

LEARNING

Belief Learning

- Form beliefs about opponent's future play using past experience
- Plays best response to those beliefs
e.g. Panic Buying during Covid-19
Believe that everyone else will panic buy
⇒ More inclined to panic buy

Belief that Player i
will play strategy j
at round t

$$B_i^j(t) = \frac{N_i^j(t-1)}{\sum_m N_i^m(t-1)}$$

No. of times player i
played strategy j
until round $t-1$

$$\uparrow \quad \uparrow \quad \uparrow$$

$$N_i^j(t-1)$$

↓ sum of no. of times player i
played each strategy until round $t-1$

Reinforcement Learning

- Plays strategies that worked well previously, based on the reinforcement level of previous rounds
eg. Unpleasant experience at restaurant X
⇒ Less likely to go back

$$A_i^j(t) = \begin{cases} \phi A_i^j(t-1) + \pi, & \text{if } i \text{ chosen} \\ \phi A_i^j(t-1), & \text{if } i \text{ not chosen} \end{cases}$$

↑
payoff of strategy if chosen
↓
forgetting rate

Experience Weighted Attraction (EWA) Learning (Camerer & Ho, 1999)

- Combines both belief and reinforcement learning
- Considers forgone payoff overlooked by reinforcement learning

$$A_i^j(t) = \frac{\phi N(t-1) A_i^j(t-1) + \delta \pi_i(s_i^j, s_{-i}(t))}{N(t)}$$

discount factor for
forgone payoff

← $N(t) = \rho N(t-1) + 1$
depreciable past experience

when $\delta=0, \rho=0, N(0)=1$, EWA ≡ Reinforcement

$$B_{-i}^k(t) = \frac{\rho N(t-1) B_{-i}^k(t-1) + I(s_{-i}^k, s_i(t))}{\rho N(t-1) + 1}$$

$$E_i^j(t) = \frac{\rho N(t-1) E_i^j(t-1) + \pi_i(s_i^j, s_{-i}^k)}{\rho N(t-1) + 1}$$

LEVEL-K THINKING

- Game Theory assumes **unlimited** cognitive ability to solve games optimally to achieve Nash Equilibrium
- Not realistic and Nash Equilibrium often not played

Someone who is entirely random in actions → Level-0 thinker
Assume everyone is Level-0 thinker and responds bestly → Level-1 thinker
Assume everyone is Level-(K-1) thinker and responds bestly → Level-K thinker
NOT EQUILIBRIUM, SINCE PEOPLE'S BELIEFS ABOUT OTHERS INCORRECT

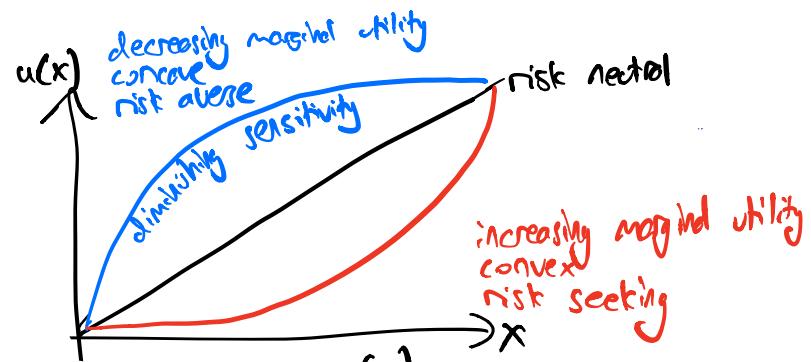
Multiplayer games → Too simplistic to assume everyone is at same level
Poisson-CH model more accurate $f(k) = e^{-u} \frac{u^k}{k!}$

PROSPECT THEORY

probability objective
e.g. SGI Sweep RISK vs UNCERTAINTY probability unknown subjective
e.g. Horse Racing

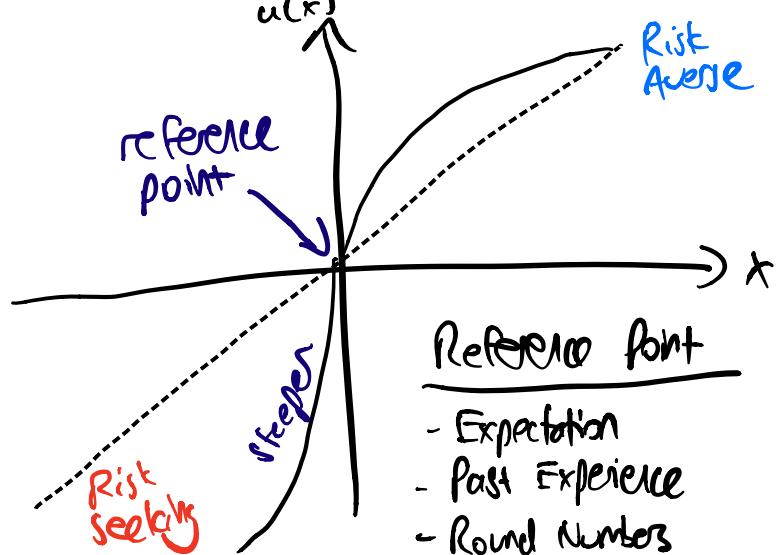
Expected Utility Theory

- People either risk averse, risk neutral or risk seeking
- Need only know x to determine utility



Prospect Theory

- People are risk-averse in the gain domain and risk-seeking in the loss domain
- Need to know reference state to determine utility
- Loss more powerful than gains (**Loss Aversion**)



- ## Reference Point
- Expectation
 - Past Experience
 - Round Numbers

FAIRNESS

- Fairness is an important reference point
- Children: 3-4 year olds behave selfishly
7-8 year old removed inequality (egalitarian)
- Cultural differences determine when kids learn to play fair
All children rejected disadvantageous deals, some rejected advantageous deals, but at a later age

Pay what You want

- Last minute sales
 - For charity
 - Customer has personal relationship with business
- ⇒ Lower earnings per customer
More visits

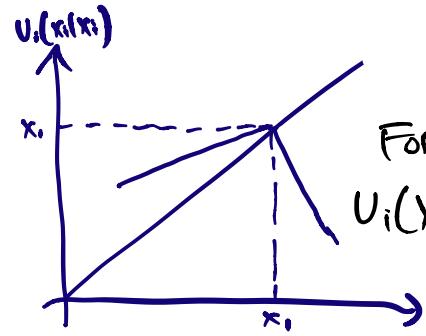
RECIPROCITY

Negative Reciprocity: Hostile Actions → Nasty and Unfriendly response
 Positive Reciprocity: Friendly Actions → Nicer and cooperative response
 Response even if no gains can be expected/pay a price to reciprocate
 Altruism: Unconditional kindness, **not** a response

Ultimatum Game mean 40-50% vs Dictator Game mean 20%
 P is strategic (to avoid rejection) and altruistic
negative reciprocity of unfairly treated

Games with dominant strategy, constant-sum, winner-take-all reward
 eliminate social preference

Inequality Aversion: People care about their own payoffs and their relative payoff
 (Fehr & Schmidt, 1999)
 Envy & Guilt
 Include other player's payoff into own utility function



For social allocation $x = (x_1, x_2, \dots, x_n)$, $\beta_i \leq x_i$, $0 \leq \beta_i \leq 1$

$$U_i(x) = x_i - \frac{\alpha}{n-1} \sum_{k \neq i} \max(x_k - x_i, 0) - \frac{\beta}{n-1} \sum_{k \neq i} \max(x_i - x_k, 0)$$

Envy Guilt < Envy Guilt < wanting payoff
 Guilt

TIME INCONSISTENCY

Present-biased preferences: $U_t = u_t + \beta \delta u_{t+1} + \beta^2 \delta u_{t+2} + \beta^3 \delta u_{t+3} + \dots$
 Favour gratification/avoid non-gratification Now at the expense of FUTURE gratification/non-gratification
 $\hookrightarrow \beta=1$, time consistent
 $\beta < 1$, time inconsistent

Time Consistent: $\beta=1$

Sophisticates: $\beta < 1$, aware they are present-biased e.g. never exercise \rightarrow don't join gym will choose a pre-commitment device when offered (Schwartz et al. 2014)

Noifs: $\beta < 1$, think they are only present-biased now but time-consistent in the future falsely believe their future selves will maximize today's preferences e.g. never exercise \rightarrow still join gym

Costs are immediate: Present-biased will procrastinate. Noifs more than sophisticates e.g. homework chores

Rewards are immediate: Present-biased will pre-emptive. e.g. vacation, movie

(Machado & Sinha, 2007) Sophisticates not always better than Noifs.

Noif underestimate immediate cost of smoking in future period \rightarrow try to quit in current period
 Sophisticate aware of immediate benefit of smoking in future period \rightarrow continue to smoke

(Arely & Wertenbroch, 2002) Self-imposed deadlines not as effective as external deadlines

(Saddoff, Sank & Sprenger, 2019) Those with least self-control are also least aware \rightarrow commitment policies have limited impact
 Mandatory commitment best improves overall welfare

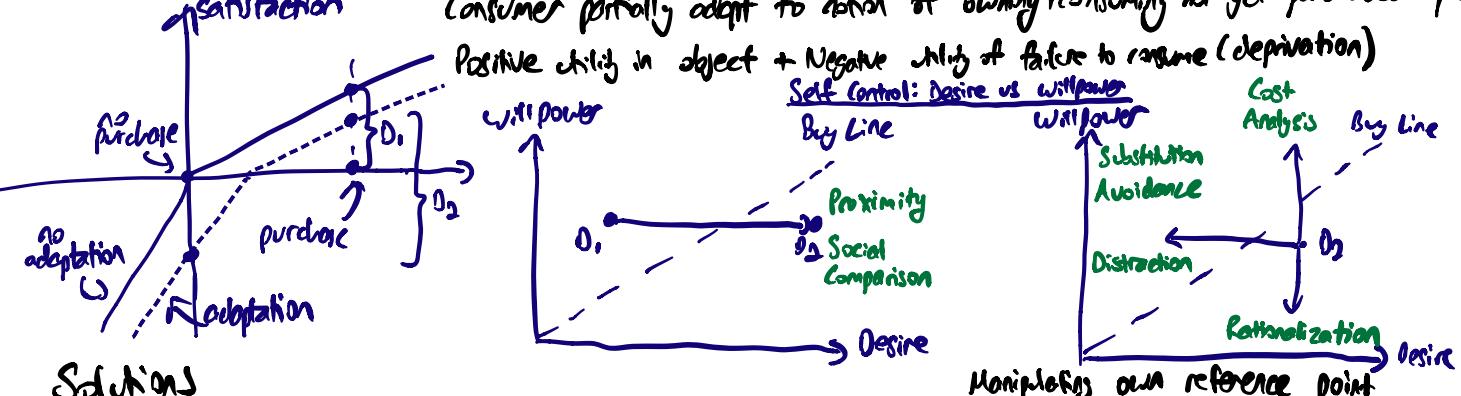
(John, 2020) Partial sophisticates adopt weak commitments and fail, full sophisticates more cautious about committing.
 Sophistication $\uparrow \rightarrow$ Commitment Penalty chosen \uparrow , Commitment take up \downarrow , Commitment failure \downarrow

(Hoch & Loewenstein, 1991) Time-inconsistent preferences due to shift in reference point.

Consumer partially adapt to notion of owning/consuming not yet purchased product

Positive utility in object + Negative utility of failure to consume (deprivation)

Self-control: Desire vs Willpower



Solutions
 Binding behavior - Voluntary imposition of constraints on ones future choices in a strategic attempt to resist future temptations

Make Rewards of long-term behavior more immediate

Make cost of procrastination more immediate

Remove procrastination triggers from environment

SOCIAL PRESSURE

People's behaviour have 2 dominant interests: Economic Gain & Social Acceptance

(Asch, 1951) Participants conformed with clearly incorrect majority for fear of ridicule or seems polar
They want to fit in with the group (normative influence)
believe the group is better informed (informational influence)

The bigger the majority group, the more conformed, Majority effect stops at 3-5 people.

Dissenting confederate reduces conformity up to 80%

The more difficult the task, the greater the conformity → uncertain and look for confirmation
when answering in private, conformity decreases → fewer group pressure & normative influence

(Berss 2005) Seeing is believing what the group tells you to believe

Those than conformed changed their picture of reality measured using fMRI imaging on spatial perception
But if made aware of their uncorrectness, they may avoid conforming when not in self-interest

(Cochrane & Fehr, 1999) Social approval & reducing social distance both had weak effect on contributing to public good.

When both are present, there is a strong effect on contributing to public good

Social approval incentives are more important the greater the density of social interaction among people

$$u_i = \begin{cases} 0 & \text{perceived social approval} \\ b_i + \delta p - c_i & \text{proportion of people participating} \\ & \text{did not participate} \\ & \text{participate} \end{cases}$$

An individual engages in u_i when $b_i + \delta p - c_i > 0$

When incentives are introduced: Direct Effect: More benefits (b_i) and less cost (c_i)

Indirect Effect: More people engaging in prosocial activity (p)
Social pressure increases (social multiplier effect)

(McAuley et al., 2019) Highly connected individuals accumulate a much higher payoff

↳ Rep contributions of more people ↳ cheaper cost & cost of producing social good fixed
May not yield socially optimal outcomes

(Heber, 2008, 2010) No appreciable interactions between social pressure and sense of civic duty.
Social influence more effective than appeal to moral standards

Threat of making behavior visible more effective

Charitable giving: Social pressure more than Altruism

PROSOCIAL BEHAVIOUR

- Money Looked at as a contract, shifts focus away from prosocial activity
Introduction of money breaks down social norms
- Fines People don't want to be perceived that their efforts are driven by private gain
Attaches a price tag to transgressions → Is it economically worth?
Change perceptions of people → Feel less pressure to follow rules
Can detect undesirable behaviour if large enough

Performance varies in non-monotonic way with incentives

- For all positive but small compensations → reduction in performance
- High monetary incentive → higher performance
- Monetary reward (extrinsic motivation) displaces intrinsic motivation
- Subject interprets his motive as monetary reward (crowding out effect)
- Can no longer feel good about activity
- Utility of activity decreases as more greedy people will go (image spoiling effect) \rightarrow decreases
- Image Spilling likely main mechanism behind crowding out effect (Coetze & Silver, 2020)
- Highly motivated donors experience stronger crowding out effect

HABIT FORMATION

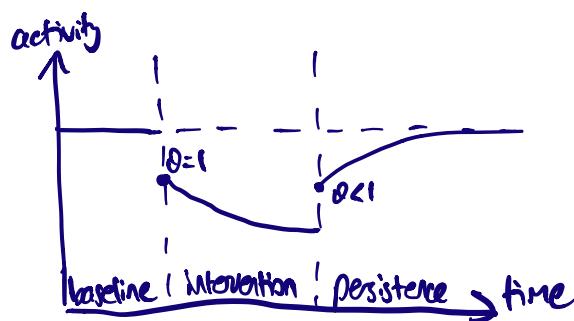
Habit Stock Model

$$U = u(a_t, h_t) - \theta p_a t$$

↑ salience bias who feedback

activity level a_t habit stock h_t

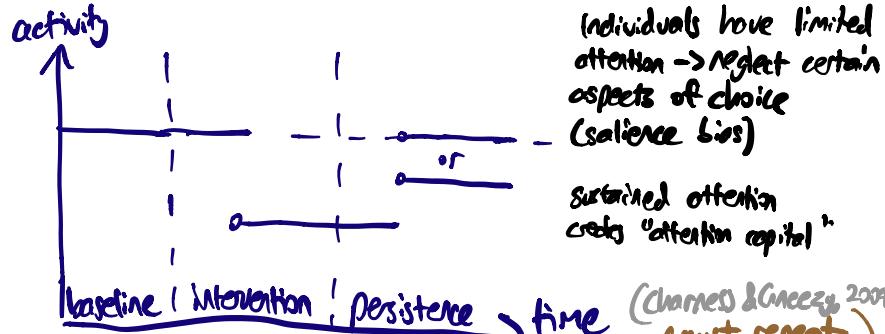
$$h_t = \alpha h_{t-1} + (1-\alpha)a_t$$



No point having short-term interventions

Shortcut Model

Individuals stick to their behaviour unless strong evidence accumulates for them to re-optimize
 ↳ cognitively costly to keep reevaluating decision since some answer
 ↳ formation of habit



Temporary incentives lead to re-optimization
 Behavior persists when intervention removed

(Chambers & Gneezy, 2009)

must repeat (incentive multiple times first)

Status Quo Bias : Tendency to prefer things stay as they are (also avoid risk generated by change)
 ↳ people react negatively to changes → make small incremental solutions