Decentralization, Autonomy, and Participation in Multi-User/Agent Environments

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Evolution of computing architectures
1970  Multi-user terminals

1980  1:1  Personal computing

1990  1:1  Internet

1:1  Internet
2000 - present

P2P computing: BitTorrent, Skype

Ubiquitous computing
resulting in...
Evolution of e-learning architectures
History of e-learning architectures

1960, 1970

Multi-user terminals

Lecture Model

server

S
C
L
I
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S

teacher

S
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1:n
1980-1990

Individualized Instruction

Teacher → Student

Tutor model

Intelligent tutoring system

1:1
1990–present

designer

teacher

discussion forum

on-line resources

teacher

S T U D E N T S

S T U D E N T S

T E A C H E R

T E A C H E R

designer

S T U D E N T S

S T U D E N T S

C L E N T

C L E N T
2000 - present

Emphasis on collaboration

Community of Peer Learners

P2P Architecture
This region is a main hub for classes participating in our Campus:Second Life program (more details at www.secondlife.com/education). Here you can meet students and educators currently working on class projects as well as find landmarks to other real-life education projects happening in Second Life. On Campus there's also a public meeting area, a sandbox for temporary building, a public pictureboard for sharing photos, a sculpture garden for relaxing between classes, and a campfire for late-night fireside chats!
Why did we do all that research

Individualized learning?
Learner Modelling?
Instructional Planning?

... even Collaborative Learning?

All that seems important now is graphics, multimedia, the next social thing.
So, let’s buy an island in SecondLife!
no place for AI in Ed on this island

Yet..
• Knowledge is built gradually:
  – can students learn by themselves, without any guidance?

• We want teachers and students to participate:
  – 85% of users do not participate

• We want some order and predictability:
  – many people put together usually make a crowd, not a team

• People learn in different ways:
  – will students be able to find the best way for them, the best helpers / partners?
“no place for AI in ED”
Implications from Web 2.0?

- Decentralization of resources and control
  - User contributed content (user = teacher, learner, designer, ...)
  - Autonomous, self-interested users
- Rule: hard/impossible to impose hard rules
  - Ease of use is very important
  - Complexity of “intelligent techniques” has to be hidden
Example Application

• Comtella: social bookmark sharing system
• Used in a class
• Students do research, find web-resources related to the class and share them
• They have to pick resources to summarize one each week
More examples

• Open Learning Object repositories
• Teachers sharing educational games they have developed
• Teachers blogging about what worked in their physics grade 5 class on planetary systems...
• Learners sharing digital photos from a school-trip to the local swamp
Problems

How to find what you want?

How to contribute so that you (and others) can find it?

→ Annotation
How to ensure mutual understanding?
Implementation of taxonomy-based annotation
Solution: in the middle

"Snap to grid" (Gruber)

Suggest tags

Features of the solution

• Easy for the user – just like a folksonomy
• The AI happens in the background, user is not aware of it
• Simplicity and ease of use preserved, advantages of ontology added
• User in the loop
How to stimulate participation and contributions?

Users are autonomous
They won’t follow hard rules
Designing an incentive mechanism in the system (like a game)

Mechanism design – a branch of economics / game theory

Incentives can be economic, social
Design to allow for social comparison

Social Psychology (Festinger)

Upwards: positive, leads to growth through competition, peers that are better off serve as role models

Downwards: leads to feeling good about oneself
Incentive Mechanism Design

- Comtella 2004
- User participation is rewarded by status (user model)
- Participation and status are shown in a community visualization
Incentive: Status

Customer Loyalty Programs

Image from depts.washington.edu/.../painting/4reveldt.htm
Why does it work?

• Social Psychology:

• Theory of Discrete Emotions: Fear
  – When people are afraid of losing 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.
  – Points accumulate and result in higher status for the user

• Memberships:
  - Gold: 10%
  - Silver: 60%
  - Bronze: 30%
<table>
<thead>
<tr>
<th>Rating</th>
<th>Title</th>
<th>URL</th>
<th>Sharing Time</th>
<th>Relationship</th>
<th>Comment</th>
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<tbody>
<tr>
<td>★★★★★</td>
<td>Court Orders More Info From S...</td>
<td><a href="http://www.wired.com/news/culture/0,12">http://www.wired.com/news/culture/0,12</a>...</td>
<td>2004-03-12 17...</td>
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<td>Click Me</td>
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<td>2004-03-12 17...</td>
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<td>2004-03-12 17...</td>
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<td><a href="http://news.com.com/2100-1039-515171">http://news.com.com/2100-1039-515171</a>...</td>
<td>2004-03-16 14...</td>
<td>-</td>
<td>Click Me</td>
</tr>
<tr>
<td>★★★★★</td>
<td>Microsoft Press Software Unpaid...</td>
<td><a href="http://www.internetweek.com/showArtic">http://www.internetweek.com/showArtic</a>...</td>
<td>2004-04-14 16...</td>
<td>-</td>
<td>Click Me</td>
</tr>
</tbody>
</table>

Your level in week 9 is Gold Member.

Your contributions (compared to the top contributor in each category):

- Your login frequency: 80 /100
- The number of new links you brought in: 74 /100
- The number of links you shared: 35 /100
- The number of your comments: 20 /100
- Your online time: 69.9 /100
Comtella 2004: interactive vis.

Lingling Sun
M.Sc.
Results: group contributions

Distribution of the Original Contributions on Each Topic over Time

Without status and visualization

With status and visualization
Results: 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

• 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 → cognitive overload and withdrawal
  – need to stimulate contributions early in the week
  – Multi-views in visualization not useful


Orchestrating the desired behaviours

• Adapt dynamically the incentives
  – “Contributions needed early in the week – higher reward”
  – “If one tends to contribute junk, do not reward him as much as one who contributes good stuff”

• Teacher defines a target number of contributions each week
• Adaptive rewards mechanism
Points for rating

Weight for sharing \( W_s \)

Weight for rating \( W_r \)

User Membership

User Actions

Share papers

Rate papers

Different user interface

More ratings to give out

Glory in the community

Personalized messages

Community Model

Expected # of Total Contributions \( Q_c \)

Community Reward Factor \( F_c \)

Individual Model

Average Quality of Contributions \( C_i \)

Individual Reward Factor \( F_i \)

Expected # of Contributions \( Q_i \)

Average Quality of Rating \( R_i \)
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: Not available until next week.
- Overall: Not available until next week.

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

Your Current Membership:

Comtella User Survey

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

NEW! Comtella User Survey

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:

<table>
<thead>
<tr>
<th>Rank</th>
<th>Title</th>
<th>Provider</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Roundtable looks at issue of licensing software engineers</td>
<td>Asadul</td>
</tr>
<tr>
<td>1</td>
<td>When Is A Software Engineer Not A Software Engineer?</td>
<td>Michael</td>
</tr>
<tr>
<td>1</td>
<td>Don't learn too heavily on the 'code of ethics'</td>
<td>Lawrence</td>
</tr>
<tr>
<td>1</td>
<td>Ethical Problems with Modern Technology</td>
<td>Just a bronze 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>
</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>
</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>
</tr>
<tr>
<td>20+</td>
<td>Technology &amp; Happiness</td>
<td>4</td>
<td>Rate</td>
<td>12</td>
<td>Fake</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>
</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>
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<tr>
<td>10+</td>
<td>Special Issues for Teens</td>
<td>2</td>
<td>Rate</td>
<td>8</td>
<td>Fake</td>
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<tr>
<td>10+</td>
<td>UK 3rd party campaign</td>
<td>3</td>
<td></td>
<td>3</td>
<td>Fake</td>
</tr>
</tbody>
</table>
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
Visualization – Final Design 2005

Comtella 2005 MADMUC Lab
Department of Computer Science  University of Saskatchewan
Lessons learned

• Incorporating an incentive mechanism can stimulate a desired behaviour in an online community
  – the c-points stimulated twice as many ratings in controlled study
    • 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 (71% vs 60% of contributions submitted in the first 3 days)
• It is important to make the user aware of the rewards for different actions at any given time
Implications from Web 2.0?

- Decentralization of resources and control
  - User contributed content (user = teacher, learner, designer, ...)
  - Autonomous, self-interested users

- Rule: hard/impossible to impose hard rules
  - Ease of use is very important
  - Complexity of “intelligent techniques” has to be hidden
Comtella-D: using “gentler” social incentives

- Users building relationships
  - Support users in building relationships
  - Relationships may stimulate reciprocation
  - Reciprocation is an emerging social norm

- “If he reads / rates / comments my postings, I will also read / rate / comment his postings”
Social Visualization

Shows the two directions of reciprocity on a XY-graph from the viewpoint of the user looking at the visualization. Axis X – how close the viewer is to other users from their point of view, Axis Y – how close are others from the viewer’s point of view. Only the “closeness” and the “symmetry of relationship” between the viewer and other users is shown, not any other information.
Incentive for rating

- Immediate reward after desirable actions – pleasing effect (makes rating more fun)
- Showing immediately the social and personal impact of the given rating
The quick red fox jumped over the lazy brown dog.
By Andrew

All generalizations are false, including this one.
By Mark Twain
Immediate gratification for rating

http://fire.usask.ca

Topics and individual postings that are rated higher appear “hot”, those rated lower appear “cold”
→ colours ease navigation in the content
→ aesthetically pleasing, intuitive
Lessons Learned

• The immediate reward stimulated ratings (2 times more than in control group)
• The visualization stimulated reciprocation – more symmetrical relationships in test group
  – Involved the lurkers to participate more in test group

Link to Open Learner Modeling

To harvest the advantages of multi-user system, need to consider the user features NOT in isolation, but in relation to those of other users in the community

Make the learner aware of her Social Context!

Stimulate reflection, activate social norms

Social Visualization
Open Learner Modeling (in AI-Ed)

• Ensure learner’s awareness of her progress towards her learning goals and stimulate reflection
• Provide a way for the learner to annotate or correct errors in the learner model and thus involve the user in construction of the user model or engage the user in dialogue / argument
• Provide for the teacher an ongoing evaluation of the learner’s performance
CourseViz, Mazza & Dimitrova

Zapata-Rivera & Greer

Bull, S. & McEvoy

Brusilovsky, P. & Sosnovsky
Interaction Analysis (in CSCL)

• provide the teacher with an overview of the learners’ progress so that she can take remedial actions or carry out evaluation

• provide a model of collaborative activities for the teacher so that she can influence the process and make it more productive

• provide the teacher with an overview of the interactions in the group, e.g. if someone is isolated or dominating the discussion
Sociogram for a class discussion forum

Dark nodes indicate facilitators (TAs, staff, faculty), lighter nodes indicate learners.

The inner circle is made up of participants, four of which are very important to the community (as shown by having a larger node size).

A casual observation of this network indicates that, while some learners write a fair bit (many interconnected nodes in the middle), there are lots of learners who haven’t ever read anything (the outer ring of delinquents), and many lurkers who read very little.

Note that the ring of delinquents includes a disproportionately high number of facilitators as our currently deployment gives access to this forum to most staff and faculty in the department.
Sociograms of large communities

In this visualization of a high school’s empirical friendship network from the scientists’ data, the different colored (blue, green, purple, orange) nodes represent students in different grades. Links between nodes are drawn when a student nominates another student as a friend.
Social Visualization (in HCI)

• provide social awareness about the other users’ existence or actions and contributions to

• encourage social norms and participation

Tom Erickson: The Babble Chat System.
For what purpose do we want to open the model?
Which data do we want to visualize?
How do we represent user information so that it is understandable and effective?
Learner Modeling Architectures

- Autonomous and heterogeneous services, mashups
  - Variety of user features modeled, variety of representations, variety of adaptation techniques (what and how it is adapted).

- User data fragments everywhere

- Decentralized architectures for UM
Context is important!

*Draw a picture of me please!*
Decentralized / Active User Modeling (DUM)

• User Modeling Servers
  – Loss of context
  – Need to adhere to a common representation schema (ontology needed)
  – But it is hard to impose an ontology to autonomous services

• DUM
  – Every application / agent / service stores learner data locally in its own representation format
  – Partial mapping of formats is sufficient
  – Data is close to the context of its harvesting and use
DUM

- Applications/agents/services share user data
  - only on a “need to know” basis
  - for particular purpose
  - data from different agents (contexts) is relevant for different purposes
  - need just to know “whom do ask”

**References**


DUM

• User modeling:
  – Searching, retrieving and integrating fragmented learner information from diverse sources at the time when it is needed for a particular purpose.
  – Emphasis on the process not the data-structure; “to model” (verb)

Knowledge Representation → Modelling Process
Maintain Consistency → Determine Relevance
Long Term Modelling → Just-in-time Computing
Centralized vs Decentralized UM

• Centralized
  – collecting at one place as much information as possible
  – about many users,
  – make sure it is correct and consistent,
  – so that it can be used for many purposes.

• Decentralized
  – user information fragmented among many agents/services
  – each agent/service models one or more users
  – inherently inconsistent (gathered in different contexts, by autonomous services created by different designers)
  – fragments are retrieved and combined just in time for one specific purpose only
Example: Trust and reputation

- **Trust**: *subjective* evaluation of the reliability, quality, competence which one agent has of another agent based in its own experiences and interactions. *(in context)*
- **Reputation**: *objective* evaluation of the .... Based on the experience of many agents. *(decontextualized, like a centralized UM)*
Trust and Reputation

Simple trust update formula: reinforcement learning

\[ T_{new} = \alpha \times T_{old} + (1-\alpha) \times \varepsilon, \]

where \( \varepsilon \) – the new evidence,
\[ \alpha \] – the agent’s conservatism

• Gossiping:
  – two agents sharing their trust values about a third agent

• Two kinds of trust:
  – Basic trust – in an agent as provider of a service
  – Trust as a referee – similar tastes, interests, benevolent, not lying.
Trust-based Community Formation Mechanism in Comtella

Users share, read and rate papers
  – Personal agents keep track of their user’s download history and ratings

User agents compute Trust in other users
  – Ability to provide “good” papers
  – Subjective – depends on compatibility of tastes of the users

Agents compute also Trust in communities
  – Collective trust in the members of a community
Updating trust from direct evidence

T_{new} = a \cdot T_{old} + (1-a) \cdot e

0.8
Trust is asymmetric

\[ T_{\text{new}} = a \times T_{\text{old}} + (1-a) \times e \]

Rating -1
Updating trust through gossiping

How much do you trust C?

\[ T_c = 0.7 \times 0.5 + 0.3 \times 0.8 \times 0.6 \]

\[ T_c = 0.5 \]

\[ T_c = 0.4944 \]
Community formation based on trust and reputation

Individual Trust can be computed in different ways

• Reinforcement learning

• An explicit way of computing trust using different types of evidence (trust-aspects), e.g. Bayesian Belief Network
Combining trust from referees

Simplest approach: weighted sum
Trust in A based on referees X, Y, Z
\[ T_{\text{new}} = aT_{\text{old}} + (1-a) (T_xT_{xA} + T_yT_{yA} + T_zT_{zA}) \]

This works since trust is a single number

How to combine evidence in more complex
Decentralized User Models?
Purposes for user modeling

- A “Purpose” is like a recipe – a procedural knowledge representation construct
  - Retrieval – which are the relevant sources to get user data from
  - Interpretation – mapping information to own representation / context
  - Integration – reasoning based on the user data and possibly generating new user data
  - Adaptation – using the user data to make a decision about adaptation of interface or functionality.
Example of a purpose

• Selecting new graduate students
  – Retrieve data from transcripts, ask for letters of reference (but not his mom)
  – Interpret the marks: 6 in Bulgaria corresponds to 1 in Germany, to A+ in USA, to 93-95% in Saskatchewan
  – Integrate the interpreted data from all sources, for all considered students
  – Adaptation – generate a ranked list
Collections of purposes

- Designed separately – libraries
- Can be searched by services / agents
- Use standard language for representing UM features (ontology, taxonomy, mapping)

Example: Distributed UM in communities

• Many communities exist
• Few collaborate and share users yet, but in the future they will.
• One day, users will be traveling seamlessly across online communities, as they travel from city to city in the real world.

• How to share user data (interests, status, friends, resources) across?
• Authentication and Identity?
• How to update and synchronize models of users who are members of many communities?
Policies in Online Communities

• UM in OC are based on policies describing the role, status, and rights of each user
• Roles, status, imply rights and adaptation of the functionality and interface of the OC to the user.
• Examples:
  – “New users can not delete links” =
    If user_participation_C1 < threshold
    disable “delete link” functionality.
  – “Users from community C2 are not treated as new users”.
    If user_participation_C2 <> 0,
    user_participation_C1 = user_participation_c2
• The purpose-based approach can be implemented through policies
  – Transparent
  – Editable by users in certain roles (moderators)
Comtella Framework for OCs

• Every user can create a community → “owner”
• Communities can be hosted at different websites (Comtella nodes)
• Every owner defines the policies for rewarding participation (e.g. bronze, silver, gold status), the privileges with each status level, the roles that users can take (e.g. guest, member, moderator) and the rights associated with the role.
• Policies are like decision making procedures that use LM data to generate new LM data or to make an adaptation decision – enabling or disabling a particular interface feature.
• LM data can be from any community in the NW
# Examples of policies

<table>
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<tr>
<th>Policy to update user participation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Policy Type:</strong></td>
<td>Status</td>
</tr>
<tr>
<td><strong>Effective Date:</strong></td>
<td>Jan 10, 2007</td>
</tr>
<tr>
<td><strong>Node:</strong></td>
<td><a href="http://kardam.usask.ca">http://kardam.usask.ca</a></td>
</tr>
<tr>
<td><strong>Community id:</strong></td>
<td>1</td>
</tr>
<tr>
<td><strong>Community Title:</strong></td>
<td>Pictures</td>
</tr>
<tr>
<td>$W_{rq} \rightarrow$ Weight for Rating Quality</td>
<td>4</td>
</tr>
<tr>
<td>$W_{rn} \rightarrow$ Weight for Rating Quantity</td>
<td>3</td>
</tr>
<tr>
<td>$W_{pq} \rightarrow$ Weight for Paper Quality</td>
<td>4</td>
</tr>
<tr>
<td>$W_{pn} \rightarrow$ Weight for Paper Quantity</td>
<td>3</td>
</tr>
<tr>
<td><strong>Action</strong></td>
<td>$UP=W_{rq}*r+*W_{rn}*m+W_{pq}*p+W_{pn}*p$</td>
</tr>
</tbody>
</table>

This is a policy to control the parameters for calculation the user participation. The community owner controls the rewards by changing the weight for the frequency and quality of each activity.

<table>
<thead>
<tr>
<th>Status level definition policy</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level</strong></td>
<td><strong>Description</strong></td>
</tr>
<tr>
<td>1</td>
<td>Gold</td>
</tr>
<tr>
<td>2</td>
<td>Silver</td>
</tr>
<tr>
<td>3</td>
<td>Bronze</td>
</tr>
<tr>
<td>4</td>
<td>Plastic</td>
</tr>
<tr>
<td><strong>Action</strong></td>
<td>If (Plastic(StartValue)&lt;= UP &lt;= Plastic(Endvalue)) $\rightarrow$ US=Plastic If(Bronze(StartValue)&lt;=UP &lt;=Bronze(Endvalue)) $\rightarrow$ US=Bronze If (Silver(StartValue)&lt;= UP &lt;= Silver(Endvalue)) $\rightarrow$ US=Silver If (Gold(StartValue)&lt;= UP &lt;= Gold(Endvalue)) $\rightarrow$ US=Gold</td>
</tr>
</tbody>
</table>

This policy defines each status level by setting the range of participation points required for each level. The participation points are earned according to the policy for participation update.
Policies in Comtella: user editable UM processes

User models created by different policies in different communities

Policies created by different community owners

Transfer policy between two communities

<table>
<thead>
<tr>
<th>Policy of Status in Community</th>
<th>Policy of Access Rights</th>
<th>Policy of Status in Community</th>
<th>Policy of Access Rights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share Link</td>
<td>Share File</td>
<td>Share Link</td>
<td>Share File</td>
</tr>
<tr>
<td>Post Message</td>
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<tr>
<td>Level</td>
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<td>Level</td>
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</tr>
<tr>
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<td>GOLD</td>
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<tr>
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<td>SILVER</td>
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</tr>
<tr>
<td>BRONZE</td>
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<td>BRONZE</td>
<td>300</td>
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<tr>
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<td>PLASTIC</td>
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<tr>
<td>10</td>
<td></td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

When a member of "Gardening" visits "picture" community

<Editing existing transfer policy>

* To enforce current policy Save without change
* To use the same policy as in previous community of the user click "Use policy of Gardening community" button and click "Save"
* To change policy, edit policy and click "Save" button

Comella 2005 MADMUC Lab
Department of Computer Science University of Saskatchewan
Implications from Web 2.0?

• Decentralization of resources and control
  – User contributed content (user = teacher, learner, designer, ...)
  – Autonomous, self-interested users

• Rule: hard/impossible to impose hard rules
  – Ease of use is very important
  – Complexity of “intelligent techniques” has to be hidden
## Summary: Web 2.0 needs AI!

### AIED

- Knowledge representation – ontologies
- Instructional planning
- Learner modeling
  - Open learner modeling
  - Interaction analysis
  - Centralized LM servers

### Web 2.0

- Tagging: user-based, automatic, hybrid with ont.
- Orchestration of participation through incentive mechanism design
- Community Modeling
  - Social visualization
  - Decentralized LM: trust mechanisms, purpose-based modeling, LM policies for communities
Yao (trust and reputation)

Andrew (mechanism design)

Tariq (policy-based user modeling)

http://madmuc.usask.ca