Advanced **Social** and **Information Networks**

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no laptops / smartphone usage please!

such usage negatively impacts your peers

Faria Sana, Tina Weston, Nicholas J. Cepeda, Laptop multitasking hinders classroom learning for both users and nearby peers, Computers & Education, Volume 62, 2013, Pages 24–31,

This class will focus on **strategic interaction** on **networks**, where actors are **resource constrained**

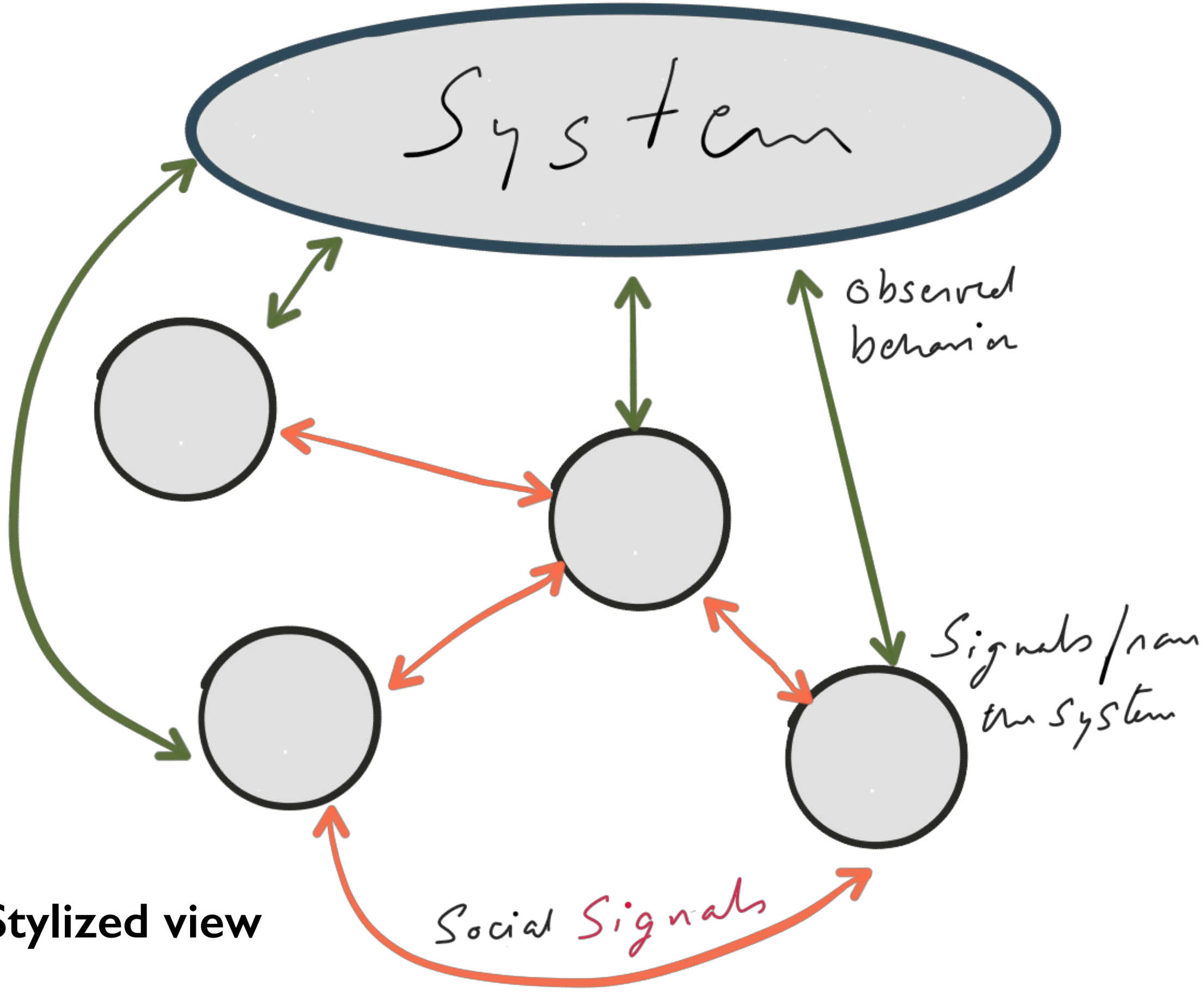
Examples of large-scale **strategic behavior** problems include

Sustainability

Public Health

congestion

A confluence of ideas from **game theory**, **behavioral economics**, **advertising** and **computer science** will play a key role in addressing these challenges



A Stylized view


When do people
cooperate?

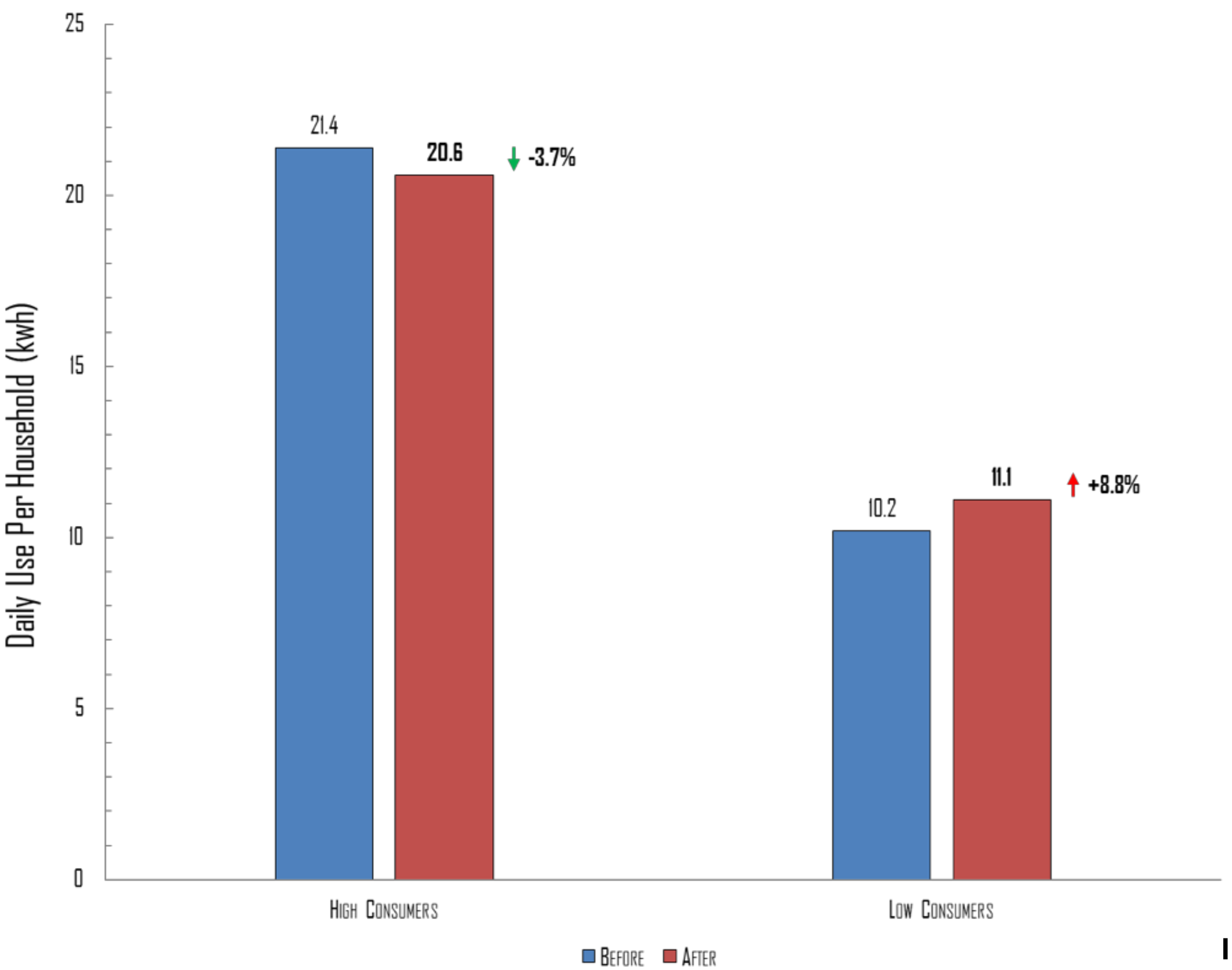
What are examples when large scale **technological** networks have facilitated collective behavior?

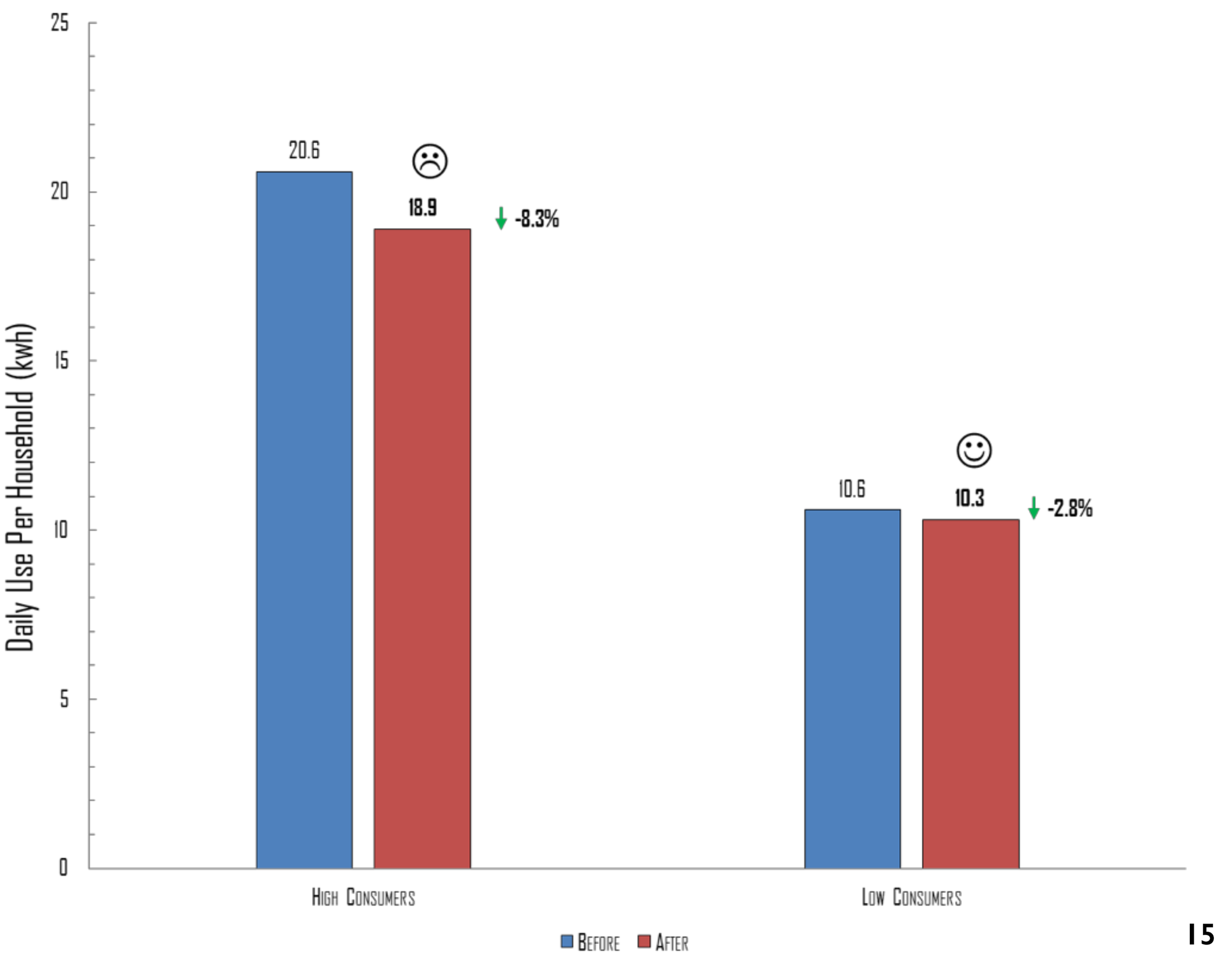

Iran, 2009


Cairo, 2011


Birmingham, 2011

San Marcos, California [Schultz, 2007]


Daily Use Per Household (kwh)
25
20
15
10
5
0
21.4
20.6
-3.7%
10.2
11.1
+8.8%
High Consumers
Low Consumers
Before
After


25
20
15
10
5
0
Daily Use Per Household (kwh)
20.6
18.9
-8.3%
10.6
10.3
-2.8%
High Consumers
Low Consumers
Before
After

November Neighbor Comparison

You used **28% MORE** energy than your efficient neighbors

HOW YOU'RE D

GREAT

GOOD

MORE TH

* This energy index combines electricity (kWh) and natural gas (therms) into a single measurement.

WHO ARE YOUR "NEIGHBORS"?

ALL NEIGHBORS
Approximately 100 occupied nearby homes that are similar in size to yours (avg 2,023 sq ft) and have both electricity and natural gas service.

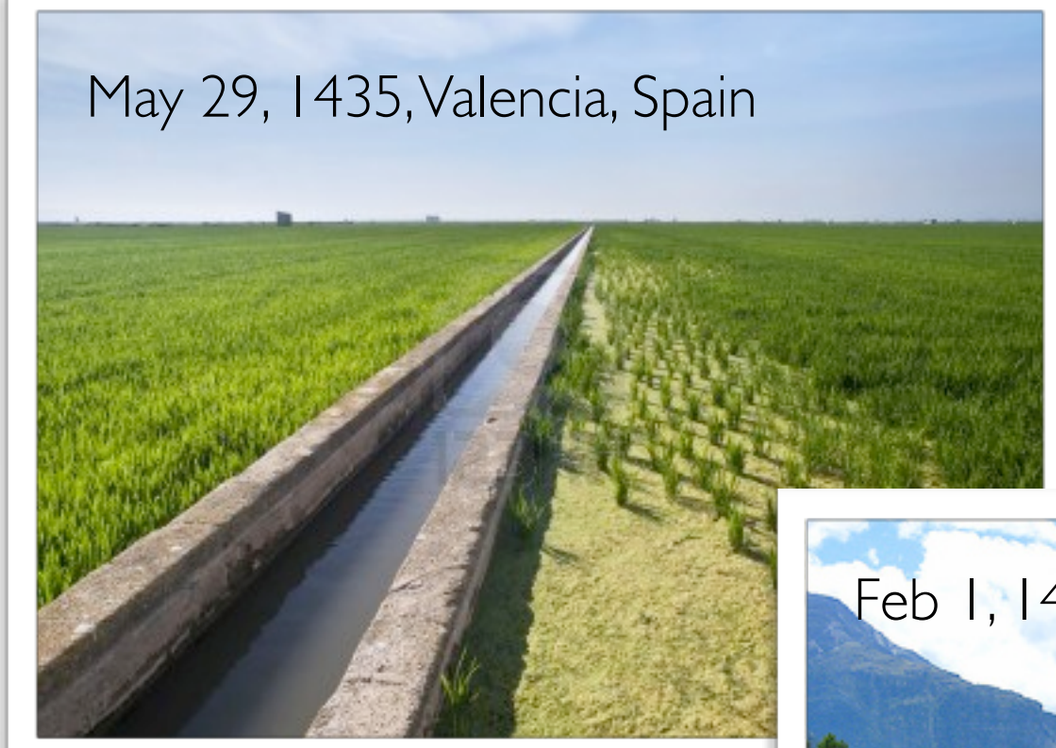
ighbor Comparison

You used **74% MOR**
This costs you a

people tend to cooperate if they expect others to do so too

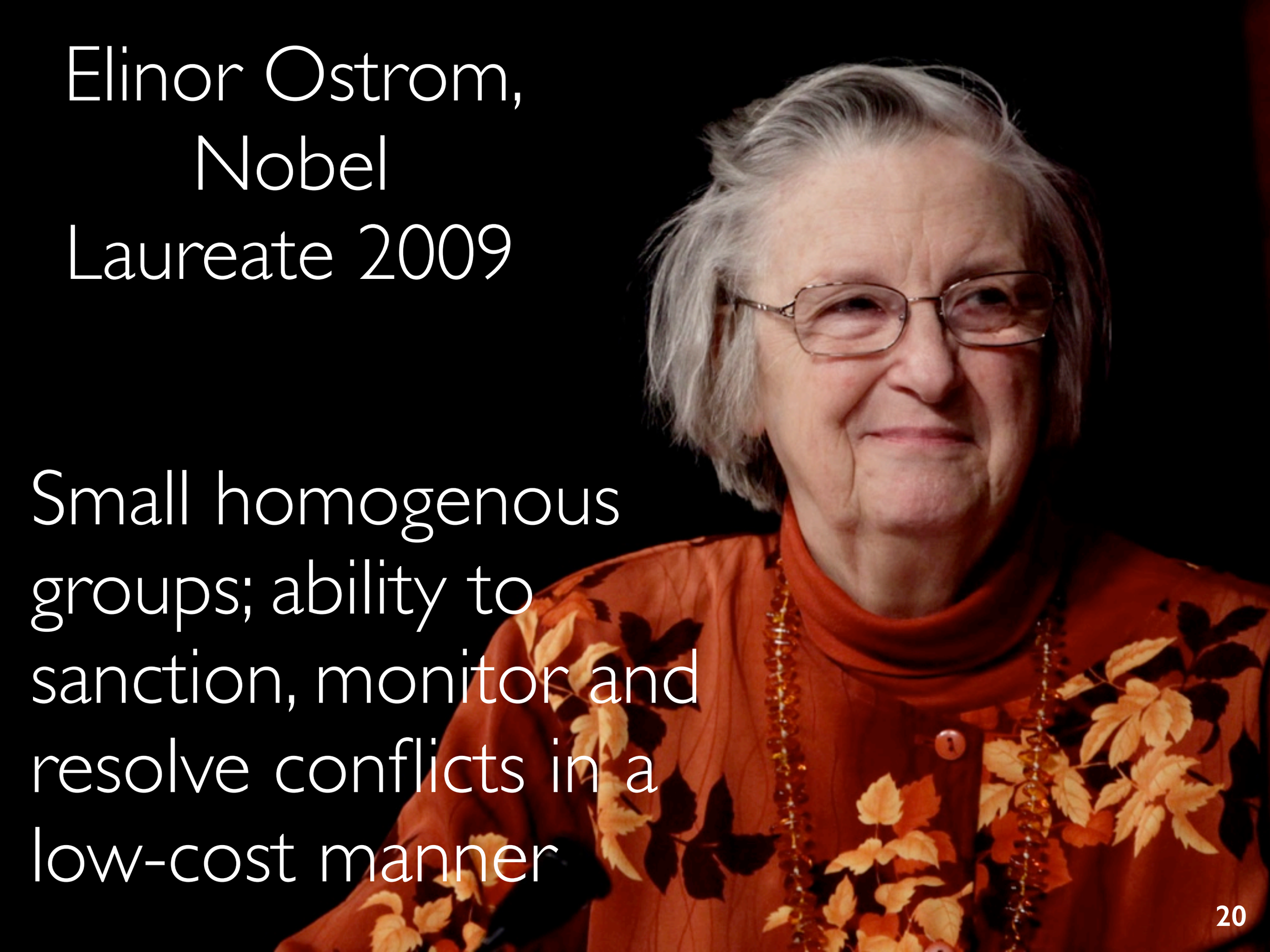
people who share resources have a selfish reason not to cooperate

[Hardin, 1968]


May 29, 1435, Valencia, Spain


Feb 1, 1483, Törbel, Switzerland

Elinor Ostrom, Nobel Laureate 2009

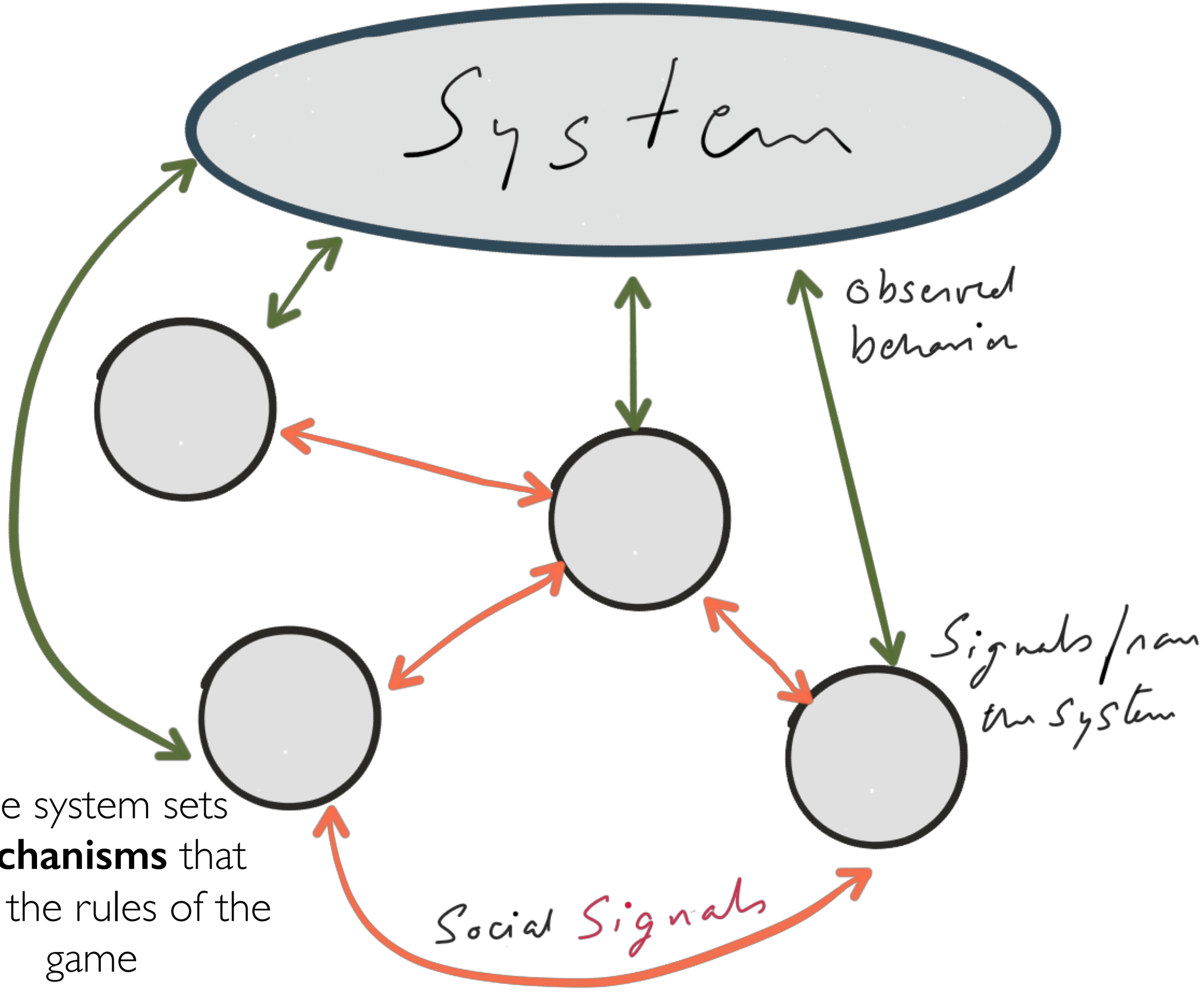


Small homogenous groups; ability to sanction, monitor and resolve conflicts in a low-cost manner

The CS question:

How do we scale up?

mechanisms, realistic models, interventions



The system sets **mechanisms** that form the rules of the game

Incentive compatible

The riot that wasn't: How Twitter spread rumours of communal violence in Kolkata

On Monday, a road blockade was portrayed as a full-blown riot by some social media users – part of a worrying trend of misinformation being spread online.

Sreemoy Talukdar
@sreemoytalukdar

Follow

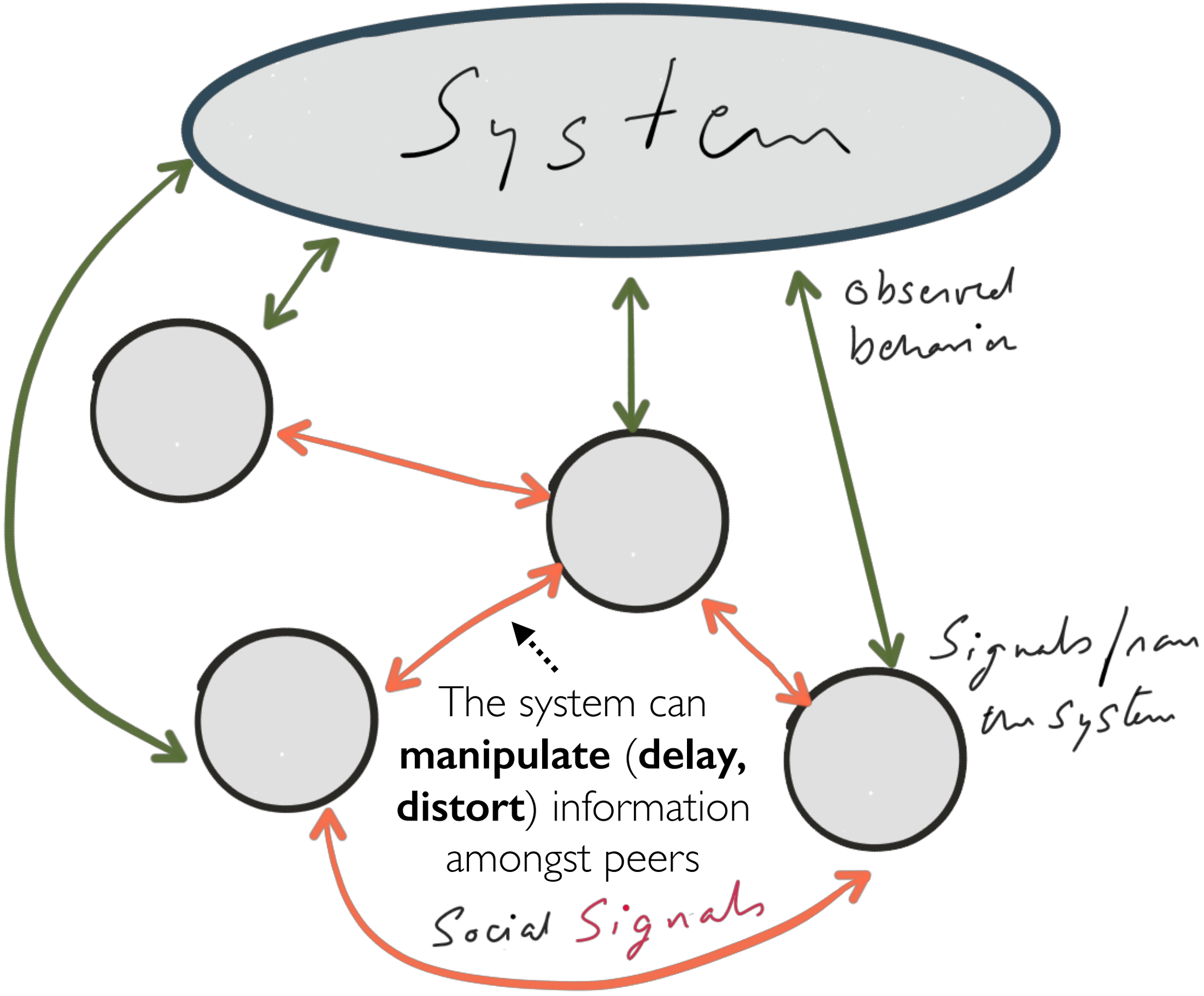
Riot in Kolkata. All Muslim-dominated areas are burning. Many injured. No deaths yet. Mamata's cops are spectators. Media blackout. Total.

RETWEETS 115 FAVORITES 15

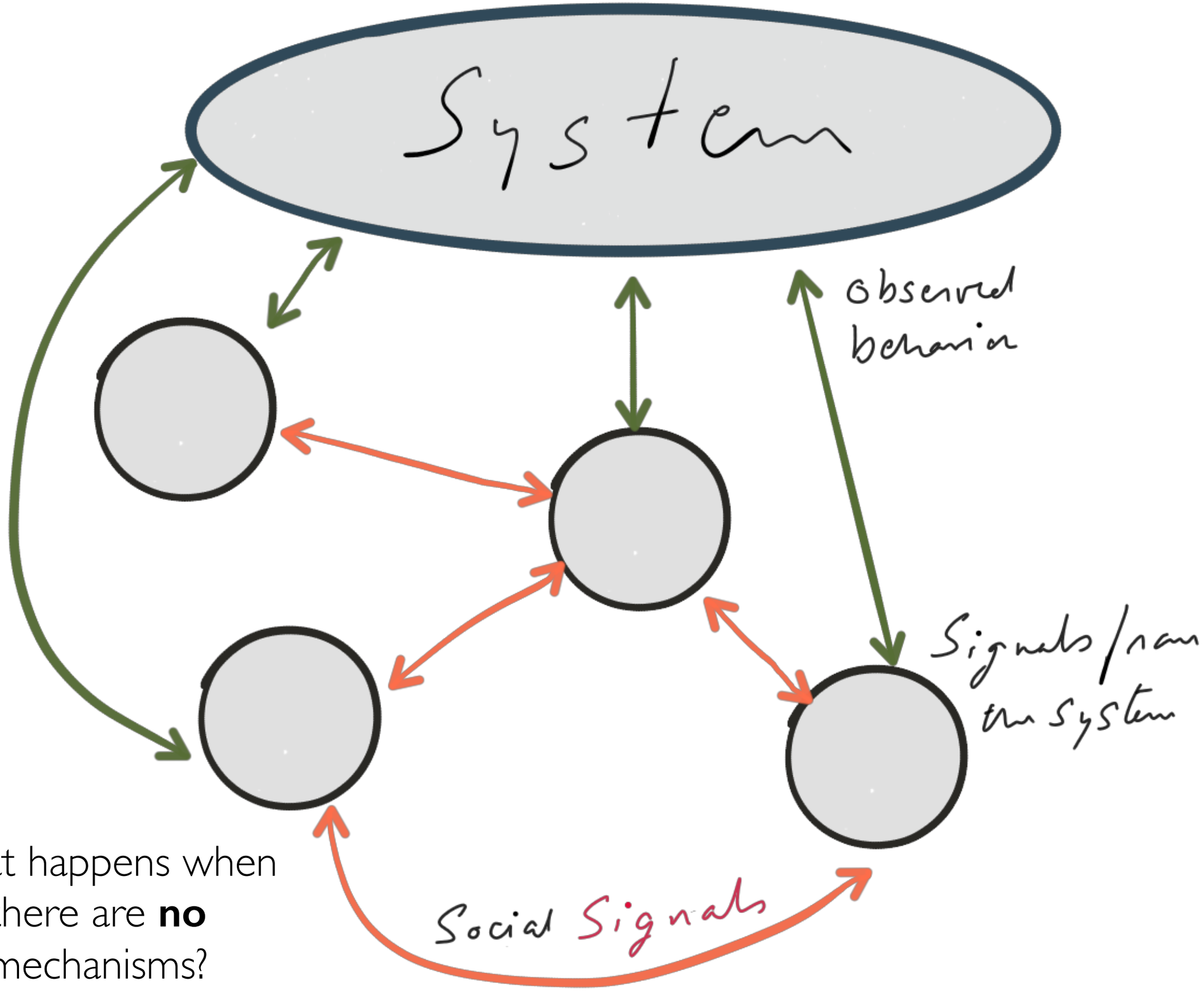
11:42 PM - 3 Aug 2015

Talukdar is an editor at news website, Firstpost.

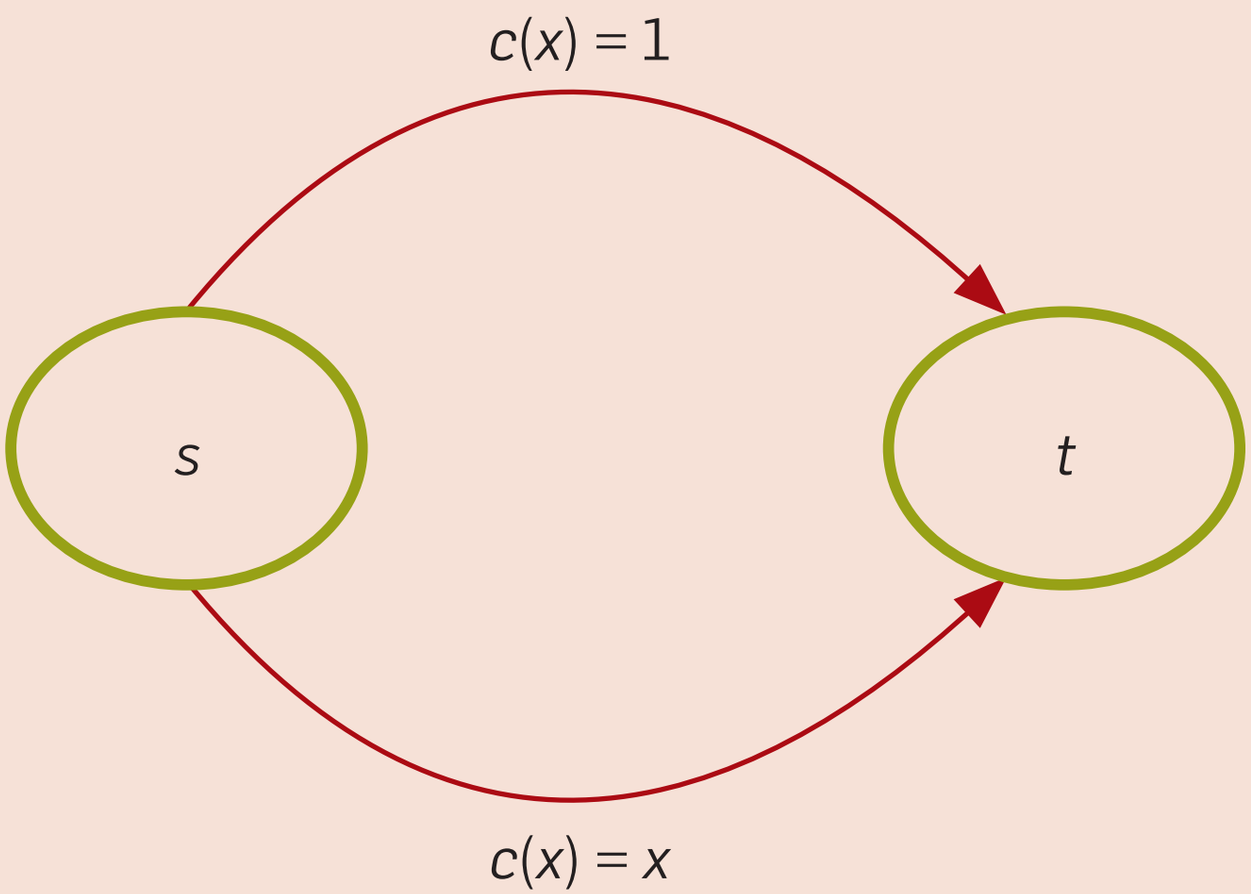
How do we create **incentive-compatible** reporting on social networks?


System
observed behavior
Signals/ran the system
The system can **manipulate** (**delay, distort**) information amongst peers
Social Signals

Can peers cooperate to **discover** manipulation in polynomial time?



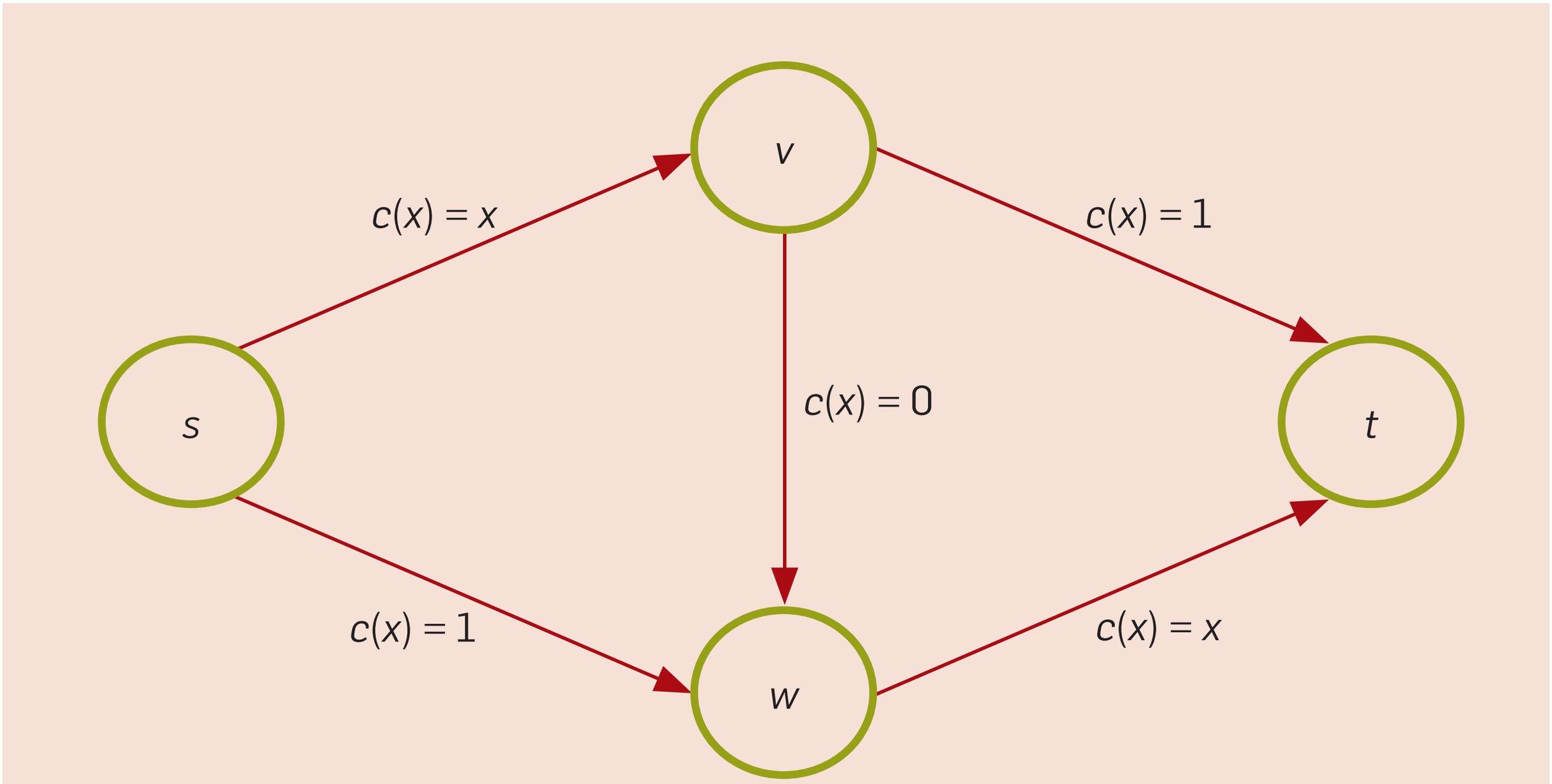
What happens when there are **no** mechanisms?



(a) Pigou's Example

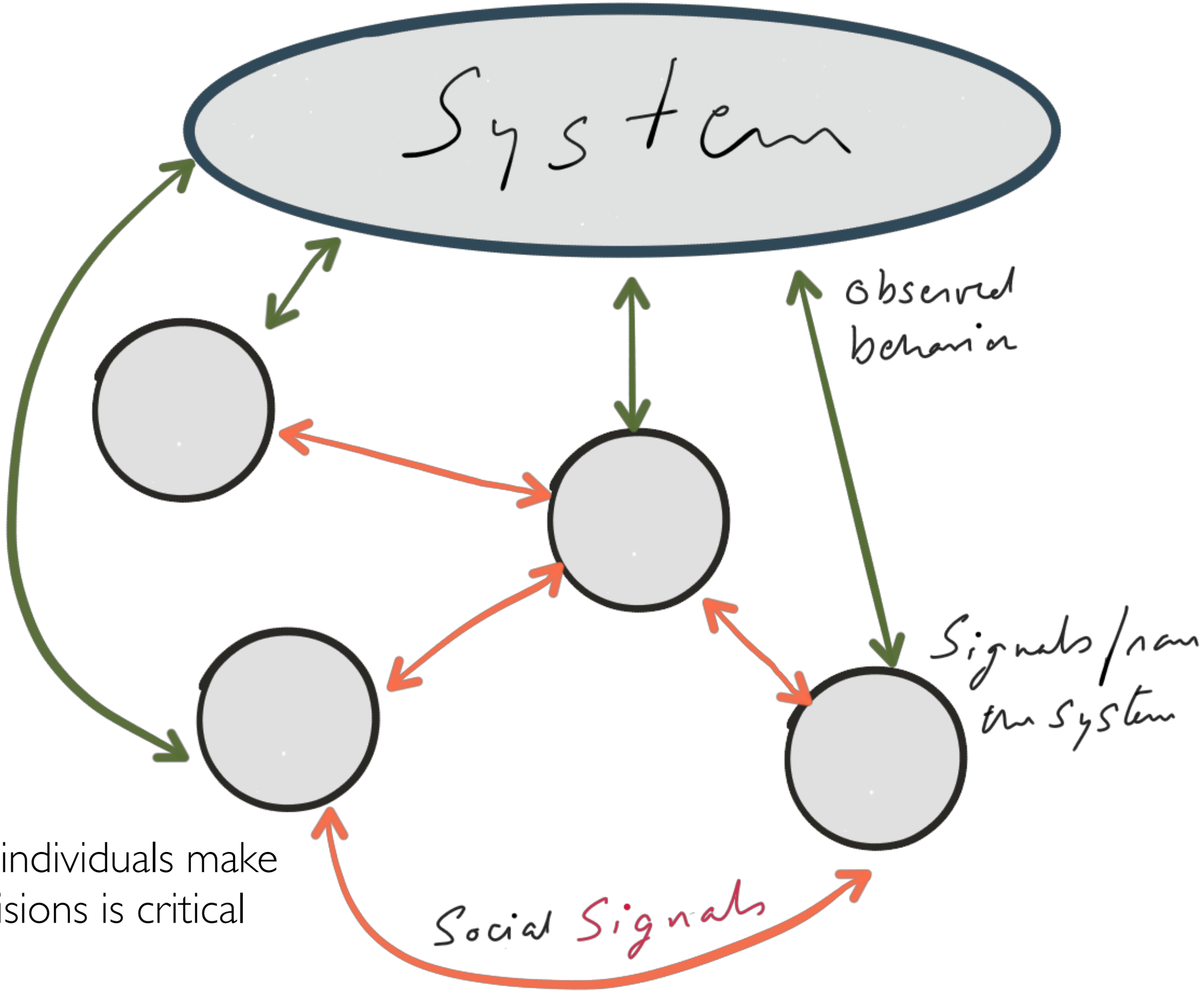
What happens when there are **no** mechanisms?

The **price of anarchy** is upper bounded by **4/3** for **all** networks with **affine** (ax+b) costs



(b) Braess' Paradox

Adding edges to the network can make it **worse**!



How individuals make decisions is critical

In this class, we will re-examine **rational behavior**, which forms the basis of game theory and mechanism design

Stanley mows his lawn every weekend and it gives him terrible hay fever. I ask Stan why he doesn't hire a kid to mow his lawn. Stan says he doesn't want to pay the $10. I ask Stan whether he would mow his neighbor's lawn for $20 and Stan says no, of course not.

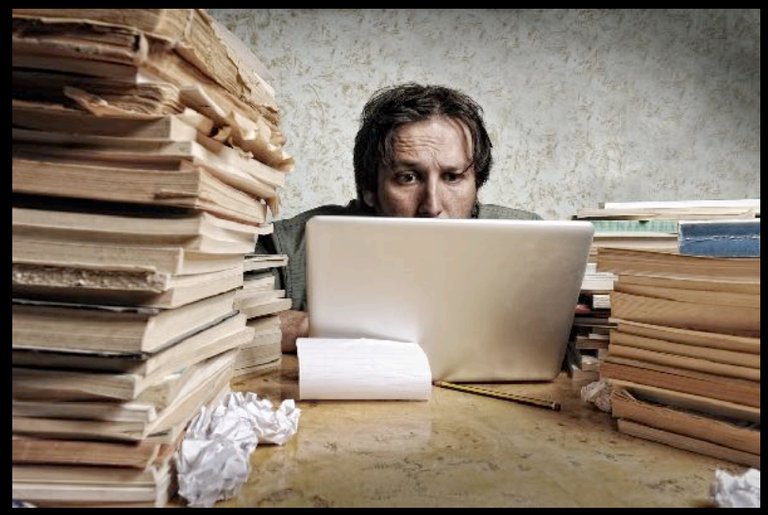
Thaler, Richard H.. Misbehaving: The Making of Behavioral Economics (p. 20). W. W. Norton & Company. Kindle Edition.

Linnea is shopping for a clock radio. She finds a model she likes at what her research has suggested is a good price, $45. As she is about to buy it, the clerk at the store mentions that the same radio is on sale for $35 at new branch of the store, ten minutes away, that is holding a grand opening sale. Does she drive to the other store to make the purchase?

On a separate shopping trip, Linnea is shopping for a television set and finds one at the good price of $495. Again the clerk informs her that the same model is on sale at another store ten minutes away for $485.

Thaler, Richard H.. Misbehaving: The Making of Behavioral Economics (p. 20). W. W. Norton & Company. Kindle Edition.

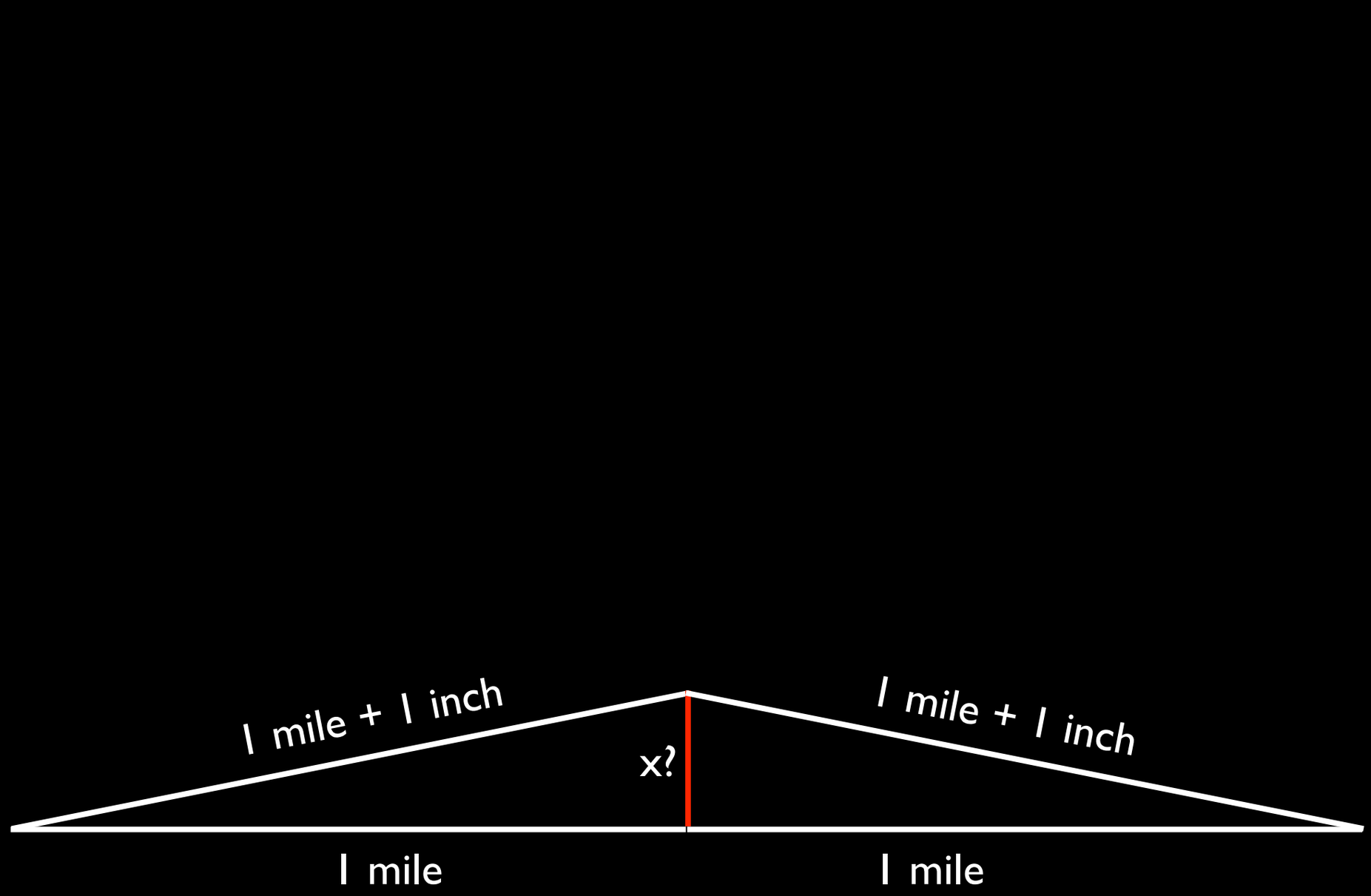
Imperfect knowledge
Limited resources
Make sub-optimal decisions

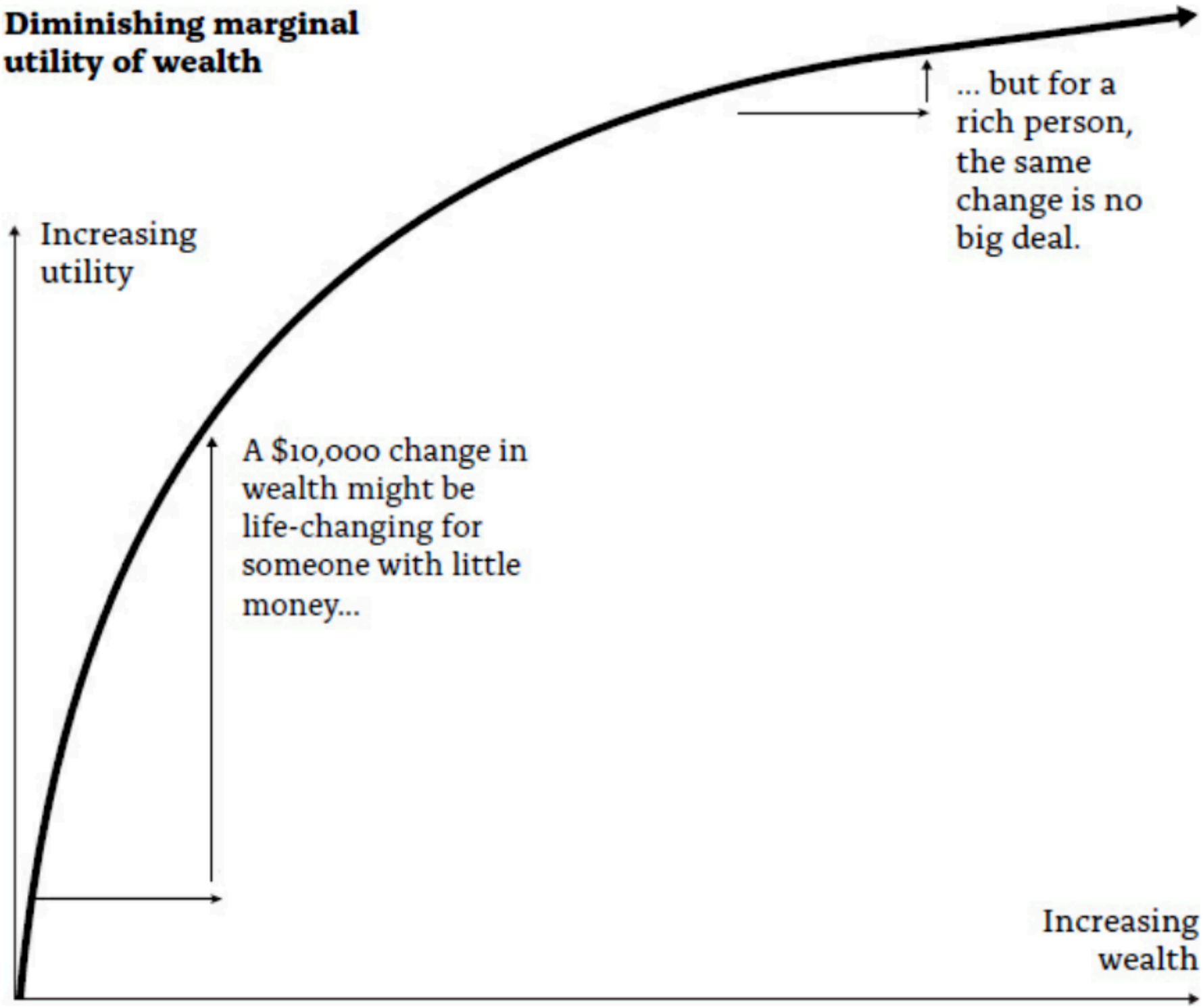


Econs **vs.** Humans

Have complete knowledge
Always possess resources to act on decisions
Make optimal decisions

Normative v. descriptive

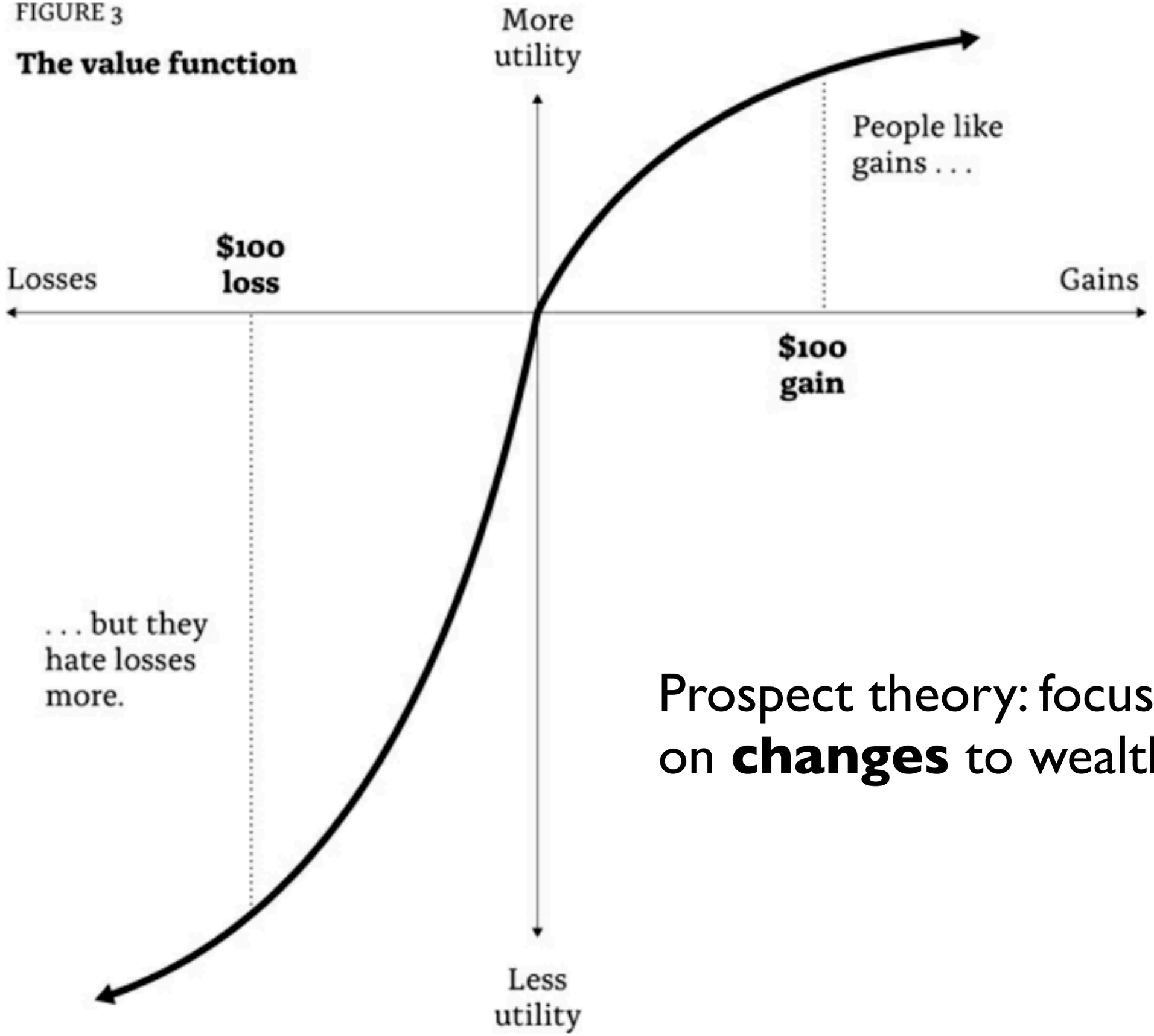

1 mile + 1 inch
x?
1 mile + 1 inch
1 mile
1 mile



Expected utility: diminishing returns; focus on **levels** of wealth

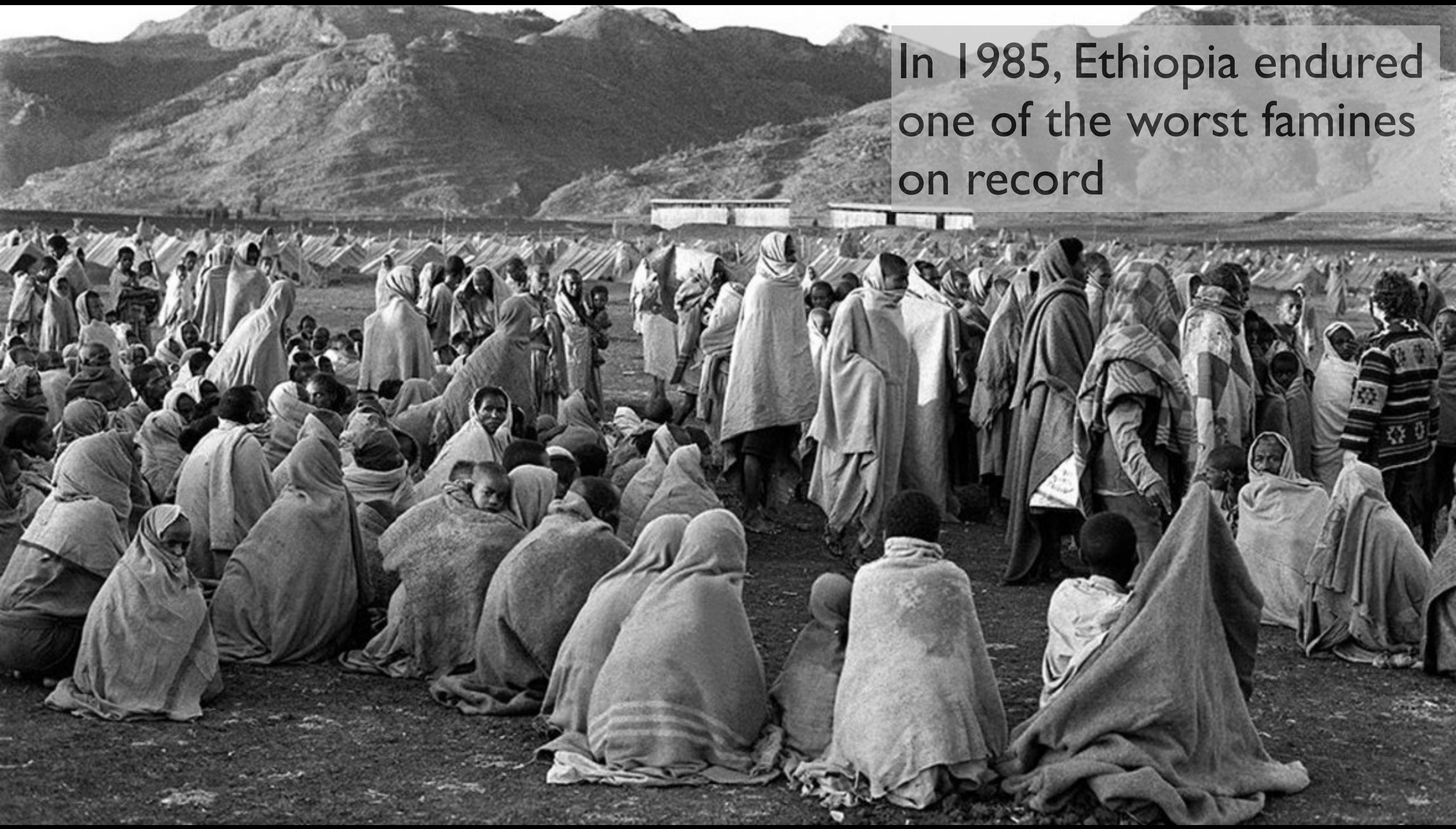
FIGURE 3

The value function



Prospect theory: focus on **changes** to wealth

reciprocity



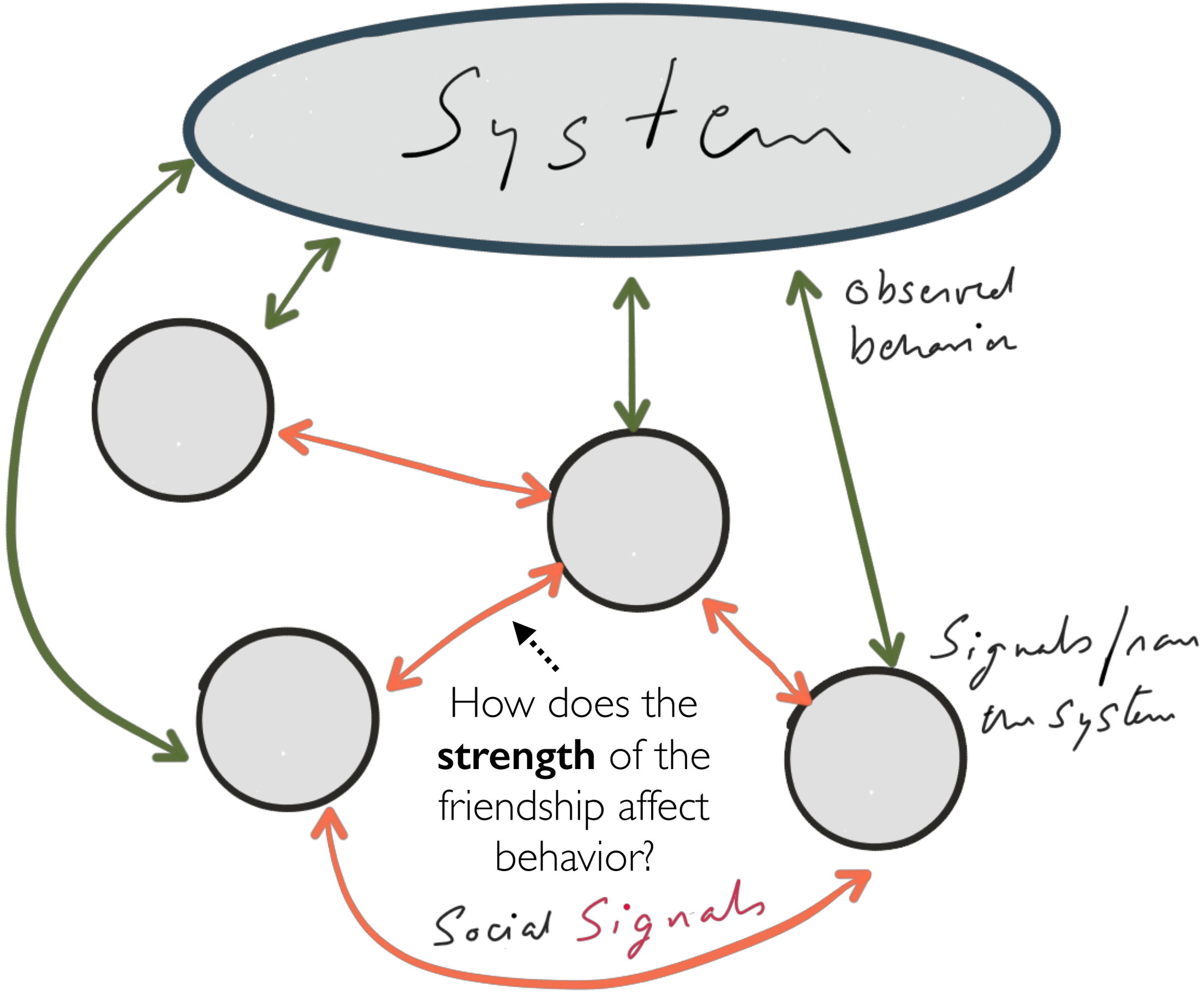
In 1985, Ethiopia endured one of the worst famines on record

In 1985, Mexico City suffered a devastating earthquake

Yet, Ethiopia, then one of the poorest countries in the world, offered $5,000 to help Mexico!

Because, in 1935, Mexico had sent aid to Ethiopia, when it was invaded by Italy.

Cialdini, Robert B.. **Influence: Science and Practice**. Pearson HE Inc.


System
observed behavior
Signals/ran the system
How does the **strength** of the friendship affect behavior?
Social Signals

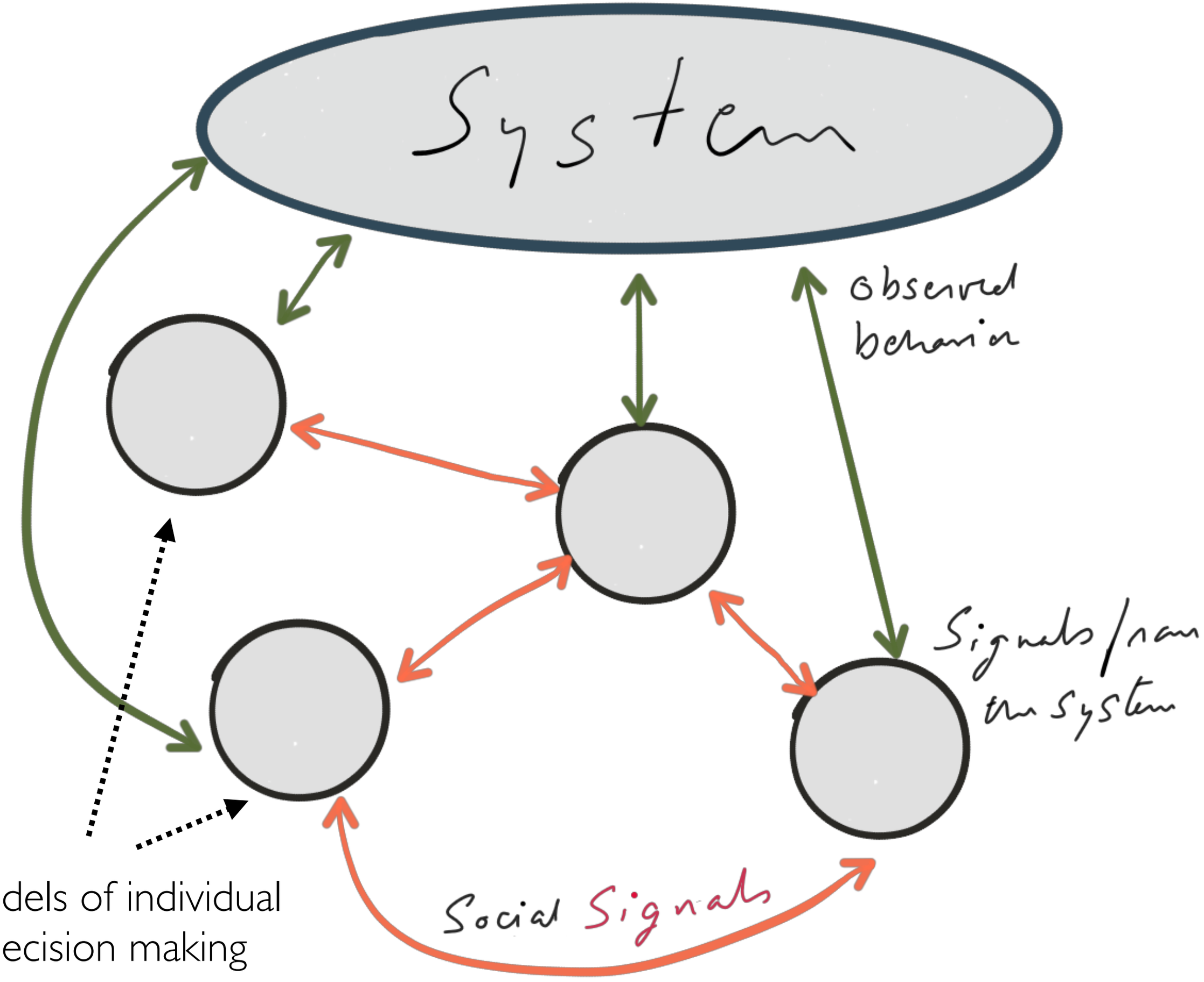
$$\frac{\sum_{i \in N_v} \omega_i \phi(i)}{|N_v|} \geq \theta_v$$

Linear Threshold model

When did **he** decide to join?

Monday, Feb. 1st , 1960

Greensboro, NC, Woolworth's sit-in



Models of individual decision making

Linda is thirty-one years old, single, outspoken, and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and also participated in antinuclear demonstrations.

Which alternative is more probable?

- Linda is a bank teller.
- Linda is a bank teller and is active in the feminist movement.

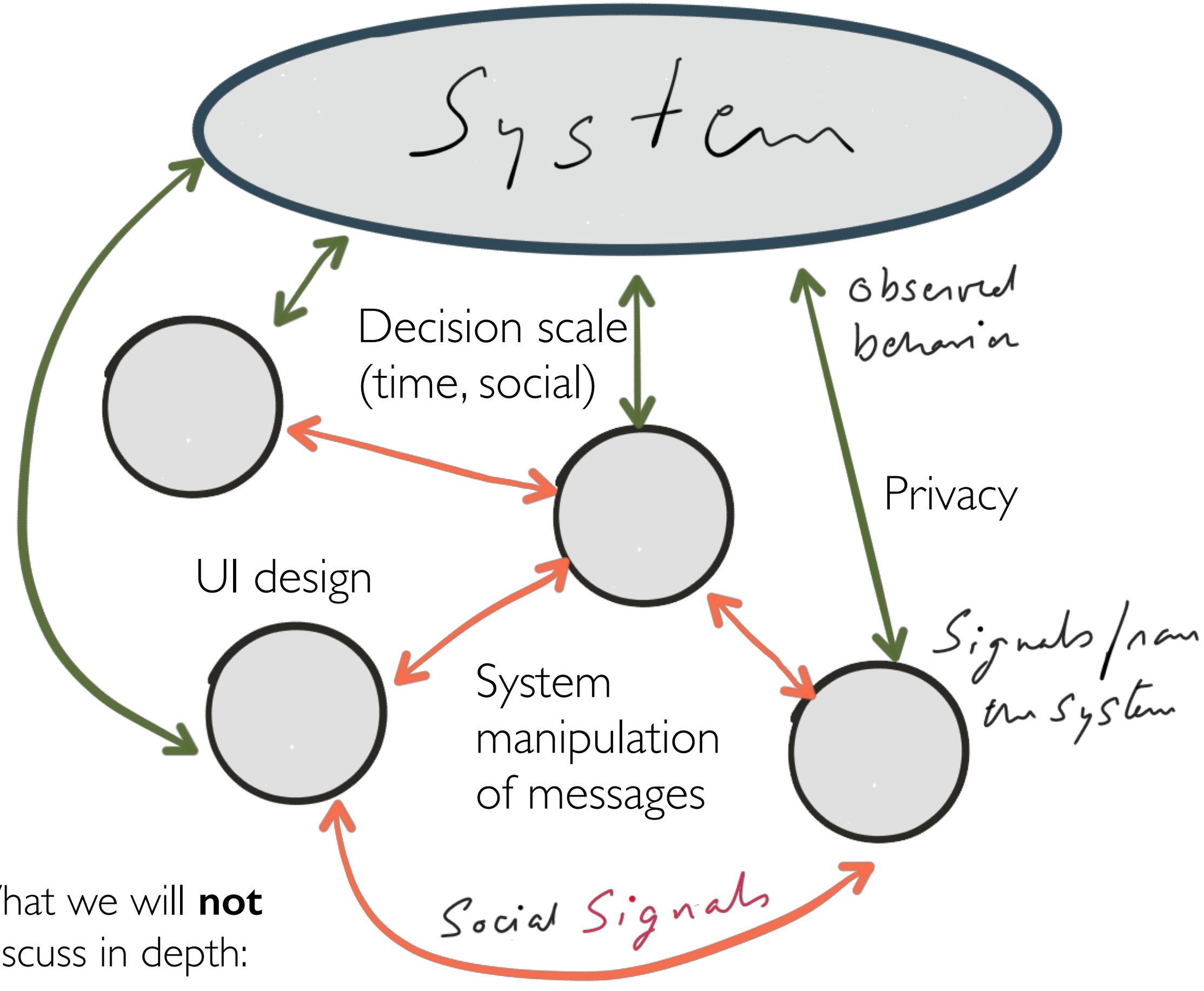
Assume that you have two choices: a nearly sure bet (97%, called ‘p’ bet) of winning $10, or a 37% chance of winning $30 (called ‘$’ bet)

what would you choose, p or $?

how much will you pay in exchange for the **p** bet?

how much will you pay in exchange for the **$** bet?

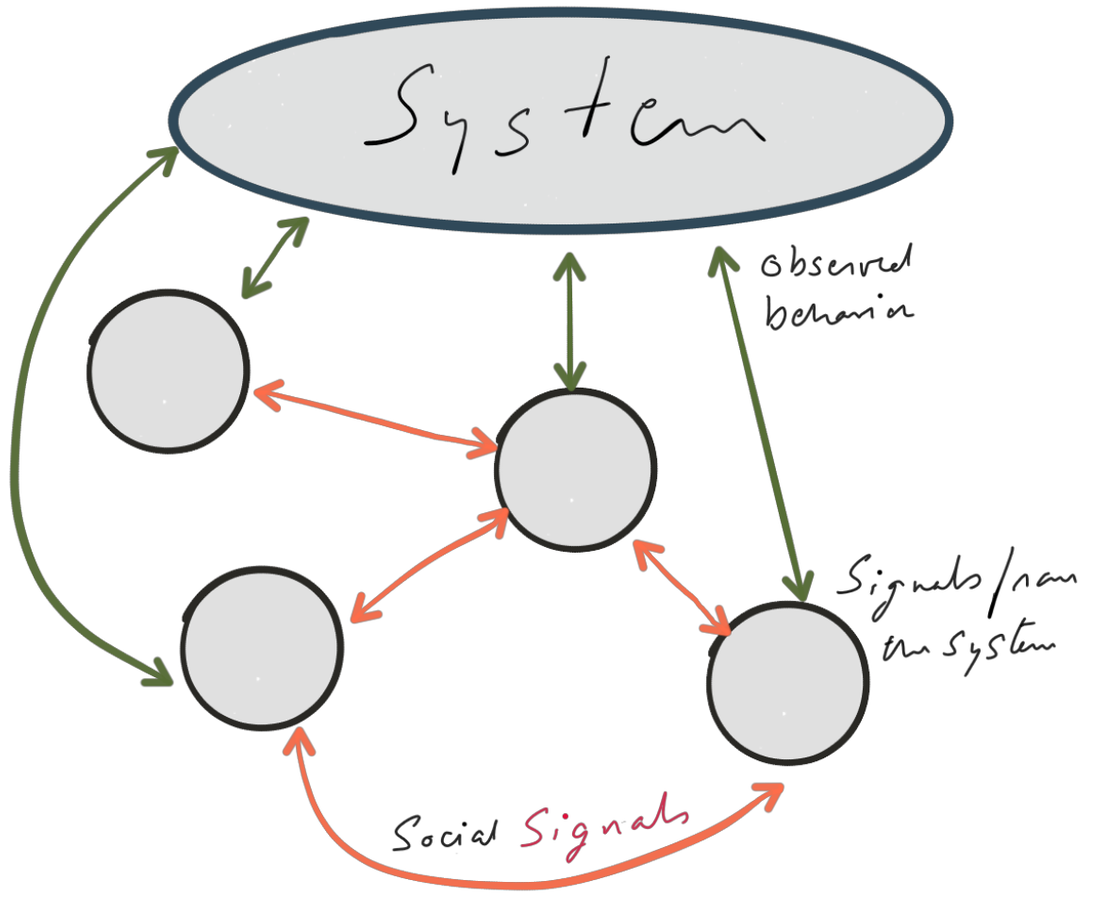
We shall be discussing several open problems in this class, and brainstorm over solutions



What we will **not** discuss in depth:

CS598 CLASS MECHANICS

Everything you wanted to know



class website:

https://courses.engr.illinois.edu/cs598hs/sp2019/

Let's go over the class schedule

paper review

1 paper presentation	15%

weekly, open ended questions

1 each week (pass / fail); can re-submit in case of fail for 50% credit	20% (total)

project

proposal **10%**

paper **30%**

Final presentation **10%**

best presentation (**extra credit**) 2%

participation

feedback on final presentations	10%
class particpation	5%

you can miss two classes; for every class beyond two, you will lose a third of a letter grade

i.e. A → A- (for missing three classes)

i.e. A → B+ (for missing four classes)

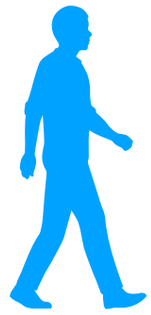
academic integrity

zero tolerance policy!

Plagiarism deserves special mention. **It is an academic violation to copy, to include text from other sources, including online sources, without proper citation**. Any student found to be violating this code will be subject to disciplinary action.

http://www.cs.uiuc.edu/academics/honor-code

MEET THE TA



Rick