Incentive Mechanisms for Encouraging Participation in Online Communities

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Outline

- Introduction: why is participation important?
- Comtella 2002-2007: a sharing community
- Approaches for motivating participation:
 - Social incentives: awareness

stimulating reciprocity

status

– Rewards :

money \rightarrow power pleasing effects of actions

Conclusions







Online communities

• Large interest based communities

- Usenet discussion groups
- Blogs: LifeJournal, MySpace, Blogger, etc.
- Game communities: e.g. World of Warcraft, Second Life, EverQuest
- Sharing communities: filesharing (*BitTorrent*), digital photos (*Flickr*), bookmarks (*CiteULike*)
- Social networking: Orkut, LinkedIn, OpenBC
- Small custom-made communities for particular purpose, e.g. knowledge management
 - Expertise finding in enterprises, or peer-help systems in education, e.g. I-Help
 - Sharing resources, e.g. lecture notes, papers within a research lab/group, e.g. *Comtella*
- Network effects:
 - more users more diverse and interesting materials more users....
 - less users nothing is happening those who come by chance leave...
 - Feedback loop!
 - After reaching a "critical mass" of participation, the community becomes selfsustained





Reaching critical mass

• By chance:

- YouTube, mySpace, Flickr, Wikipedia,

- By purchase:
 - YouTube by Google \$1.6 billion in Oct 2006,
 - Flickr by Yahoo in 2005, ...
 - \$\$\$\$\$\$\$
- By design:
 - build incentives in the software, e.g Slashdot





Incentives to participate

- People try to maximize utility
 - they choose to do what is rewarding
- Rewards can be different
 - Intrinsic rewards contributing to a shared cause, expressing oneself, aesthetic pleasure
 - Extrinsic rewards money, marks
 - Social rewards status, power, networking, reciprocation





Comtella: History

Year	Technolo gy	What is shared	Comm unity	Incentive approach	Publications
2002- 03	P2P	papers (files)	research lab	Community visualization	(Vass.@ CoopIS'02) Bretzke & Vass.@ UM'03)
2004	Centralized P2P	Links to papers	class	Com. visualization Social Status	(Cheng+Vass.@ ITS2004) (Cheng+Vass.@HICSS05) (Sun+Vass.@ CRIWG2006)
2005	Web- server- based	Links to papers	class	Com visualization Status with adaptive rewards Currency → power	(Cheng+Vass.UMUAI 2006) (Sun+Vass., submitted)
2006	Web- server- based	Links and Discussi on	class	Visualization of relationships Immediate gratification for desirable actions	(Webster & Vass, AH2006)





Comtella P2P: 2003, 2004

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40+	NETSPIONAGE COSTING BILLIONS - Internet Hacking	3 /3	N/A	16	<u>Fake</u>	0	Detail Remark(0)
30+	Face-off: Hiring a hacker	2 /4	N/A	15	<u>Fake</u>	0	Detail <u>Remark(</u> 0)
30+	Liability for computer crime in Russia	-2 /4	N/A	5	<u>Fake</u>	0	Detail <u>Remark(</u> 0)
20+	E-Crime to Rise in 2005	2 /2	N/A	11	<u>Fake</u>	0	Detail Remark(0)
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10+	Movie - Recommended by Terry Roebuck - Various Hacker-Related Subjects	0 /2	N/A	13	<u>Fake</u>	0	Detail Remark(1)
10+	U.S. agencies flunk cybersecurity test	0 / 0	N/A	0	<u>Fake</u>	0	Detail Remark(0)
10+	Secret War Against Hackers	3 /3	N/A	8	<u>Fake</u>	0	Detail Remark(0)
10+	AOL man steals 92mill screen names	-5 /5	N/A	12	Fake	0	Detail Remark(0)
10+	An Introduction to Computer Security: the NSIT Handbook	-5 /5	N/A	7	<u>Fake</u>	0	Detail Remark(1)
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	http://www.thesheaf.com/opinion/rate_my_internet_anonymity	
	Summary:	
	This article talks about a girl who took a class, received a bad mark in it, and therefore went to <i>www.ratemyprofessors.com</i> to give the prof a bad grading. The author then states how good idea (since they grade us, why can't we grade them?), but in practice she goes onto say that it is not. She says how she would see that the more competent profs have the lower rat unprepared and easier profs have better ratings. She states that achieving a good rating for a prof is determined by how easy their class is. Near the end of the article she states how has rating system is bad, and the solutions she says are:	in theory, rating a pro ings where as the mor ving an ambiguous and
	The only solution would be to form a more comprehensive rating system. For instance, the rating for each professor would include statistics for each class they teach, such as class students. This would give more objectivity than the five star "easiness" criteria they have now.	average and numbe
	In order to post a comment, students would have to provide their grade point average and a letter grade mark in that class or on the last paper/assignment they received. This we their motivation for marking and would eliminate the obvious cyber-vengers who flunked their last paper.	ould give some contex
	Comments:	
	Personally, I think having a more comprehensive rating system as well as having to provide a little bit of information about yourself to post would be beneficial. We are still allowed to sa comprehensive and saying who we are, I think that what we say would have more merit behind it, rather than being seen as random flaming. Some people might say it's their right to sa anonymously about a prof who is able to rate them too anyways, but when we get a grade in a class we know who is responsible for that grade, and if we have any concerns we can go ta think it's only fair that if we want to say something about our prof we should let them be able to come see us about our criticisms too.	y what we want, but l y what they want lk to the prof about it.
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	I agree that having a more comprehensive rating system might help make readers make an informed decision as to the credibility of the information provided, but what would be the in supply more information?	centive for the studen
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Incentive Approach

Social awareness



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Theories in social psychology

Social Conformity – Asch

 People want to fit in their peer group: e.g. have similar ideas, do similar things

Social Comparison – Leon Festinger

- People tend to compare with their peer group
- Knowing that their peers may align to them, they behave more responsibly, care about positive social image and status

Real versus Online Communities – MovieLens experiment







Community visualization in Comtella 2002



Lessons learned

Deployed in our Department, 2 months, ~20 users, fall 2003 User Feedback:

- Visualization is "a nice feature"
- "Useful: easy to discover who has what...interesting"
- Major problems
 - Shows only users that are currently online (emphasizes loneliness)
 - Size depends on who is active at the moment
 - Uninteresting to compare the contributions of people interested in very different areas (peer group?)
 - Random graphical location, but users tried to interpret the position
 - Hard to distinguish between sizes of stars
 - Hard to keep in mind what colour means
 - Lacks interactivity

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Comtella 2004: interactive vis.

Comtella File Sharing System - MADMUC Lab, University of Saskatchewan

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Evaluation: # new contributions Vs. visualization usage



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Lessons learned

- Interactivity not used
 - Default view (original contrib.) most important
- Stars need to be more attractive
- Quality needs to be rewarded, not just quantity of contributions
 - Need to find a way to visualize "user reputation"





Comtella 2005 visualization



Colour (4) – membership (status)

Brightness (4) – reputation (quality of contributions)





Size (4) – number of original contributions

State (2) – offline or online



128 images generated using OpenGL with parameters:

- size, colour, temperature/brightness

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Comtella 2005 Vis. Evaluation





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Data





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Data



Results

- Statistical tests (t-Distribution Test and Wilcoxon's Matched Pairs Signed Rank Test) show that the difference between the performances of the two groups is significant for all activities together,
 - Statistical significance for logging in (0.95 for both ttest and Wilcoxon) and rating activities (0.975 for ttest and 0.95 for Wilcoxon)
 - No statistical significance for *sharing* and reading activities.
- The visualization has a positive effect on increasing participation but not exactly as expected





Incentive approach: Status

Customer Loyalty Programs



8TAR ALLIANCE







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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







Incentive mechanism in Comtella 2004

- Rewarding participatory acts with points and status
 - The user earns points by:
 - sharing new links, rating links, etc.

Comtella

Gold

- Points accumulate and result in higher status for the user
- Memberships:

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Comtella

Silver



Comtella

Bronze





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Results: group contributions

Distribution of the Orginal Contributions on Each Topic over Time



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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

Sun, L., Vassileva, J. (2006) Social Visualization Encouraging Participation in Online Communities, Proc. CRIWG'06, Springer LNCS 4154, 345-363.

Cheng, R., Vassileva J. (2005) User Motivation and Persuasion Strategy in P2P Communities, Proc. HICSS'38, Minitrack on Online Communities, IEEE Press.





Adaptive incentive mechanism: requirements

- 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







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Extrinsic incentive for rating

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

Cpoint	Paper Title	Earned Ratings	My Rating	View Times	Fake?	Fa Co
40+	PORNOGRAPHY: SOCIAL EXPRESSION OR SOCIAL DISEASE?	1	Rate	7	<u>Fake</u>	
30+	Google ? the only archive we'll ever need?	2	Rate	8	<u>Fake</u>	
20+	Technology & Happiness	4	Rate	12	<u>Fake</u>	
20+	<u>Video Games, Not TV, Linked to Obesity in Kids</u>	4	-1 <u>Rate</u>	13	<u>Fake</u>	
10+	Alzheimer's patients to trial MS labs life-blog gadget	з	Rate	4	<u>Fake</u>	
10+	Special Issues for Teens	2	Rate	8	<u>Fake</u>	
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Comtella 2005 Evaluation

Comtella used in the "Ethics and IT" class
 32 students, divided into:

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

Control Group: with status



- 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%.

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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.





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





Incentive approach: entangle lurkers in social relationships

- Encouraging Social Reciprocation
 - "Who reads my postings?"
 - "What did they post?"

Andrew Webster

- Through social visualization
 - Modeling and visualizing the asymmetry of interpersonal relations
 - Expectation that users will try to correct the asymmetry





Online community composition



We want to "connect the dots"



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Modeling relations: mutual visibility



Relations visualization



Comtella-D: 2006 **Relationships visualization**



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Incentive Approach

- Immediately reward desirable actions
 - Rating is important

Andrew Webster

- Reward it with esthetically pleasing effect (something "fun" to watch)
- The user sees immediately the effect of her rating
- Emphasize what is valued in the community
 - Highly rated content is valued emphasize it visually → generates "recommendation" in the interface (something useful, value added)
 - Gentle social comparison based on contributions, not ego





Community energy







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Intellectual Property	Fair-use, cop	ying music/movies/software, solutions,	1 energy unit		
Wiretapping and Encryption	Role of secred	y, trust in government, cryptography			
Computer Security and Crime	Hacking, hact	ivism, law, identity theft, privacy and c	2 energy units		
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<u>Broader social issues</u>	What can go y	a community, aigital aivide, bad technolo wrong. Therac-25 case study, reliability ar	4 energy units		
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Study: Comtella-D

- Online discussion forum for 2 courses:
 - CS 408 (required use) (N=19; simulated core)
 - Phil 236 (recommended use) (N=32; peripheral members)



Listing forums control interface

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Privacy	Big Brother, databases, risks, protection, awareness, philosophical views	82	1/4/200
Freedom of Speech	Censorship, anonymity, laws, offensive/dangerous speech	93	1/4/200
Intellectual Property	Fair-use, copying music/movies/software, solutions, copyrights vs patents	78	1/4/200
Wiretapping and Encryption	Role of secrecy, trust in government, cryptography	70	1/4/200
Computer Security and Crime	Hacking, hactivism, law, identity theft, privacy and civil liberties, crime fighting	72	1/4/200
Computers and Work	Changing nature of work, impact on employment, employee monitoring, teleworking	g 79	1/4/200
Broader social issues	Computers and community, digital divide, bad technologies, who benefits the most	73	1/4/200
Can we trust the computer?	What can go wrong, Therac-25 case study, reliability and safety, computer models	70	1/4/200





Listing forums test interface

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<u>Main Forums</u> : Information Tech	nnology Searc	ch coming sooi	n Find
Forums	Description	# of Posts	Created or
<u>Privacy</u>	Big Brother, databases, risks, protection, awareness, philosophical views	82	1/4/2006
Freedom of Speech	Censorship, anonymity, laws, offensive/dangerous speech	93	1/4/2006
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Broader social issues	Computers and community, digital divide, bad technologies, who benefits the most	73	1/4/2000
Can we trust the computer?	What can go wrong, Therac-25 case study, reliability and safety, computer models	70	1/4/200
	Destactional and an idelinant across a master of professional ethics	50	1/1/200





Post header

Control Interface

Main Forums : Information Technology : Computer Security and Crime : Articles : Terror? Who's scared? Terror? Who's scared? [409] by \$ 2/26/2006 6:09:52 PM Comments (1)	Search cording soon Find Energy: 3 [heat cool]	III
Test Interface	anzed for it land ask instead	
Main Forums : Information Technology : Computer Security and Crime : Articles : Terror? Who's scared? Terror? Who's scared? [409] by 2/26/2006 6:09:52 PM Comments (1)	Search coming soon Find	

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Results

	Contribution Counts				Average Access / Views		
Group	Threads	Posts	Comments	Ratings	Logins	Reads	Relavis
CS test	72	326	17	55	66.3	233.6	4
CS ctrl	60	299	5	11	48.6	180.2	n/a
Phil test	6	10	0	6	15.9	28.1	1.1
Phil ctrl	1	6	1	4	7.9	19.2	n/a

Significant, p<0.02

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More results

- Counted the number of interactions between members of the groups: core (test), core (control), periphery (test), periphery (control).
 - Periphery test users interacted more often with the core group than periphery control users (p<0.01)
 - Within the core group, members of the test group engaged in more symmetrical relations





Claims and questions

- The users' behavior can be dynamically "orchestrated" by
 - Providing social awareness through visualization
 - Providing explicit rewards (status, power, esthetic pleasure, social binding) for desired user activities
 - Adapting the rewards according to what activities are currently needed most by the community.

 What should be the "score"?









Summary

- Motivating participation is an interesting and underexplored area in social computing
- On the cross-roads of:
 - Economics (mechanism design)
 - Game theory
 - Social Psychology
 - HCI
 - Distributed AI
 - Applications in education, online communities and game design, web 2.0, enterprise 2.0 etc...
- In this talk I presented a spectrum of approaches
 - All were successful (encouraged participation)
 - Choosing one is a matter of beliefs and knowledge of the community





More Info? http://bistrica.usask.ca/madmuc



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Evaluation

- The hypothesis is confirmed by the results:
 - The inactive group becomes more active when it has access to the visualization, while the active group remains the same without the visualization
 - \rightarrow The difference between the performance of the two groups shrinks
 - The inactive group becomes less active when it did not have access to the visualization, and the active group becomes more active when it had the visualization \rightarrow
 - The difference between the performance of the two groups increases
- Statistical tests (t-Distribution Test and Wilcoxon's Matched Pairs Signed Rank Test) show that the difference between the performances of the two groups is significant for all activities, i.e. it is not due to chance or randomness -> it is a result of applying the visualization.
 - Statistical significance for logging in (0.95 for both t-test and Wilcoxon) and rating activities (0.975 for t-test and 0.95 for Wilcoxon)
 - No statistical significance for sharing and reading activities.

• The visualization has a positive effect on increasing participation 14 November 2007 / CMU Saskatchewan