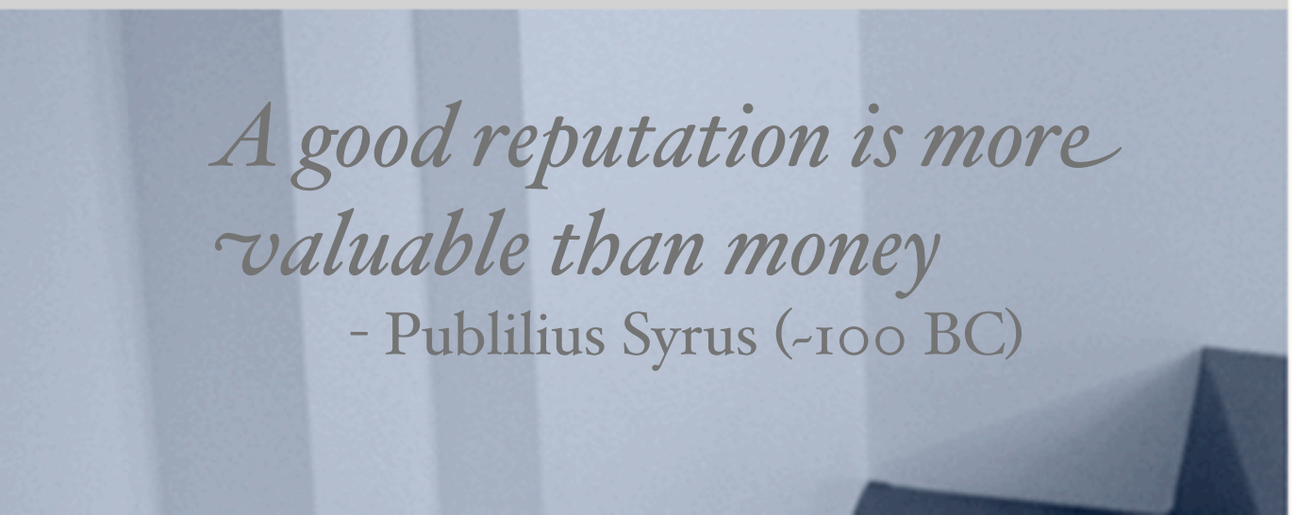


Reputation Systems

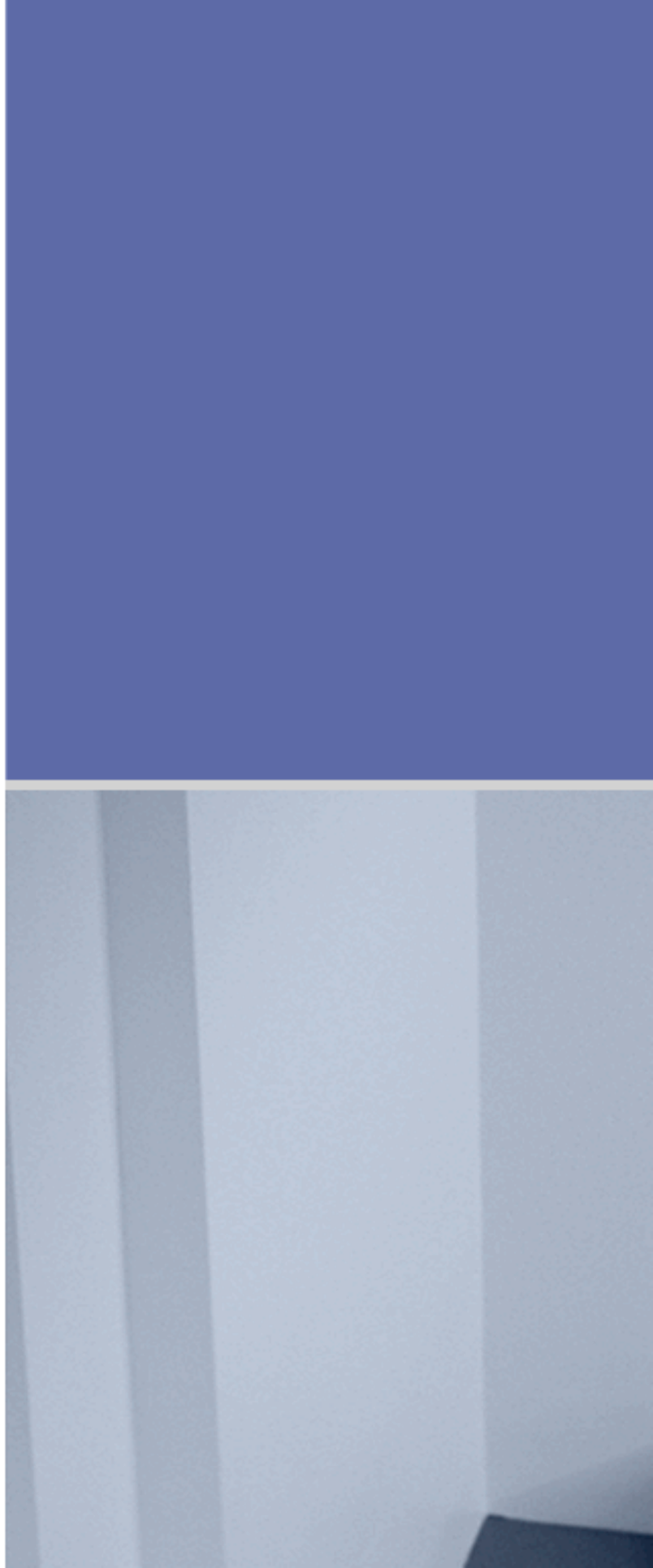
Kevin Regan

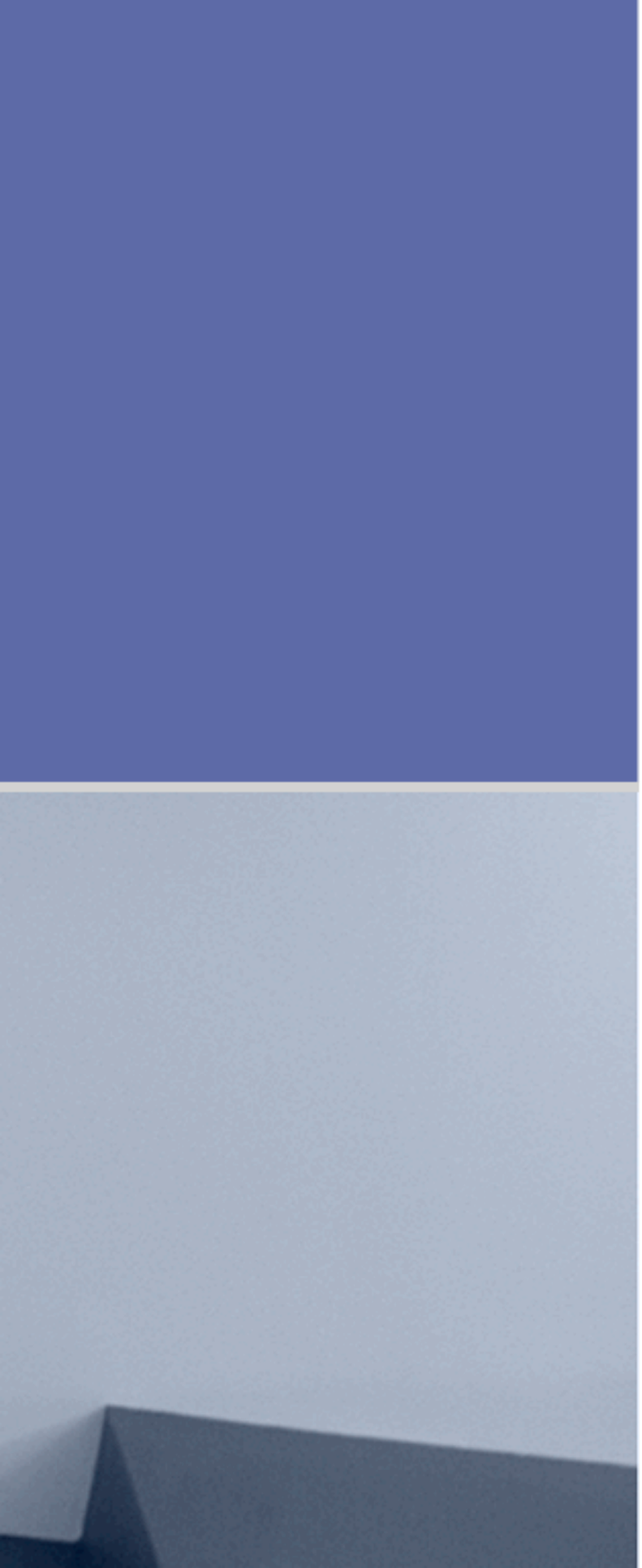
Outline

- Introduction
- Challenges
- Current Research
- Conclusions

Outline

- ***Introduction***
- Challenges
- Current Research
- Conclusions





Reputation \Rep`u*ta”tion\

1. The estimation in which one is held; character in public opinion; the character attributed to a person, thing or action; repute
2. A feedback profile that allows prediction of future behavior based on past interactions

Properties

- A reputation system should
  1. Capture feedback
  2. Guide trust decisions
  3. Persist over time

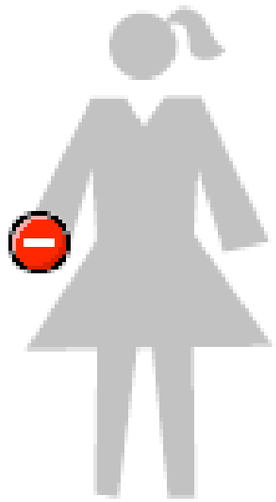
Real World Reputation Systems

eBay Example

- Alice has bought and sold 10 items with 5 people
- After these transactions her feedback score has increased by 3 points
- We now examine each transaction and how it affected her score

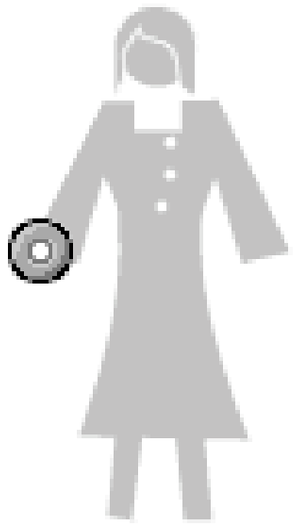
eBay Example

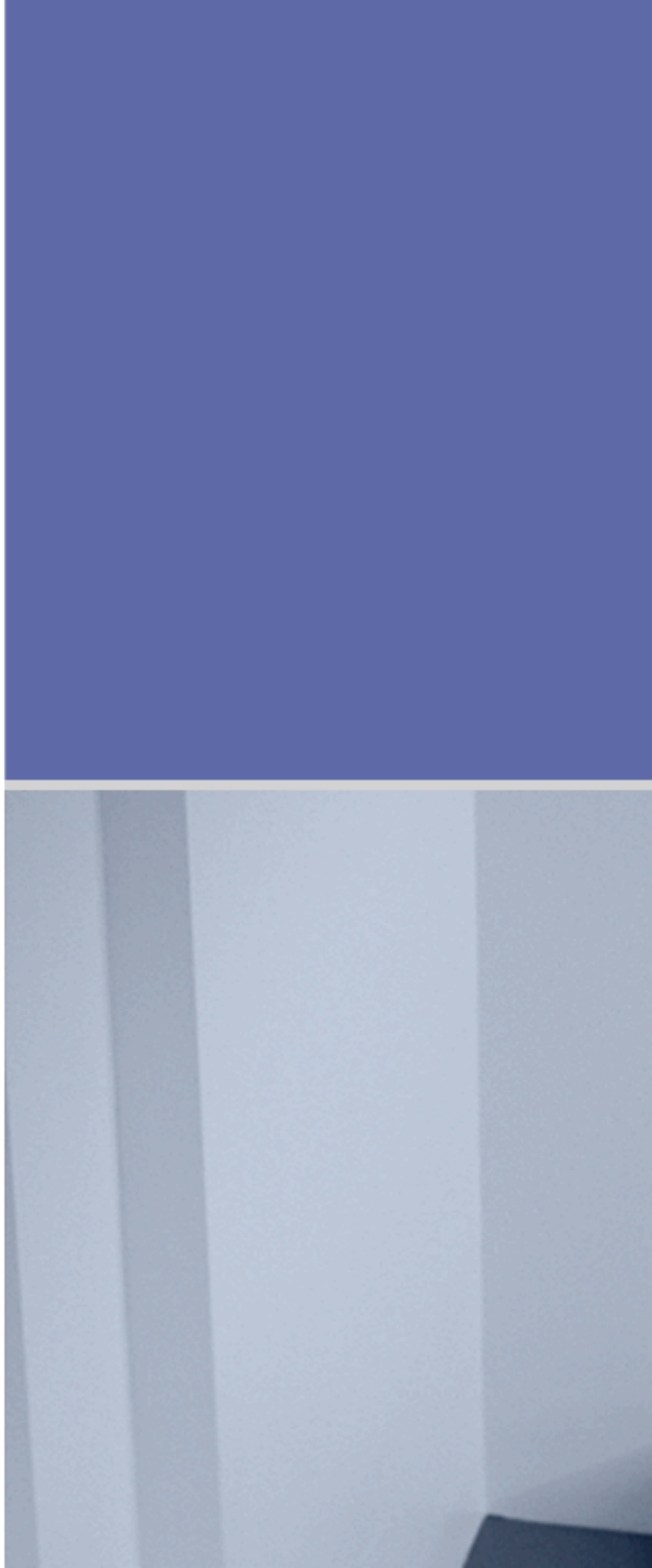
- Score decreases by 1



eBay Example

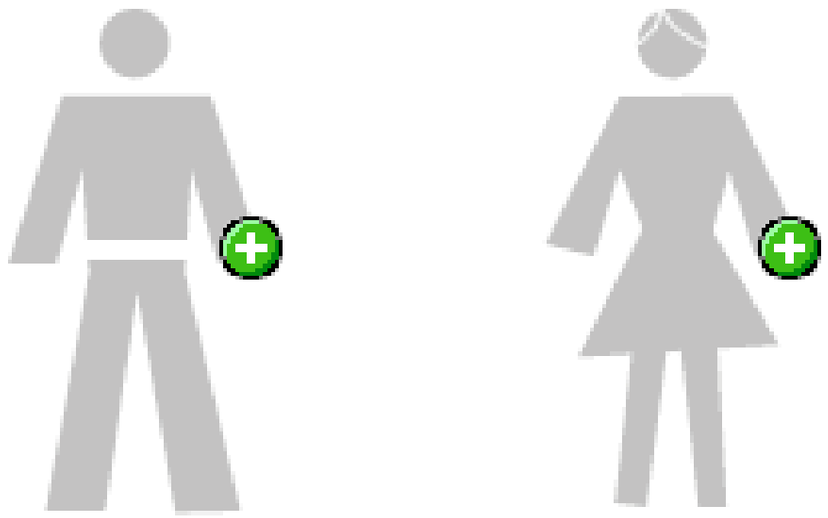
- Score stays the same





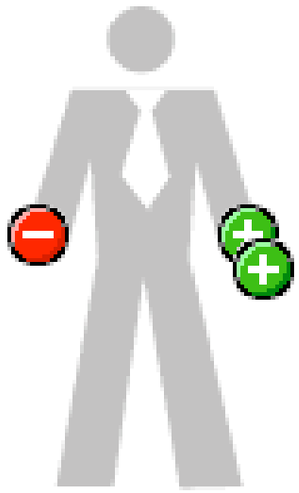
eBay Example

- Score increases by 2



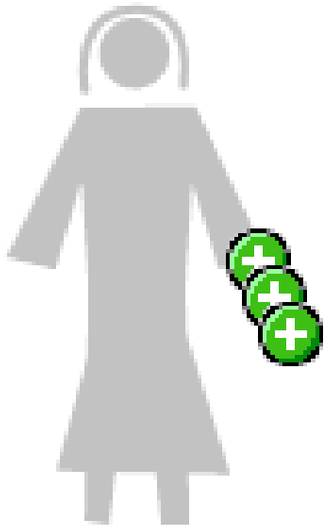
eBay Example

- Score increases by 1



eBay Example

- Score only increases by 1



eBay Feedback

Thin Lizzy / Bad Reputation / remastered cd Item number: 4049966767

You are signed in Email to a friend | **Watch this item** in My eBay

Go to larger picture

Starting bid:	**US $13.98**
	Place Bid >
Time left:	**3 hours 57 mins** 7-day listing Ends Nov-11-04 17:15:19 PST
Start time:	Nov-04-04 17:15:19 PST
History:	0 bids
Buy It Now Price:	**US $16.50**
	Buy It Now >
Item location:	ALPHA, OH United States /Dayton-Springfield
Ships to:	United States, Mexico, Europe, Australia, Canada
Shipping costs:	US $3.00 - Standard Flat Rate Shipping Service (within United States)

Seller information

www.thecdcellar.com (21010) Power Seller me

Feedback Score: 21010
Positive Feedback: 97.9%
Member since Aug-22-98 in United States

Read feedback comments
Add to Favorite Sellers
Ask seller a question
View seller's other items

Visit this seller's eBay Store!
stores **THE CD CELLAR**

Safe Buying Tips

eBay Feedback

Member Profile: www.thecdcellar.com (21010 ☆) PowerSeller me

Feedback Score: **21010**
Positive Feedback: **97.9%**

Members who left a positive: 21439
Members who left a negative: 462

All positive feedback received: 31779

Learn about what these numbers mean.

Recent Ratings:

	Past Month	Past 6 Months	Past 12 Months
positive	140	2281	6378
neutral	3	20	81
negative	2	48	127

Bid Retractions (Past 6 months): 0

Member since: Aug-22-98
Location: United States

- ID History
- Items for Sale
- Visit my Store
- Add to Favorite Sellers
- Learn more About Me

Contact Member

All Feedback Received | From Buyers | From Sellers | Left for Others

32615 feedback received by www.thecdcellar.com (0 mutually withdrawn) Page 1 of 1305

Comment	From	Date / Time	Item #
Excellant service and delivery. Thank you.....5 STAR!!!!!!!!!	Buyer 94c12069 (14 ☆)	Nov-10-04 12:00	4048940647
Excellent service, great communication, would deal with again A+++	Buyer beatvox325 (8)	Nov-09-04 20:59	4038705884
¤º°`°º¤ø,,,ø¤º°`°º AWESOME EBAY SELLER ¤º°`°º¤ø,,,ø¤º°`°º	Buyer tdwolf66 (267 ☆)	Nov-09-04 08:00	4049169403
CD new, as promised. No complaints.	Buyer macattack30 (171 ☆)	Nov-08-04 21:58	4037587477
Very quick delivery, great product, great seller!! A++++++++++++++++++++	Buyer antlerjoe1960 (217 ☆)	Nov-08-04 20:56	4048941176
great ebayer fast shippment AAAAAAAAAAAAAAAAAAAAAA++++++++++++++++++++++	Buyer mrs_myers (39 ☆)	Nov-08-04 09:35	4048938118
Excellent item, Thanks!	Buyer blizard_of_ozz (91 ★)	Nov-06-04 19:56	4039609641
Excellent packaging. CD's in perfect condition Thanks!!!!	Buyer whatzup026 (14 ☆)	Nov-06-04 14:13	4040165769

eBay Feedback

Stars

The feedback rating system is easy. You receive:

- +1 point for each positive comment
- 0 points for each neutral comment
- -1 point for each negative comment
- A star icon for 10 or more comments.

Stars are awarded to eBay members for achieving 10 or more feedback points. Here's what the different stars mean:

Yellow Star ( ) = 10 to 49 points

Blue Star ( ) = 50 to 99 points

Turquoise Star ( ) = 100 to 499 points

Purple Star ( ) = 500 to 999 points

Red Star ( ) = 1,000 to 4,999 points

Green Star ( ) = 5,000 to 9,999 points

Yellow Shooting Star ( ) = 10,000 to 24,999 points

Turquoise Shooting Star ( ) = 25,000 to 49,999 points

Purple Shooting Star ( ) = 50,000 to 99,999 points

Red Shooting Star ( ) = 100,000 or higher

Feedback Forum: Reply to Feedback Received

An important part of the Feedback Forum is sharing with the community your experience with other members. In addition to leaving feedback, there may be occasions when you want to reply to a comment another member has left in your member profile; it will appear directly below that comment in your member profile.

Please note:

- You can reply only once to a comment. You cannot edit or retract your reply.
- It's always best to keep you feedback factual; avoid making personal remarks.
- Leaving a reply does not affect your feedback score or number of ratings.
- If you have a dispute, contact your trading partner to try and resolve the dispute before replying.

Seller: linsmart_com (2580)
Item: 2080284948
Date/Time left: Dec-20-02 08:03:02 PST
Feedback: picked up item on time! thanks!
Reply:

80 chars max.

Leave Reply

Outline

- Introduction
- ***Challenges***
- Current Research
- Conclusions

Properties

- A reputation system should
  1. Capture feedback
  2. Guide trust decisions
  3. Persist over time

Challenges

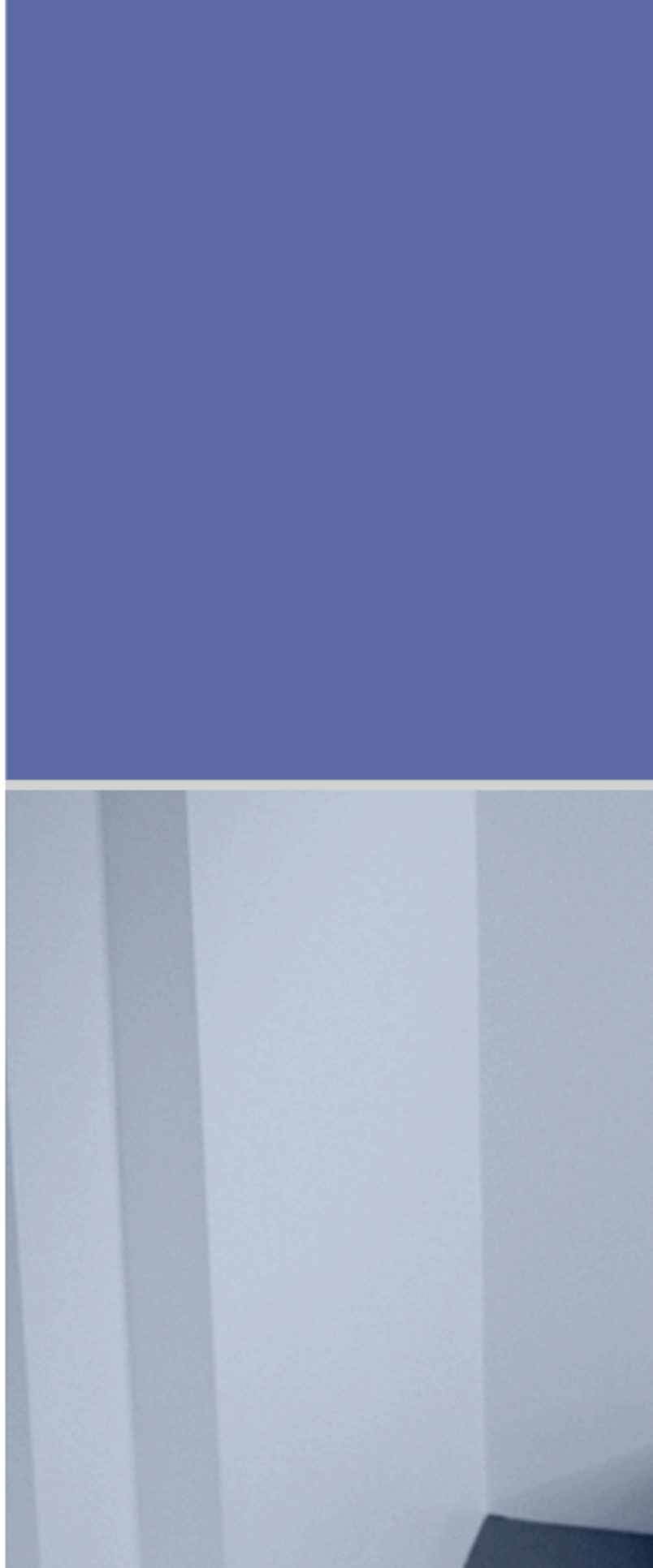
1. Capturing feedback

- Why leave feedback?
- “If you don’t have anything nice to say, don’t say anything at all”
- Why leave honest feedback?

Challenges

2. Guiding trust decisions

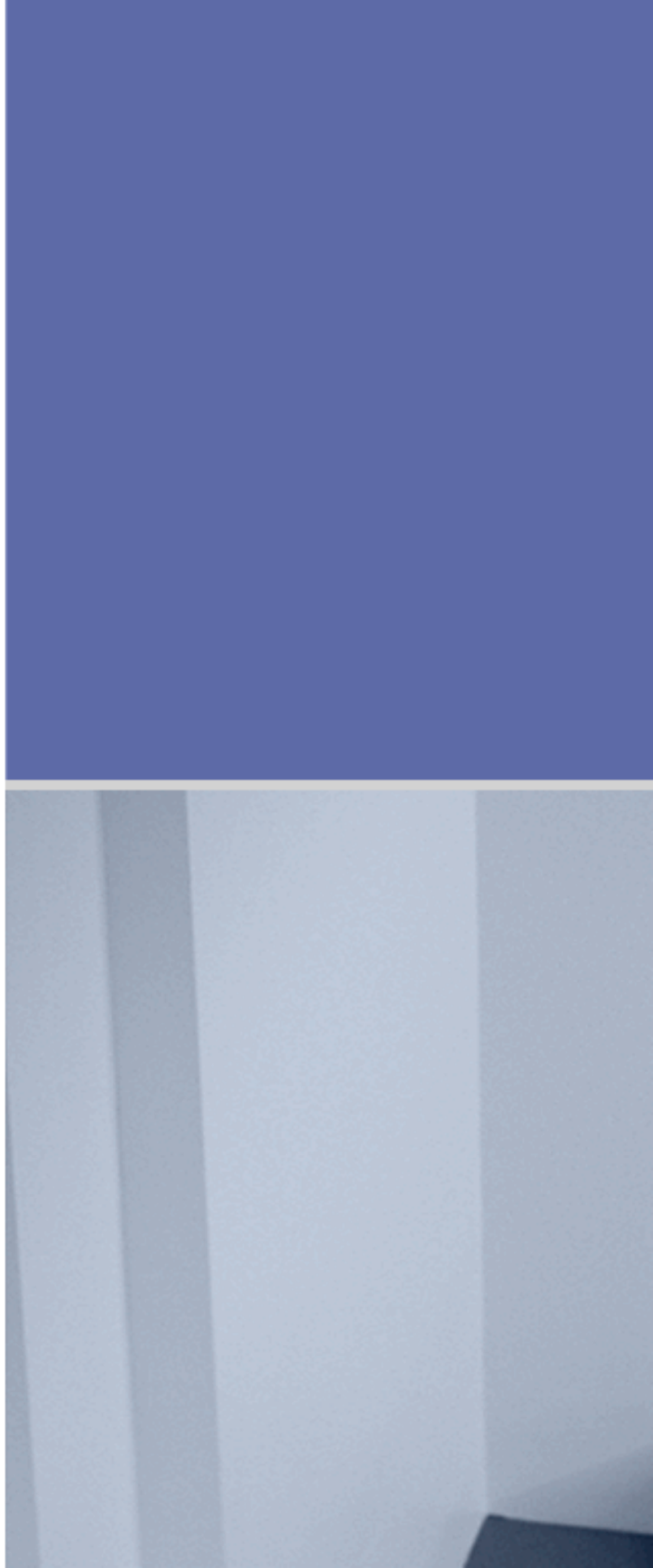
- How do we summarize and display feedback?
- Are all interactions created equal?
  - Weighted feedback



Challenges

3. Persist over time

- If reputation is easily built and discarded, we cannot place trust in it
- How to be attribute feedback across name changes?
- Can we enable feedback across systems?

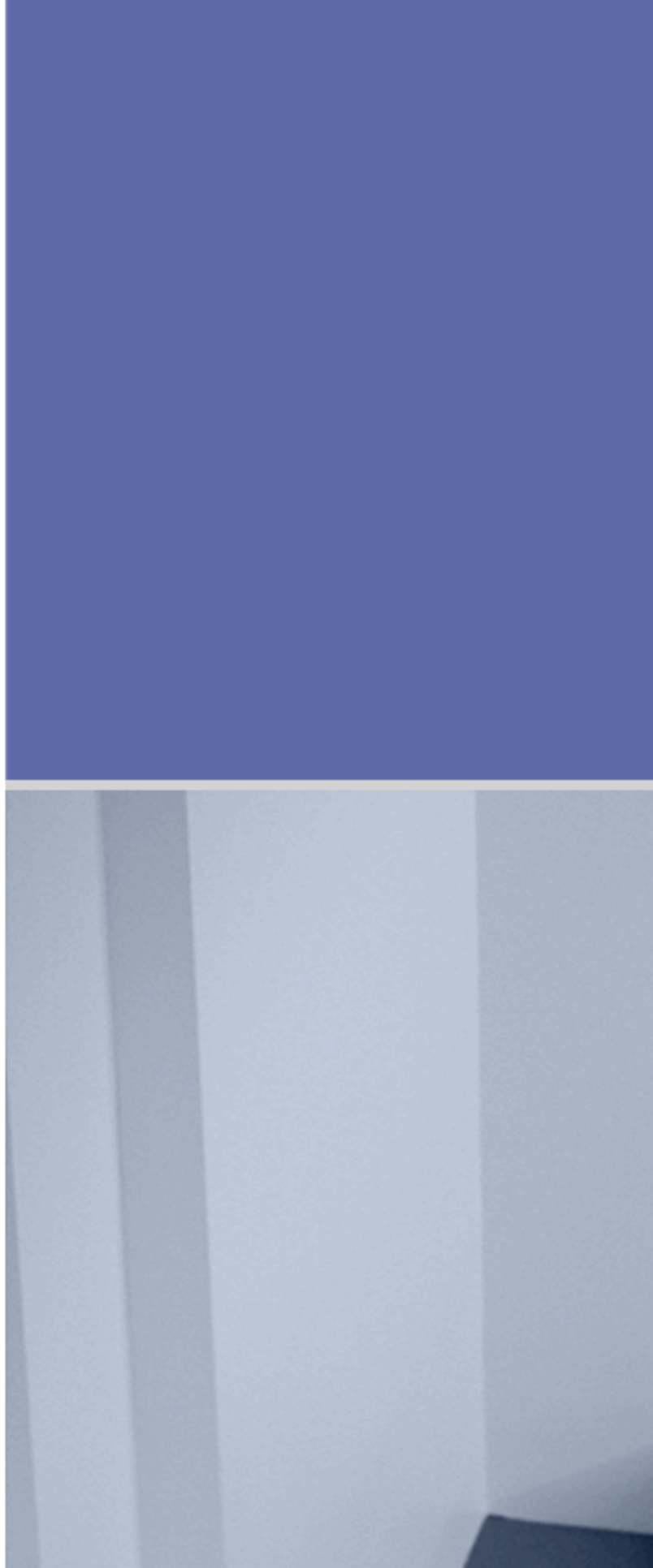


Outline

- Introduction
- Challenges
- ***Current Research***
- Conclusions

Research

- Study of reputation not new
  - Rogerson 83, Schmalensee 78, Shapiro 82, Wilson 85 …
- Current research of online markets
  - Empirical studies
  - Mathematical modeling



Empirical Studies of eBay

Citation	**Items Sold**
Ba and Pavlou, 2002	Music, Software, Electronics
Bjari and Hortacsu, 2003	Coins
Dewan and Hsu, 2001	Stamps
Eaton, 2002	Electric guitars
Houser and Wooders, 2000	Pentium chips
Kalyanam and McIntyre, 2001	Palm Pilots
Kauffman and Wood, 2000	Coins
Lee, Im and Lee, 2000	Computer monitors and printers
Livingston, 2002	Golf Clubs
Lucking-Reiley et al., 2000	Coins
Melnick and Alm, 2002	Gold coins
McDonald and Slawson, 2002	Dolls
Resnick and Zeckhauser, 2002	MP3 Players, Beanie Babies
Resnick, Zeckhauser Swanson and Lockwood, 2002	Vintage Postcards

Observations

- Mostly one-time deals
  - 89% of all buyer-seller pairings were not repeated
- Majority left feedback
  - 52.1% submitted feedback
- Feedback overwhelmingly positive
  - 99.1% of all comments

Analysis of eBay

- Dellarocas constructs a model for eBay-like binary reputation systems
- Examines whether such a model can be well functioning
  1. Advertised quality does not oscillate
  2. Buyer's can predict true quality

Analyzing the Economic Efficiency of eBay-like Online Reputation Reporting Mechanisms

Chrysanthos Dellarocas

Paper Outline

- We will examine
  - Model of buyer, seller, feedback
  - Analysis of estimating seller deception
  - Steady-state behavior of advertised quality

Model Outline

- Model Assumptions
- Notions of quality
- Seller & buyer motivations
- Buyer satisfaction
- Quality assessment
- "Binary" rating function

Model Assumptions

- The following assumptions are stated explicitly

a. True quality of item unknown to buyer

b. Seller has complete control over advertised quality

c. Buyer only knows advertised quality and reputation of seller

Kinds of Quality

Motivations

Seller wishes to maximize profit by over advertising quality

$$\pi(x, q_r, q_a) = G(x, q_r, q_a) - c(x, q_r)$$

Buyer wishes to maximize (subjective) utility

$$U = \theta \cdot (q_r + \epsilon) - p \qquad \epsilon \sim N(0, \sigma)$$

Buyer Satisfaction

- Buyer satisfaction is how quality exceeds expectations

$$
\begin{aligned}
S &= U - U_e \\
&= \theta \cdot (q_r + \epsilon) - p - (\theta \cdot q_e - p) \\
&= \theta \cdot (q_r + \epsilon - q_e)
\end{aligned}
$$

Quality Assessment

- A buyer makes an estimate of quality with which to compare the real quality

$$S = \theta \cdot (q_r + \epsilon - q_e)$$

$$f(q_a, R) = q_e$$

Quality Assessment

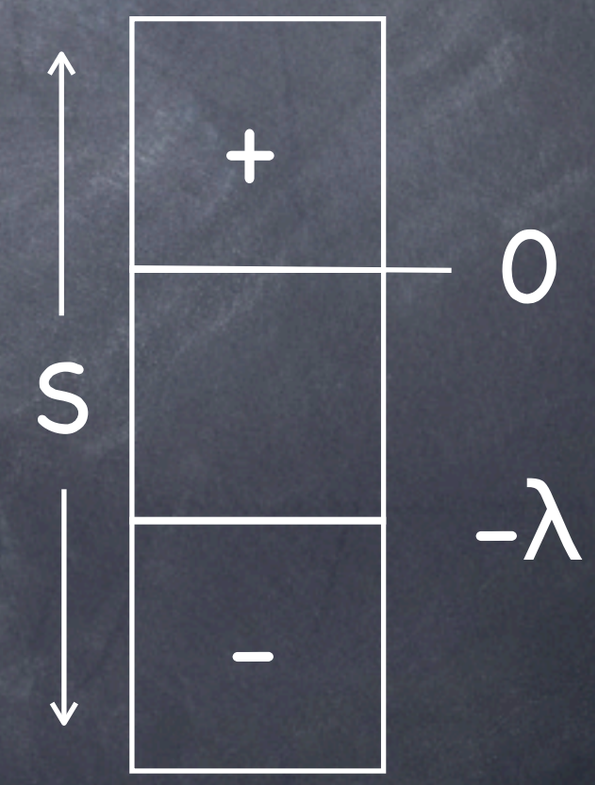
- A buyer makes an estimate of quality with which to compare the real quality
- The estimated quality is:
- The advertised quality, unless Seller is deceptive

$$q_e = f(q_a, R) = \begin{cases} q_a & \text{if} \quad \hat{\xi}(R) \leq 0 \\ 0 & \text{if} \quad \hat{\xi}(R) > 0 \end{cases}$$

Rating Function

- A Buyer will
  - Rate Positive if they are satisfied
  - Rate Negative if they are "really" unsatisfied

$$r(S) = \begin{cases} + & \text{if} \quad S > 0 \\ & \text{if} \quad -\lambda < S \leq 0 \\ - & \text{if} \quad S \leq -\lambda \end{cases}$$



Model Summary

$$q_e = f(q_a, R) = \begin{cases} q_a & \text{if} \quad \hat{\xi}(R) \leq 0 \\ 0 & \text{if} \quad \hat{\xi}(R) > 0 \end{cases}$$

$$S = \theta \cdot (q_r + \epsilon - q_e)$$

$$\downarrow$$

$$r(S) = \begin{cases} + & \text{if} \quad S > 0 \\ & \text{if} \quad -\lambda < S \leq 0 \\ - & \text{if} \quad S \leq -\lambda \end{cases}$$

Well Functioning

WF1: It optimal for sellers to settle down to a steady-state pair of real and advertised qualities

WF2: The quality of sellers as estimated by buyers before transactions take place is equal to their true quality

WF2: Model Review

$$q_e = f(q_a, R) = \begin{cases} q_a & \text{if} \quad \hat{\xi}(R) \leq 0 \\ 0 & \text{if} \quad \hat{\xi}(R) > 0 \end{cases}$$

Decide to buy

$$S = \theta \cdot (q_r + \epsilon - q_e)$$

$$\downarrow$$

$$r(S) = \begin{cases} + & \text{if} \quad S > 0 \\ & \text{if} \quad -\lambda < S \leq 0 \\ - & \text{if} \quad S \leq -\lambda \end{cases}$$

WF2: Deception Estimation

- Assuming steady state behavior from seller
- A buyer can estimate how deceptive the seller is using:
  - The fraction of positive feedback
  - The fraction of negative feedback
  - The ratio of negative to positive feedback

Decption Estimation: Positives

1. A Seller is honest if the fraction of positive ratings exceeds some threshold (0.5)

$$\hat{\eta} \equiv \frac{\Sigma_+}{N} = \Pr[S > 0] = \phi[-\xi/\sigma]$$

$$H_0 : \eta \geq 0.5 \text{ given } \hat{\eta}$$

$$q_e = \begin{cases} q_a & \text{if } \xi(\hat{H}_R) \leq 0 \text{ accepted} \\ 0 & \text{if } \xi(\hat{H}_R) > 0 \text{ rejected} \end{cases}$$

Deception Estimation: Positives

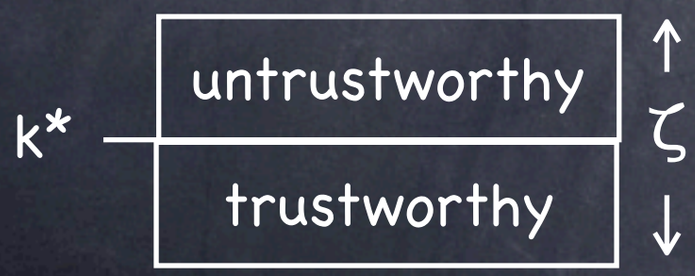
- Does not depend on λ, Θ or σ
- Need knowledge of number of ratings N
- Could allow for sellers to oscillate between good and bad reputation

Deception Estimation: Negatives

1. A seller is honest if the fraction of negative ratings is less than the optimal trustworthiness threshold, k*

$$\hat{\zeta} \equiv \frac{\Sigma_-}{N} = \Pr[S \leq -\lambda] \leq \underbrace{\phi[-\lambda/(\theta \cdot \sigma)]}_{k^*}$$

$$H_0 : \zeta \leq k^*$$



$$q_e = \begin{cases} q_a & \text{if } \hat{\zeta}(R) \leq k^* \text{ accepted} \\ 0 & \text{if } \hat{\zeta}(R) > k^* \text{ rejected} \end{cases}$$

Deception Estimation: Negatives

- The threshold k^* depends on λ, Θ or σ
  - We can estimate k^* from Σ_+ Σ_- and N
- Unless correct threshold k^* is used, buyer will not be able to estimate true quality

Deception Estimation: Ratio

- Can we estimate deception without N?

$$\hat{\rho} \equiv \frac{\Sigma_{-}(\xi)}{\Sigma_{+}(\xi)} > 2 \cdot \Phi[-\lambda \,/\, (\theta \cdot \sigma)], \quad \forall\, \xi > 0$$

$$H_0 : \rho \leq 2 \cdot \Phi[-\lambda \,/\, (\theta \cdot \sigma)]$$

$$q_e = \begin{cases} q_a & \text{if } \hat{H}_0 \text{ accepted} \\ 0 & \text{if } \hat{H}_0 \text{ rejected} \end{cases}$$

Deception Estimation: Summary

- We can find reliable estimates of deception
- To do so, we need knowledge of λ, Θ and σ, however we can make good guess using Σ_- and N
- If we can accurately estimate deception, then it becomes optimal for the seller to advertise true quality

WF1: Steady State Behavior

- In some situations it may be profitable for a buyer to oscillate between high and low quality advertisements

1. We model how this occurs
2. We analyze the model and find conditions under which advertised quality is stable

Oscillation Model

- The transactions are divided into three time periods

P0 Seller advertises true quality

P1 Seller over-advertises quality, milking reputation

P2 Seller under-advertises quality, rebuilding reputation

Oscillation Model

- Period 0
  - Seller completes some transactions
  - Accumulates good reputation since $q_r = q_a$
  - At the end of Period 0:

$$\left.\frac{\Sigma_-}{N}\right|_{P0} = k^*$$

Oscillation Model

- Period 1
  - Seller decides to milk reputation
  - Over-advertises quality by ξ_1 for N_1 transactions
  - At the end of Period 1:

$$\left.\frac{\Sigma_-}{N}\right|_{P1} > k^*$$

Oscillation Model

- Period 3
  - Assuming some buyers will buyer with quality estimate of zero
  - Seller must under-advertise quality by ξ_2 for N_2 transactions
  - At the end of Period 2:

$$\left.\frac{\Sigma_-}{N}\right|_{P2} = k^*$$

Conditions for Stability

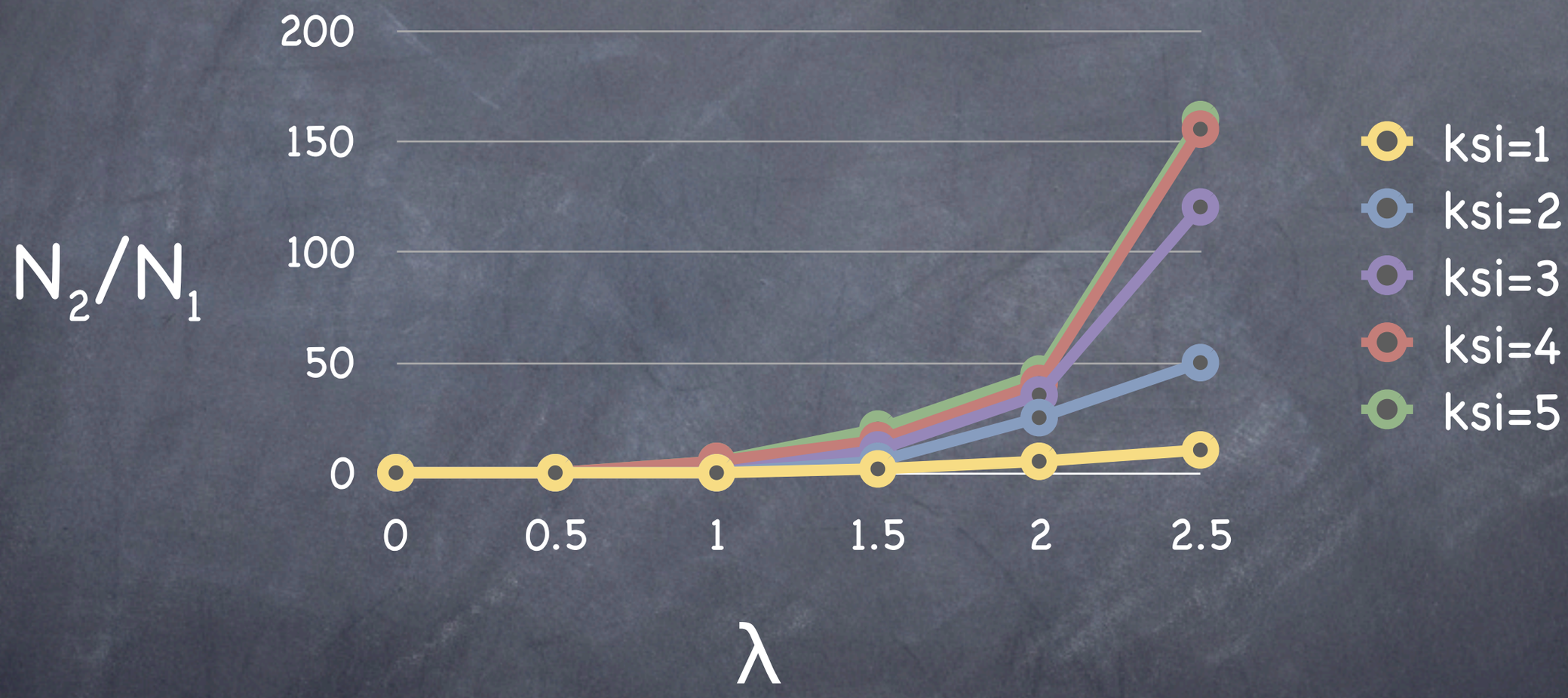
- We would like the time it takes to rebuild a reputation N_2 to be high compared to the time during which a seller can milk it, N_1

$$\frac{N_2}{N_1} = \frac{\Phi[\xi_1/\sigma - \lambda/(\theta\cdot\sigma)] - \Phi[-\lambda/(\theta\cdot\sigma)]}{\Phi[-\lambda/(\theta\cdot\sigma)] - \Phi[-\xi_2/\sigma - \lambda/(\theta\cdot\sigma)]}$$

$$= g(\lambda, \xi_1, \xi_2)$$

$$\frac{\partial g}{\partial \lambda} > 0$$

Minimum ratio vs Leniency factor



ksi = $\xi = \xi_1 = \xi_2$?

WF1: Summary

- Given a strict quality assessment function, a lenient satisfaction threshold when giving feedback make it optimal for sellers not to oscillate
- The lack of oscillation makes it possible to better predict real quality

Paper Summary

- Given a binary reputation mechanism it is theoretically possible to have it be well functioning:

WF1: It optimal for sellers to settle down to a steady-state pair of real and advertised qualities

WF2: The quality of sellers as estimated by buyers before transactions take place is equal to their true quality

Outline

- Introduction
- Challenges
- Current Research
- ***General Conclusions***

Paper Summary

- Given a suitable seller assessment function we can ensure
  - Seller's reputations will be stable
  - The buyer will accurately predict true quality of seller's product

Model Critique

- Dellarocas is successful in showing that his binary reputation model is well functioning, but what assumptions are made?
  - Explicit Assumptions
  - Implicit Assumptions

All models are wrong, some are more useful than others

- George Box

Explicit Assumptions

- Some buyers never rate
  - Incorporate probability of rating B
- Buyers differ in quality sensitivity and leniency
  - Define $\omega = \lambda/\theta$ in some distribution

Implicit Assumptions

- Strategic interests of buyer not taken into account when rating a seller
- Buyers all use same rating process
- Each Well Functioning theorem relies on the other

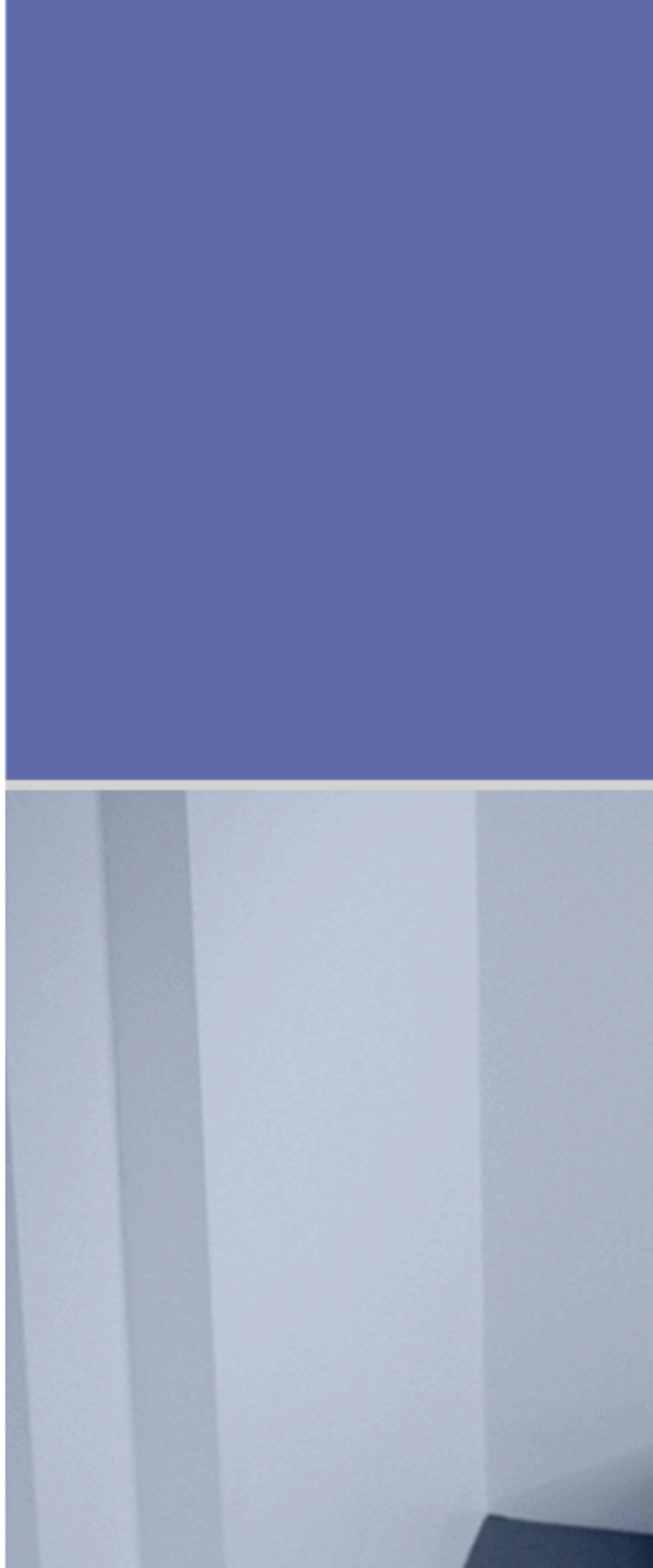
Conclusion

- Reputation mechanisms can be well functioning
  - Using reputation information not necessarily simple
  - We need to provide information to aid the buyer in the use of reputation

Conclusion

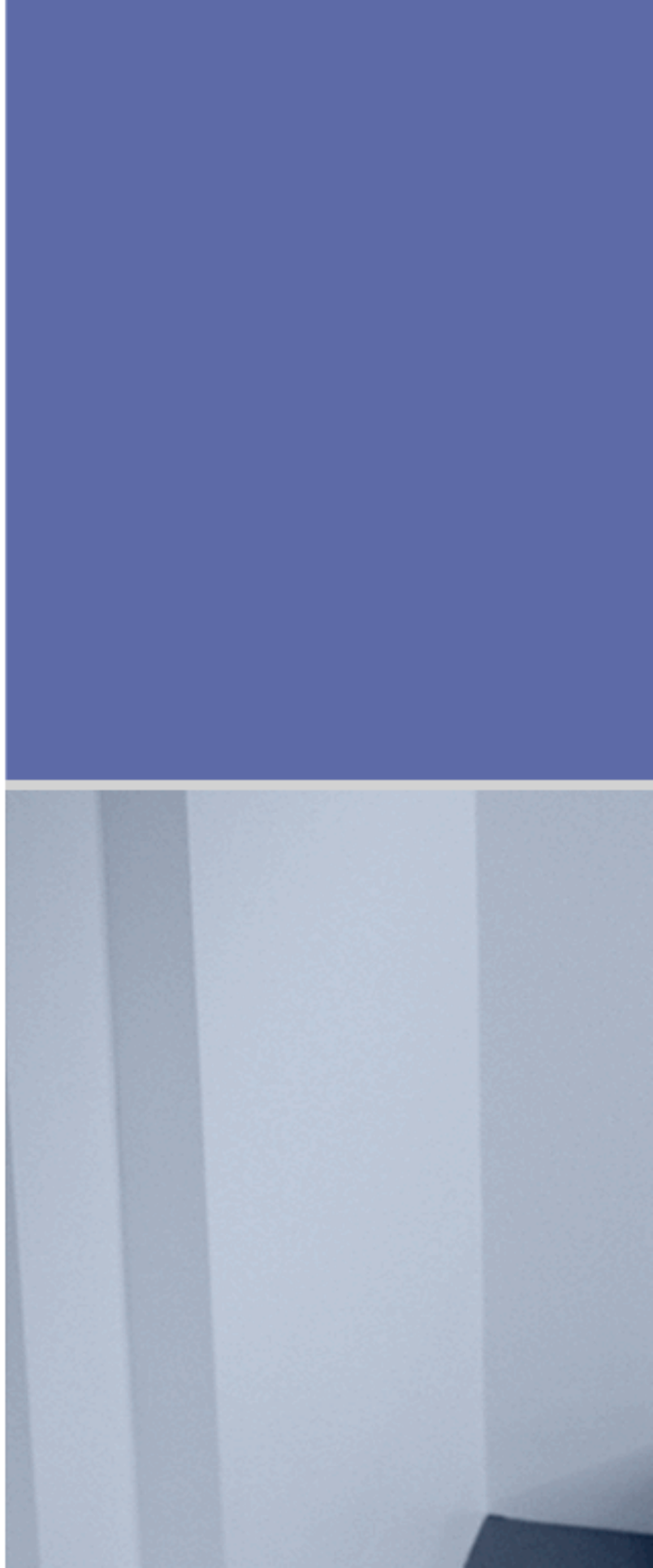
"Reputation systems are the worst way of building trust on the Internet, except for all those other ways that have been tried from time-to-time"

-Paul Resnick *by way of Winston Churchill*



Related Work

- Distributed reputation systems
  - peer 2 peer networks
- Reputation in Multi Agent Systems
  - Results of interactions are known, but limited to direct interactions



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