Announcements

Talk to me about Grad Studies

Graduate Recruitment Fair, which will take place
Tuesday, Nov. 17 and Wednesday, Nov. 18th
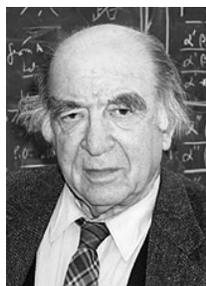*from 11:00 am to 2:00 p.m. in Convocation Hall*

Your projects → the i3 Idea Challenge? → video
http://www.usask.ca/wilsoncentre/

Designing an incentive mechanism for participation in Comtella

Julita Vassileva

Social Computing Class, week 12
CMPT418/898, T1, 2008/09

2007 Prize in Economic Sciences in Memory of Alfred Nobel

Leonid Hurwicz
USA
University of Minnesota
Institute for Advanced Study
b. 1917

Eric S. Maskin
USA
Princeton, NJ,

b. 1950

Roger B. Myerson
USA
University of Chicago

b. 1951

"for having laid the foundations of **mechanism design** theory"

Nobel Prize is offered to those who have "conferred the greatest benefit to mankind"

1   DEVELOPMENT of THEORY
  – Theory helps us interpret the world
  – Fills gaps in understanding

2   MEASUREMENT
  – Careful measurement of phenomenon
  – Creation of instruments of measurement

3   IMPACT on PUBLIC POLICY
  – Application of Theory to Current Issues
  – Impact of Policy Analysis

Last year's winners have contributed to the d**evelopment of theory but also contribute to how we live our everyday life.**

The *Economist Magazine* joked that this was a Nobel for "Intelligent Design"

Standard economic theory views people as economic agents who are "atomistic": they react to the world and create our world but, individually, have no power.

Market outcomes are evaluated using the idea of a "social planner" who is omniscient, omnipotent, and perfectly altruistic.

Sometimes, markets fail to achieve what the social maximizer would dictate.

So, how can we design social and economic institutions that would do so?

This is the focus of mechanism design.

What is mechanism design?

In Game theory, **mechanism design** is the art and science of designing rules of a game to achieve a specific outcome, even though each participant may be self-interested.

This is done by setting up a structure in which each player has an incentive to behave as the designer intends. The game is then said to implement the desired outcome.
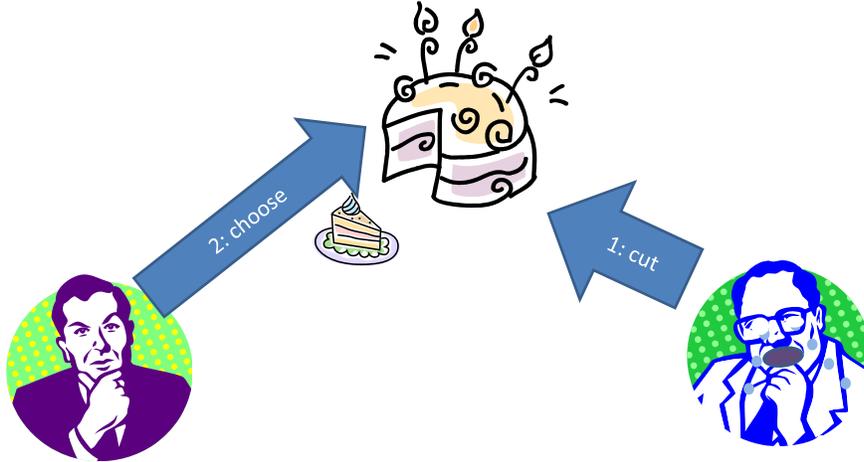
- Example: A and B should divide a cake. Of course, each of them wants to have the larger piece.
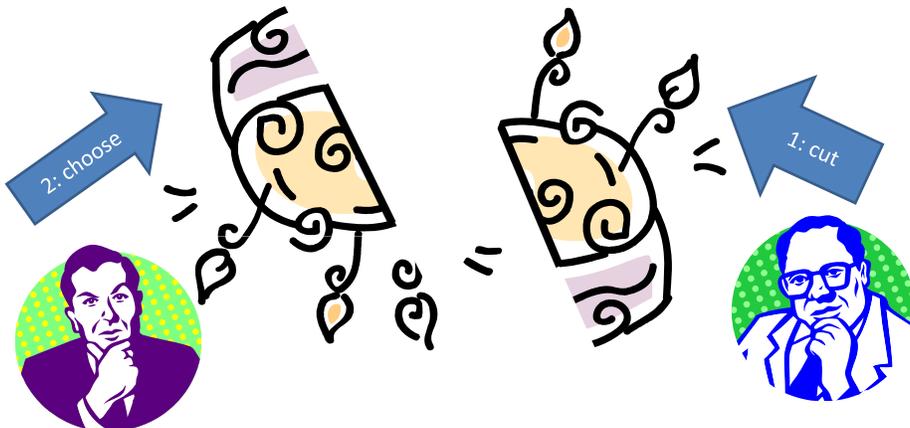- What rules for cutting and choosing should they follow to avoid conflict and ensure fairness?

- If the one who cuts can pick first:

2: take or leave

1: cut and choose
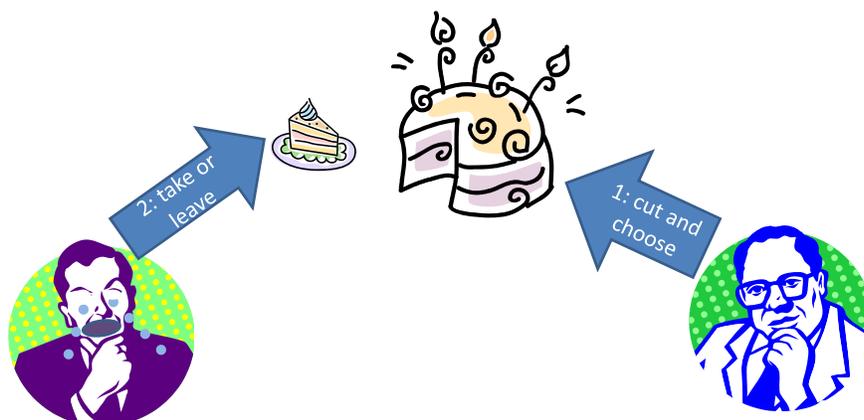
- One cuts the cake, but the other one picks first.

2: choose

1: cut

- Then the one who cuts has an incentive to make 2 equal sized pieces.

2: choose

1: cut

- Desirable properties of mechanisms:
  – *Convergence/guaranteed success*
  – *Maximizing social welfare*
  – *Pareto efficiency*
  – *Individual rationality*
  – *Stability*
  – *Simplicity*
  – *Distribution*

Example of mechanism: auction

- An auction takes place between an agent known as the *auctioneer* and a collection of agents known as the *bidders*
- The goal of the auction is for the auctioneer to allocate the *good* to one of the bidders
- In most settings the auctioneer desires to maximize the price; bidders desire to minimize price
- Auctioneer chooses the auction mechanism (rules)
- Bidders choose a strategy for bidding (by the rules)

English Auction

- Most commonly known type of auction (e.g. Sotheby's):
  - *first price*
  - *open cry*
  - *ascending*
- Dominant strategy is for agents to successively bid a small amount more than the current highest bid until it reaches their valuation, then withdraw
- Susceptible to:
  - *Winner's curse – paying more than the valuation (if there is uncertainty about the common value of the good)*
  - *-- therefore best strategy is to pay less than the valuation ("shading" the bid); more bidders → less shading*
  - *Shills – auctioneer conspires with some bidders to bid high; or collusion among bidders (conspiring not to bid high).*

Dutch Auctions

- Dutch auctions are examples of *open-cry descending* auctions:
  - auctioneer starts by offering good at artificially high value
  - auctioneer lowers offer price until some agent makes a bid equal to the current offer price
  - the good is then allocated to the agent that made the offer
- Also susceptible to the winner's curse.
- There is no dominant strategy for Dutch A.

First-Price Sealed-Bid Auctions

- First-price sealed-bid auctions are *one-shot auctions*:
  - there is a single round
  - bidders submit a sealed bid for the good
  - good is allocated to agent that made highest bid
  - winner pays price of highest bid
- Best strategy is to *bid less than true valuation*
  - *Since winner could have paid just 1c more than the second highest bid and still won, the difference (highest bid -2nd highest bid) is "wasted money" for the winner.*
  - *But how much less? No general solution.*

Vickrey Auctions

- Vickrey auctions are:
  - *one-shot*
  - *second-price*
  - *sealed-bid*
- Good is awarded to the agent that made the highest bid; but it pays the price of the *second highest* bid
- *Bidding to your true valuation is dominant strategy in Vickrey auctions*
- Vickrey auctions are susceptible to *antisocial* behavior
  - bidding higher than your true valuation (if you are certain that the other bidder values the good higher);
  - in this way you force him to pay more; a way of "punishing" the other bidder.

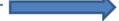# Why is being honest the best strategy in a Vickrey auction?

Suppose you are bidding for a or

100 → Your valuation
90 → Your bid
80 → Highest rival bid

You win! You pay only 80.
But you would have won the same
also if you had bid 100.

---

120 → Highest rival bid

100 → Your valuation

90 → Your bid

You lose!
Your rival pays only 90 (your bid)…
If you had bid 100, he would have
had to pay more

100 → Your valuation
95 → Highest rival bid
90 → Your bid

You lose!
Your rival pays 90 (your bid)…
If you had bid 100, you would have won
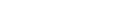
110 → Your bid
100 → Your valuation
80 → Highest rival bid

You win! You pay only 80.
But you would have won the same
also if you had bid 100.

110 → Your bid
105 → Highest rival bid
100 → Your valuation

You win! But you will have to pay
105, which is more than your
valuation.

Applications

- the creation of markets, auctions, and combinatorial auctions.
- the design of matching algorithms, such as the one used to pair medical school graduates with internships.
- the provision of public goods and the optimal design of taxation schemes by governments.

"The influence of mechanism design theory can be seen in the structure of auctions, such as the UK government's sale of 3G mobile phone licenses in 2000, which netted the exchequer more than £22bn in revenue. That was thanks to an innovative procedure designed to squeeze potential buyers into making bids that reflected what they saw as the true worth of the licenses, and prevented them colluding to pay lower prices."

Broader Mechanism Design Problems

- Designing rules for competition by granting agencies
- Designing the rules of encounter in computer games
- Design of "Games with a Purpose"
- Design of incentive mechanisms for participation in online communities

How to make people participate?

Contribution to the community should be rewarded
- With reputation (ranking)
- With visibility
- With more rights / privileges
- With cash…
- … but when there is a reward, people will try to cheat – simple utility theory
- Cheating should be controlled / discouraged
- Designing the "rules of the game"
  - What activities are rewarded? What rewards?
  - What activities are punished? What punishments?

Case study - the Comtella system

Customer Loyalty Programs

Image from
depts.washington.edu/.../painting/4reveldt.htm

Incentive – status / reputation

Social psychology again

- Theory of Discrete Emotions: **FEAR**
  - When people are afraid of loosing something, they are very sensitive to messages about how to avoid the danger

© Anne Popperwell

Incentive mechanism in Comtella 2004

Ran Cheng

- Rewarding participatory acts with points and status
  - The user earns points by:
    - sharing new links, rating links, etc.
  - Points accumulate and result in higher status for the user

10%	Gold
60%	Silver
30%	Bronze

- Memberships:

10 November 2009 / CMU

Comtella Gold   Comtella Silver   Comtella Bronze

Weidong Han

Results: group contributions

Distribution of the Orginal Contributions on Each Topic over Time
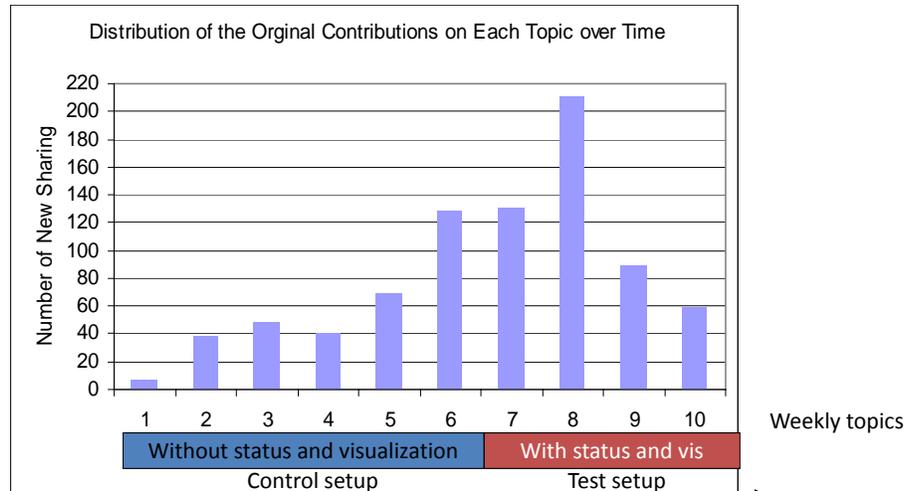
Ethcis and Computer Science Class (CMPT 490, T2, 2003/2004)

Lessons learned

- User Status is very effective in increasing participation in sharing new papers, **but**
  - stimulated low quality papers; excessive number of contributions, students gaming the system
  - need to stimulate contributions early in the week

Next attempt: Adaptive incentive mechanism

- To ensure sustainability, the incentive mechanism needs to reward contribution of new resources, but
  - Encourage **timely contributions**
  - **Discourage excessive** contribution
  - Encourage **high quality contributions**
    - Ensure a way to **measure the quality** of contributions → reward ratings
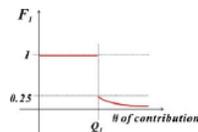
New web-based implementation:
http://comtellawise.usask.ca (closed community now)
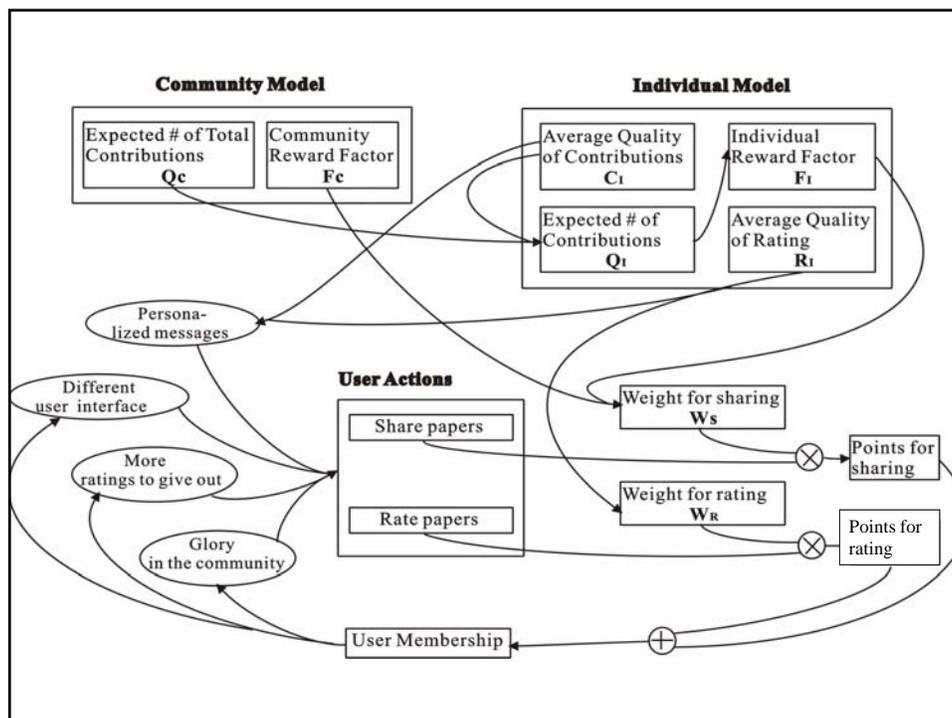
Individual rewards

- Depend on the number of contributions
  - But capped with a limit
  - The limit depends on the desirable total number of contributions for the week, depending on the current topic (set by instructor)
  - The limit is personalized (Q_I) – depends on the ratings of I's previous contributions $Q_I \approx Q_C \bullet \frac{C_I}{\sum C_I}$
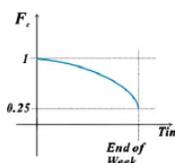- User's reputation rating – the deviation from the average $R_I = \frac{N}{\sum_{i=1}^{N} |r_i - \bar{r}_i|}$
- The weight for contributions depends on the time in the week

$W_S = W_{S0} \bullet F_C \bullet F_I$ → weight for new resources

$W_R = K \bullet R_I (K \text{ is a constant})$ → weight for ratings

$V_{oe} = \sum_{i=1}^{n} \left[\sum_{t=1}^{T_i} W_i(t) \right]$ → the overall evaluation

Comtella

Welcome	Search	Share	Discussion	Summary	Review	Community	Help

Welcome to Comtella 2005. Current week is Week# 11

Your contribution level in last week:

		in current week:		Points*
Paper Quantity:	0 papers, 0.0 points	Paper Quantity:	5 papers, 2.3 points	0.13
Paper Quality:	avg rating:0.0, 0.0 points	Paper Quality:	avg rating:0.2	N/A
Rating Quantity:	1 ratings, 3.0 points	Rating Quantity:	0 ratings, 0.0 points	3.0
Rating Quality:	0.0 points	Rating Quality:	Not available until next week.	N/A
Overall:	0.0 points	Overall:	Not available until next week.	

Your Current Membership:

*: The points you can get through doing the sort of contributions now.

Comtella Member

Comtella Messages:

Want to change your Alias or Password? Please click here.

1. The system expects you to contribute 0 paper(s) for the current topic.
2. In this week, you will receive 6 Cpoint (s) whenever you rate a paper.
3. Please pay attention to the quality of the papers when you share them.

NEW! Comtella User Survey

Learn more about "Cpoint"

Mark all reviews

Community News:

Comtella User Survey (03/30/2005 From Ran)
It is time to run the survey. Please fill out the questionnaire. We appreciate your effort and time!

Pay attention to the "Comtella Messages". (02/28/2005 From Ran)
Please pay attention to your "Comtella Messages" part. It provides different suggestions for different persons. Following these suggestions is a shortcut to upgrade your memberships.

Cpoint has expiry date (2 weeks). (01/24/2005 From Ran)
Please use your cpoints as soon as possible. it can be used to increase the visibility of your articles. For more info, click "help".

Submit a news item

Top users of last week:

Terrell   JamesBond007   MingHui

Best papers of last week:

Rank	Title	Provider
1	Roundtable looks at issue of licensing software engineers	Asadul
1	When Is A Software Engineer Not A Software Engineer?	Michael
1	Don't lean too heavily on the 'code of ethics'	Lawrence
1	Ethical Problems with Modern Technology	Just a bronze member

Comtella 2005 MADMUC Lab
Department of Computer Science University of Saskatchewan

Introducing an extrinsic incentive for rating - currency

- Payment for rating - C-points
  - Earned with each act of rating
  - Can be invested to "sponsor" one's own links (like Google's sponsored links)
  - Decay over time

Result:				<<Previous Next>>	Total: 5 Page		
Cpoint	Paper Title	Earned Ratings	My Rating		View Times	Fake?	Fak Cou
40+	PORNOGRAPHY: SOCIAL EXPRESSION OR SOCIAL DISEASE?	1		Rate	7	Fake	0
30+	Google ? the only archive we'll ever need?	2		Rate	8	Fake	0
20+	Technology & Happiness	4	1	Rate	12	Fake	0
20+	Video Games, Not TV, Linked to Obesity in Kids	4	-1	Rate	13	Fake	0
10+	Alzheimer's patients to trial MS labs life-blog gadget	3		Rate	4	Fake	0
10+	Special Issues for Teens	2		Rate	8	Fake	0

Comtella 2005 Evaluation

- Comtella used in the CMPT 412 "Ethics and Computer Science" class 2004/2005, T2

Test Group: with status, adaptive rewards, c-points, personalized messages

Control Group: with status

1 2 3 4 5 6 7 8 9 10 → topics

- Compared the numbers of contributions in each group (links, ratings)
- Post-study online questionnaire

Comtella 2005 - Results

- Did the users in the test group (Comtella 1) give more ratings?
  - **Yes:** nearly twice as much as Comtella 2: 1065 vs. 613 ratings (significant)

- Did the summative ratings in Comtella 1 reflect better the quality of the contributed links?
  - **Yes:** in Comtella 1, 56% (9 users) felt that the final summative ratings that their links received reflect fairly their quality, while in Comtella 2, only 25% (4 users) thought so.

- Did the users in Comtella 1 tend to share links earlier in the week?
  - **Yes:** users in Comtella 1 shared 71.3% of their contributions in the first 3 days after introducing the topic; users in Comtella 2 shared 60.6% of their contributions in the first 3 days.
    The difference was significant for all topics and ranged between 7-14%.

Comtella 2005 - Results (2)

- Did the users in Comtella 1 participate more actively in general?
  - **Yes:** they **read more papers** (3419 vs. 2416) and **logged in the system** more frequently (1714 vs. 982).

- Is there a significant difference in the total number of contributed links between the test and the control group?
  - **No:** 613 in Comtella 1 versus 587 in Comtella 2
  - There was no excessive paper contribution in either case.

Cheng R., Vassileva J. (2006) Design and evaluation of an adaptive incentive mechanism for sustained educational online communities, User Modeling and User Adapted Interaction, 16 (2/3), 321-348.
http://www.springerlink.com/content/t477ngk0wl641612/fulltext.pdf

Lessons learned

- Incorporating an incentive mechanism can stimulate a desired behaviour in an online community
  - the **c-points** stimulated ratings
    - can be useful for collaborative filtering systems
- An adaptive rewards mechanism can orchestrate a desired pattern of collective behaviour
  - the **time-adaptation** of the rewards stimulated users to make contributions earlier
- It is important to make the user aware of the rewards for different actions at any given time