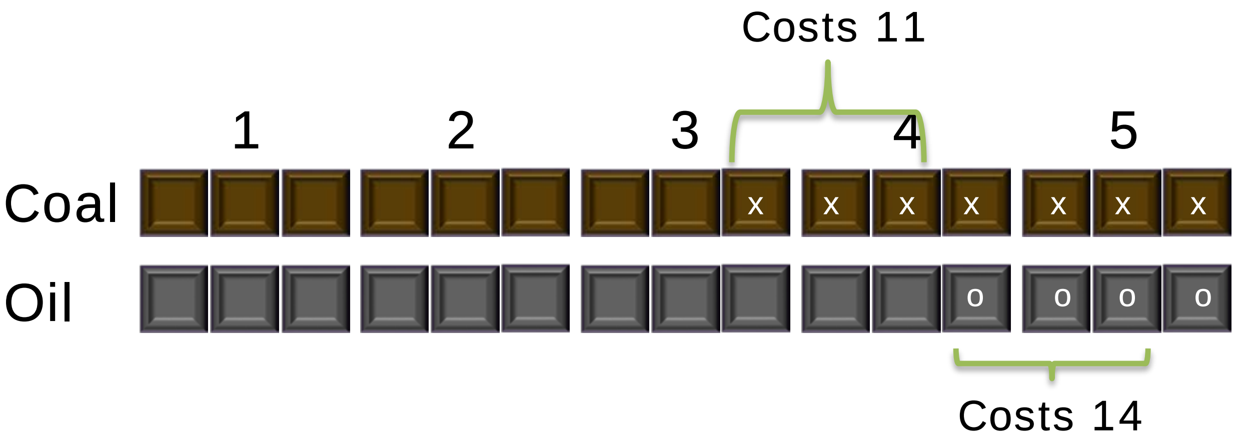
	1			2			3			4			5		
Coal									x	x	x	x	x	x	x
Oil					o	o	o	o	o	o	o	o	o	o	o

Player buys increase the price

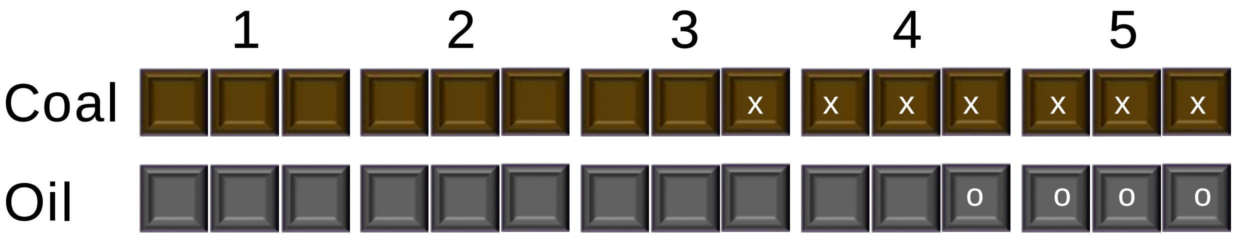
1. How tall is Castronova, in inches? 2. Submit a number between 0 and 100, inclusive. The winning number is the one closest to 2/3 of the average of submitted numbers.



1. How tall is Castronova, in inches? 2. Submit a number between 0 and 100, inclusive. The winning number is the one closest to 2/3 of the average of submitted numbers.

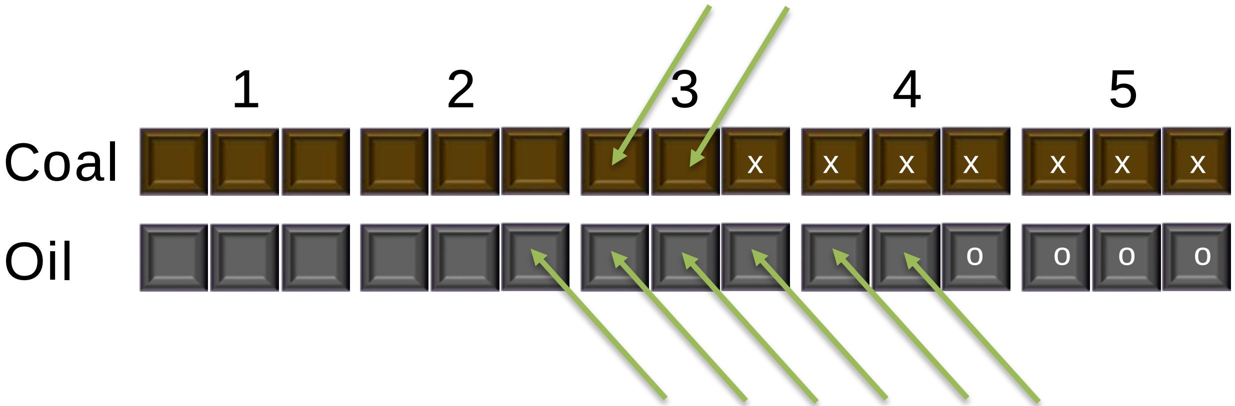


1. How tall is Castronova, in inches? 2. Submit a number between 0 and 100, inclusive. The winning number is the one closest to 2/3 of the average of submitted numbers.



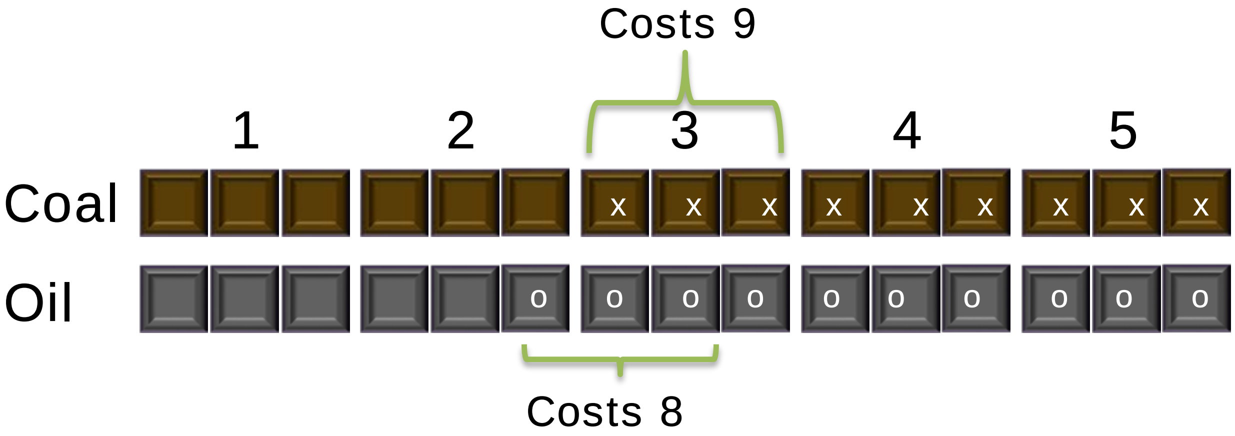
Restocking lowers the price

1. How tall is Castronova, in inches? 2. Submit a number between 0 and 100, inclusive. The winning number is the one closest to 2/3 of the average of submitted numbers.



Restocking lowers the price

1. How tall is Castronova, in inches? 2. Submit a number between 0 and 100, inclusive. The winning number is the one closest to 2/3 of the average of submitted numbers.



1. How tall is Castronova, in inches? 2. Submit a number between 0 and 100, inclusive. The winning number is the one closest to 2/3 of the average of submitted numbers.

Power Grid's market has the price-adjustment features depicted in the supply and demand model. Even though it is a market of 2-5 players, it acts like a market of thousands.

1. How tall is Castronova, in inches? 2. Submit a number between 0 and 100, inclusive. The winning number is the one closest to 2/3 of the average of submitted numbers.

Example 2: Tipping Points

1. A tipping point is a location that marks a discrete change in a functional relationship.

$Y = -X + 5$ if $X < 2$

$Y = 3X - 4$ if $X >= 2$

1. How tall is Castronova, in inches? 2. Submit a number between 0 and 100, inclusive. The winning number is the one closest to 2/3 of the average of submitted numbers.

Example 2: Tipping Points

1. A tipping point is a location that marks a discrete change in a functional relationship.

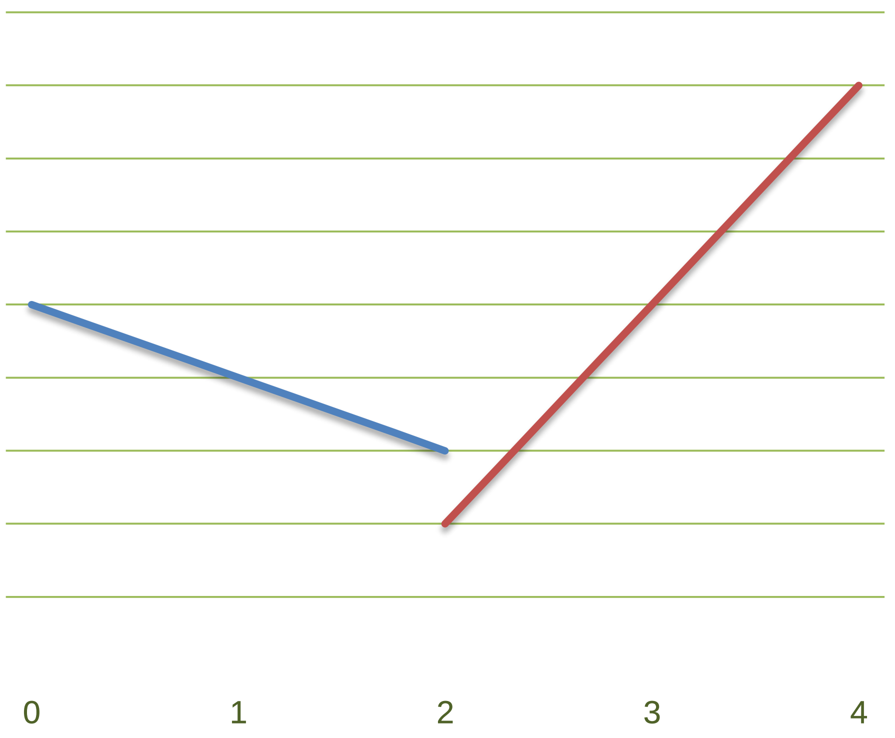
$$Y = -X + 5 \text{ if } X < 2$$

$$Y = 3X - 4 \text{ if } X >= 2$$

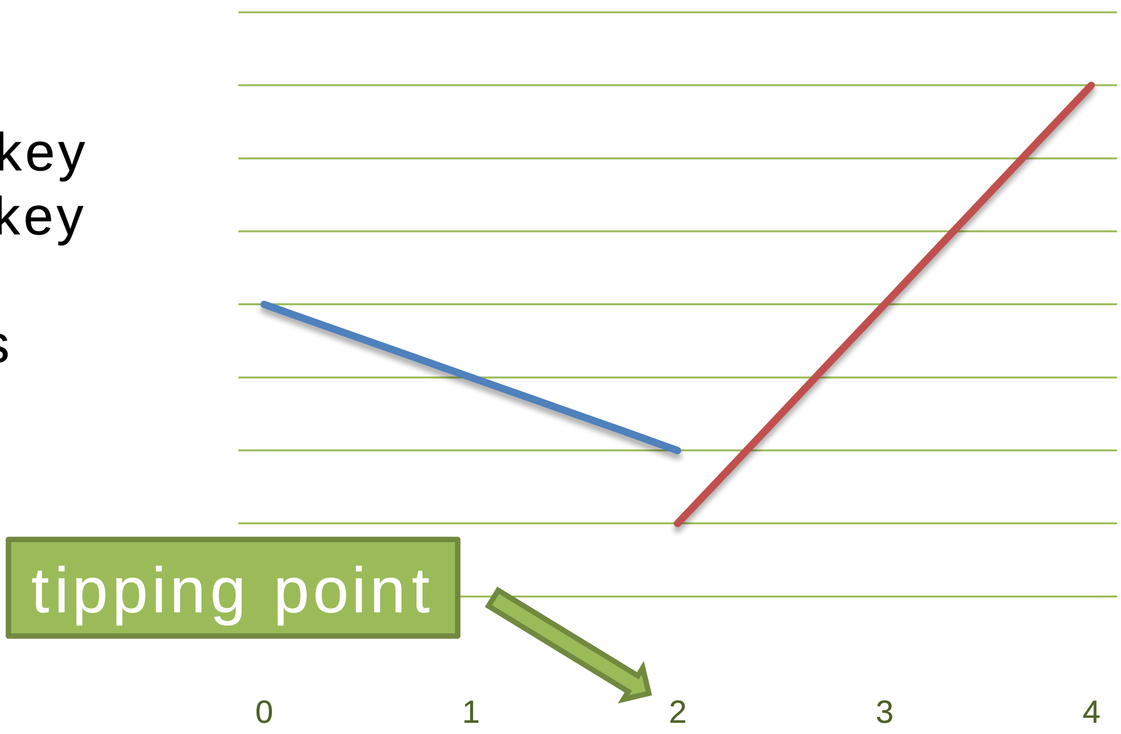
Tipping point

1. How tall is Castronova, in inches? 2. Submit a number between 0 and 100, inclusive. The winning number is the one closest to 2/3 of the average of submitted numbers.

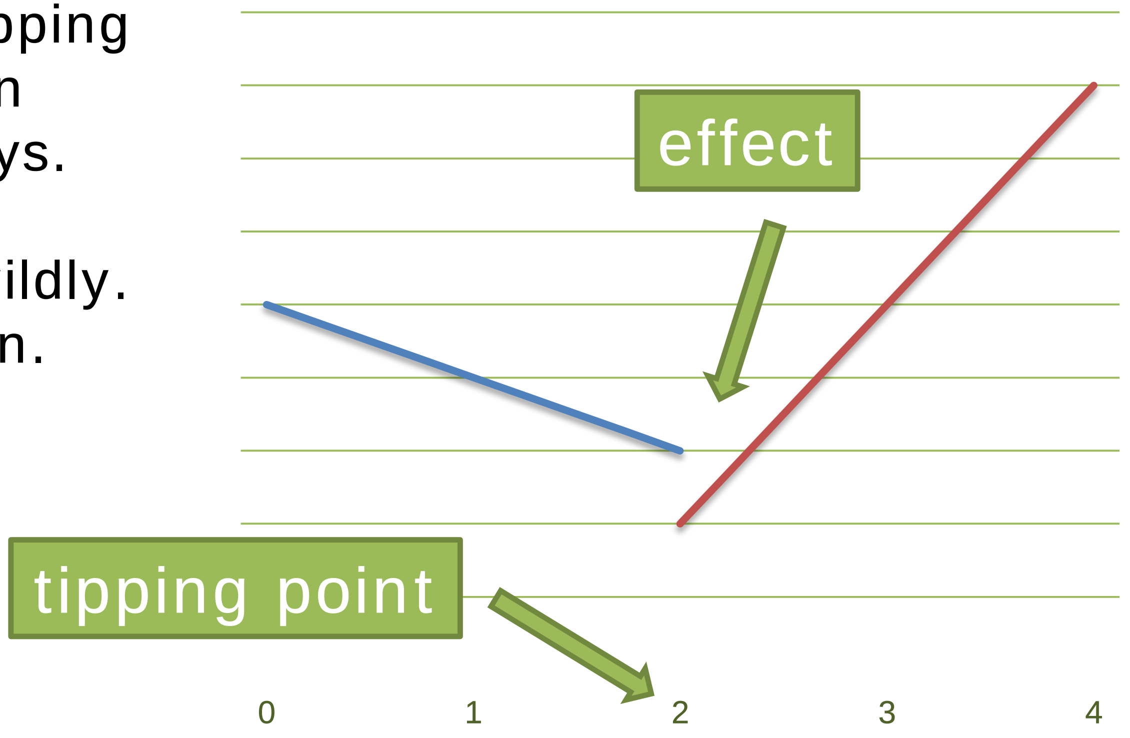
2. A system exhibits completely different dynamics when certain key variables are in certain key ranges. The boundary between those ranges is called a “tipping point.”



2. A system exhibits completely different dynamics when certain key variables are in certain key ranges. The boundary between those ranges is called a “tipping point.”



3. On either side of a tipping point, the system acts in completely different ways. Forces that used to be stable now accelerate wildly. Or change their direction.



Tipping points come to mind when talking about sudden runaway conditions – “breakdowns” etc.

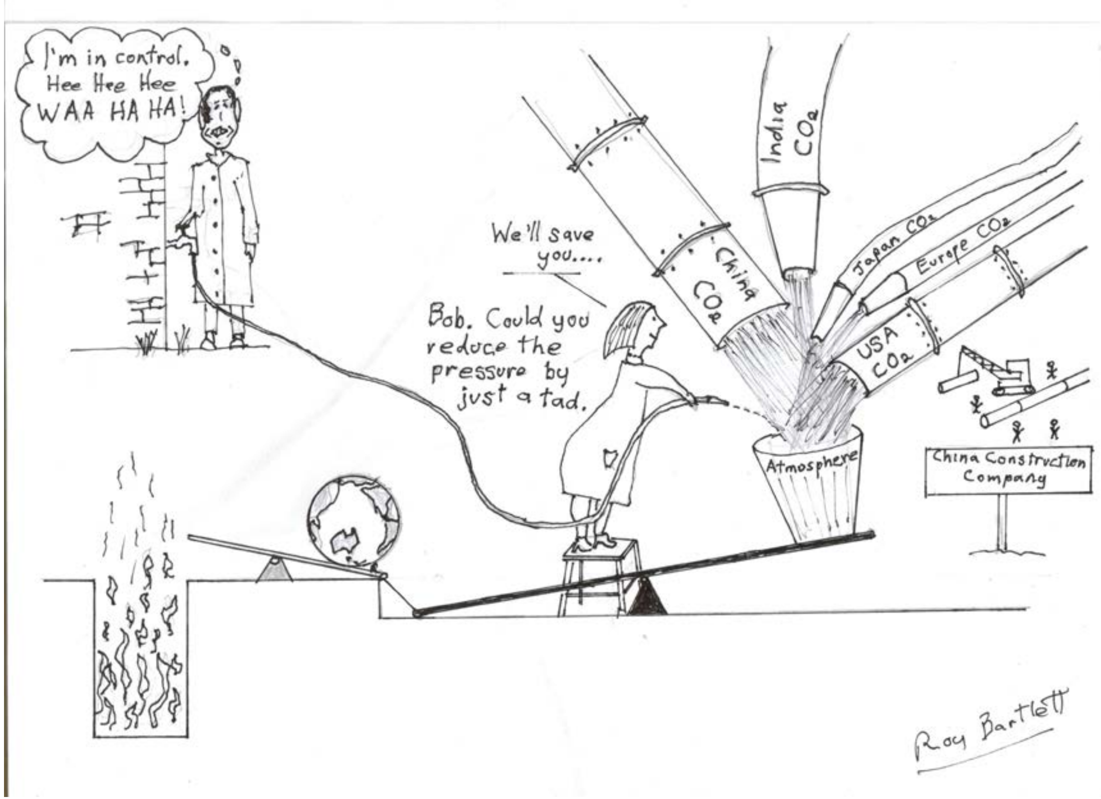
1. How tall is Castronova, in inches? 2. Submit a number between 0 and 100, inclusive. The winning number is the one closest to 2/3 of the average of submitted numbers.

Tipping points come to mind when talking about sudden runaway conditions – “breakdowns” etc.

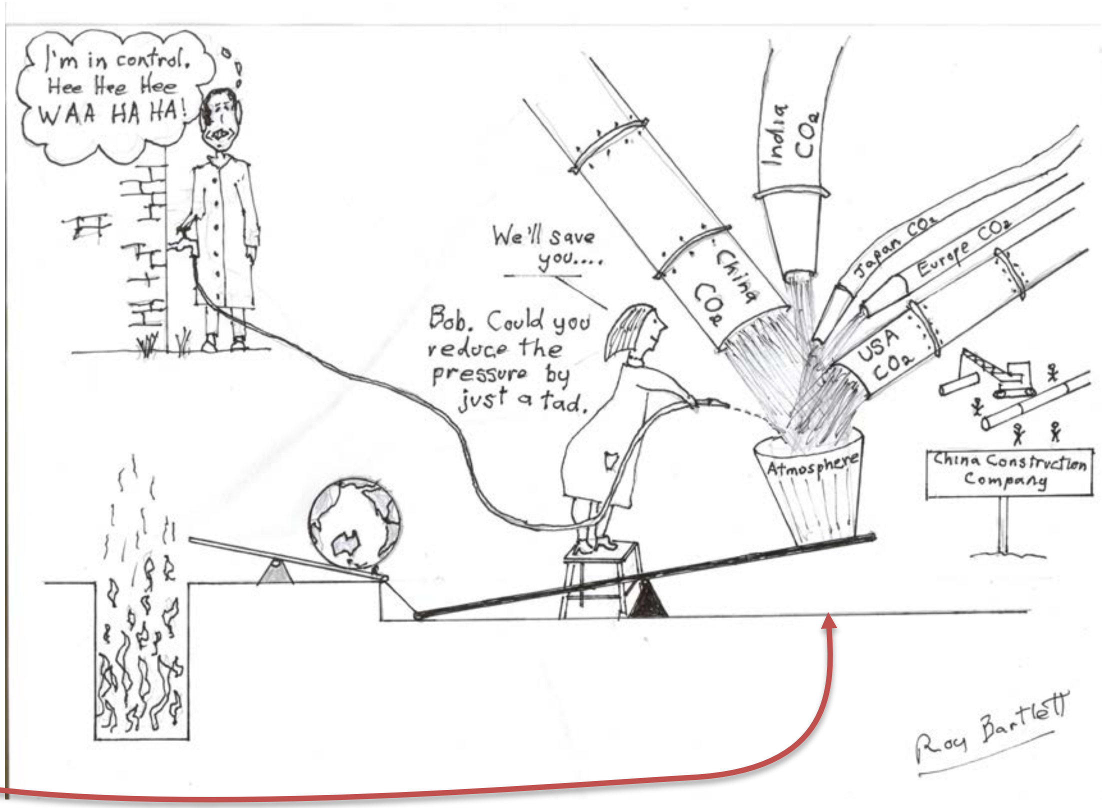
For example, here is a picture of global warming from an Australian point of view

Tipping points come to mind when talking about sudden runaway conditions – “breakdowns” etc.

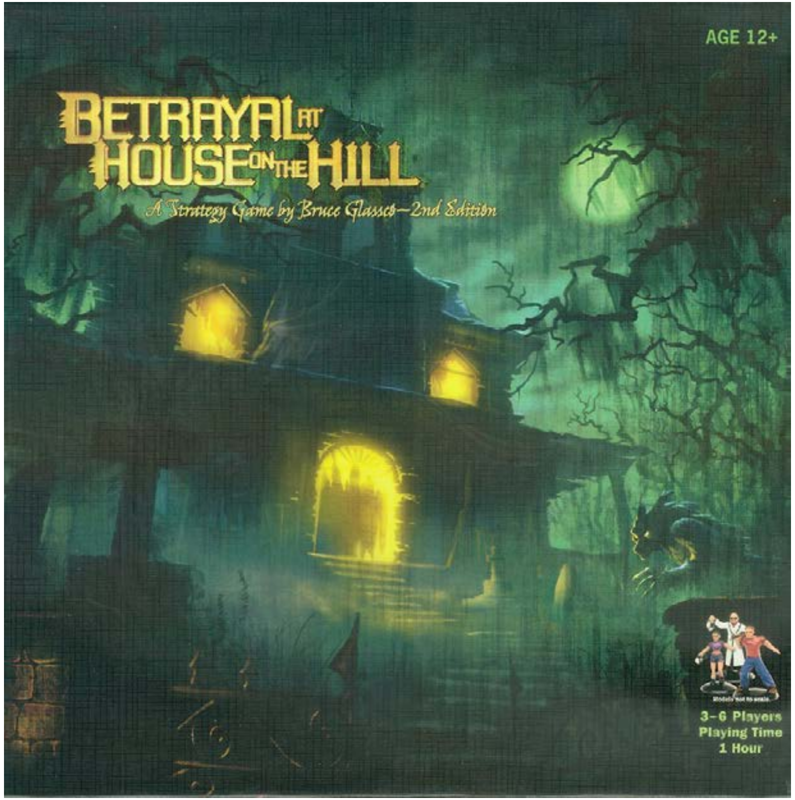
For example, here is a picture of global warming



Note the tipping point

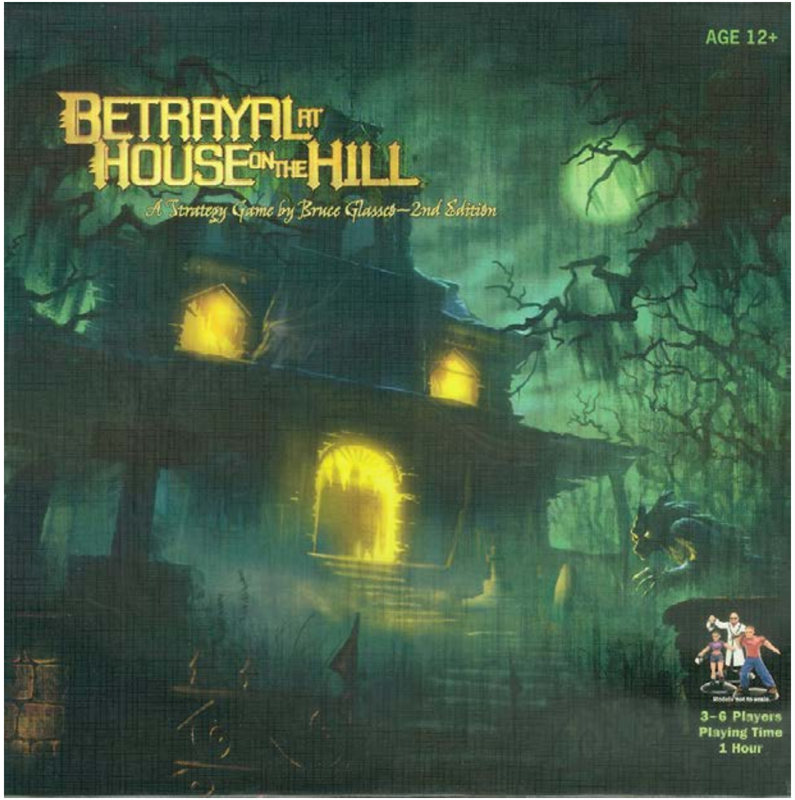


4. Betrayal at the House on the Hill has a tipping point mechanic



4. Betrayal at the House on the Hill has a tipping point mechanic

A group of 3-6 foolish explorers go into a haunted house



4. Betrayal at the House on the Hill has a tipping point mechanic

A group of 3-6 foolish explorers go into a haunted house

As they explore rooms, they acquire Omen cards

Whenever you get an Omen card, you make a Haunt Roll

1. How tall is Castronova, in inches? 2. Submit a number between 0 and 100, inclusive. The winning number is the one closest to 2/3 of the average of submitted numbers.

Whenever you get an Omen card, you make a Haunt Roll

If the roll is less than the number of Omens, the Haunt begins

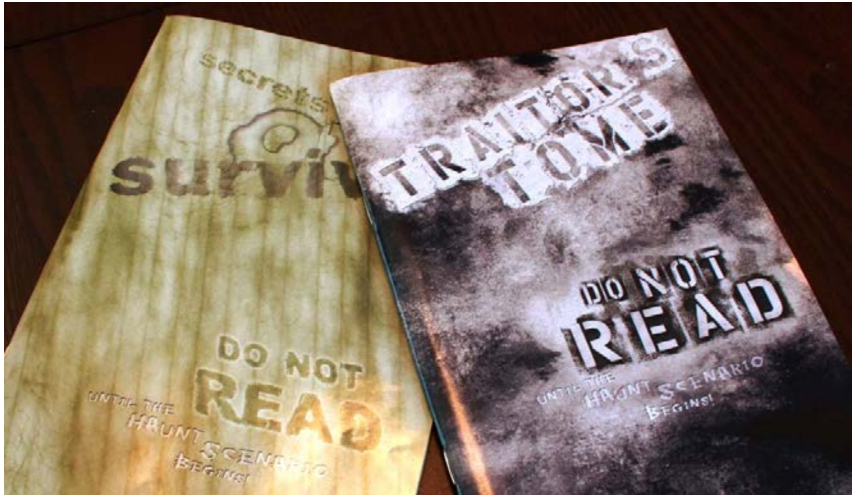
1. How tall is Castronova, in inches? 2. Submit a number between 0 and 100, inclusive. The winning number is the one closest to 2/3 of the average of submitted numbers.

What is the Haunt?

1. How tall is Castronova, in inches? 2. Submit a number between 0 and 100, inclusive. The winning number is the one closest to 2/3 of the average of submitted numbers.

What is the Haunt?

One of the group becomes a traitor

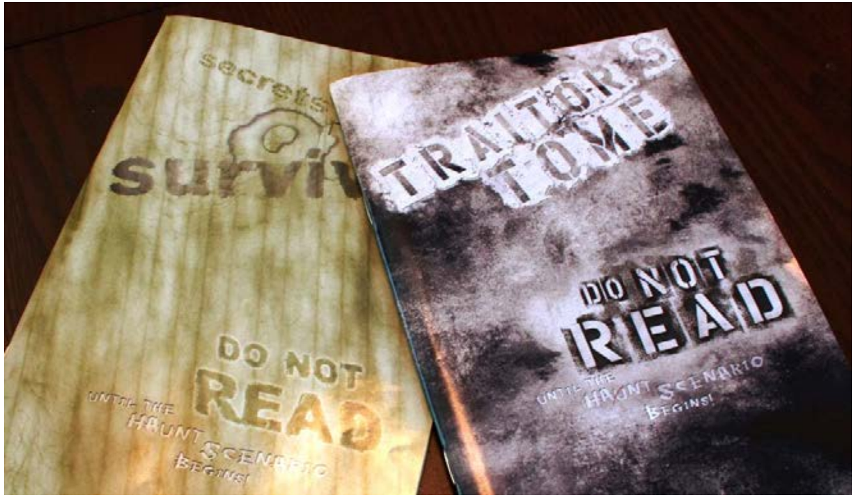


1. How tall is Castronova, in inches? 2. Submit a number between 0 and 100, inclusive. The winning number is the one closest to 2/3 of the average of submitted numbers.

What is the Haunt?

One of the group becomes a traitor

And the rest try to kill them



1. How tall is Castronova, in inches? 2. Submit a number between 0 and 100, inclusive. The winning number is the one closest to 2/3 of the average of submitted numbers.

A bunch of other rules change

1. How tall is Castronova, in inches? 2. Submit a number between 0 and 100, inclusive. The winning number is the one closest to 2/3 of the average of submitted numbers.

A bunch of other rules change

And the game as a whole switches from exploration and item acquisition

1. How tall is Castronova, in inches? 2. Submit a number between 0 and 100, inclusive. The winning number is the one closest to 2/3 of the average of submitted numbers.

A bunch of other rules change

And the game as a whole switches from exploration and item acquisition

To PvP horror

1. How tall is Castronova, in inches? 2. Submit a number between 0 and 100, inclusive. The winning number is the one closest to 2/3 of the average of submitted numbers.

A bunch of other rules change

And the game as a whole switches from exploration and item acquisition

To PvP horror

1. How tall is Castronova, in inches? 2. Submit a number between 0 and 100, inclusive. The winning number is the one closest to 2/3 of the average of submitted numbers.

So, what is the tipping point in BHH?

1. How tall is Castronova, in inches? 2. Submit a number between 0 and 100, inclusive. The winning number is the one closest to 2/3 of the average of submitted numbers.

So, what is the tipping point in BHH?

It is a turn whose exact value is random but follows a distribution that can be discerned...

1. How tall is Castronova, in inches? 2. Submit a number between 0 and 100, inclusive. The winning number is the one closest to 2/3 of the average of submitted numbers.

So, what is the tipping point in BHH?

It is a turn whose exact value is random but follows a distribution that can be discerned...

And more important, *used to guess when it will come*

So, what is the tipping point in BHH?

It is a turn whose exact value is random but follows a distribution that can be discerned...

And more important, *used to guess when it will come*

MAKES TIPPING POINTS FUN

Rule: Haunt if d6 < Omens

Omen Cards	Pr(Haunt)
2	.17
3	.33
4	.50
5	.67
6	.83

Rule: Haunt if d6 < Omens

One of these omens will cause the haunt

Omen Cards	Pr(Haunt)
2	.17
3	.33
4	.50
5	.67
6	.83

Rule: Haunt if d6 < Omens

One of these omens will cause the haunt

It will be drawn on a certain turn

Omen Cards	Pr(Haunt)
2	.17
3	.33
4	.50
5	.67
6	.83

Rule: Haunt if d6 < Omens

One of these omens
will cause the haunt

It will be drawn
on a certain turn

That turn is
The tipping point

Omen Cards	Pr(Haunt)
2	.17
3	.33
4	.50
5	.67
6	.83

Rule: Haunt if d6 < Omens

One of these omens
will cause the haunt

It will be drawn
on a certain turn

That turn is
The tipping point

Omen Cards	Pr(Haunt)
2	.17
3	.33
4	.50
5	.67
6	.83

You don't know when it will come, but you do know it is getting closer and closer...

Example 3. Arms Races

1. Two or more competitors commit to being at least equal in power to the others. Lack of information and mistrust leads everyone to build more weapons than necessary for basic security.

Example 3. Arms Races

1. Two or [illegible] competitors commit to being at least [illegible] in power to the others. Lack of information [illegible] mistrust leads everyone to build more [illegible]ons than necessary for basic security.

CERTIFIED PRISONER'S DILEMMA

Felix: Should I build another bomb?

Felix: Should I build another bomb?

That depends on Felicity!

Felix: Should I build another bomb?

That depends on Felicity!

Felicity is building a bomb!

Felix: Should I build another bomb?

That depends on Felicity!

Felicity is building a bomb!

I build a bomb

I don’t build a bomb

Felix: Should I build another bomb?

That depends on Felicity!

Felicity is building a bomb!

I build a bomb → $Pr(Win) = \frac{1}{2}$

I don't build a bomb → $Pr(Win) = 0$

Felix: Should I build another bomb?

That depends on Felicity!

Felicity is building a bomb!

I build a bomb → $Pr(Win) = \frac{1}{2}$

I don't build a bomb → $Pr(Win) = 0$

Felix: Should I build another bomb?

That depends on Felicity!

Felicity is building a bomb!

I build a bomb → $Pr(Win) = ½$

I don't build a bomb → $Pr(Win) = 0$

Felicity is not building a bomb!

Felix: Should I build another bomb?

That depends on Felicity!

Felicity is building a bomb!

- I build a bomb → *Pr(Win) = ½*
- I don't build a bomb → *Pr(Win) = 0*

Felicity is not building a bomb!

- I build a bomb
- I don't build a bomb

Felix: Should I build another bomb?

That depends on Felicity!

Felicity is building a bomb!

- I build a bomb → *Pr(Win) = ½*
- I don't build a bomb → *Pr(Win) = 0*

Felicity is not building a bomb!

- I build a bomb → *Pr(Win) = 1*
- I don't build a bomb → *Pr(Win) = ½*

Felix: Should I build another bomb?

That depends on Felicity!

Felicity is building a bomb!

- I build a bomb → $Pr(Win) = \frac{1}{2}$
- I don't build a bomb → $Pr(Win) = 0$

Felicity is not building a bomb!

- I build a bomb → $Pr(Win) = 1$
- I don't build a bomb → $Pr(Win) = \frac{1}{2}$

Felix: Should I build another bomb?

That depends on Felicity!

Felicity is building a bomb!

I build a bomb

Felicity is not building a bomb!

I build a bomb

Felix: Should I build another bomb?

~~That depends on Felicity~~

I build a bomb

suboptimal

2. The system contains two subsystems that may amplify each other, creating a positive feedback loop that will eventually move into toxic levels. Only by reducing signal from both subsystems can the overall system be kept in control.

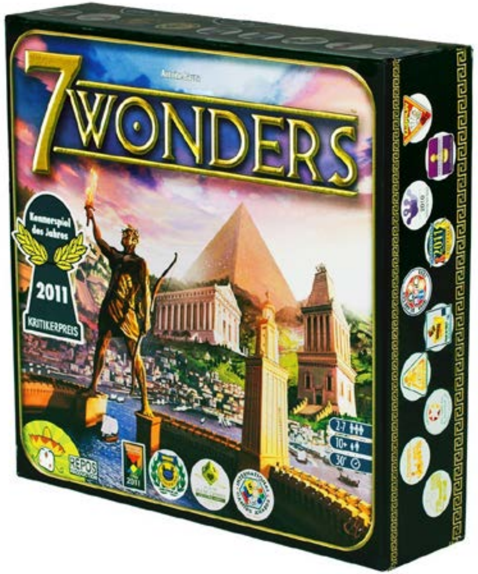
3. When winning is all that matters, the other person’s effort forces you to invest more in your own effort. But because you’re both working harder, neither gets an advantage. All you did was work harder, for nothing.

3. When winning is all that matters, the other person's Drugs forces you to invest more in your own Drugs But because you're both wo Drugs arder, neither gets an advantage. All you did was w Drugs rder, for nothing.

3. When winning is all that matters, the other person's Drugs forces you to invest more in your own Drugs But because you're both wo Drugs harder, neither gets an advantage. All you did was w Drugs rder, for n  g.

4. Example: 7 Wonders

- In 7 Wonders, people build civilizations
- You fight wars with your neighbors only

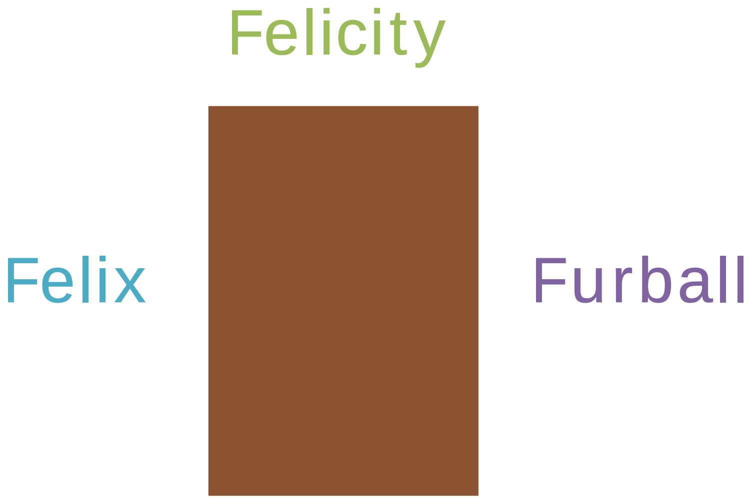


A game with four players sitting around a table

Felix

Felicity

Felix


Felicity
Felix
Furball

Felicity

Felix

Furball

RANDALL F. BAUMANN

Players can build military cards (“shields”)

Felicity

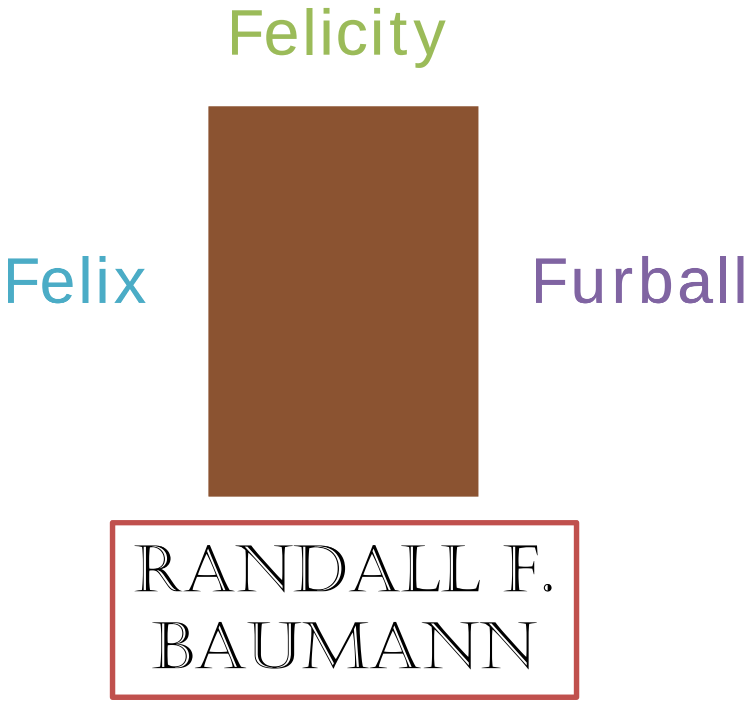
Felix

Furball

RANDALL F. BAUMANN

Players can build military cards ("shields")

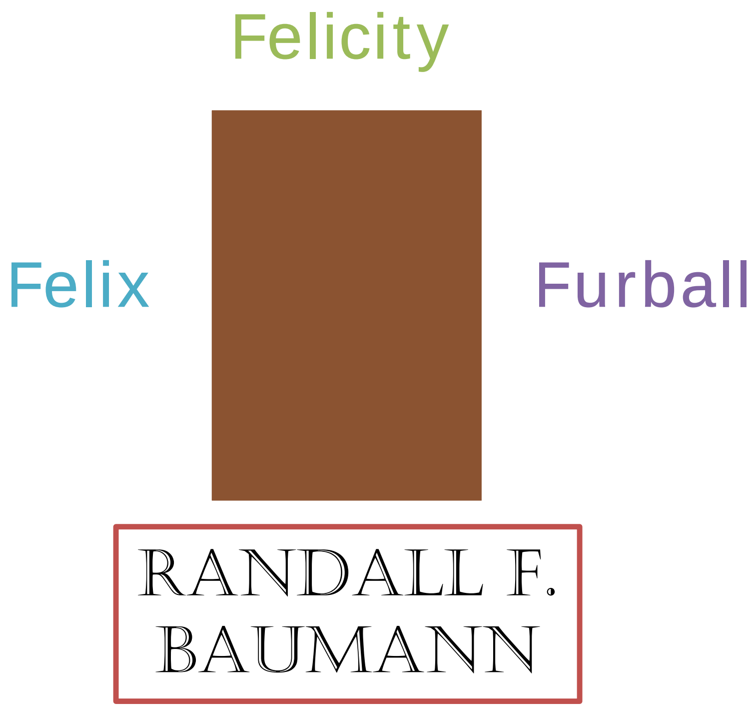
Three times per game, shields are compared with neighbors



Players can build military cards (“shields”)

Three times per game, shields are compared with neighbors

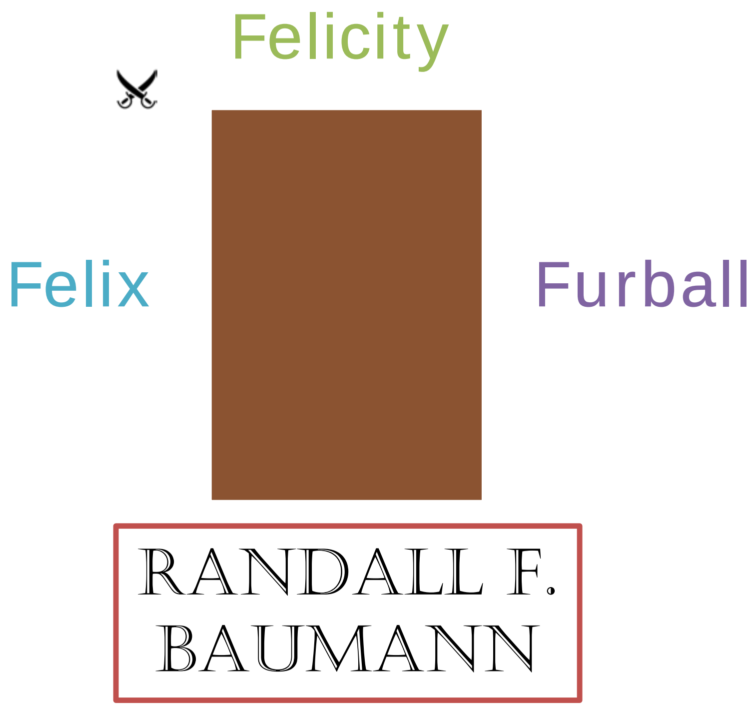
Felix has wars with Felicity



Players can build military cards (“shields”)

Three times per game, shields are compared with neighbors

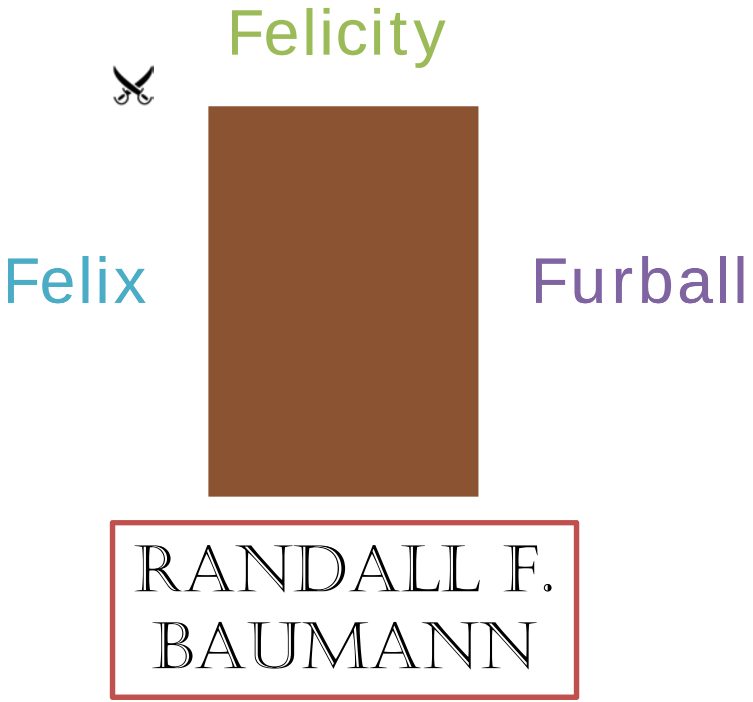
Felix has wars with Felicity



Players can build military cards ("shields")

Three times per game, shields are compared with neighbors

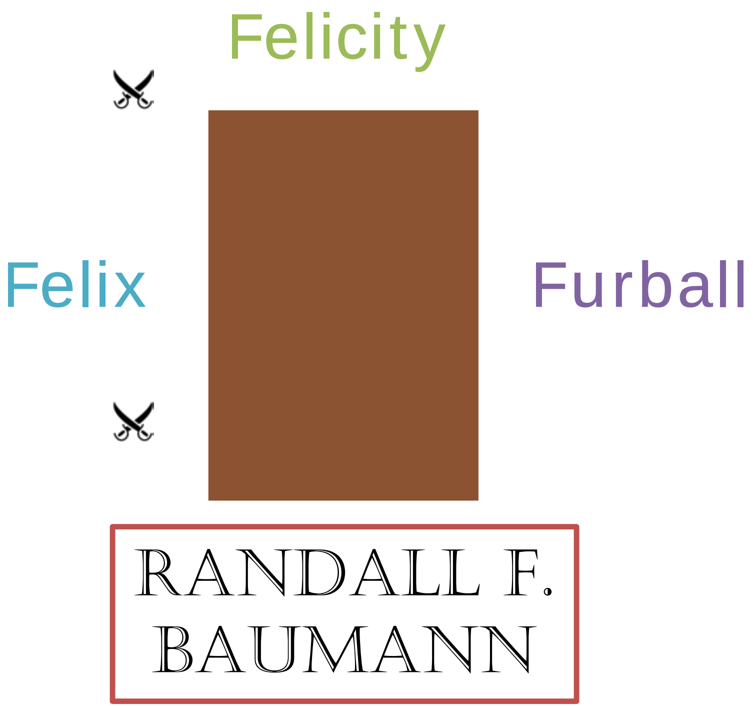
Felix has wars with Felicity and Randall F. Baumann



Players can build military cards (“shields”)

Three times per game, shields are compared with neighbors

Felix has wars with Felicity and Randall F. Baumann



Shield cards cost resources and a turn

Shield cards cost resources and a turn

Building these three shields costs three turns

In a game with 18 turns, that's 17 percent of the action economy

In a game with 18 turns, that’s 17 percent of the action economy

The benefit:

-17%

The benefit:
Winning

The benefit:
Winning

Age I: 1 VP

The benefit:

Winning

Age I: 1 VP

Age II: 3 VP

The benefit:
Winning

Age I: 1 VP
Age II: 3 VP
Age III: 5 VP

But there's a risk.
If you lose, it's a -1 VP penalty.

0 VP for a tie.

But there's a risk. If you lose, it's a -1 VP penalty.

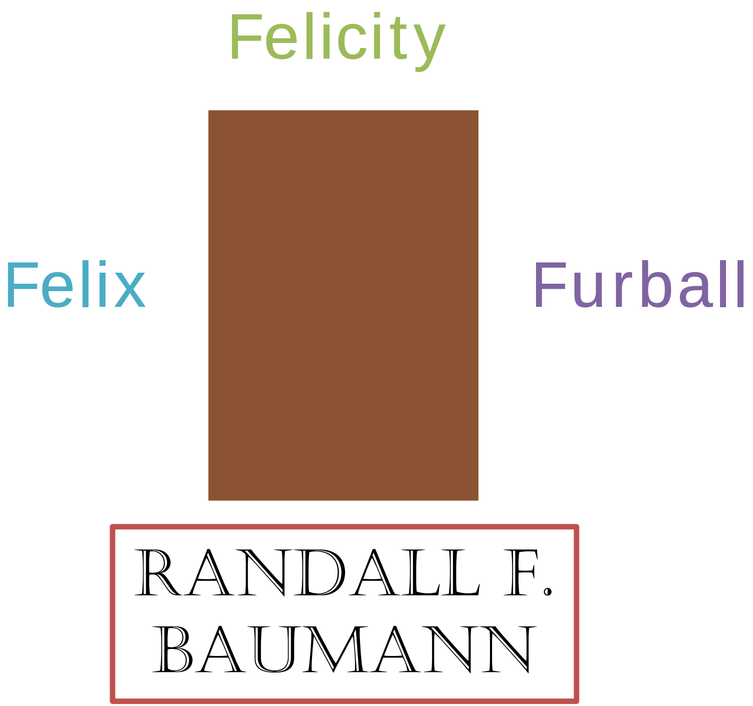
0 VP for a tie.

-17%

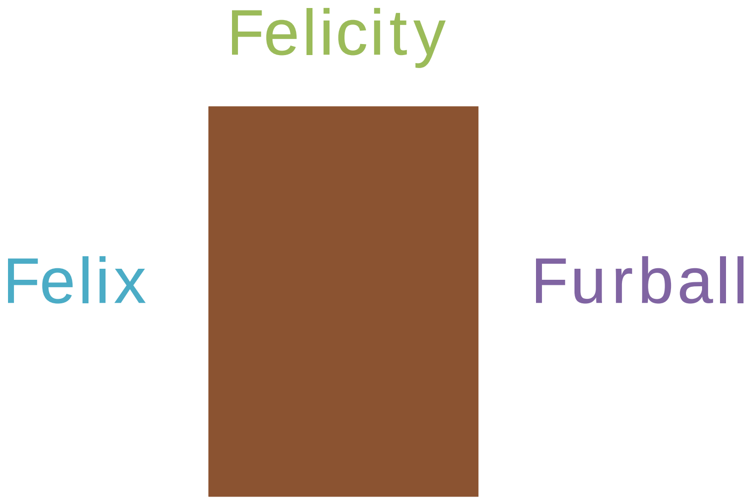
And maybe –3VP anyway, depending on what your neighbor does

Your neighbor faces the same situation

Back to the table.



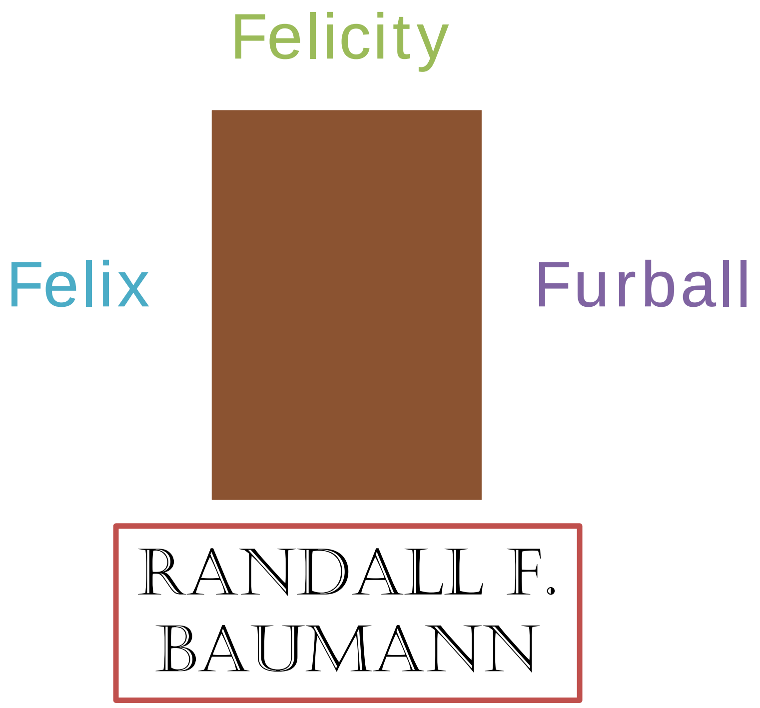
Back to the table. If Felix and RFB get into an arms race and neither wins...



RANDALL F. BAUMANN

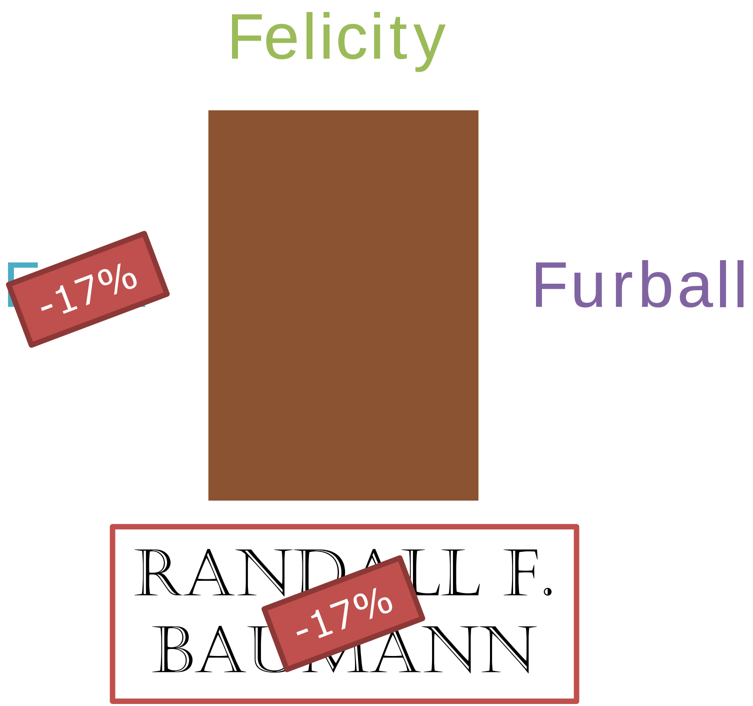
Back to the table. If Felix and RFB get into an arms race and neither wins...

They both lose 17% of their actions...



Back to the table. If Felix and RFB get into an arms race and neither wins…

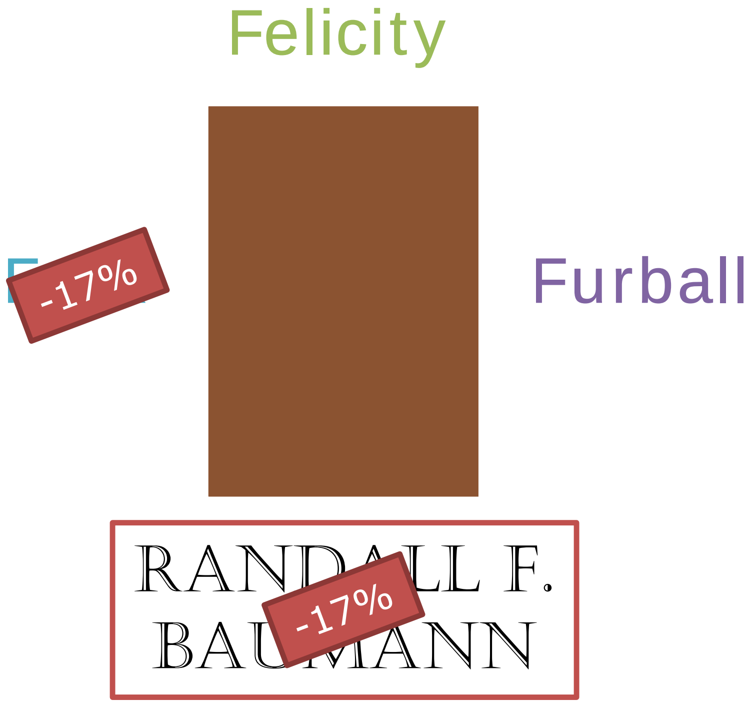
They both lose 17% of their actions…



Back to the table. If Felix and RFB get into an arms race and neither wins…

They both lose 17% of their actions…

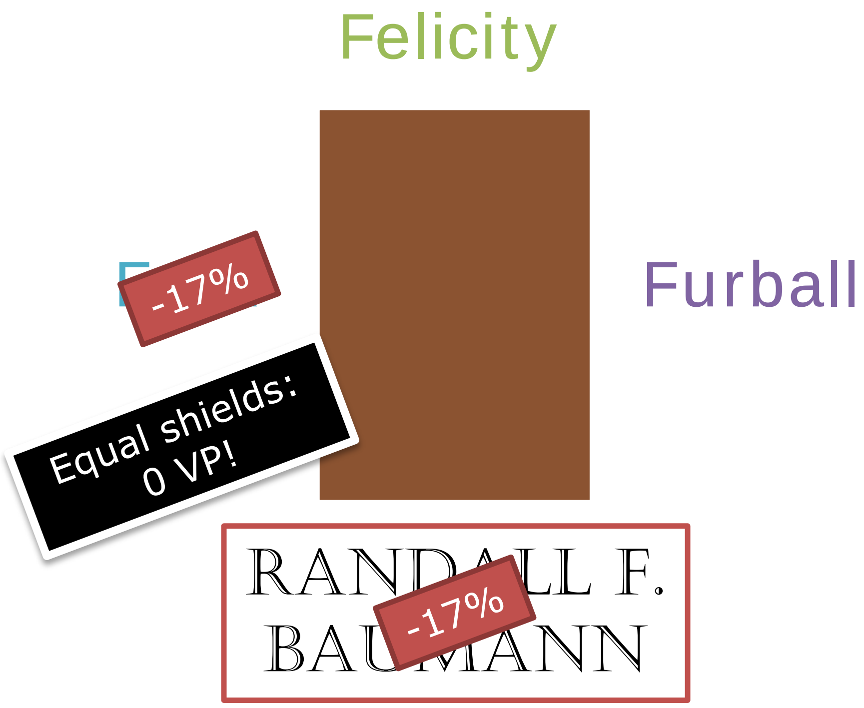
For 0 VP.



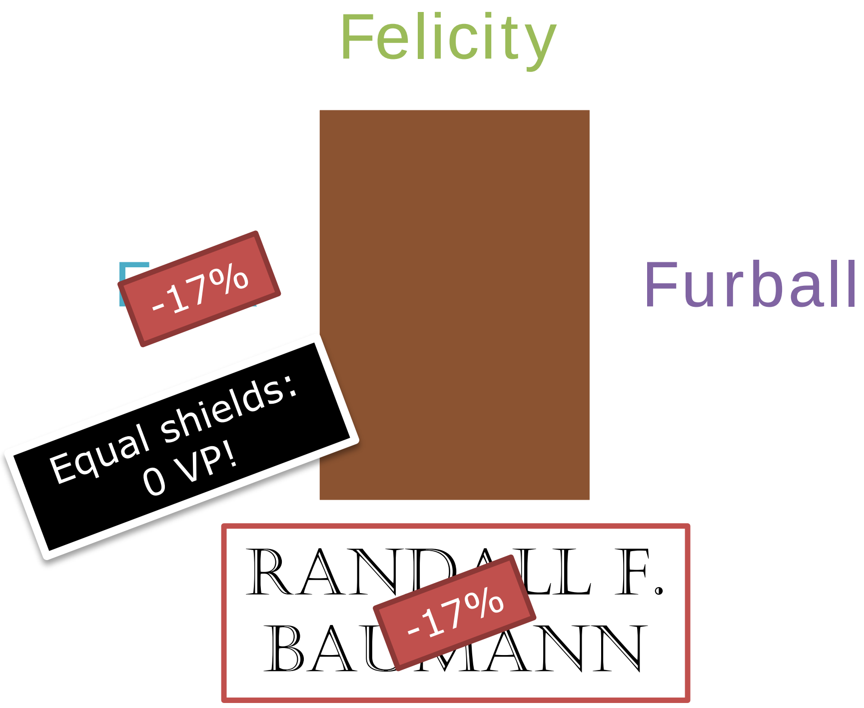
Back to the table. If Felix and RFB get into an arms race and neither wins...

They both lose 17% of their actions...

For 0 VP.

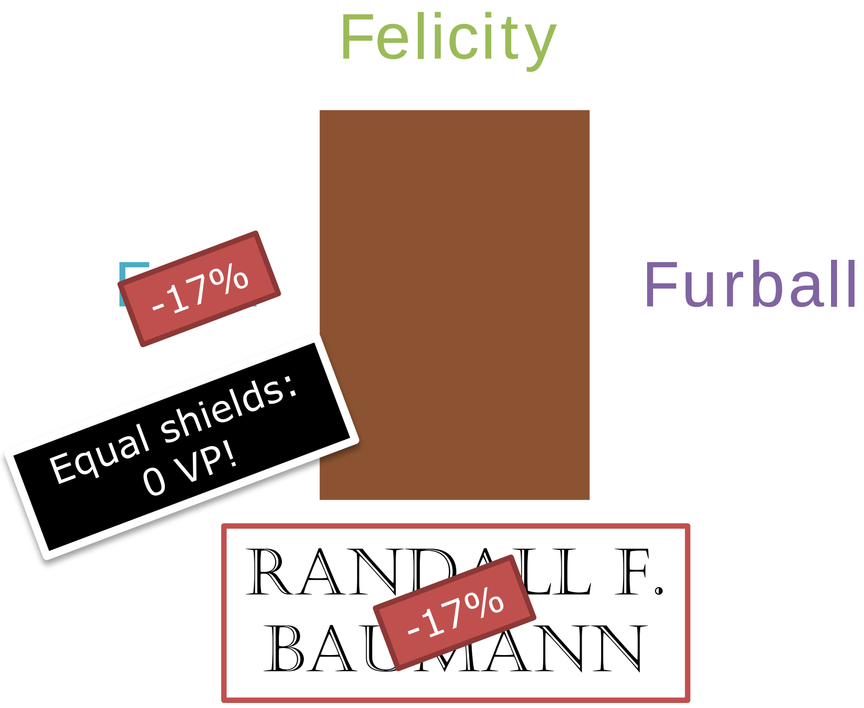


Meanwhile, Felicity and Furball choose the path of peace …



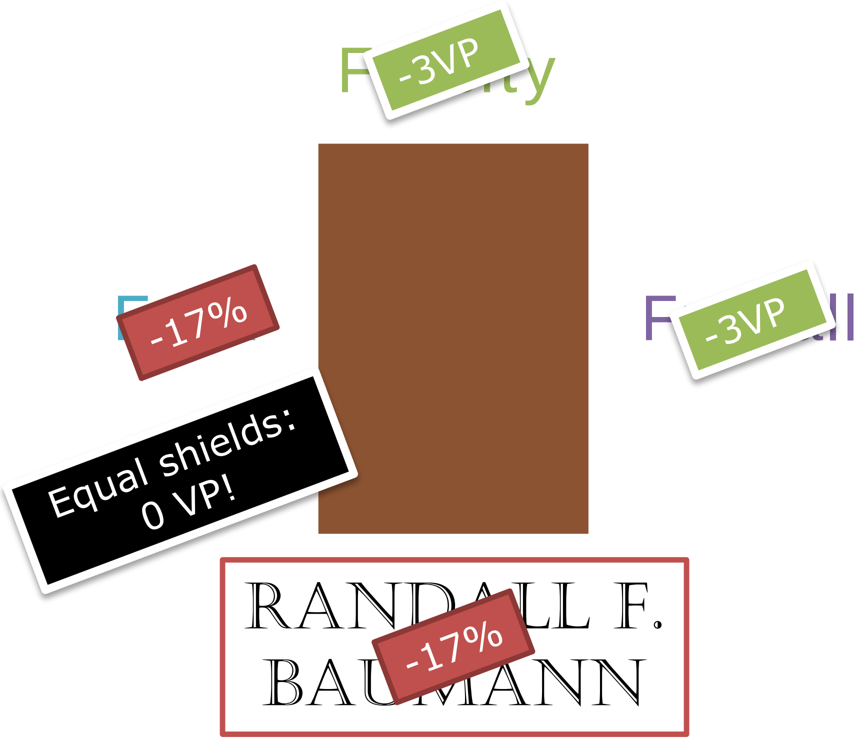
Meanwhile, Felicity and Furball choose the path of peace …

And lose 3 VP each.



Meanwhile, Felicity and Furball choose the path of peace …

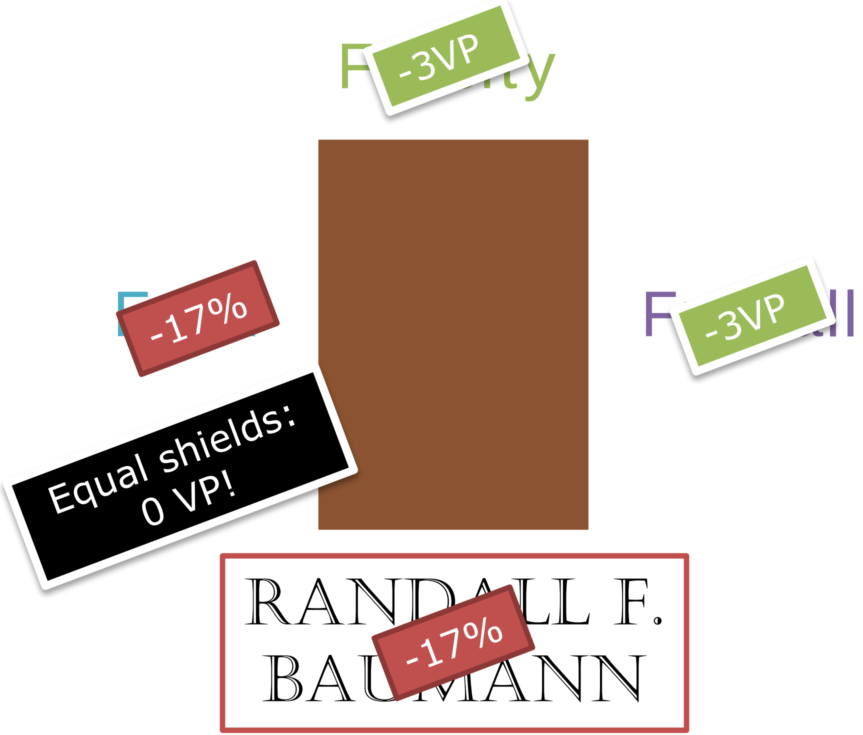
And lose 3 VP each.



Meanwhile, Felicity and Furball choose the path of peace …

And lose 3 VP each.

At some level of military investment, it becomes a disaster for both parties, eating up actions and handing the game to the other players.

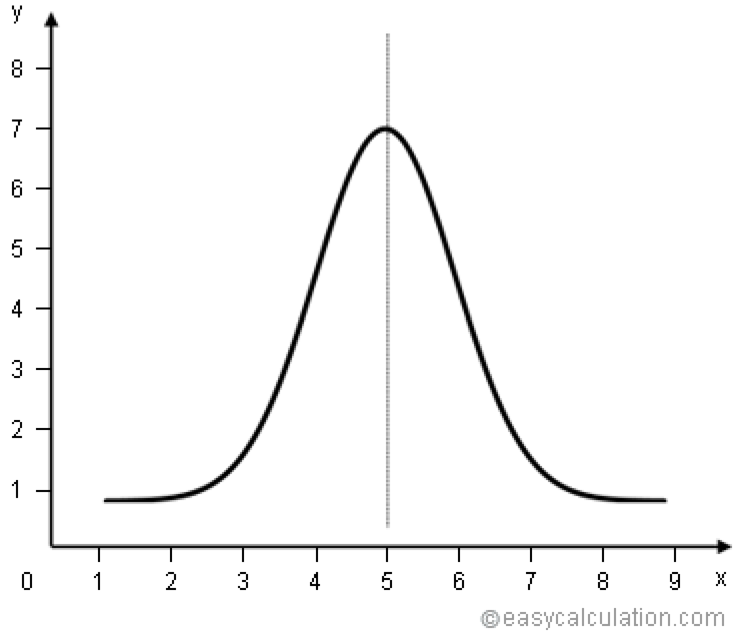


Wisdom of Crowds

1. If errors are normally distributed around the truth, the average of guesses will be close to the truth.

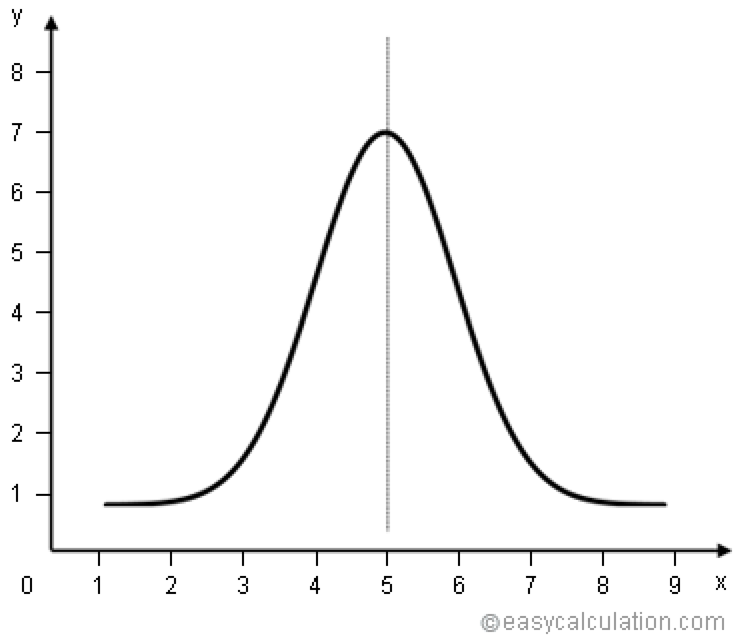
Wisdom of Crowds

1. If errors are normally distributed around the truth, the average of guesses will be close to the truth.



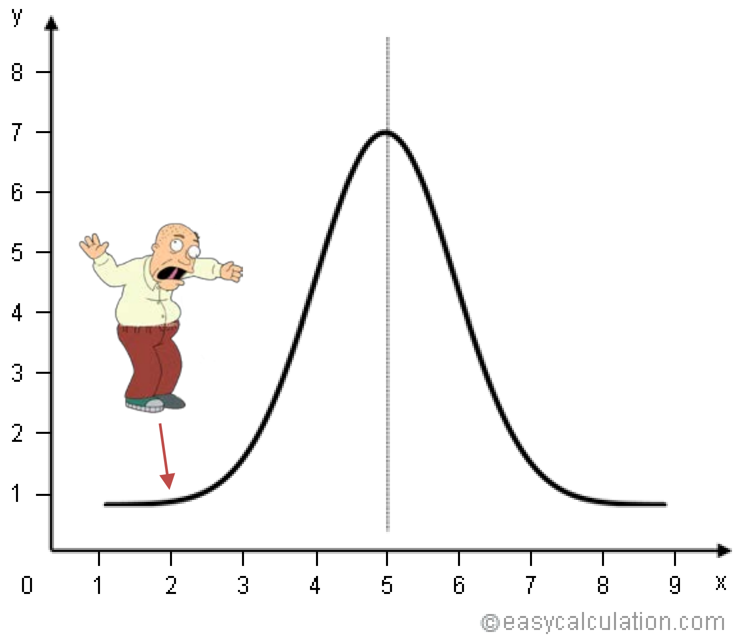
Wisdom of Crowds

One person's madness...



Wisdom of Crowds

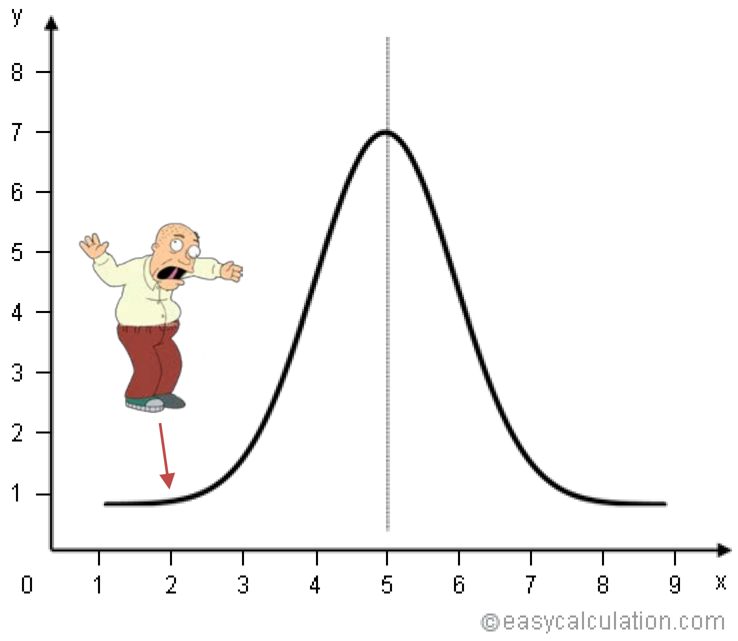
One person's madness...



Wisdom of Crowds

One person's madness...

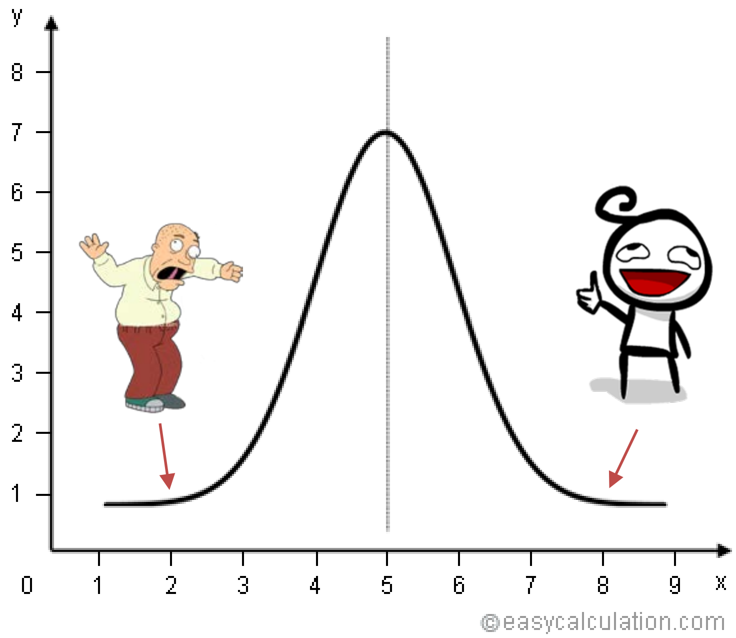
is cancelled by another's.



Wisdom of Crowds

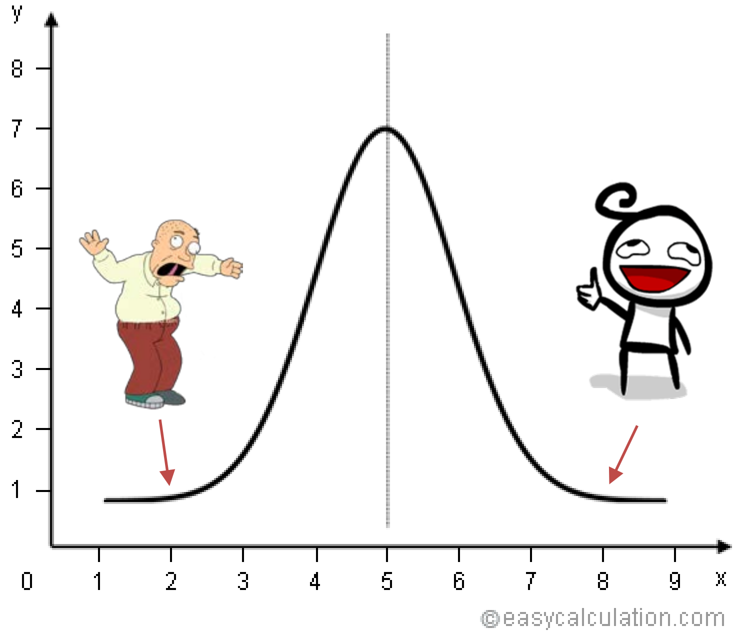
One person's madness...

is cancelled by another's.



Wisdom of Crowds

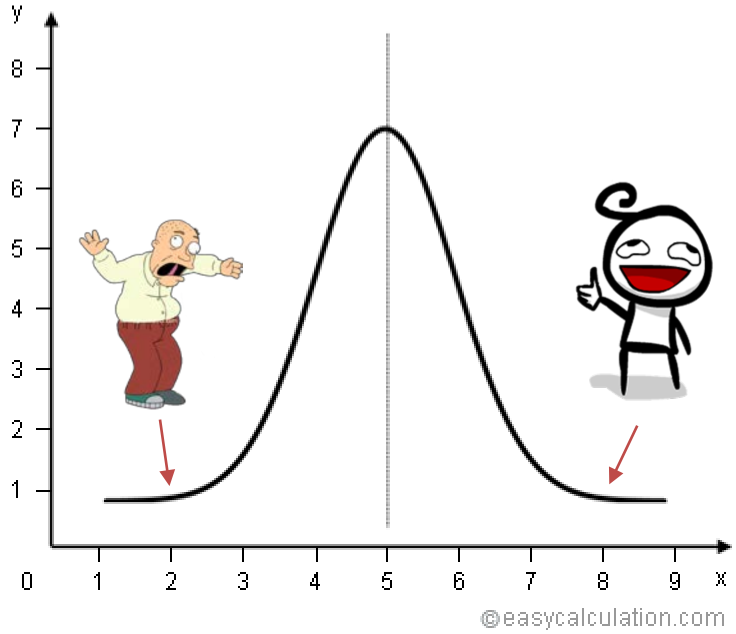
This breaks down if guesses are not independent.



Wisdom of Crowds

This breaks down if guesses are not independent.

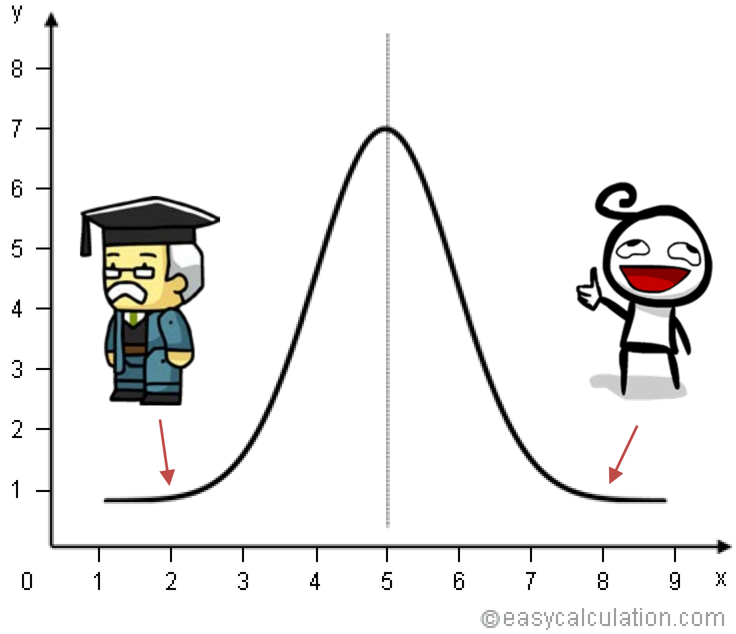
Suppose people are afraid of being wrong...



Wisdom of Crowds

This breaks down if guesses are not independent.

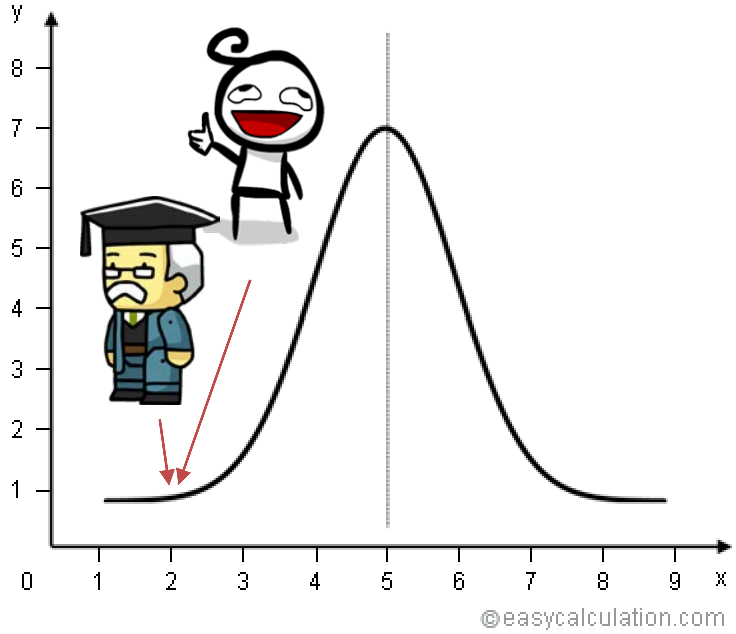
Suppose people are afraid of being wrong...



Wisdom of Crowds

This breaks down if guesses are not independent.

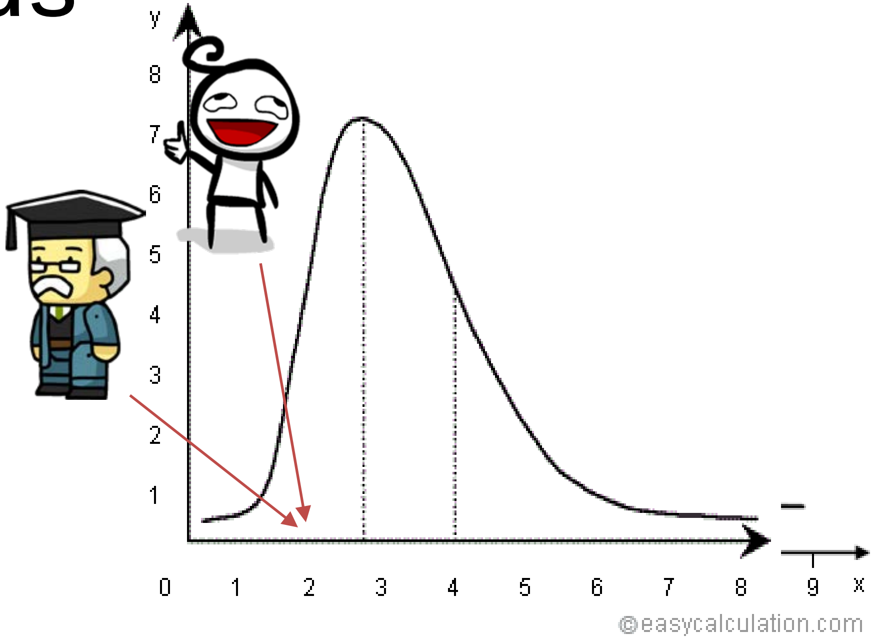
Suppose people are afraid of being wrong...



Wisdom of Crowds

This breaks down if guesses are not independent.

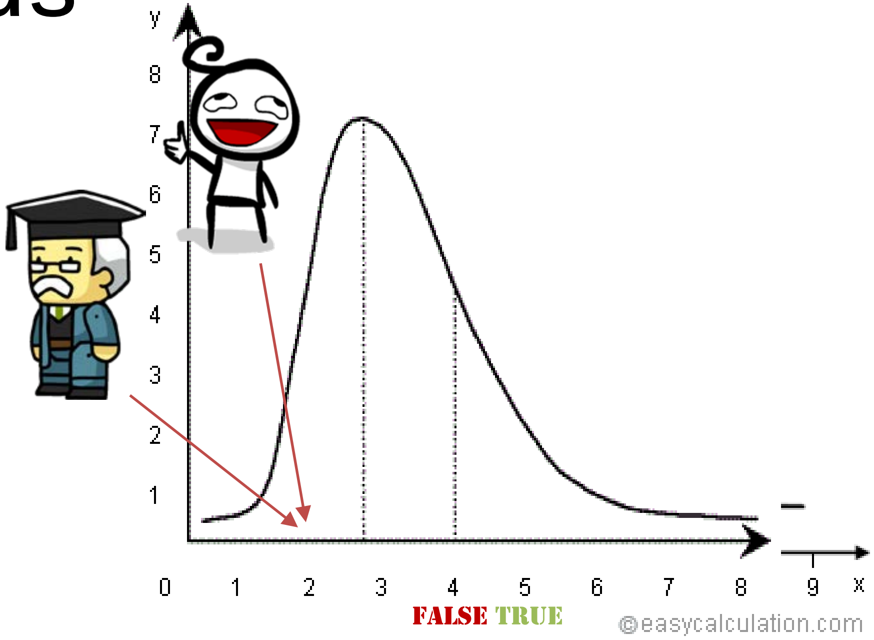
Suppose people are afraid of being wrong...



Wisdom of Crowds

This breaks down if guesses are not independent.

Suppose people are afraid of being wrong...



2. Systems with information error (such as player heuristics) will be centered on the true values, IF the information of each agent in the system is independent and unbiased. If information is correlated across agents, the central tendency of beliefs will not be near true values.

3. When people aren't thinking about the guessing process itself and how it might affect the game, their guesses will be good. But if agents are paying attention to each other's guesses, everyone's guesses can be way off.

OK I don’t have a specific board game for this one.

Question 1. Does the average guess get close to my real height?

Question 2. What does the average guess tell us about the wisdom of self-referential crowds?

OK I don't have a specific board game for this one.

Question 1. Does the average guess get close to my real height? 68!

Question 2. What does the average guess tell us about the wisdom of self-referential crowds?

The usual answer in the guess-the-2/3 game is **22**.

The usual answer in the guess-the-2/3 game is **22**. (The right answer is 0)

The usual answer in the guess-the-2/3 game is **22**. (The right answer is 0)

Crowds do **two rounds** of reasoning!

The usual answer in the guess-the-2/3 game is **22**. (The right answer is 0)

Crowds do **two rounds** of reasoning!

"The average of guesses between 0 and 100 will be around 50.

The usual answer in the guess-the-2/3 game is **22**. (The right answer is 0)

Crowds do **two rounds** of reasoning!

“The average of guesses between 0 and 100 will be around 50. 2/3 of that is 33.

The usual answer in the guess-the-2/3 game is **22**. (The right answer is 0)

Crowds do **two rounds** of reasoning!

“The average of guesses between 0 and 100 will be around 50. 2/3 of that is 33. But people will think this through, and guess that. Which makes the average 33, not 50.

The usual answer in the guess-the-2/3 game is **22**. (The right answer is 0)

Crowds do **two rounds** of reasoning!

“The average of guesses between 0 and 100 will be around 50. 2/3 of that is 33. But people will think this through, and guess that. Which makes the average 33, not 50. What’s 2/3 of 33? 22...”

By playing through board game examples, students grasp social science concepts quickly and firmly, much more so than from a lecture about theory and something happening in a videogame.

By playing through board game examples, students grasp social science concepts quickly and firmly, much more so than from a lecture about theory and something happening in a videogame.

When the ideas are expressed in systems language and then simple English, students are able to talk about them too.

Thanks!!

Edward Castronova

Professor and Chair of Media Arts and Production

Bachelor of Science Degree in Game Design

The Media School

Indiana University

castro@indiana.edu