Model Thinking

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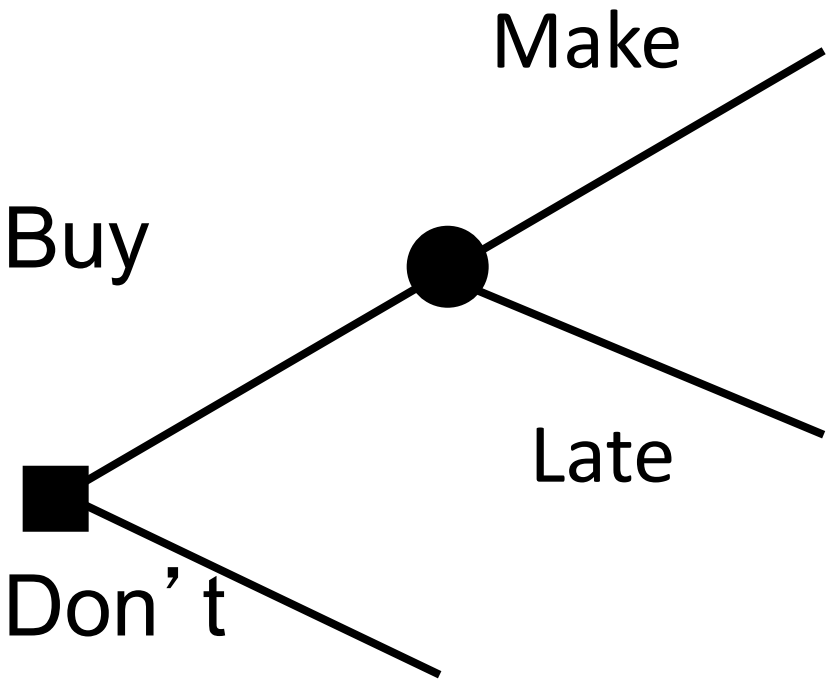
Thinking Electrons

- Purposeful Actors
- Diversity

- Rational
- Behavioral
- Rule Based

Rational

- Objective
- Optimize


Make
Buy
Late
Don’t

Behavioral

- Observe
- Neuroscience

Rule Based

Stand if

Move if

Come to life if

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Rational Actors

Objective

Optimize

Rational Actors

- Investments
- Purchases
- Education level
- Vote
- Number of children

Objectives

- Firm
  - maximize profits
- Individual
  - maximize utility
- Candidate
  - maximize votes

$100

Profits = price x quantity

quantity = q

price = 50 - q

Selfish:

Objective = me

Selfish:

My happiness

Altruistic:

Happiness of others

I: income (40k)

C: consumption

D: donations

Objective:

$C^{0.5}D^{0.5}$

Objective:

$C^{0.5}(40\text{-}C)^{0.5}$

Decision vs Game

Decision:

Objective depends only
on own action

Decision vs Game

Game:

Objective depends on
actions of others

Beliefs

	Home	City
Home	1, 1	1, 0
City	2, 1	2, 4

- Large Stakes
- Repeated
- Group Decisions

- Benchmark
- Unique
- Easiest
- People Learn
- Mistakes Cancel

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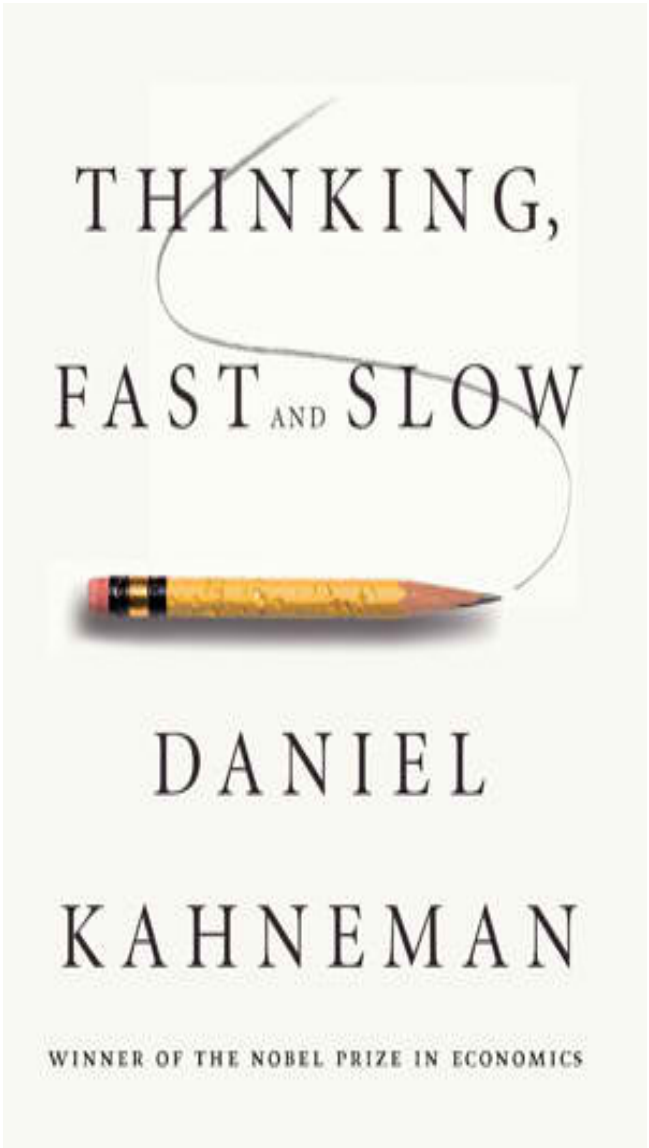
Behavioral Models

Observation

Neurology

Behavioral Models


THINKING,
FAST AND SLOW
DANIEL
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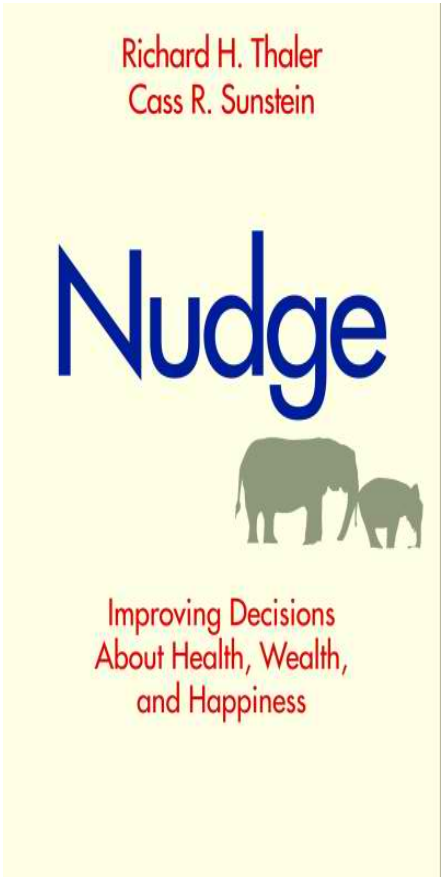

Richard H. Thaler
Cass R. Sunstein
Nudge
Improving Decisions
About Health, Wealth,
and Happiness

Examples

- Prospect Theory
- Hyperbolic Discounting
- Status Quo Bias
- Base Rate Bias

Prospect Theory

A: $400 for sure

B: $1000 50%

$0 50%

Prospect Theory

A: -$400

B: -$1000 50%

$0 50%

Hyperbolic Discounting

Option A:

$1000 today

Option B:

$1005 tomorrow

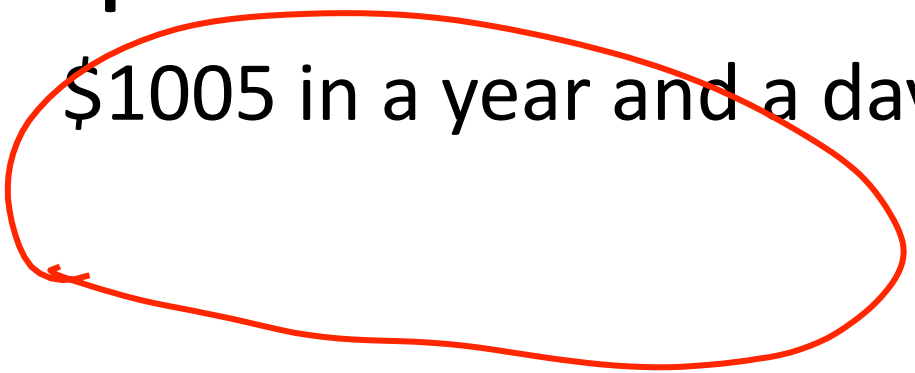
Hyperbolic Discounting

Option A:

$1000 in a year

Option B:

$1005 in a year and a day



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Status Quo Bias

Check box to contribute to pension fund ☐

Check box to **NOT** contribute to pension fund ☐

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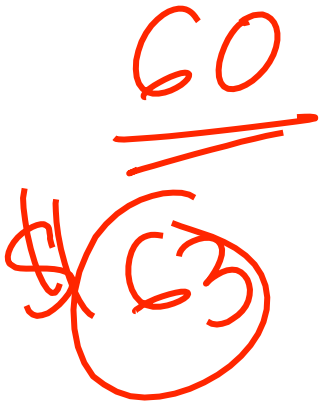
Base Rate Bias



- Lots of Biases
- WEIRD
- People Learn
- Computationally difficult

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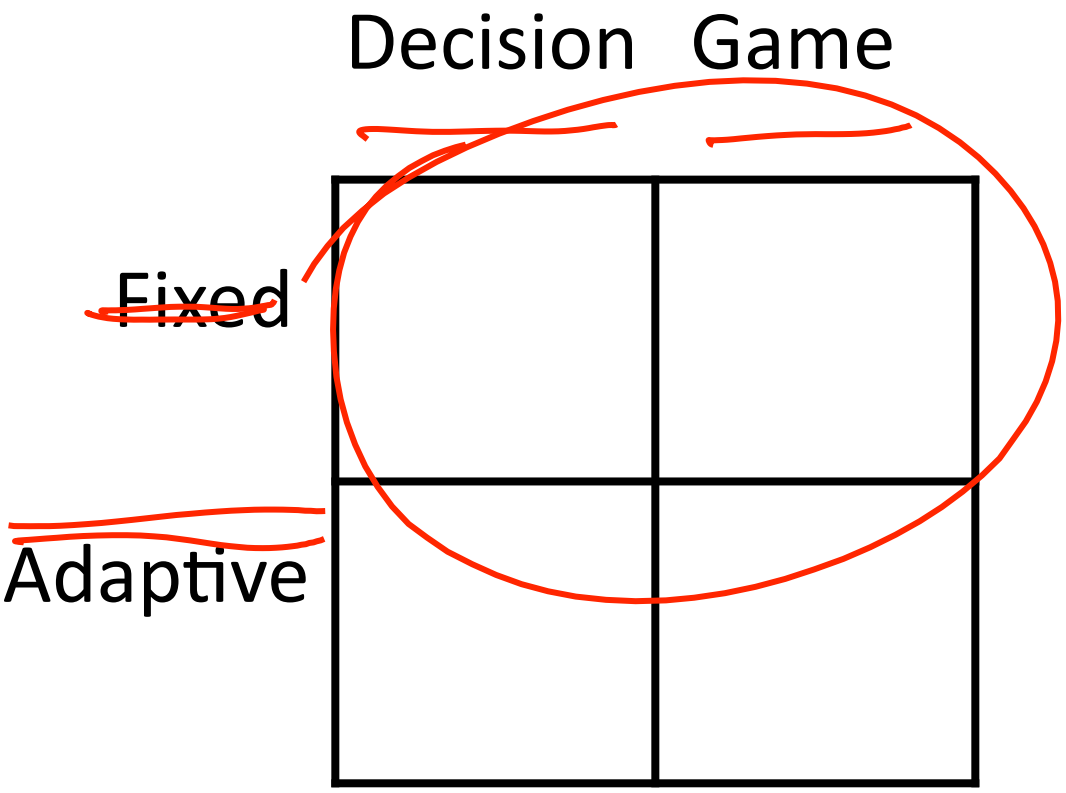
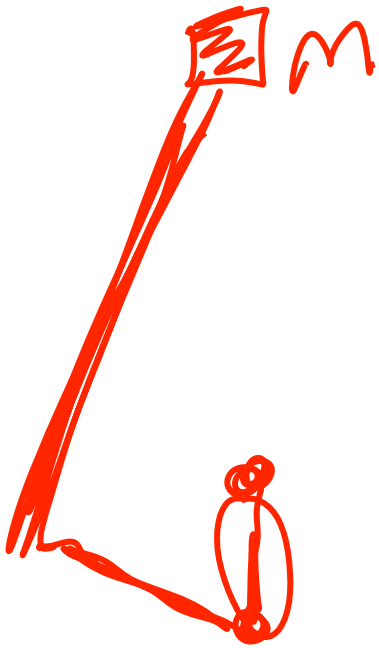
Rule Based

Types of Rules



Fixed Decision Rules

Random Choice



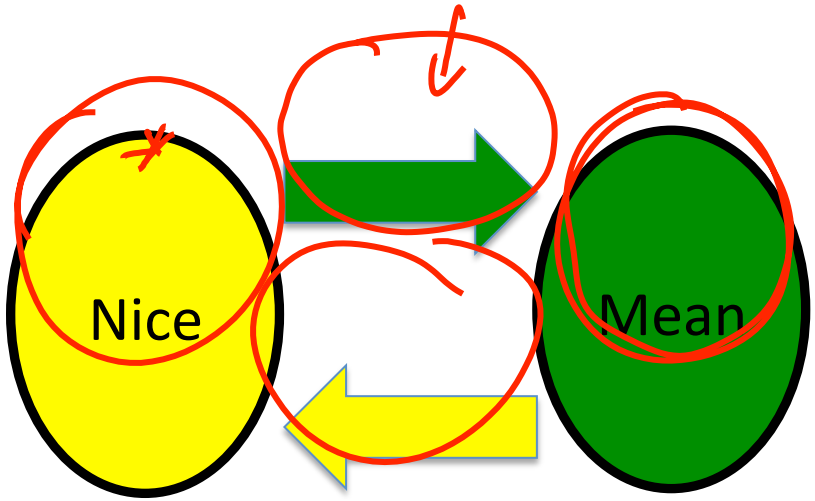
Most Direct “Route”

Fixed Strategies

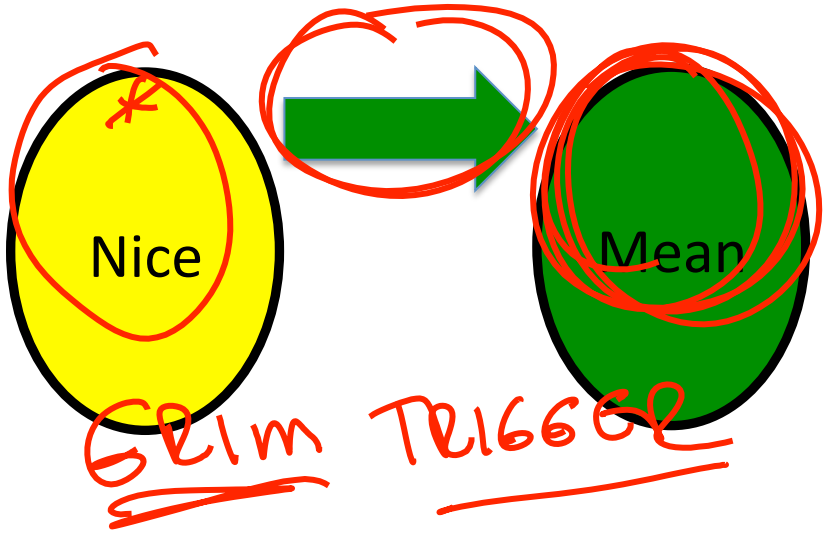
Divide Evenly

Tit for Tat

Moore Machines



Moore Machines

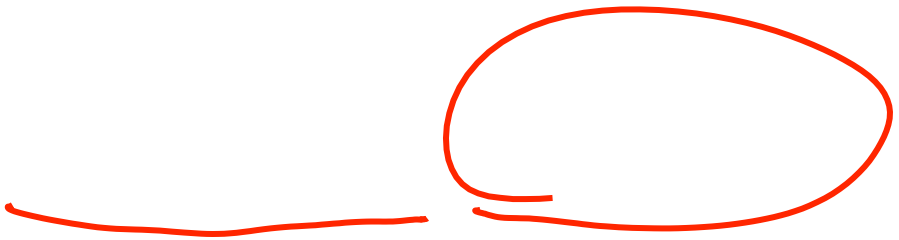


Adaptive Decision Rules

¼ Honey

#1 +5 bp

+2 +5 bp



Gradient/Random

Adaptive Strategies

Best Response

Mimicry

Replicator Dynamics

Observation #1

Sometimes optimal rules are simple

Objective: Happiness (H) depends on chocolate (C) and movies (M)

$H = C^{0.5}M^{0.5}$

p_c = price chocolate

p_m = price movies

Optimal Behavior:
Spend equal amounts on chocolate and movies

Observation #2

Simple rules can often
be exploited.

Bargaining Rule:

Accept only if I get 60% initially.

Demand 1% less each round.

- Easy to model
- Capture main effects
- Ad Hoc
- Exploitable

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- Rational
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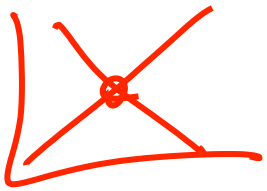
- Rule Based

- Market
- Race to the Bottom



Two Sided Market

Buyers [0, 100] [50, 150]

Sellers [50, 100] [50, 100]

P = 75

E.I.

B = 40 20

S = 60 (63)

Race to The Bottom

Pick a number in [0,100]

Closest to 2/3 of mean
wins

Rational

mean = 6

$2/3(6) = 4$

$2/3(4) = 8/3$

Bias

Rule Based

Mean = 50

2/3 of mean = 33

$\frac{2}{3}(33) = 22$

$\frac{2}{3}(22) = 14$

Two “Rational” People

One Irrational

R: Rational People

X: Irrational Person

$$R = \frac{2}{3}\left(\frac{R+R+X}{3}\right)$$

$$9R = 2(R+R+X)$$

$$5R = 2X$$

$$R = \frac{2X}{5}$$

$$X = 50$$

$$R = 20$$

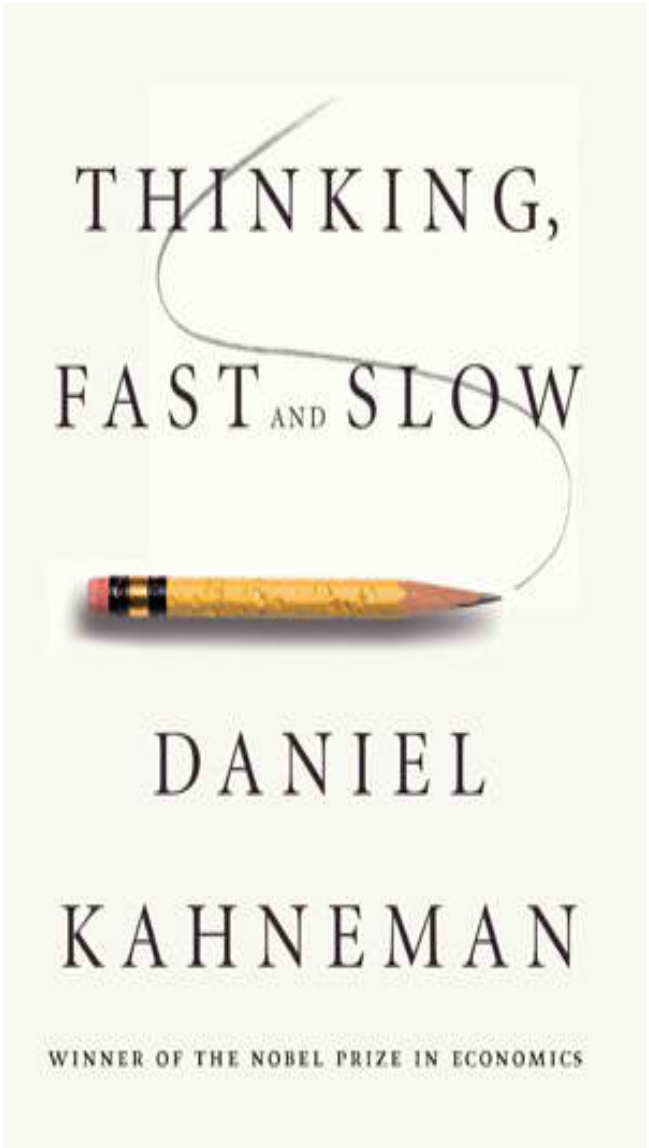
R = 20

X = 50

$$\frac{20+20+50}{3} = \frac{90}{3}$$

mean = 30

2/3 (mean) = 20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Bias Rule Rational

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