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 → 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 self-sustained
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

<table>
<thead>
<tr>
<th>Year</th>
<th>Technology</th>
<th>What is shared</th>
<th>Community</th>
<th>Incentive approach</th>
<th>Publications</th>
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<tr>
<td>2002-03</td>
<td>P2P</td>
<td>papers (files)</td>
<td>research lab</td>
<td>Community visualization</td>
<td>(Vass.@ CoopIS’02) Bretzke &amp; Vass.@ UM’03)</td>
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<td>2004</td>
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<td>class</td>
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<td>Visualization of relationships Immediate gratification for desirable actions</td>
<td>(Webster &amp; Vass, AH2006)</td>
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Comtella P2P: 2003, 2004

![Comtella File Sharing System - MADMUC Lab, University of Saskatchewan](image)

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<tr>
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<th>Earned Ratings</th>
<th>My Rating</th>
<th>View Times</th>
<th>Fake?</th>
<th>Fake Count</th>
<th>Detail</th>
<th>Remark</th>
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<td>Password selection</td>
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<td>N/A</td>
<td>15</td>
<td>Fake</td>
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<td>Quantum field security</td>
<td>0 / 2</td>
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<td>U</td>
<td>Detail</td>
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<td>Detail</td>
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<td>Remark(0)</td>
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<td>4</td>
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<td>0</td>
<td>Detail</td>
<td>Remark(0)</td>
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<td>20+</td>
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<td>0</td>
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<td>Fake Tsunami Donation Gite Terminated</td>
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<td>0</td>
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<td>N/A</td>
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<td>Detail</td>
<td>Remark(0)</td>
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<td>AOL man steals 92mln screen names</td>
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<td>12</td>
<td>Fake</td>
<td>0</td>
<td>Detail</td>
<td>Remark(0)</td>
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<tr>
<td>10+</td>
<td>An Introduction to Computer Security: the NSIT Handbook</td>
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<td>N/A</td>
<td>7</td>
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<td>0</td>
<td>Detail</td>
<td>Remark(1)</td>
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This was an article in The Sheaf this past Thursday (January 19).

http://www.thesheaf.com/opinion/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 www.ratemyprofessors.com to give the prof a bad grading. The author then states how in theory, rating a prof a good idea (since they grade us, why can't we grade them?), but in practice she goes on to say that it is not. She says how she would see that the more competent profs have the lower ratings whereas as the more 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 having an ambiguous and rating system is bad, and the solutions she says are:

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 average and number of students. This would give more objectivity than the five star "easiness" criteria they have now.

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 would give some context for their motivation for marking and would eliminate the obvious cyber-trolls who flunked their last paper.

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 say what we want, but 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 not their right to say what they want 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 talk to the prof about it. I 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.

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 incentive for the students to supply more information?
Incentive Approach

• Social awareness
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

Helen Bretzke

Chris Cox

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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
Comtella 2004: interactive vis.
Evaluation: # new contributions Vs. visualization usage

The number of original contributions made after the visualization was introduced against the number of accesses to the visualization view of the original contributions.

Correlation: 0.66
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
Comtella 2005 Vis. Evaluation

Performance of more active group:  No vis  With vis

Performance of less active group:  With vis  No vis

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Data

The Number of Logins of Group A vs. Group B over 10 Weeks

The Number of Ratings Given by Group A vs. Group B over 10 Weeks

The Number of Shared URLs of Group A vs. Group B over 10 Weeks

The Number of Reads from Group A vs. Group B over 10 Weeks

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The difference in performance at four types of activities (login, sharing, rating, reading) between Group A and Group B before and after the Switching Point.

<table>
<thead>
<tr>
<th>week</th>
<th>login</th>
<th>sharing</th>
<th>rating</th>
<th>reading</th>
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<td>2</td>
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</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

- **login**: The trend shows a gradual increase, peaking around week 2 and stabilizing thereafter.
- **sharing**: There is a significant increase in week 2, followed by fluctuations.
- **rating**: The line remains relatively flat with minor variations.
- **reading**: The graph peaks sharply in week 4, indicating a significant change.

The chart illustrates the dynamics of performance difference over time, highlighting variations in each activity type between the two groups.
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 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 but not exactly as expected
Incentive approach: Status

Customer Loyalty Programs

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

- 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

- Memberships:
  - Comtella Gold
  - Comtella Silver
  - Comtella Bronze
Results: group contributions

Distribution of the Original Contributions on Each Topic over Time

Number of New Sharing

Without status and visualization

With status and visualization

topics

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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


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 \(\rightarrow\) reward ratings
Welcome to Comtella 2005. Current week is Week 11

Your contribution level in last week:

- **Paper:** 0 papers, 0.0 points
  - **Quantity:**
  - **Quality:** avg rating: 0.0, 0.0 points

- **Rating:** 1 ratings, 3.0 points
  - **Quantity:**
  - **Quality:**

- **Overall:** 0.0 points

**in current week:**

- **Paper:** 5 papers, 2.3 points
  - **Quantity:**
  - **Quality:** avg rating: 0.2

- **Rating:** 0 ratings, 0.0 points
  - **Quantity:**
  - **Quality:**

- **Overall:** Not available until next week.
  - **Quantity:**
  - **Quality:**

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

**Comtella Messages:**

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.

Learn more about "Cpoint"

**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:**

<table>
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<th>Rank</th>
<th>Title</th>
<th>Provider</th>
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<tr>
<td>1</td>
<td>Roundtable looks at issue of licensing</td>
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<tr>
<td></td>
<td>software engineers</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>When Is A Software Engineer Not A Software</td>
<td>Michael</td>
</tr>
<tr>
<td></td>
<td>Engineer?</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Don’t learn too heavily on the 'code of</td>
<td>Lawrence</td>
</tr>
<tr>
<td></td>
<td>ethics'</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Ethical Problems with Modern Technology</td>
<td>Just a bronze</td>
</tr>
<tr>
<td></td>
<td></td>
<td>member</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Cpoint</th>
<th>Paper Title</th>
<th>Earned Ratings</th>
<th>My Rating</th>
<th>View Times</th>
<th>Fake?</th>
<th>Fake Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>40+</td>
<td>PORNOGRAPHY: SOCIAL EXPRESSION OR SOCIAL DISEASE?</td>
<td>1</td>
<td>Rate</td>
<td>7</td>
<td>Fake</td>
<td>0</td>
</tr>
<tr>
<td>30+</td>
<td>Google ? the only archive we’ll ever need?</td>
<td>2</td>
<td>Rate</td>
<td>8</td>
<td>Fake</td>
<td>0</td>
</tr>
<tr>
<td>20+</td>
<td>Technology &amp; Happiness</td>
<td>4</td>
<td>Rate</td>
<td>12</td>
<td>Fake</td>
<td>0</td>
</tr>
<tr>
<td>20+</td>
<td>Video Games, Not TV, Linked to Obesity in Kids</td>
<td>4</td>
<td>Rate</td>
<td>13</td>
<td>Fake</td>
<td>0</td>
</tr>
<tr>
<td>10+</td>
<td>Alzheimer’s patients to trial MS labs life-blog gadget</td>
<td>3</td>
<td>Rate</td>
<td>4</td>
<td>Fake</td>
<td>0</td>
</tr>
<tr>
<td>10+</td>
<td>Special Issues for Teens</td>
<td>2</td>
<td>Rate</td>
<td>8</td>
<td>Fake</td>
<td>0</td>
</tr>
</tbody>
</table>
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

  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.

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

Andrew Webster
Online community composition

“Core” Membership (5-15%)

“Peripheral” Membership (85-95%)

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We want to “connect the dots”
Modeling relations: mutual *visibility*

Mr. Manhattan

Mr. Manhattan “sees” cosmotron

cosmotron “doesn’t see” Mr. Manhattan

1.0

0.4

Blog entry
Discussion post
Shared photos

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MADMUC Lab, University of Saskatchewan
Relations visualization

From Mr. Manhattan’s perspective

1. You watch them
2. You both watch each other
3. They ‘watch’ you
4. Unknowns

How much you see them

How much they see you
Comtella-D: 2006
Relationships visualization
Incentive Approach

- **Immediately reward desirable actions**
  - Rating is important
  - 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

@work Energy

The quick red fox jumped over the lazy brown dog.
By Andrew

All generalizations are false, including this one.
By Mark Twain

Stored Energy

14 November 2007 / CMU

MADMUC Lab, University of Saskatchewan
14 November 2007 / CMU

MADMUC Lab, University of Saskatchewan
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

14 November 2007 / CMU

![Image of forum listing interface](image)

### Main Forums: Information Technology

<table>
<thead>
<tr>
<th>Forums</th>
<th>Description</th>
<th># of Posts</th>
<th>Created on</th>
</tr>
</thead>
<tbody>
<tr>
<td>Privacy</td>
<td>Big Brother, databases, risks, protection, awareness, philosophical views</td>
<td>82</td>
<td>1/4/2006</td>
</tr>
<tr>
<td>Intellectual Property</td>
<td>Fair-use, copying music/movies/software, solutions, copyrights vs patents</td>
<td>78</td>
<td>1/4/2006</td>
</tr>
<tr>
<td>Wiretapping and Espionage</td>
<td>Role of secrecy, trust in government, cryptography</td>
<td>70</td>
<td>1/4/2006</td>
</tr>
<tr>
<td>Computer Security and Crime</td>
<td>Hacking, activism, law, identity theft, privacy and civil liberties, crime fighting</td>
<td>72</td>
<td>1/4/2006</td>
</tr>
<tr>
<td>Broader social issues</td>
<td>Computers and community, digital divide, bad technologies, who benefits the most</td>
<td>73</td>
<td>1/4/2006</td>
</tr>
<tr>
<td>Can we trust the computer?</td>
<td>What can go wrong, Therac-25 case study, reliability and safety, computer models</td>
<td>70</td>
<td>1/4/2006</td>
</tr>
<tr>
<td>Ethics and Professionalism</td>
<td>Professional codes and guidelines, cases, aspects of professional ethics</td>
<td>53</td>
<td>1/4/2006</td>
</tr>
</tbody>
</table>

MADMUC Lab, University of Saskatchewan

47/50
Listing forums **test interface**
Control Interface

Test Interface
## Results

<table>
<thead>
<tr>
<th>Group</th>
<th>Contribution Counts</th>
<th>Average Access / Views</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Threads</td>
<td>Posts</td>
</tr>
<tr>
<td>CS test</td>
<td>72</td>
<td>326</td>
</tr>
<tr>
<td>CS ctrl</td>
<td>60</td>
<td>299</td>
</tr>
<tr>
<td>Phil test</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>Phil ctrl</td>
<td>1</td>
<td>6</td>
</tr>
</tbody>
</table>

Significant, p<0.02
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”? 

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Summary

• Motivating participation is an interesting and under-explored 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
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
    - 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
    - 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