Measuring and Manipulating Player Trust through Choice and Game Mechanics

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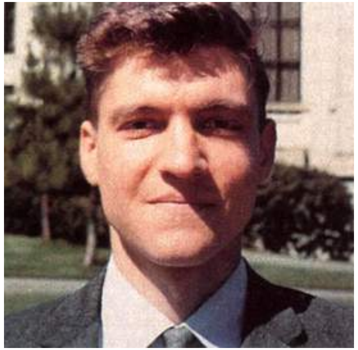
COAL PORTER
SHOVEL BOY
GRAVELLER
COAL BEARER
TANK CLEANER
MATCH DIPPER
CROSSING SWEEP
SEWER BRICKER
PIT MONKEY

from zap2it.com

from Seattle Weekly



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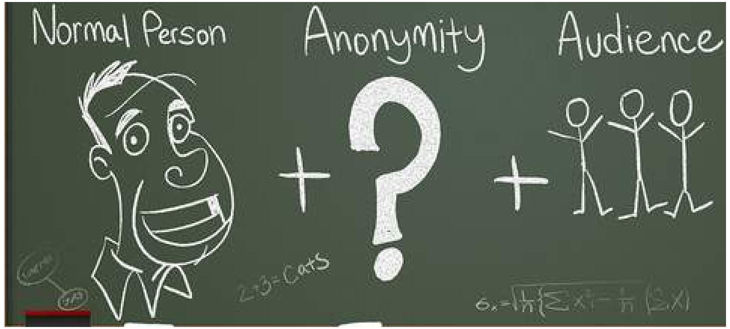

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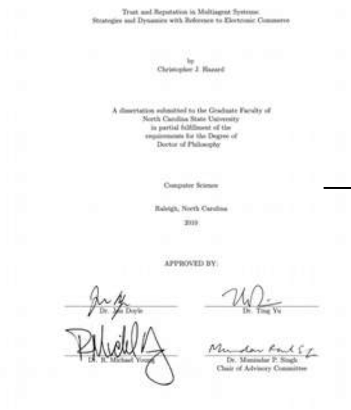

Trust and Reputation in Multiagent Systems:
Strategies and Dynamics with Reference to Electronic Commerce

by
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Doctor of Philosophy

Computer Science

Raleigh, North Carolina

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This Talk

Reputation

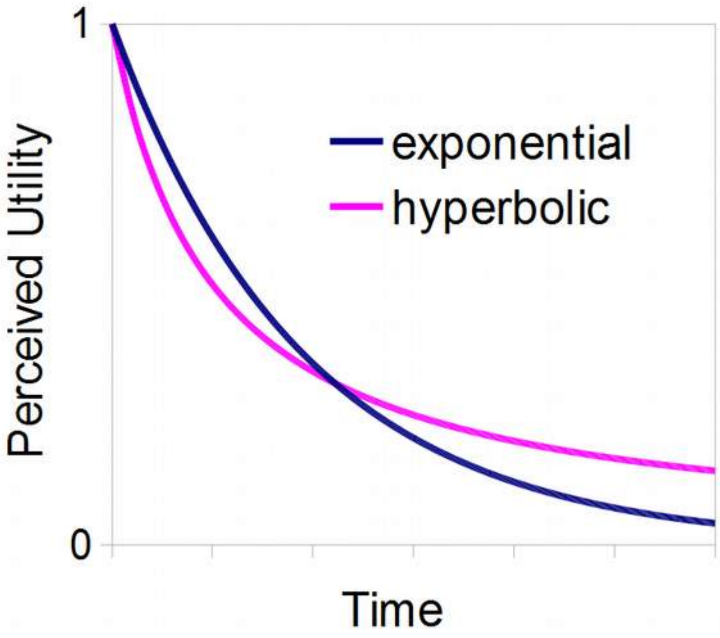
- Belief about attribute
- Hindsight, capabilities, statistics
- Concern: adverse selection

Trust

- Belief will not exploit
- Foresight, strategy, game theory
- Concern: moral hazard

- Humans are 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
- Model new situations → trustworthiness

Discounting



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

Discounting Everywhere

- Stochastic search

$$\pi(a) = \frac{\exp\left(\frac{Q(a)}{n(a)}/\tau\right)}{\sum_{b \in A(s)} \exp\left(\frac{Q(b)}{n(b)}/\tau\right)}$$

- Amortization

$$\mathrm{NPV}(i, N) = \sum_{t=0}^{N} \frac{R_t}{(1+i)^t}$$

- Bellman Equation

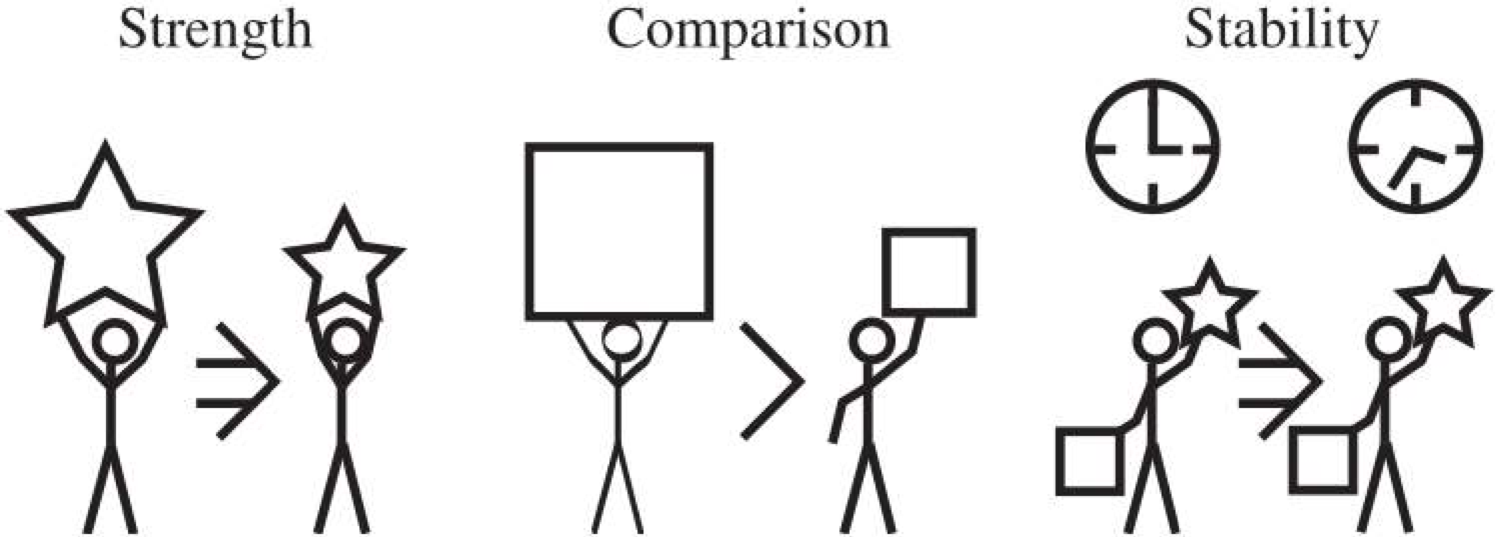
$$V(x_0) = \max_{\{a_t\}_{t=0}^{\infty}} \sum_{t=0}^{\infty} \beta^t F(x_t, a_t),$$

- Reinforcement Learning
- Markov Decision Processes & POMDPs

$$Q(s_t, a_t) \leftarrow Q(s_t, a_t) + \alpha[r_{t+1} + \gamma Q(s_{t+1}, a_{t+1}) - Q(s_t, a_t)]$$

- ***Normalize discount rate wrt time

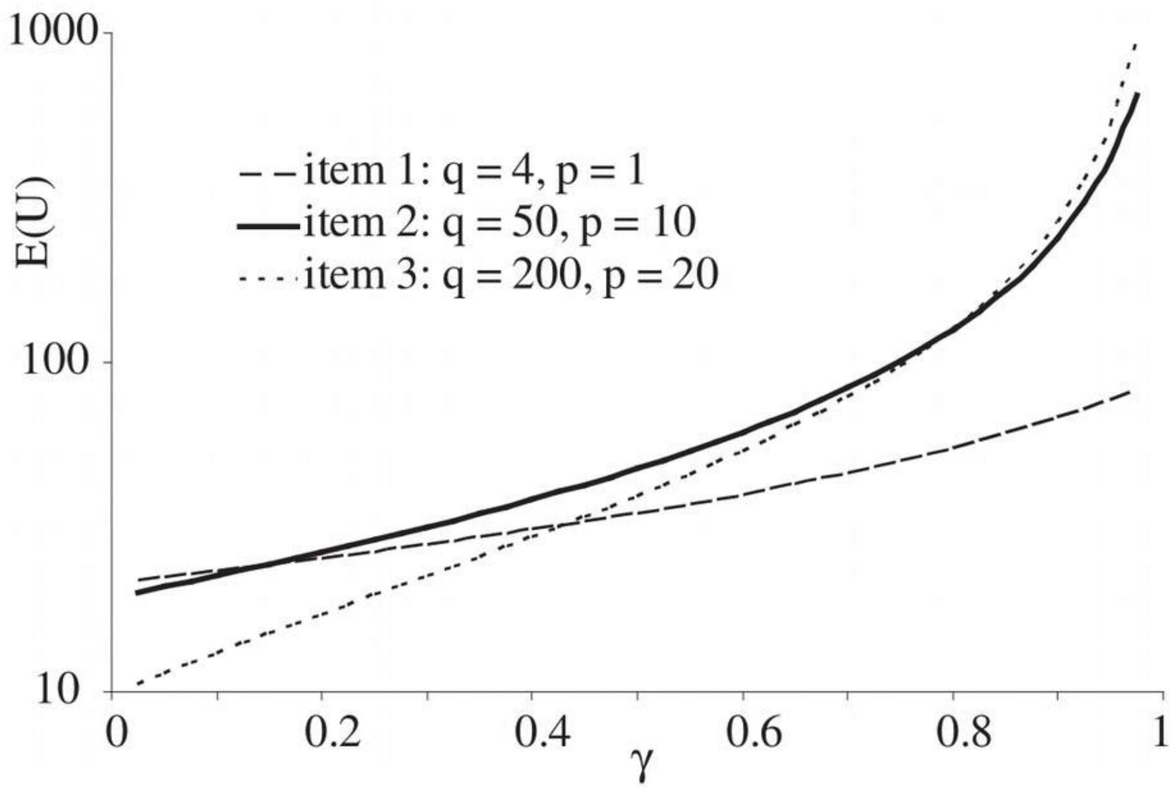
Defining Comparable Trustworthiness



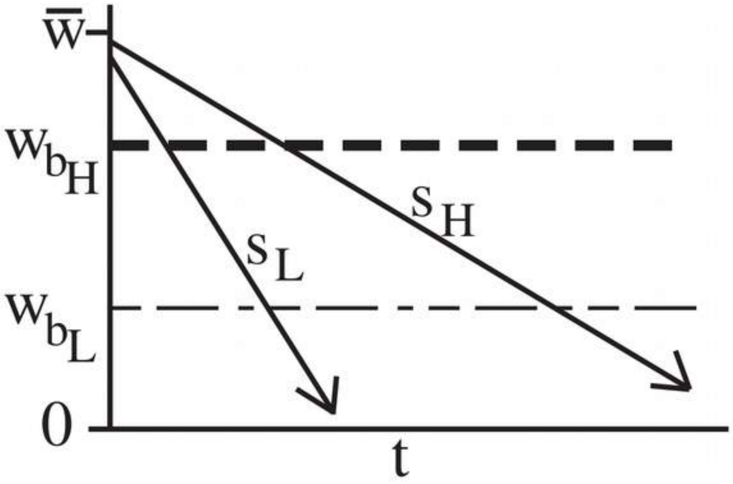
Trustworthiness Isomorphic to Discount Factor

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

Measuring discount factor by choice



Creeping Sniper's Dilemma



- Single sniper optimal strategy; slow creep out = low risk

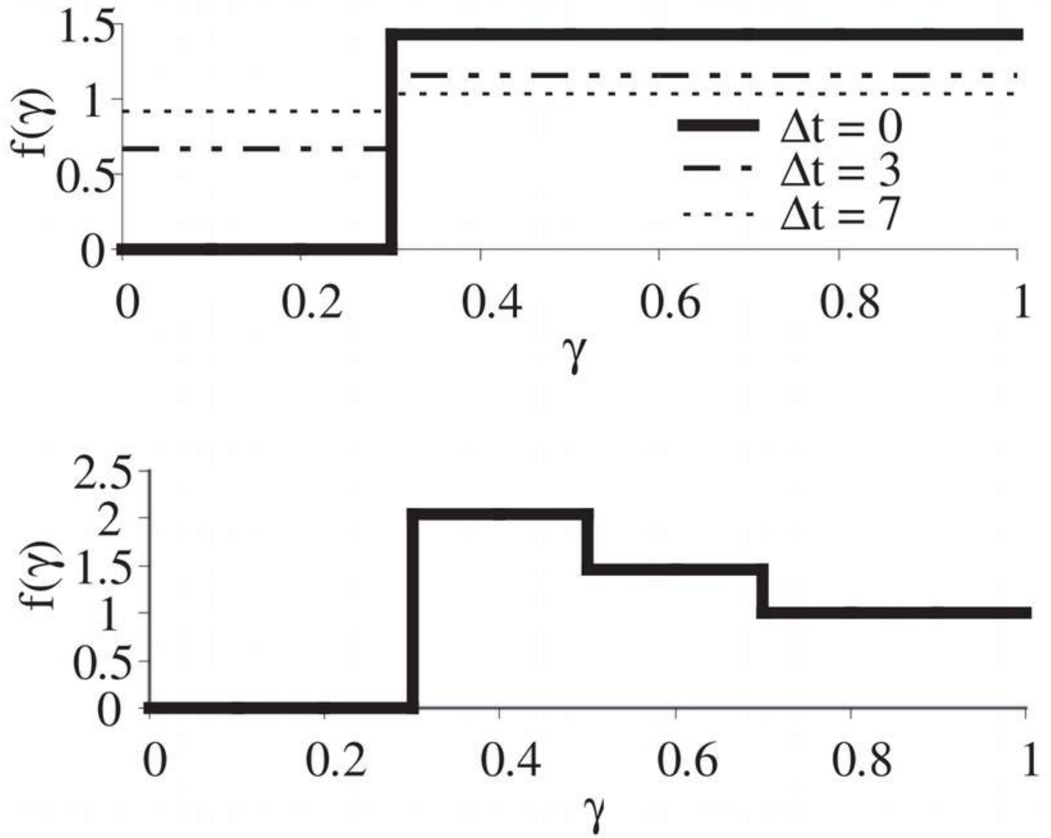
$$\sigma_t = \frac{\overline{w}}{(1+\sqrt{1-\gamma_{s_1}})}\left(\frac{1-\sqrt{1-\gamma_{s_1}}}{\gamma_{s_1}}\right)^t$$

- Multiple sniper optimal strategy
  - Match quickest visible discount strategy unless too risky

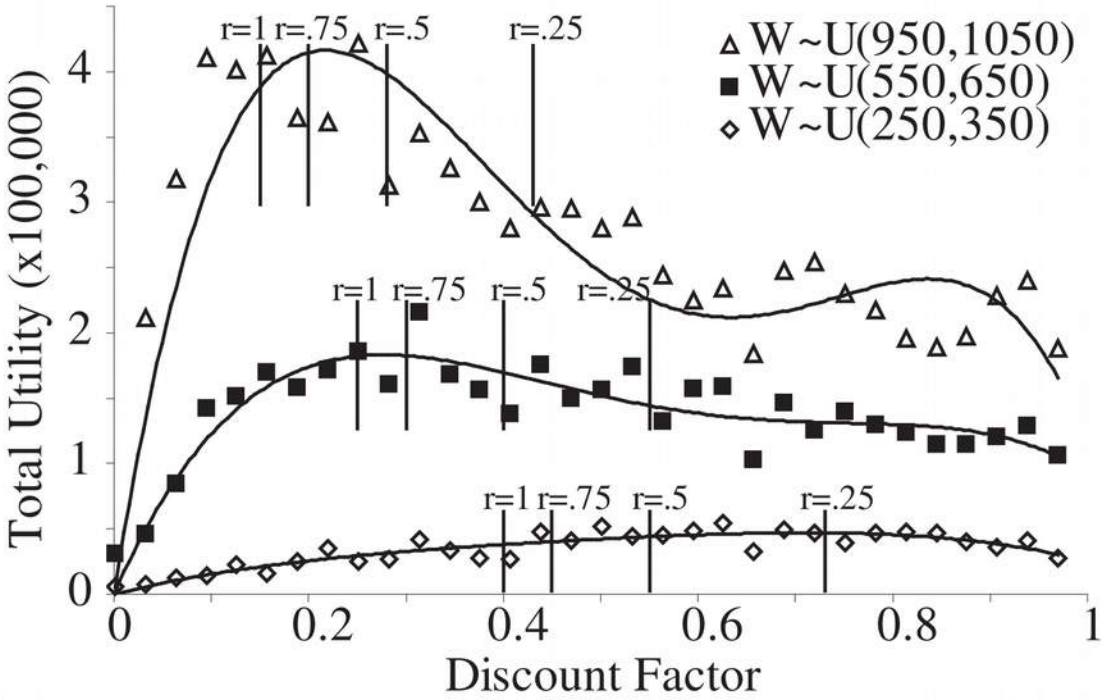
Negotiating

- Rubenstein Negotiation
  - $v_1 = (1-\gamma_2)/(1-\gamma_1\gamma_2)$
  - Inequalities if rationality not guaranteed
  - Player & NPC interaction inequalities
- Impatience $\frac{w_b - \sigma_{T-1}}{w_b - \sigma_T} < \gamma_b \leq \frac{w_b - \sigma_T}{w_b - \sigma_{T+1}}$
- NPC disagreements with player over choices

Combining Observations: Bayesian Inference



Optimal Level of Patience for Given Scenario



Trust Exploration

- Measure valuations, discount factor, beliefs, maxent regions
- NPCs of different trustworthiness
- Reputations

Trust Exploitation

- Push player's ethics buttons: “what is your price?”
- Stability & comfort vs conflict
- Trickery

Psychological Heuristics of Trust

Homophily

Image from WoW Cataclysm

Mass Effect 3

Embedding

Corroboration

Image from Heavenly Sword

Trust & Society

- Enforcing/sanctioning to combat lies
  - Incentive compatibility & revelation principle wrt information asymmetry
  - Level of trust req'd for system & efficiency
- Too trusting with homophily, embedding, corroboration?
  - Common inability to play “red player”

Direct Applications (Conclusions)

- NPC decisions: favors, purchases, alliances
- Measuring player patience
- Adversary willingness to look ahead related to organizational trust (e.g., big bad)
- NPC subordinates following player commands based on trustworthiness (explicit or implicit)

For further info

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