

Model Thinking

Scott E Page

Reason # 1: Intelligent Citizen of the World

Reason # 2: Clearer Thinker

Reason # 3: Understand and Use Data

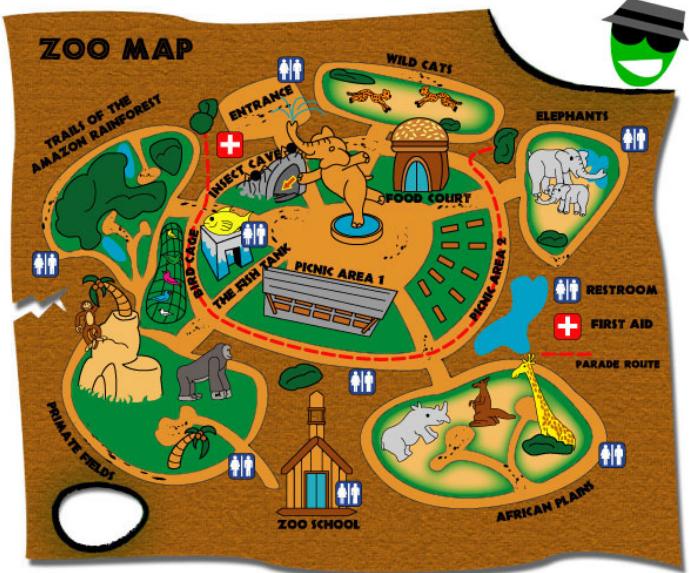
Reason # 4: Decide, Strategize, and Design

Outline and Structure



Outline

Image: Puzzledcat.blogspot



Outline

Image: Nuke Mayhem Deviant Art

Collective Action

Wisdom of Crowds

Tipping Points

Markov Processes

Colonel Blotto

Spatial Voting

Lyapunov Models

Decision Theory

Linear Models

Learning Models

Economic Growth

Online Course Format

- Videos
 - 8-15 minutes
 - Questions
- Readings
 - Linked on Wiki
- Assignments
- Quizzes
- Discussion Forum

Section Structure

Section Structure

- The model
 - Assumptions, results, applications

Section Structure

- The model
 - Assumptions, results, applications
- Technical Details
 - Measures, Proofs (Easy, Medium, Hard)
 - Practice Problems

Section Structure

- The model
 - Assumptions, results, applications
- Technical Details
 - Measures, Proofs (Easy, Medium, Hard)
 - Practice Problems
- Fertility

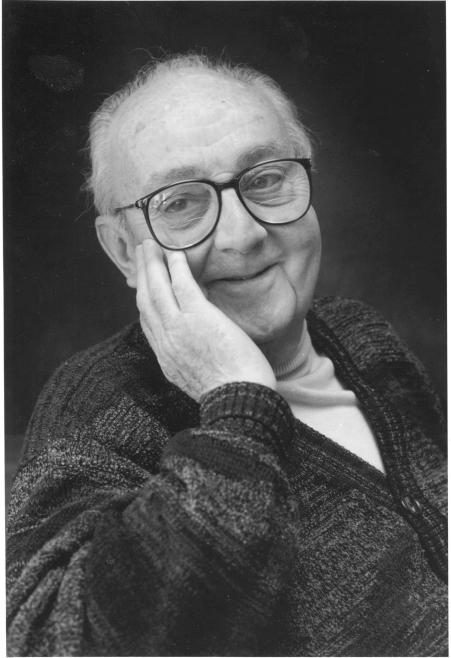
Model Thinking

Scott E Page

Model Thinking

Scott E Page

Intelligent Citizen of the World



George E. P. Box

"essentially, all
models are
wrong, but some
are useful"

The New Lingua Franca



Image: modernmythmuseum

Economics

$$\max_{\{C_t, H_t, K_{t+1}, I_t\}_{t=0}^{\infty}} \mathcal{E}_0 \sum_{t=0}^{\infty} \{\ln C_t - H_t\},$$

subject to $G(C_t, V_t I_t) \leq A_t K_t^\alpha H_t^{1-\alpha}$;

$$K_{t+1} = (1 - \delta)K_t + (1 - \theta_t s(I_t/I_{t-1}))I_t;$$

$$\ln A_t = g_A + \ln Z_{t-1} + \eta_t + \sum_{i=1}^8 \xi_{t-i}^i;$$

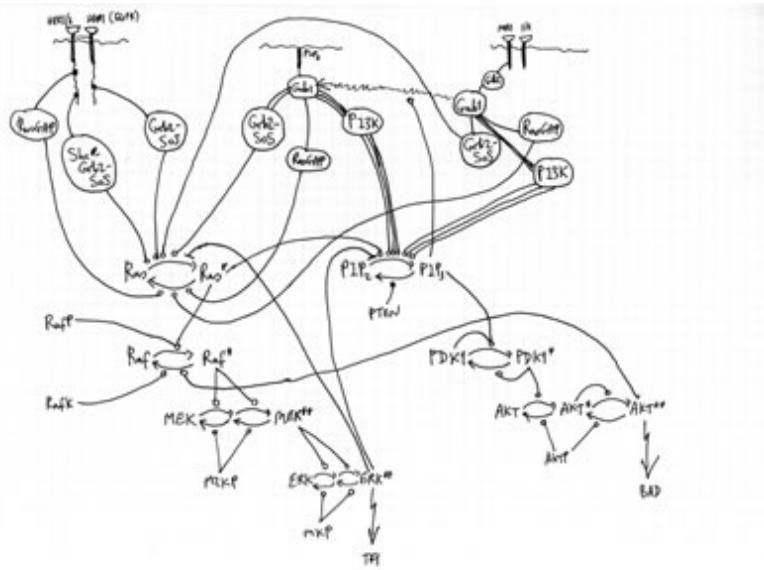
$$\ln V_t = g_V + \ln V_{t-1} + \omega_t + \sum_{i=1}^8 \zeta_{t-i}^i;$$

$$\ln \theta_t = \rho \ln \theta_{t-1} + \varepsilon_t + \sum_{i=1}^8 \varphi_{t-i}^i;$$

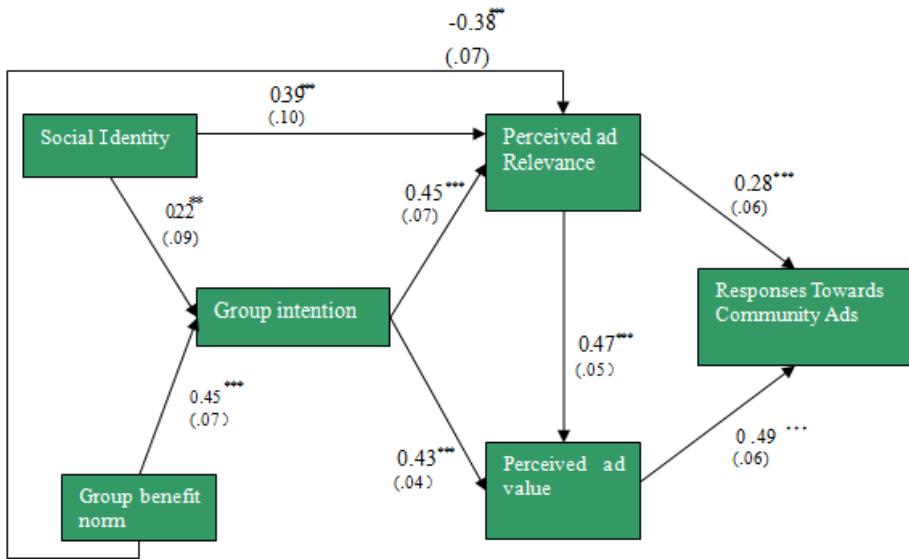
$$G(C_t, V_t I_t) = \left[\lambda_C C_t^\psi + \lambda_I (V_t I_t)^\psi \right]^{1/\psi},$$

K_0 given.

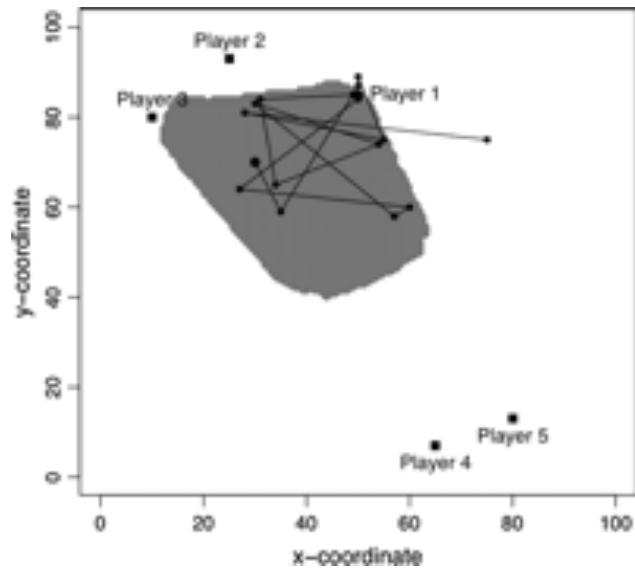
Biology



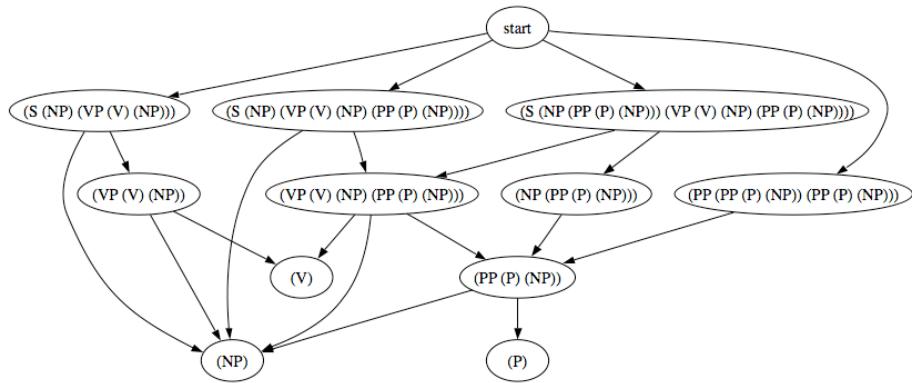
Sociology



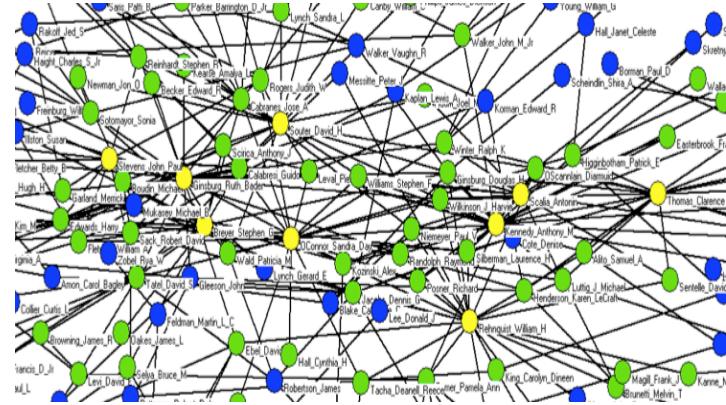
Political Science: Voting



Linguistics



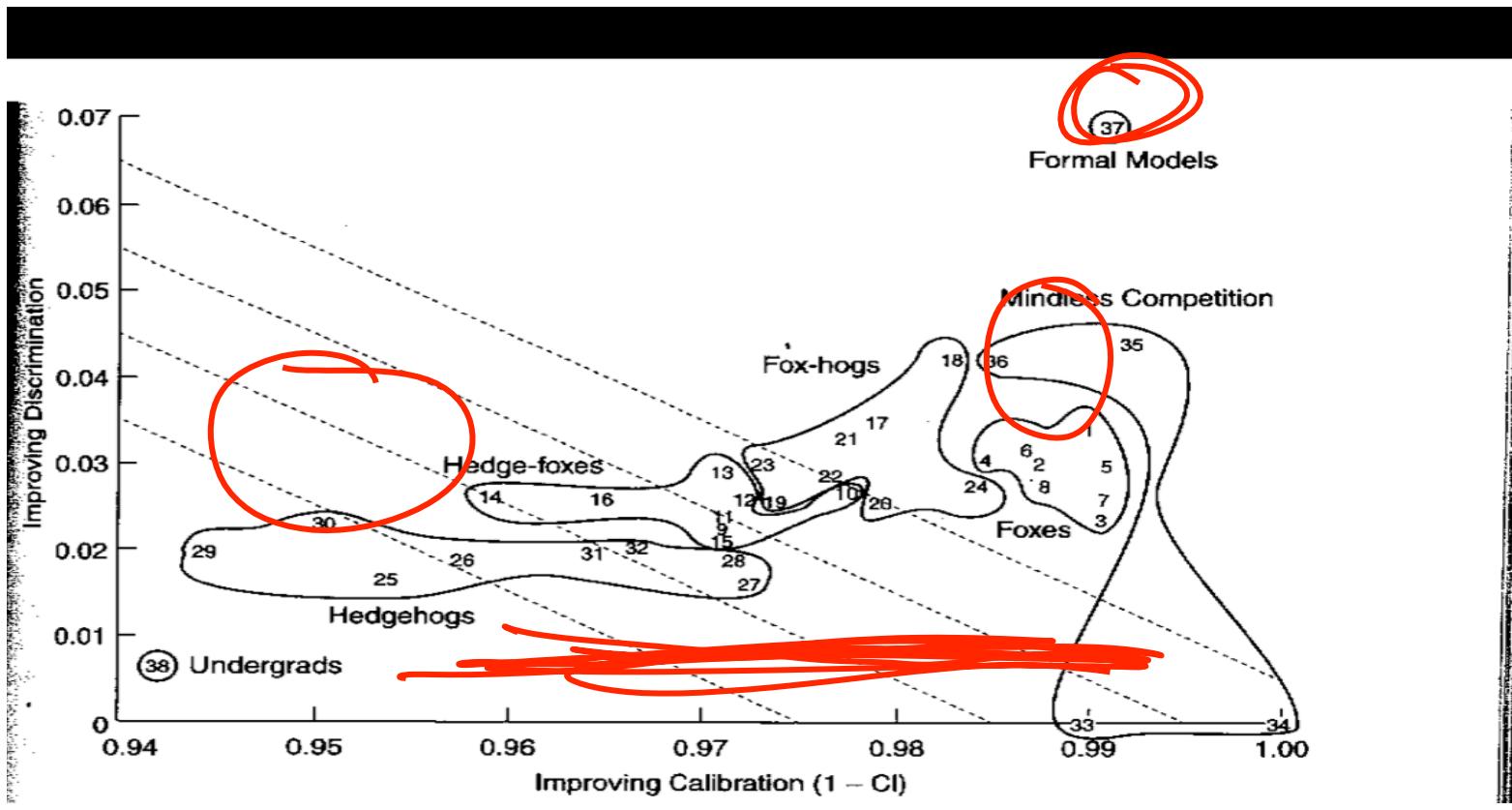
Law



Game Theory

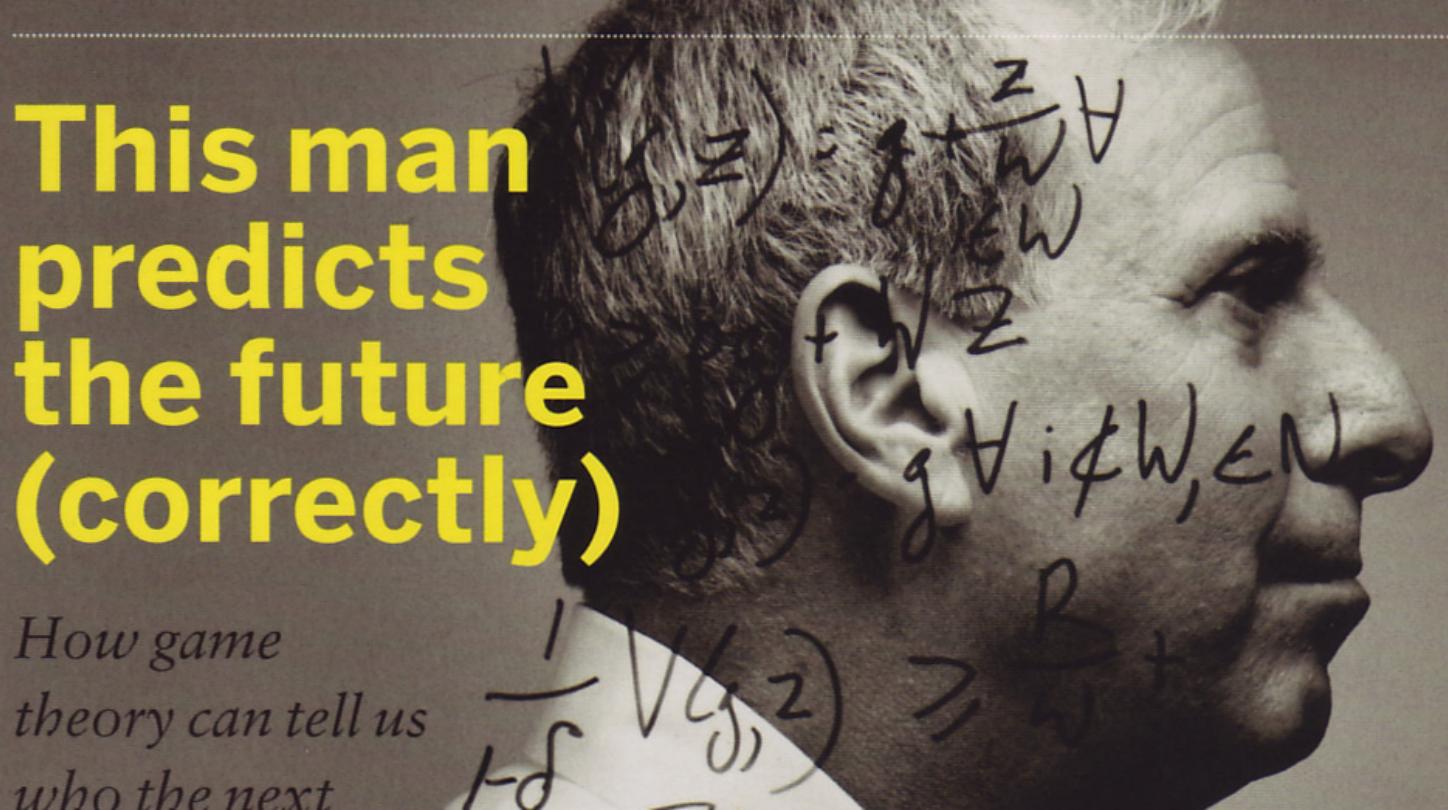
Equilibrium occurs when each player takes the best possible action for themselves given the action of the other player The dominant strategy is each prisoners' unique best strategy regardless of the other players' action Best strategy? Confess? A bad outcome - prisoners could do better by both denying - but once collusion sets in, each prisoner has an incentive to cheat!	Prisoner A		
	Confess	Deny	
	Prisoner B	Confess	(3 years, 3 years) (1 year, 10 years)
	Deny	(10 years, 1 year) (2 years, 2 years)	

Models Are Better Than We Are



the High Tech / Low Tech issue

GOOD



This man
predicts
the future
(correctly)

*How game
theory can tell us
who the next*

it's all true

THE OLDEST PROFESSION(S) 72

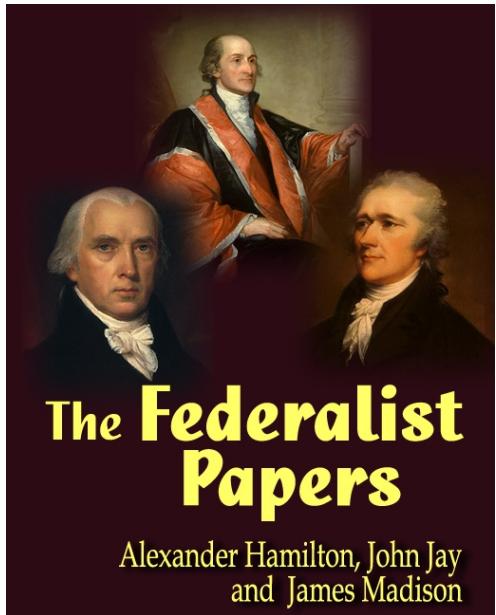
GET A SECOND LIFE 76

L.A.'S URBAN
CATASTROPHE 102

ALSO

POSTAL MULES / STEPHEN COLBERT / MAGGOTS
MIRANDA JULY / EGYPTIAN HEAVY METAL
STUDENT DEBT / AL-QAEDA'S PR / and MORE

Models Are Fertile



The Federalist Papers

Alexander Hamilton, John Jay
and James Madison

Models Make Us Humble

Tulip price index

1636–37

FICTIONAL
GRAPH

Dec 12

Nov 25

Nov 12

Dec 1

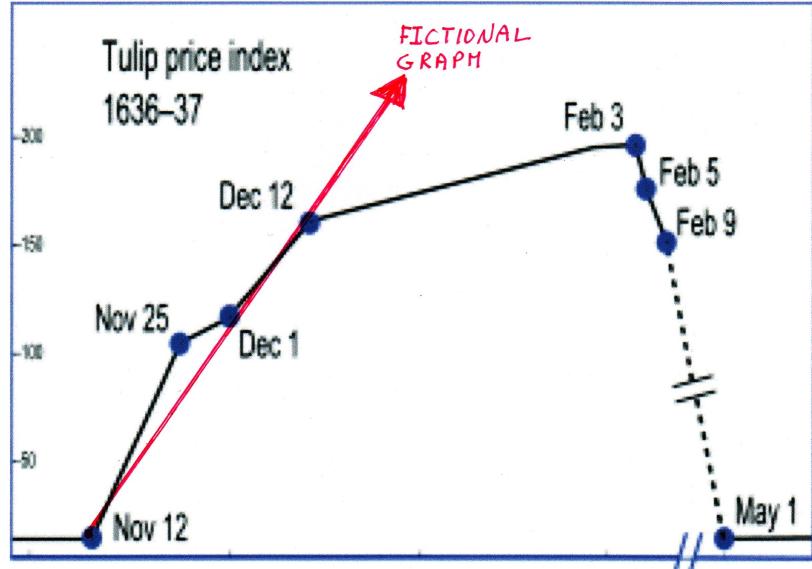
Feb 3

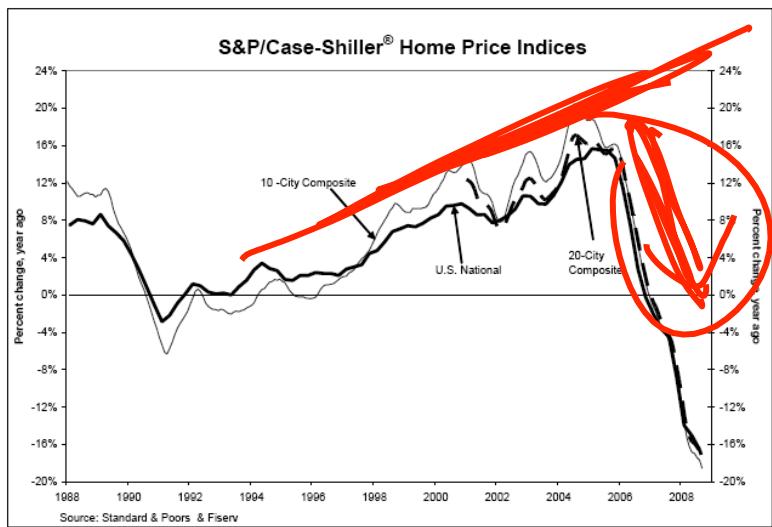
May 1

Feb 5

Feb 9

||





Many Model Thinkers Know Best

PHILIP E. TETLOCK

EXPERT



POLITICAL



JUDGMENT

How Good Is It? How Can We Know?

Model Thinking

Scott E Page

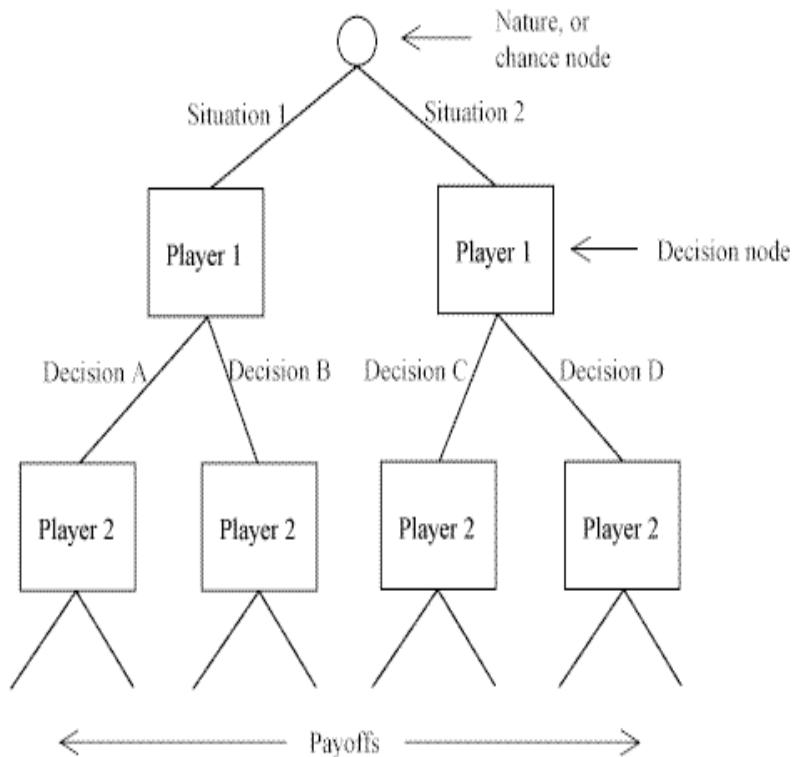
Model Thinking

Scott E Page

Clearer Thinker

Name The Parts

Identify Relationships



Work Through Logic

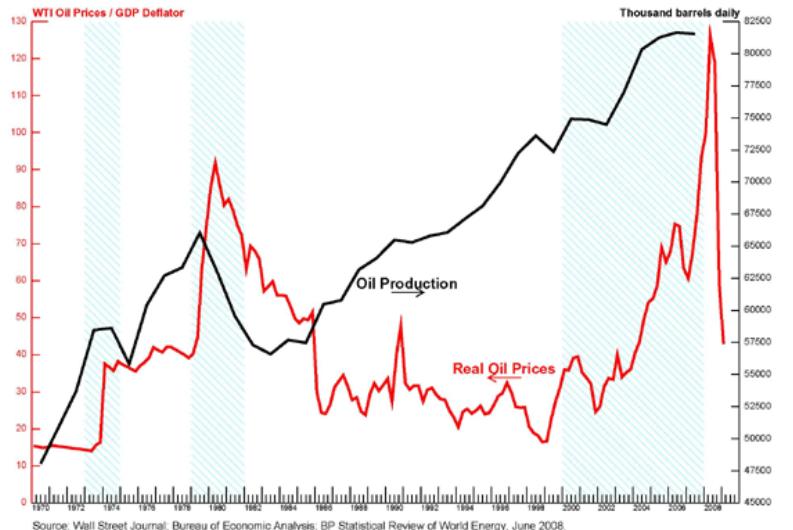


Inductively Explore

Understand Class of Outcome

Equilibrium
Cycle
Random
Complex

Understand Class of Outcome



zFacts.com

Identify Logical Boundaries

Two heads are better than one

Too many cooks spoil the broth

Communicate

Model Thinking

Scott E Page

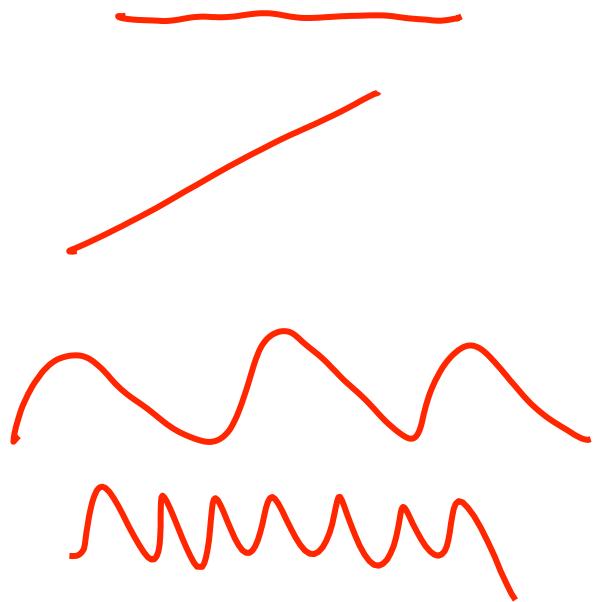
Model Thinking

Scott E Page

Use and Understand Data

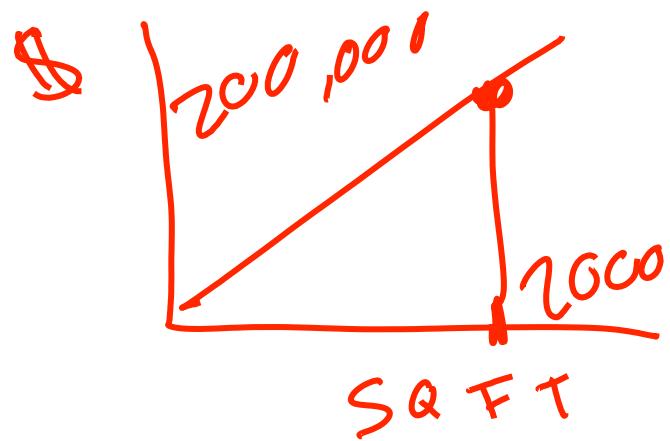
#1

Understand Patterns



#2

Predict Points



#3

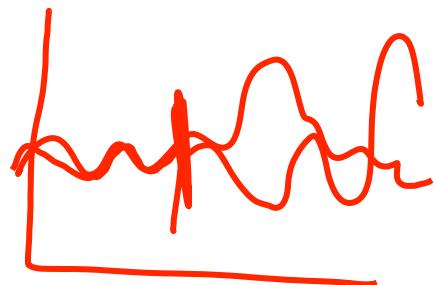
Produce Bounds

1.2%

[0, 3%]

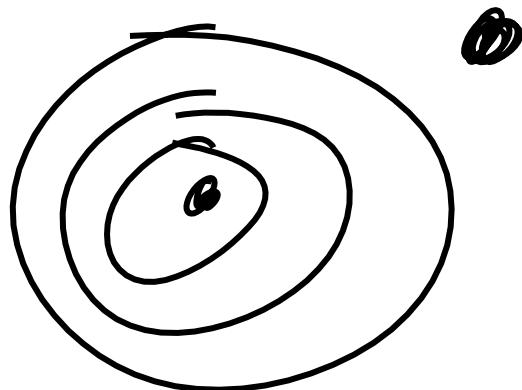
#4

Retrodict



#5

Predict Other



#6

Inform Data Collection

TQ Tech

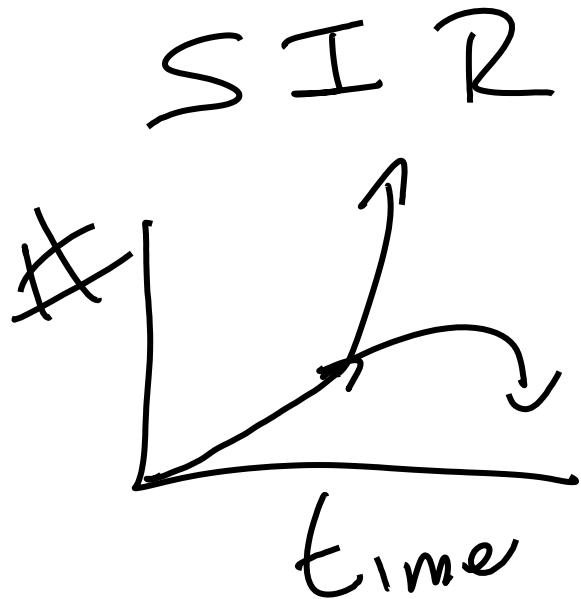
PS. Health

\$ Students

C.S.

#7

Estimate Hidden Parameters



#8

Calibrate



Model Thinking

Scott E Page

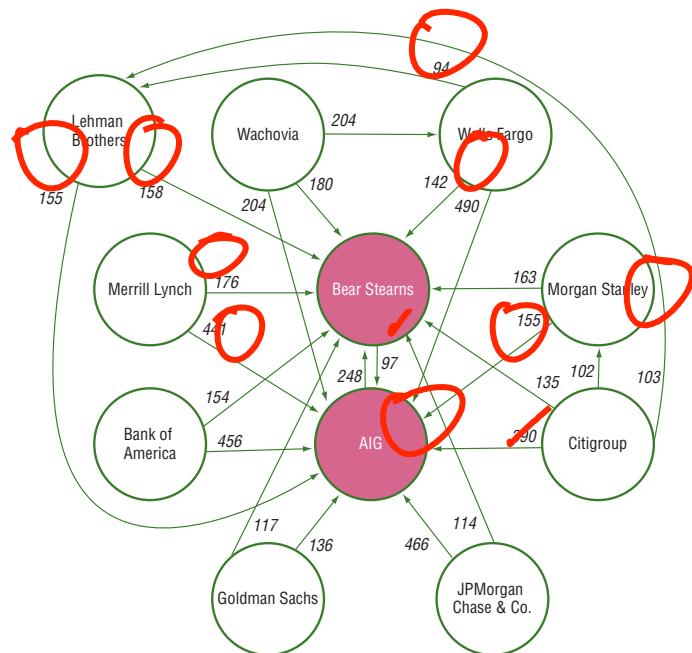
Model Thinking

Scott E Page

Decide, Strategize, Design

|

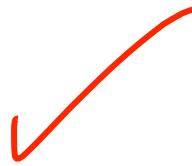
Decision Aids

Figure 2.6. A Diagrammatic Depiction of Co-Risk Feedbacks



The Monty Hall Problem

1



2

3

1



2





1/5

4/5

1

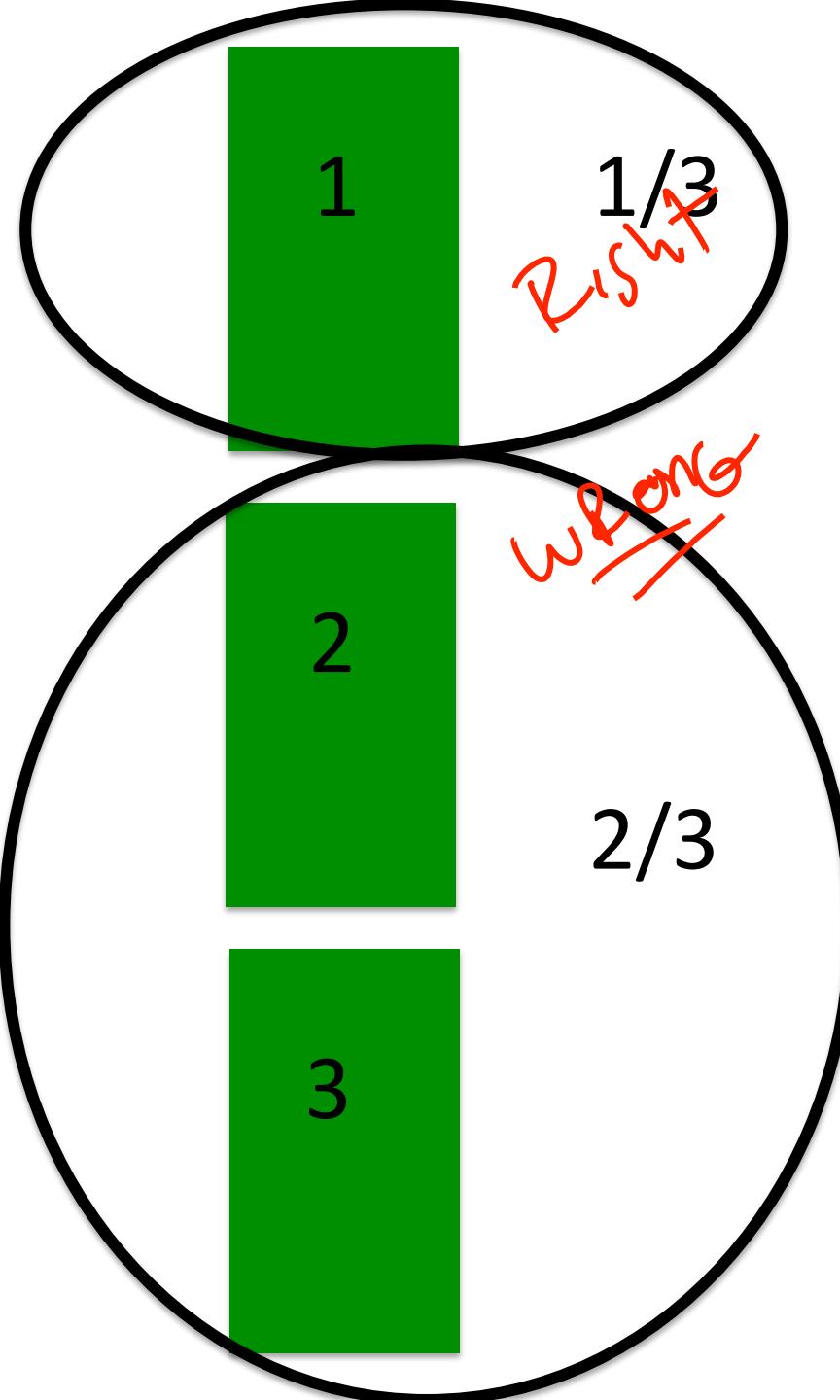
1/3

2

1/3

3

1/3



1

$1/3$
Right

2

Wrong

$2/3$

3

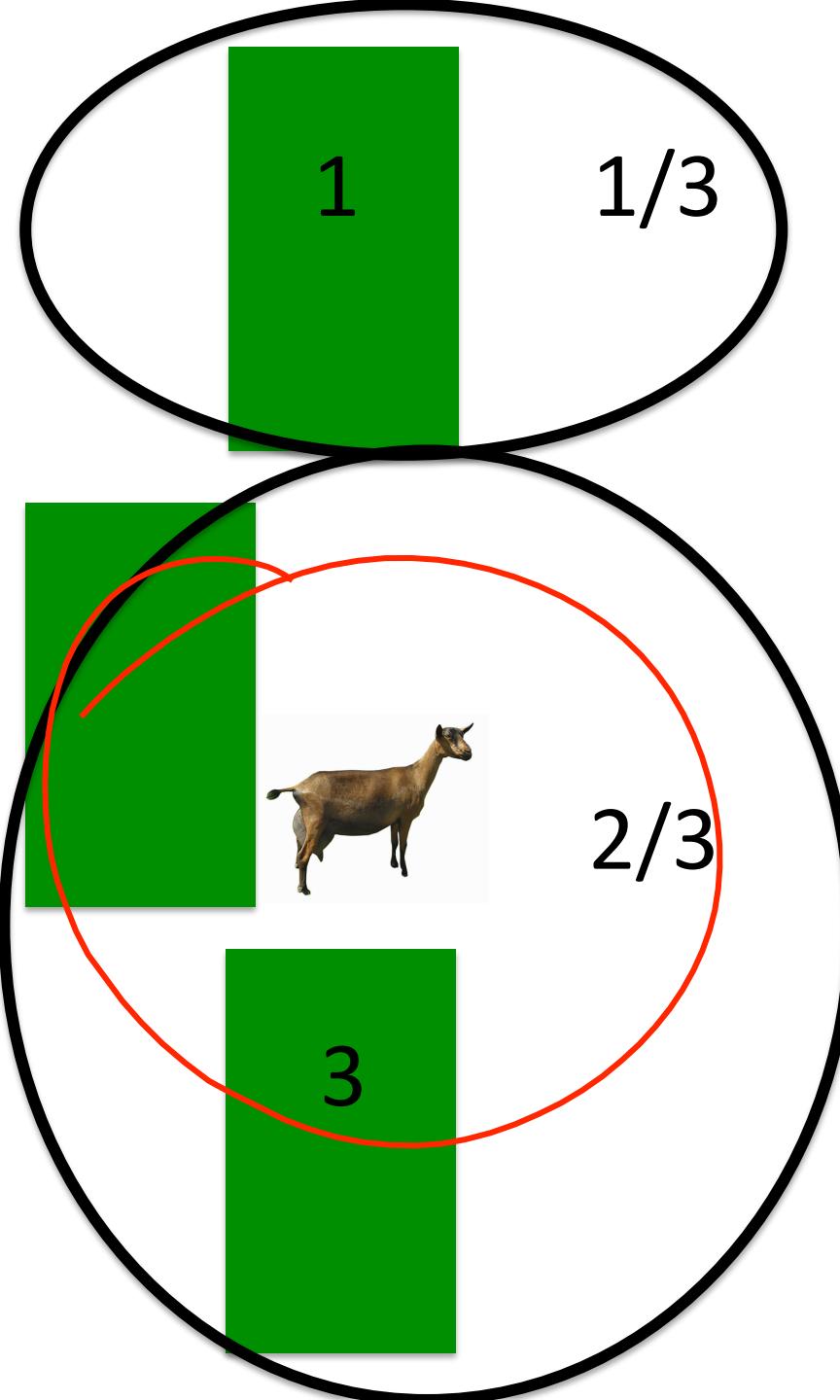
1

1/3

2

2/3



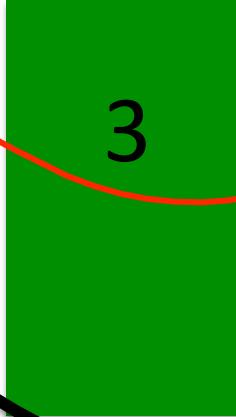


1

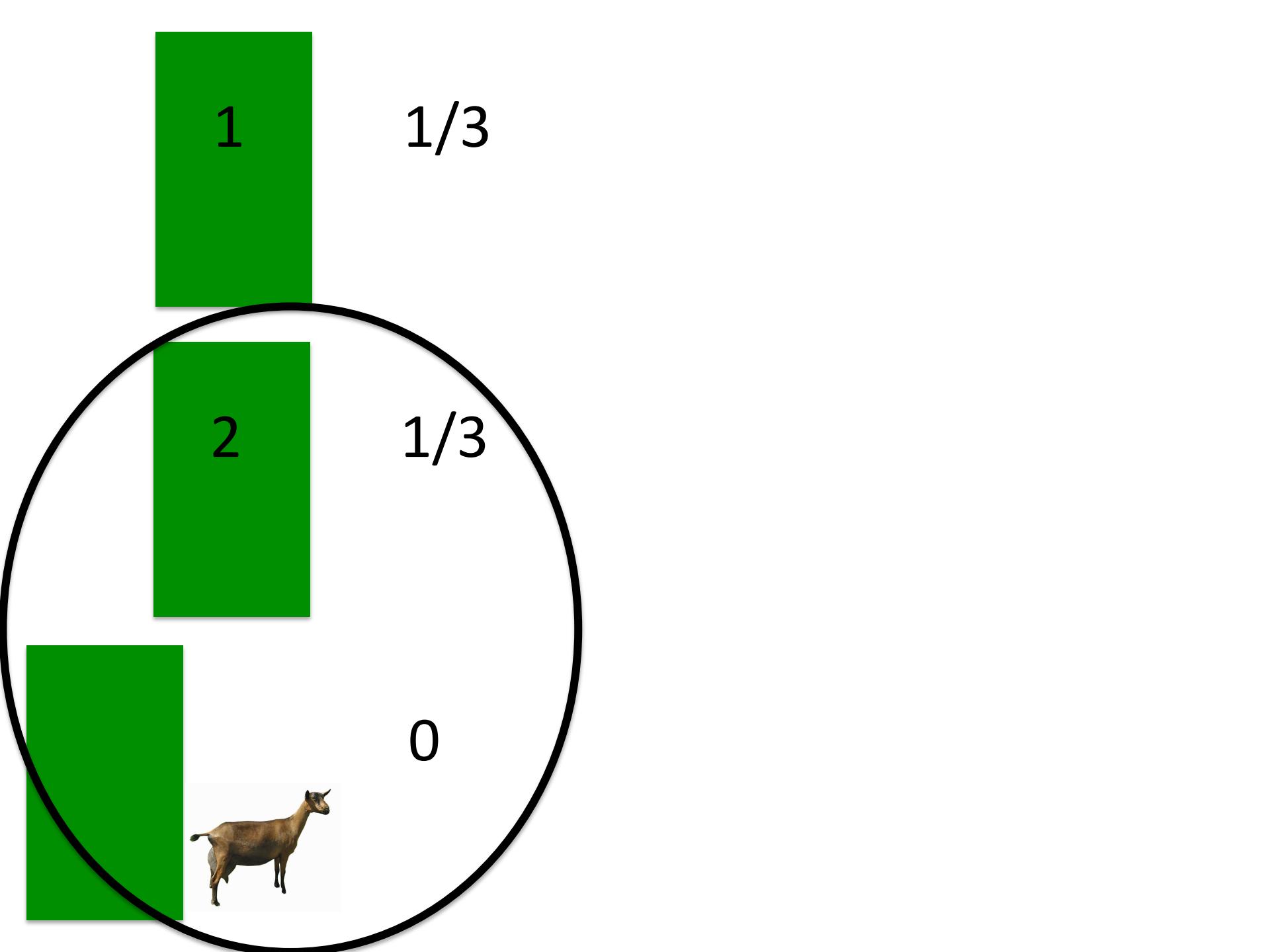
1/3



2/3



3



1

1/3

2

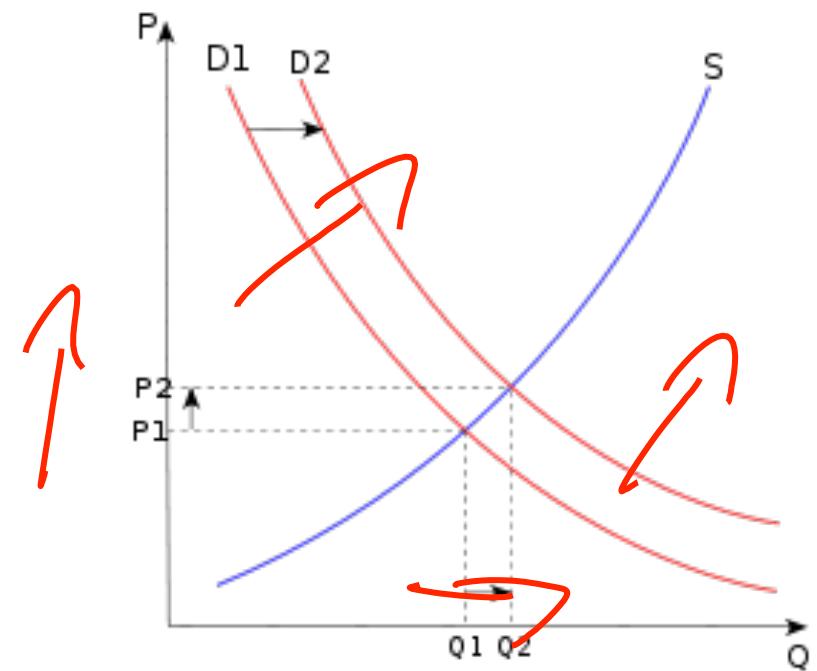
1/3

0



#2

Comparative Statics



#3

Counterfactuals

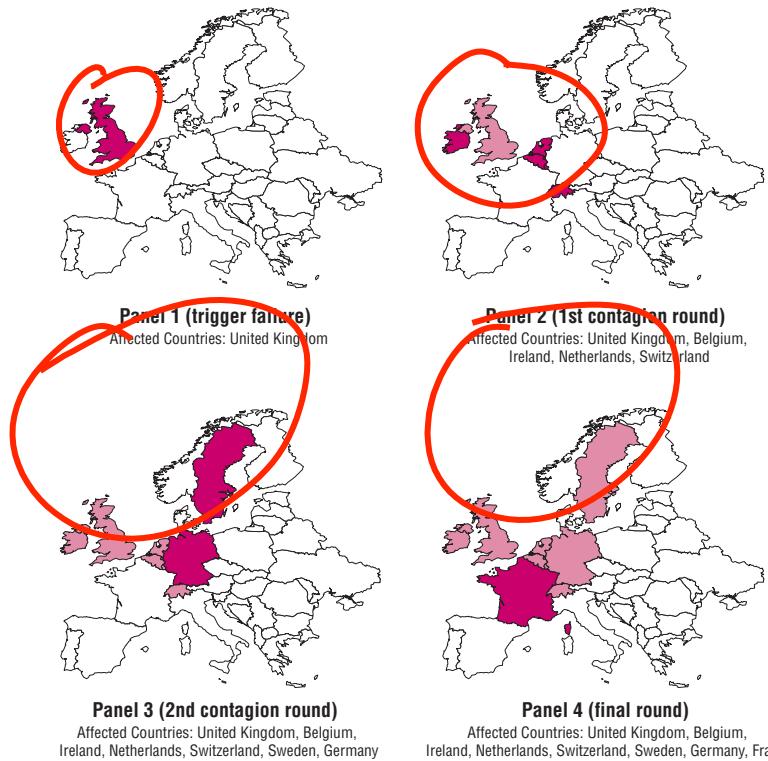
Unemployment Rate With and Without the Recovery Plan

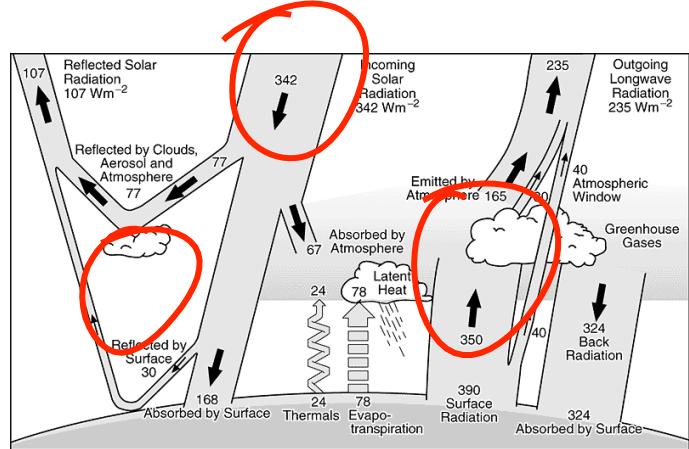


#4

Identify and Rank Levers

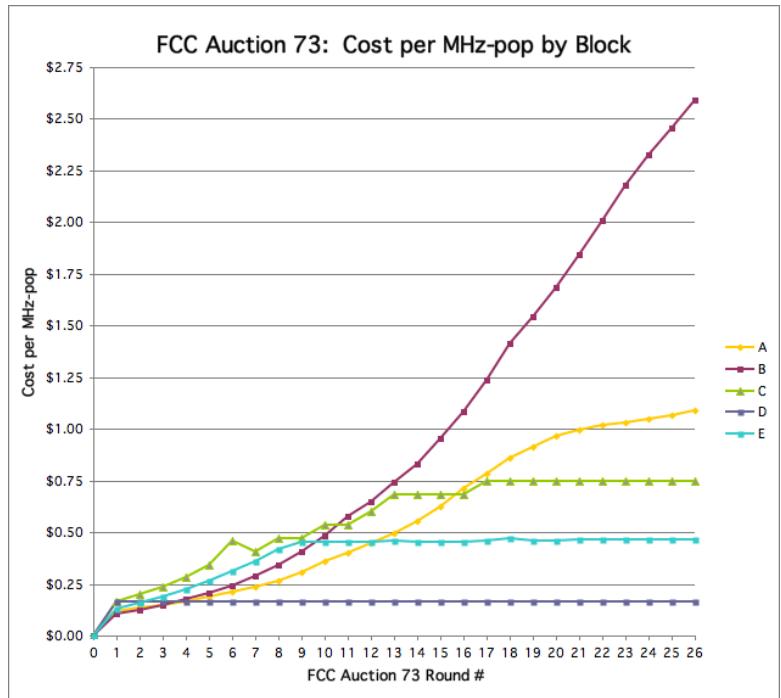
Figure 2.4. Network Analysis: Contagion Path Triggered by the U.K. Failure





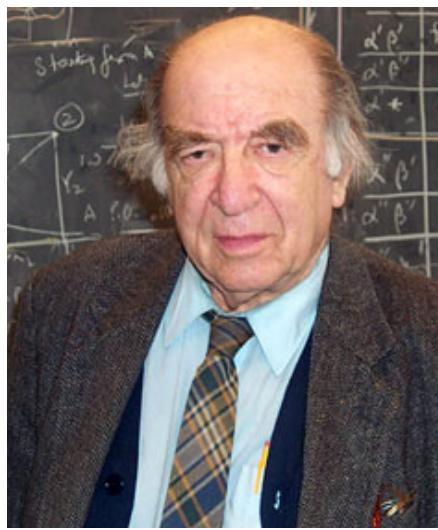
#5

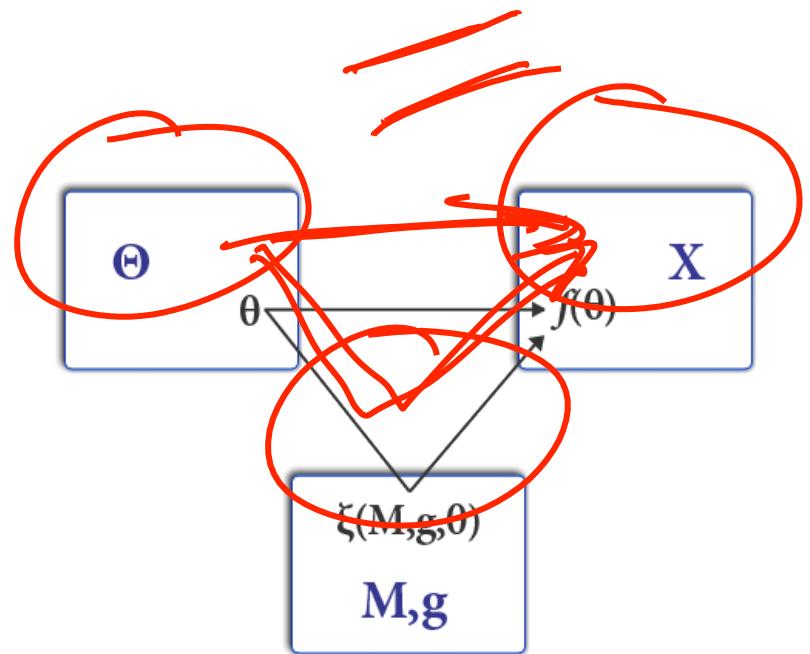
Experimental Design



#6

Institutional Design

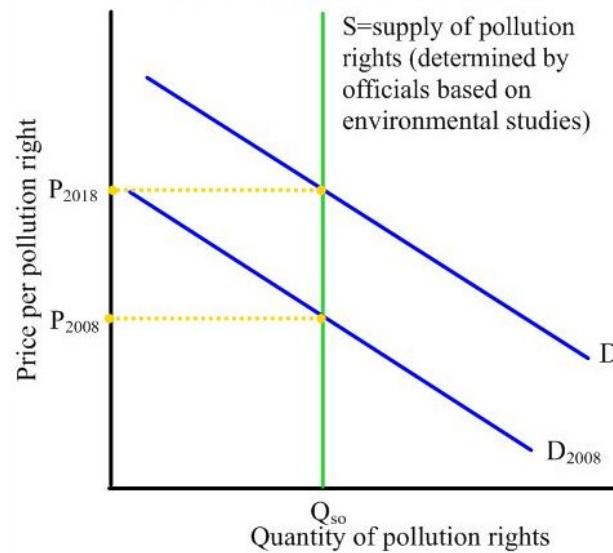


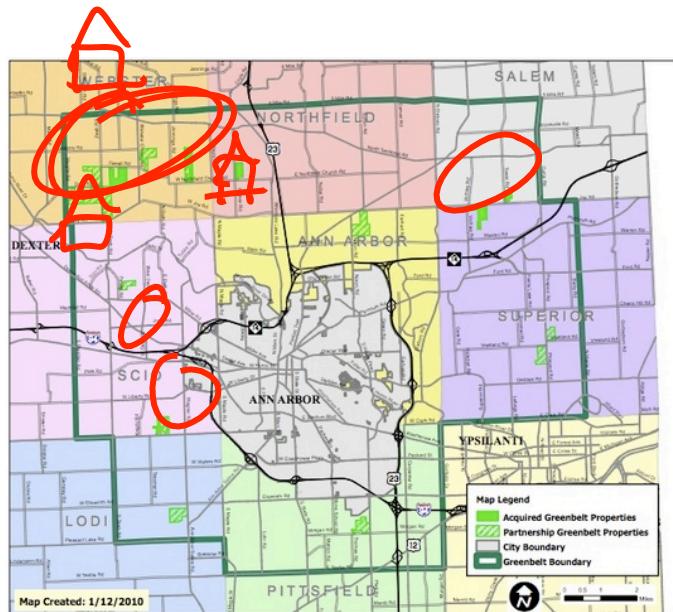


#7

Help Choose Among Policies and Institutions

The Market for Pollution Permits





Decide, Strategize, Design

1. Real Time Decision Aids
2. Comparative Statics
3. Counterfactuals
4. Identify and Rank Levers
5. Experimental Design
6. Institutional Design
7. Help Choose Among Policies and Institutions

Model Thinking

Scott E Page