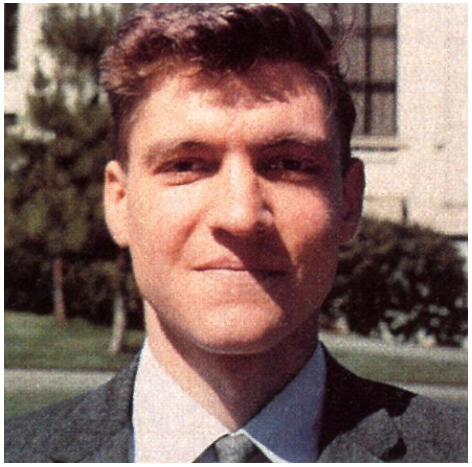
Trust as a Game Mechanic

Chris Hazard, PhD

Hazardous Software Inc.
http://hazardoussoftware.com

from zap2it.com

from Seattle Weekly



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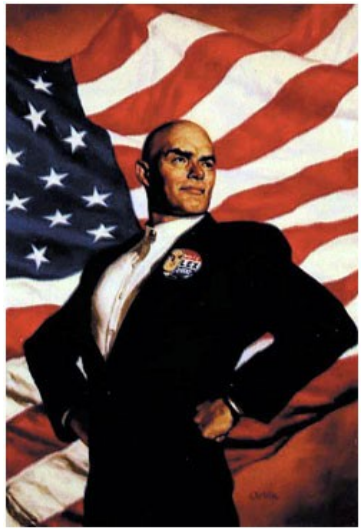

from supermanhomepage.com

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Trust Us, We Know Trust!

- In econ, CS, psychology, etc.
  - No common definition
  - No common metrics
  - No common criteria or desiderata
- It's, you know, trust!

What Is Reputation?

- Belief that an attribute is a certain way
  - He's untouchable with sniper rifle
  - That game has boring grind
- Targets adverse selection
  - “r either of u a bot?”
    “no. i is speeked englishing.”
    “Look at my pic http://ishoponline.ru/b32tacr9”
- Hindsight, capabilities, signaling, statistics

What Is Trust?

- Econ: belief that another will not exploit
  - Moral hazard
  - "help me kill this giant sewer rat on the crate" KABOOM "pwnd noob. got ur loot lol"
- Authentication vs. exploitation
  - soft security
  - "I am Spartacus"
- Forward-looking, strategy, game theory

What Can We Do With This?

- Working hypothesis:

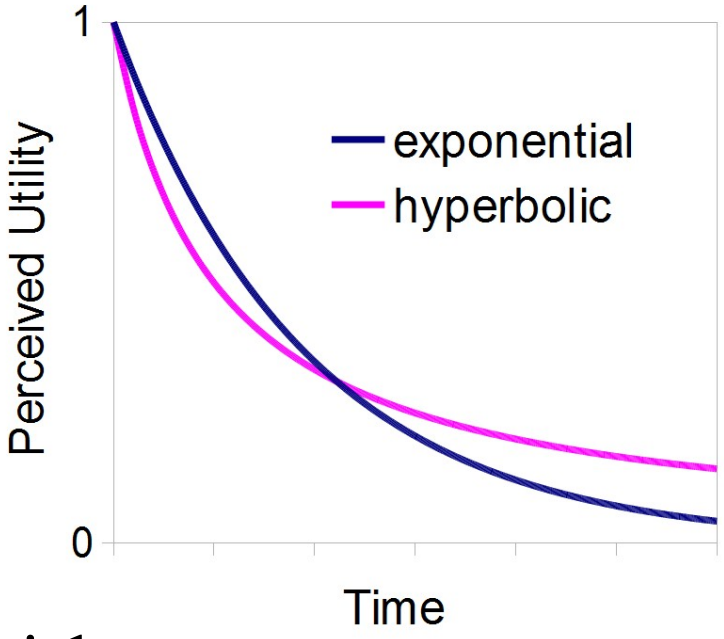
  Humans are actually rational*

  *given limited computational bounds, unfounded beliefs of others, inaccurate capability assessments, inexplicable valuations, and some level of [im]patience
- Valuations, capabilities, and patience can be measured! → reputation
- Patience core of strategy → trustworthiness

Patience (aka Intertemporal Discount Factor)

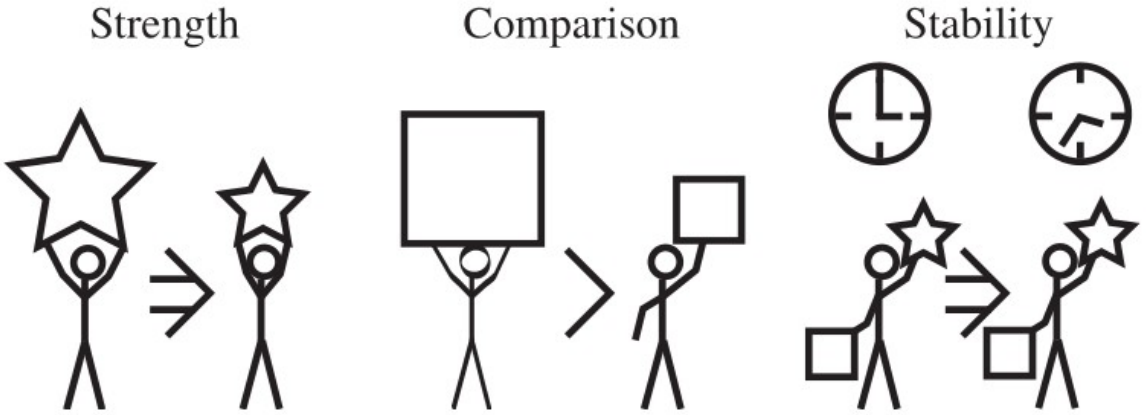
- Choices
  - $100 today vs $102 next week?
  - $100 today vs $10,000 next year?
- Qualitatively / intuitively related to trust
  - Psychology (e.g., Deutsch '73), Politics (e.g., Addison & Murshed '02), Economics (e.g., Whitmeyer '00)
  - E.g., Thieves → short-term gain for long-term risk & loss of trust (unless large pool of victims)

Discounting



- Uncertain future
  - Affect of delay on reward
  - Influenced by: patience, beliefs, risks, exogenous discount factors & value
- Expected utility =
  - Exponential, dynamically consistent: $\Sigma\ \gamma^t\ u$
  - Hyperbolic, realistic hazard rate: $\Sigma\ 1/(1+\gamma t)\ u$

Defining Trustworthiness

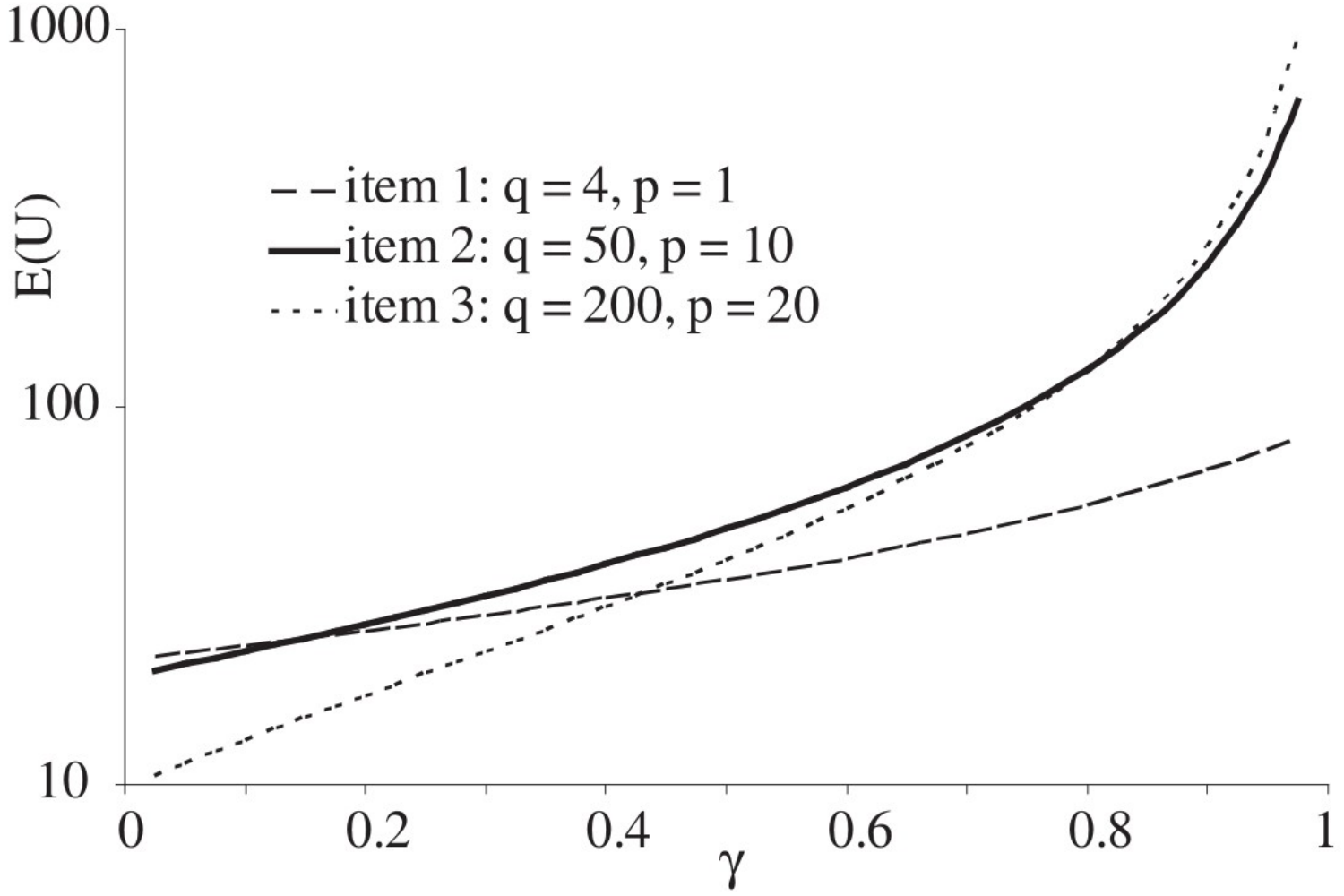


- Scalar
- Strength: Do something costly ⇒ will do something cheaper
- Comparison: Prefer b to c if b would fulfill more costly commitment than c
- Stability: Preferences stable if time shifted

Trustworthiness Isomorphic to Discount Factor

- Need valuations
- Compare two agents interacting with third in pure moral hazard situation
- Assumptions
  - Quasilinearity
  - Trustworthiness consistent enough
  - Individually rational
- All else equal, given definitions & assumptions, only factor that affects trustworthiness is discount factor

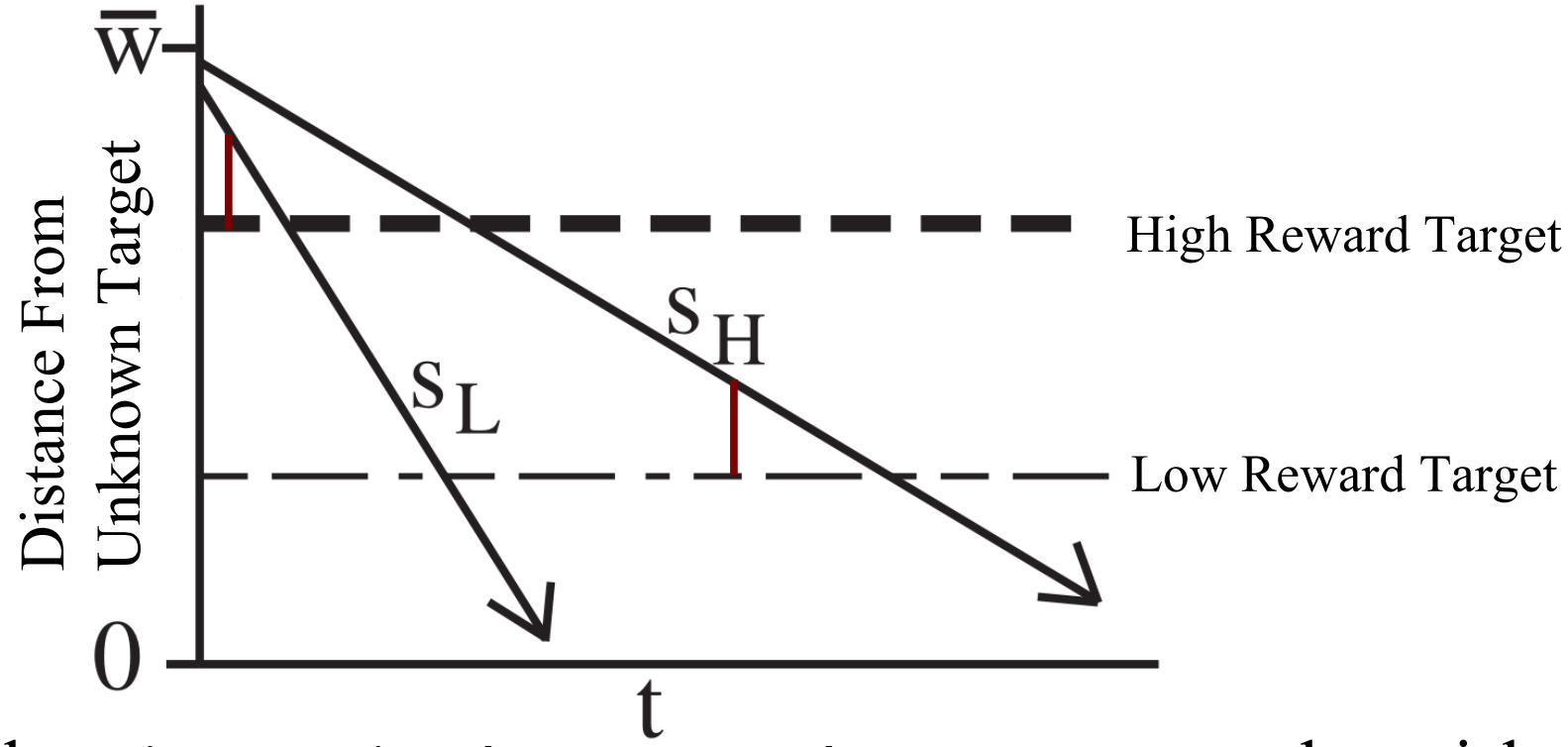
Measuring Discount Factors: Item Choice



Creeping Sniper's Dilemma

Original image from ShadowShield.com

Creeping Sniper's Dilemma

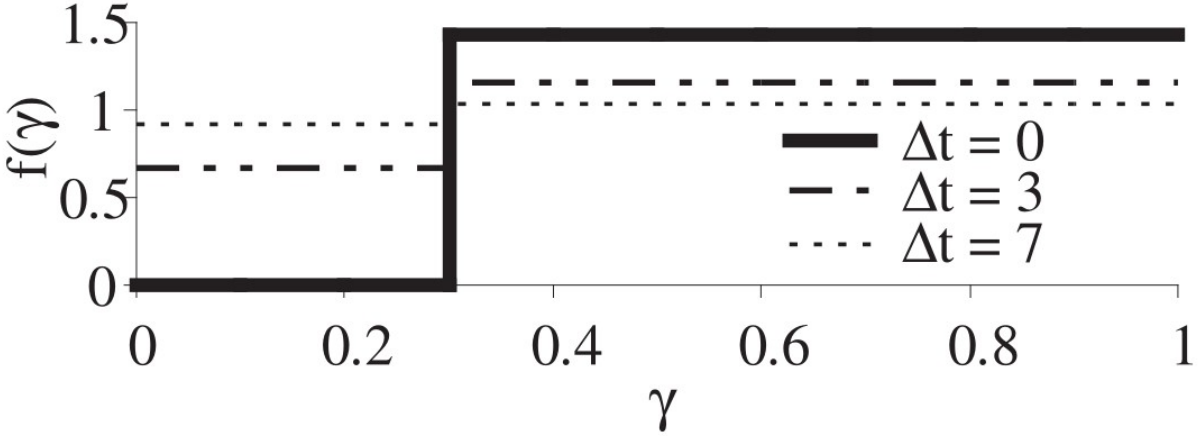


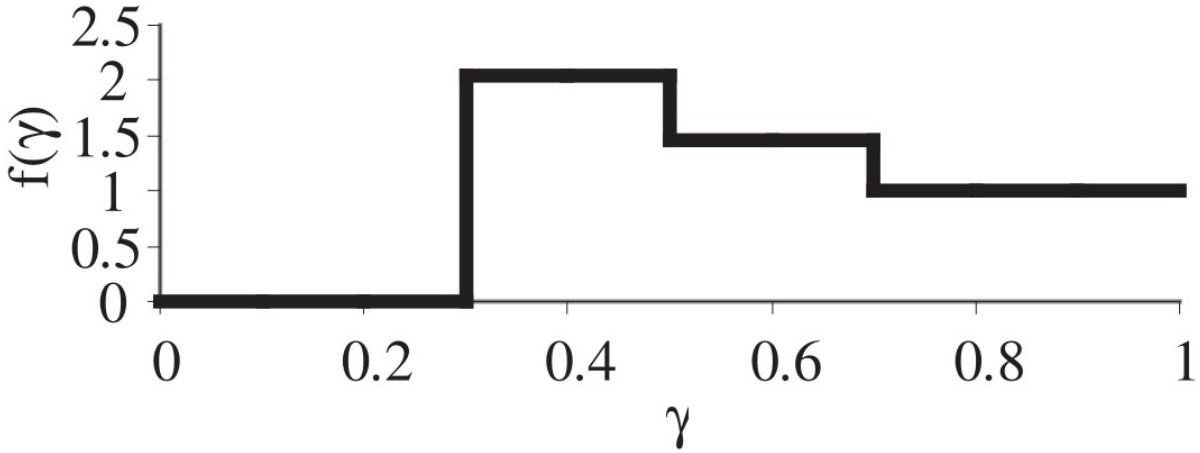
- Single sniper optimal strategy; slow creep out = low risk
  - $\sigma_t = \frac{\bar{w}}{(1+\sqrt{1-\gamma_{s_1}})}\left(\frac{1-\sqrt{1-\gamma_{s_1}}}{\gamma_{s_1}}\right)^t$
- Multiple sniper optimal strategy
  - Match quickest visible discount strategy unless too risky

Incentivizing Players to Give Favors

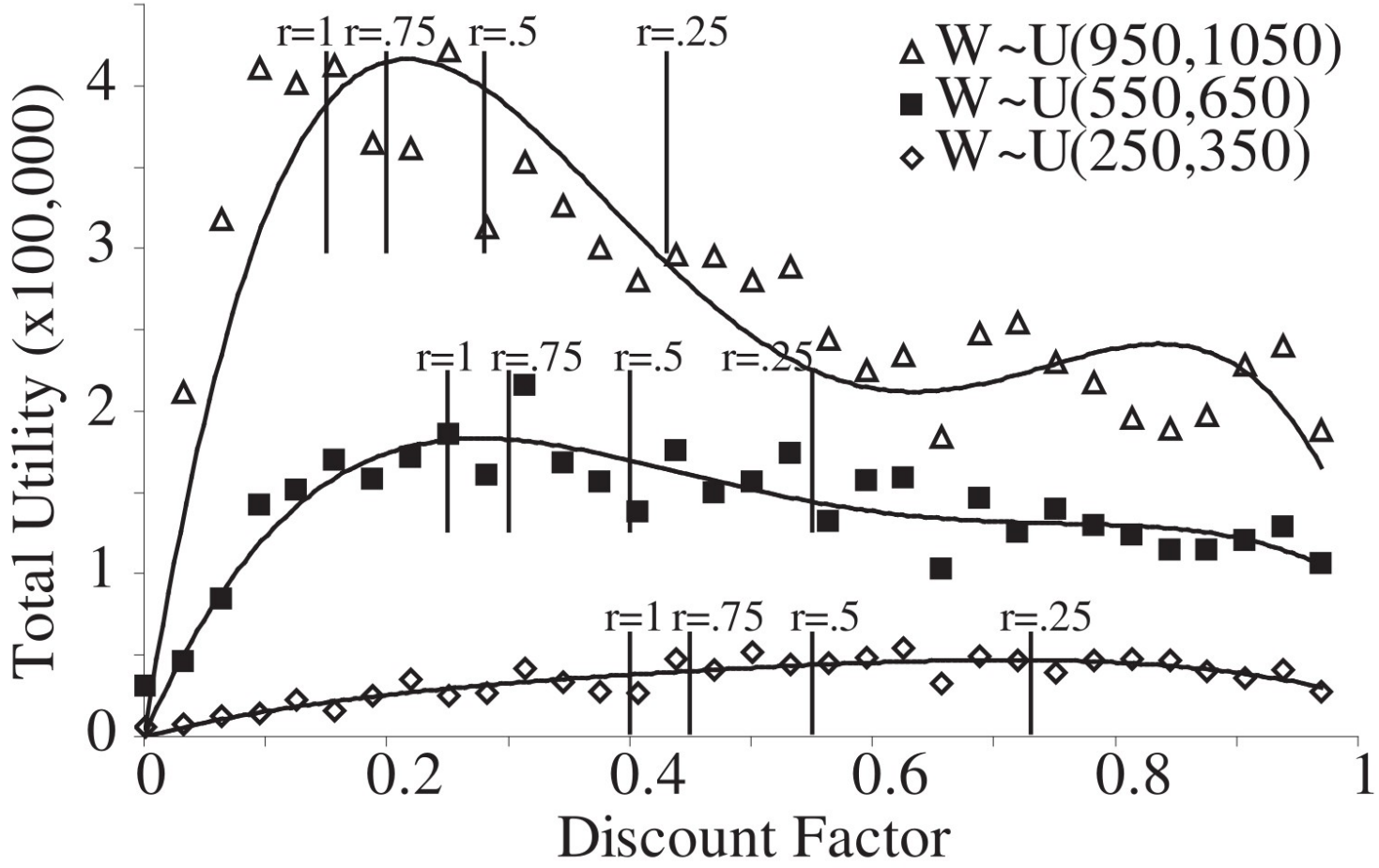
- Rational player
  expected utility = expected benefit of relationship
  – expected cost of relationship
  – cost of favor
- Pure moral hazard
- How to sanction?
  - Tit-for-tat & variations
  - Ability to negate loss by reducing favors offered (derivatives about equal)
  - Figure out discount factor required to yield observed behavior

Combining Observations: Bayesian Inference





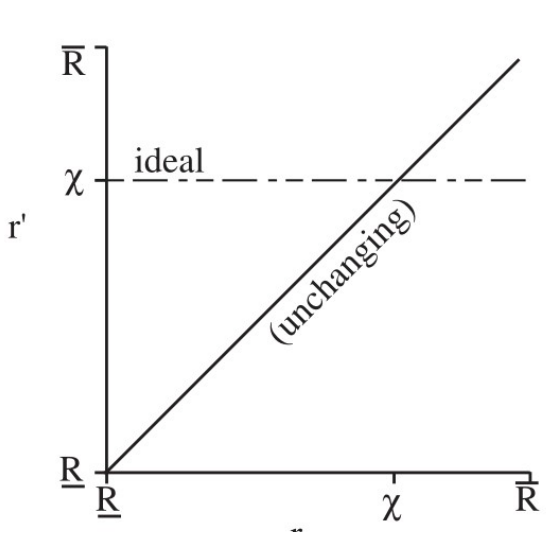
Optimal Level of Patience for Given Scenario

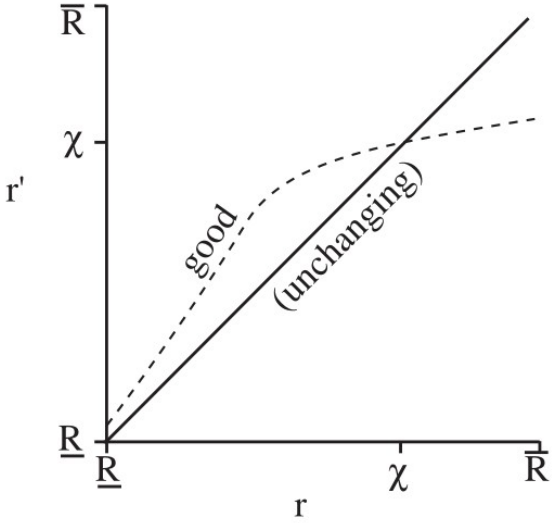


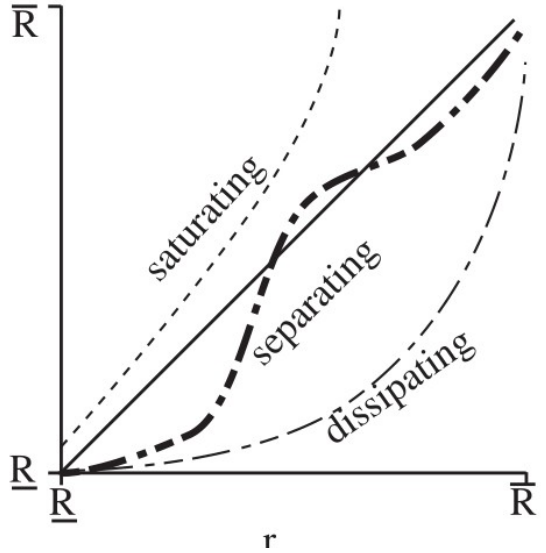
What Do We Want Out of a Reputation System?

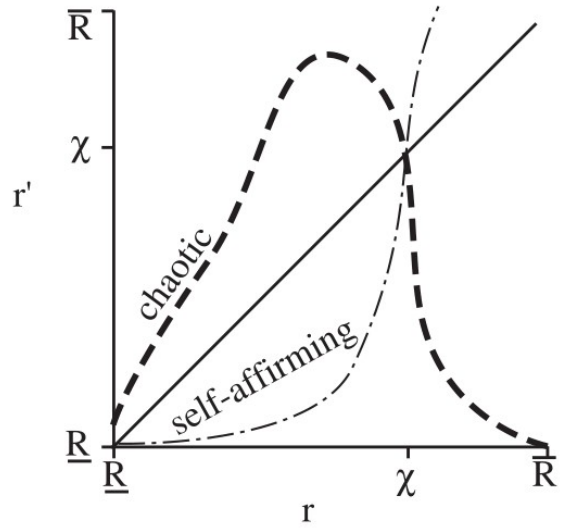
- Unambiguous
  - Player type yields one reputation
- Monotonic
  - Better reputation yields higher expected value of relationship
- Convergent
  - Reputation should converge quickly near fixed point
- Accurate
  - Reputation should converge quickly if large errors/biases exist

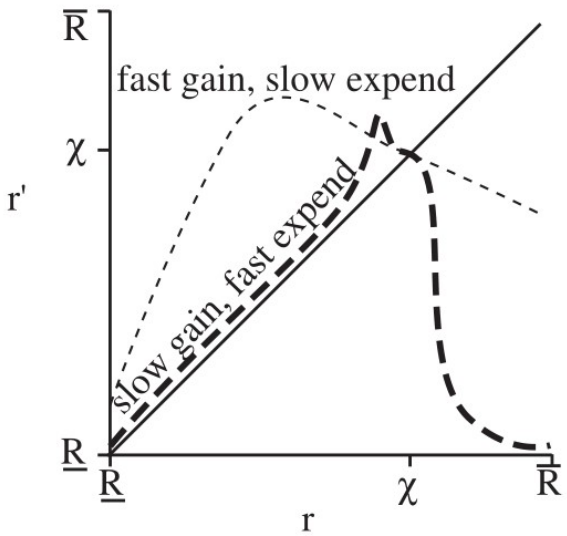
Reputation System Dynamics











How Can We Measure Trust in a Game?

- Determine utility, perceived probabilities, and risk aversion for major decisions
  - Model game interactions as “economy” w/ player time
  - Assess for all scenarios including tactical/optimizing (unilateral) and strategic (bi/multilateral)
- Compute decision thresholds based on relationship between player preferences and patience (discount factor)
  - Dynamic evaluation
  - Involve narrative engine, social network, seller ratings, other exogenous info

Trust as an Exploration Mechanic

- Quantitatively ensure “better” game
- Measure valuations & discounting distributions
  - Players' maxent regions
  - A priori playtesting
- In-game decisions:
  - Make sure level of trustworthiness required is below most users' trustworthiness
- Report user reputations

Trust as an Exploitation Mechanic

- Place player in edge situations
  - Ethical boundaries – "what is your price?"
  - ~3 choices good
  - Clear trade-offs
- Use appropriately
  - Player overload
  - "Soap Opera"
  - Players sometimes like stability, e.g., fixed alliances

Challenges to Discount Factor Approach

- Rationality of agents
- Computational complexity: Nash equilibria, combinations of actions, uncertainty
- Disagreements over definition of trust (to include capabilities, reliability?)
- No “ideal” intertemporal discount model in most situations

What Enables Trust Psychologically?

Homophily

Image from WoW Cataclysm

Image from upcoming Mass Effect 3

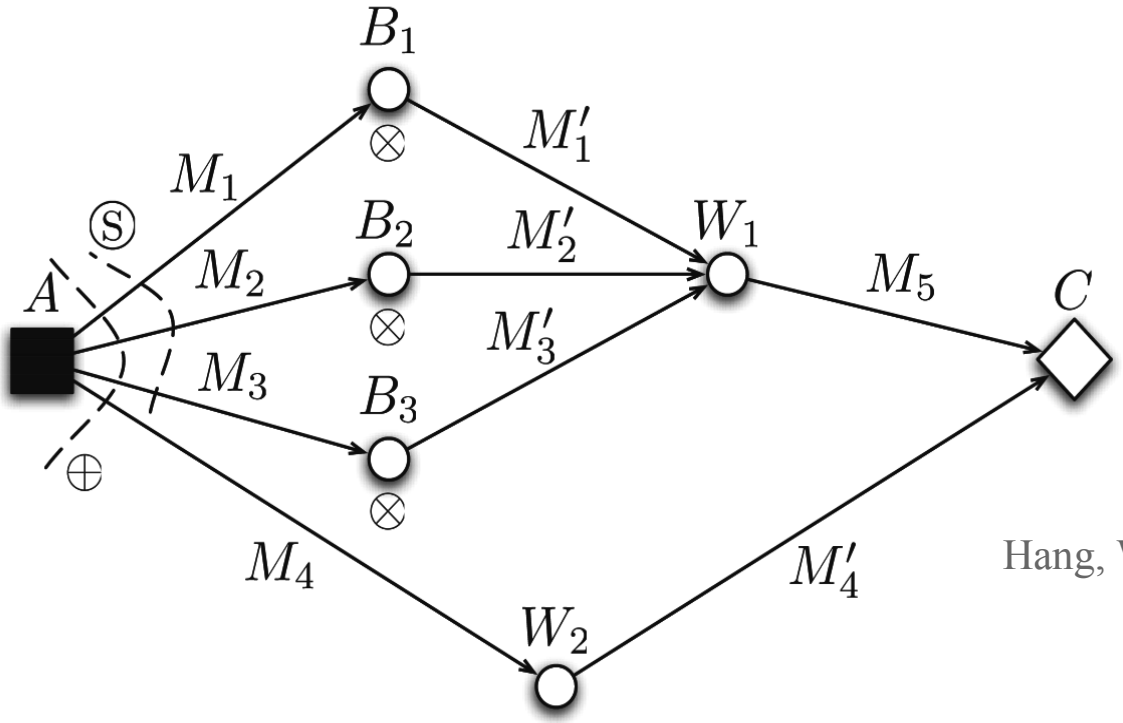
Embedding

Corroboration

Image from Heavenly Sword

Core Corroboration Caveat

- Provenance hard to assess!



Hang, Wang, & Singh AAMAS '09

- Trust transitivity & dampening

What Trust is NOT

- Social norms & laws
  - Perceived value of relationships
  - Perceived impact of norms on relationships
- Measure of good vs evil
  - Trustworthy henchman & maverick hero
- Keeper of secrets
  - Strong relation, but not necessitated
- Reliability
- Intimacy

Where Isn't Trust the Main Principle?

- MMO Raid
  - Group cohesiveness incentivized by weakness of being alone
  - Mutual dependence
    - Trust "ratcheting"
    - Not much trust but seems like it
- Self-interest vs malice
  - Malice: easier to model in full-information games, harder in partial-information games
  - Faux altruism: strategic relationship building

Trust & Society

- Enforcing/sanctioning often only tools to combat lies
  - Information asymmetry
  - When possible: incentive compatibility & revelation principle
  - Level of trust often req'd for system & market efficiency
- Too trusting with homophily, embedding, corroboration?
  - Trust researchers & high-ranking military leaders
  - Inability to play red in red v blue

Conclusions

- Trust important as games ascend further into social space
- Trust important in narrative
- Can model and compute trust metrics
- Use for game design

Questions?