



Join DMKD 2020

February 17-19, 2020 | Sydney, Australia

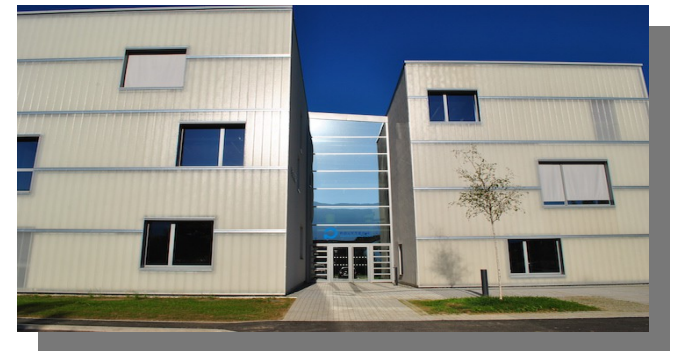
Trust-aware recommendations

Christophe COURTIN & Miguel TOMASENA
courtin@univ-smb.fr



EA4144

Université Savoie Mont Blanc
Polytech Annecy-Chambéry,
Domaine Universitaire BP80439
74944 Annecy-le-Vieux – France



Content

- Introduction
- Problems and the research question
- Scientific and experimental objectives
- Experiment description
- Trust characterization
- Trust-aware recommender systems
- Results of the experiment
- Conclusion and perspectives

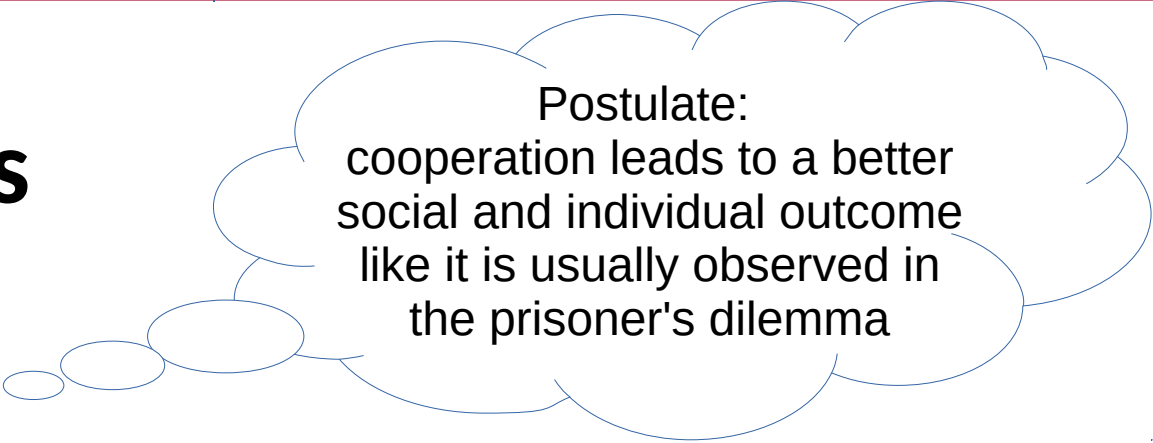
Introduction

- **Building work team**
 - based on people competencies
 - based on people relationships
- **Relationships**
 - based on trust
 - based on collaborative work
 - association of personal social networks

Problems and research question

- **Context**
 - We study situations of collaborative work without hierarchical relationships
 - In this experiment, the collaborative activity is the "prisoner's dilemma" game
- **Problems**
 - The difficulty to characterize dynamically the social trust level between people
 - The difficulty to identify dynamically the competencies through the users' activity
 - The difficulty to take into account both the competencies and the relationships between people by a human resource manager (HRM) to build work team
- **Previous work**
 - Previous work about the analysis of the users' interactive traces has led to a current work about the analysis of the competencies and their representation in graphs.
- **Research question for this study**
 - Can we efficiently predict the actual trust values between users by relying on declared one?

Objectives



Postulate:
cooperation leads to a better
social and individual outcome
like it is usually observed in
the prisoner's dilemma

❖ of the experiment

- to analyze both transitivity (FOAF for friend of a friend) and reciprocity (mutual trust) of the trust relationships
- to evaluate the link between trust and vulnerability

❖ of the research work

- to lay the foundations of a visualizator tool based on the exploitation of sharable digital traces by means of various analysis tools
- to provide the HRM with a graph of people who could potentially work altogether
- to broaden and consolidate the graph of people by exploiting transitivity and reciprocity features of trust

Experiment context

Existing data inventory of the "prisoner's dilemma" game

- 59 students with 12 girls and 47 boys
- in the same country and with the same language
- duration of study is 2 weeks
- study together for 4 months

Data collected with questionnaires before the experiment

- declared trust levels towards others
- pairs definition according to declared trust levels



Experiment progress

How does the "prisoner's dilemma" game work?

- pairs participate in challenges
- a challenge consists of sharing or not:
 - if both players share, then each obtains 10/20
 - if both players don't share, then each obtains 0/20
 - if one shares and the other one doesn't share, the former obtains 2/20 and the latter obtains 20/20
- choices are anonymous and asynchronous
- no communication between participants

Experiment setting

How do the binomials have been formed?

- binomials with declared mutual maximal trust level
- binomials with mutual maximal trust level declared by third parties (maximal transitive)
- binomials with declared mutual minimal trust level

Experiment interface (home page)

Trust
Challenge

User:
Miguel XXX

Logout

Back

Participate in this Challenges before 4/16/2018

Initiate a Challenge face to:

1.
2.
3.
4.
5.
6.
7.
8.

Answer to a challenge initiated by:

1.
2.

History of the challenges in which already participated

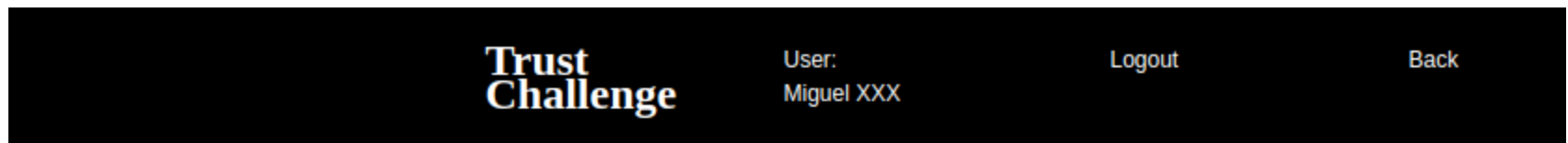
Challenges initiated by me which are waiting answer from a pair:

1. Tom XXX
2. Clement XXX
3. Sonia XXX
4. Theo XXX
5. Leandre XXX

Completed challenges with pair:

1. Simon XXX

Experiment interface (a challenge)



Challenges with Elodie XXX

Share with Elodie

Do not share with Elodie

The possible results of a "challenge" are:

- If the two members of the pair decide to "share", each will get the score of 10/20;
- If both decide "Do not share", each will get the score 0/20
- If one decides "Do not share" and the other "Share", the first will get 20/20 and the second 2/20.

Experiment interface (user results)

**Trust
Challenge**

User:
Miguel XXX

Logout

Back

History of the challenges in which already participated

Challenges initiated by me which are waiting answer from a pair:

1. Tom XXX
2. Clement XXX
3. Sonia XXX
4. Theo XXX
5. Leandre XXX

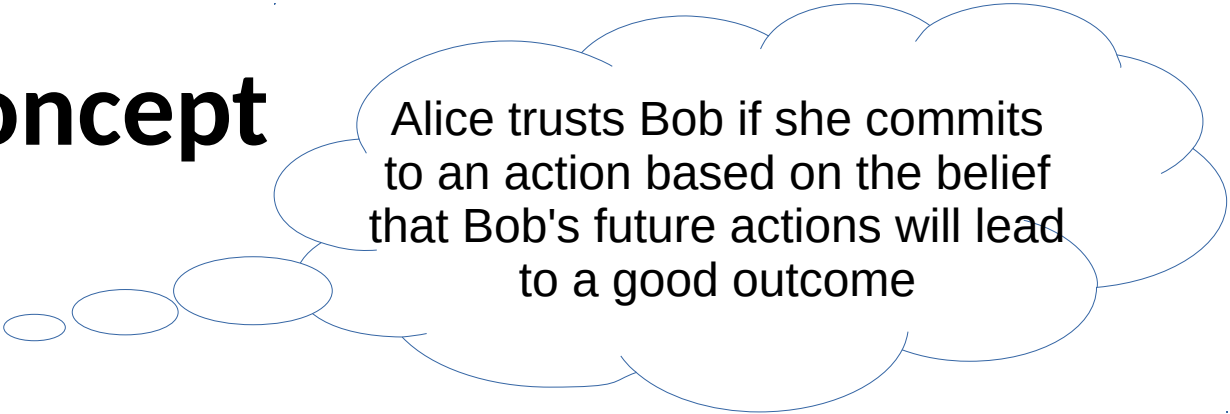
Completed challenges with pair:

1. Simon XXX

Your scores: number of completed challenges 11, average of obtained scores: 8.54

Global scores: Maximale score 15, Minimale score 2 Average score : 8.25

Trust concept



Alice trusts Bob if she commits to an action based on the belief that Bob's future actions will lead to a good outcome

Definition

❖ complex concept => 72 definitions

Representation

❖ interpersonal concept => social graph topology

Features

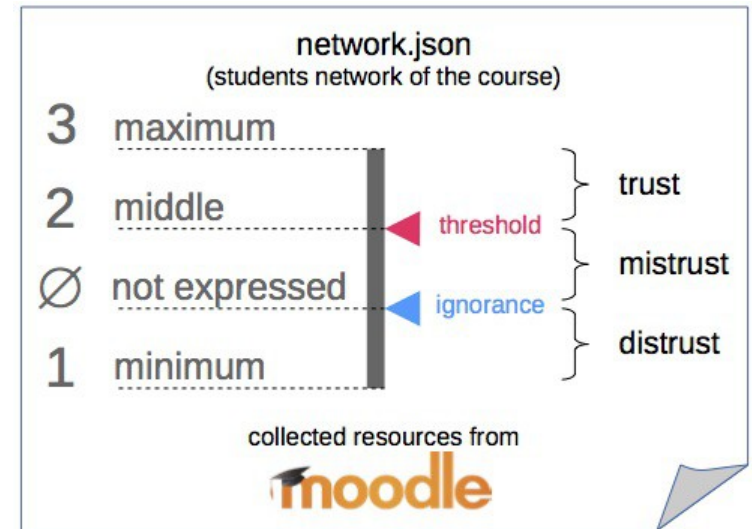
❖ transitivity of declared trust

❖ reciprocity of declared trust

Trust levels

Declared trust

- ❖ with a questionnaire
- ❖ express trust towards others



Trust propagation => broad social network

- ❖ with transitivity of declared trust

trust is not perfectly transitive and degrades along a chain of acquaintances

Trust consolidation => reduce vulnerability

- ❖ with reciprocity of declared trust

Trust and recommender systems

❖ Recommendation with social graphs

- nodes are people
- edges are trust relationships
- degree, centrality and clustering coefficient

❖ Trust in social graphs

global trust models:

Advoca, Eigen

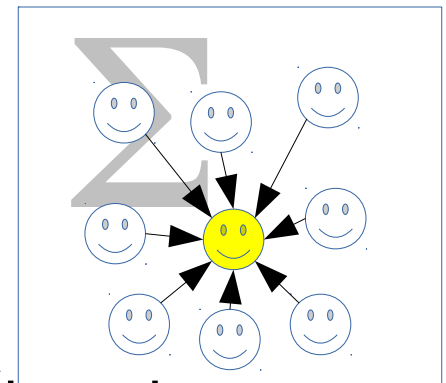
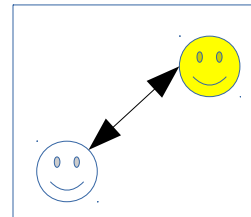
local trust models:

Bitrellitrust, LSubjtrust

both local and global:

Moletrust, Tidaltrust, Appletrust, Abdultrust, Marchtrust, O'Dontrust

- global (reputation)
- local (inside pairs)
- asymmetry => oriented and weighted graphs



Trust-aware recommendations

❖ neighboring definition in the social graph

- users' similarities matrix (eg. with Pearson correlation coefficient)
- local trust measurements matrix (eg. MoleTrust for local and PageRank for global trust metrics)
- the combination of both techniques

As the participants of our study do not use any recommender system, we choose the second technique to carry out our graph.

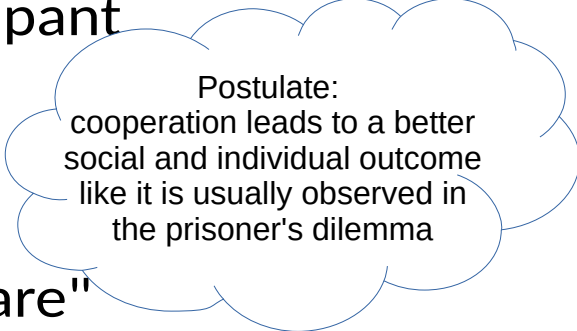
Challenge results

❖ Participation

- 302 proposed challenges => 604 potential responses
- 199 completed (i.e. by both members)
- around 10 challenges per participant

❖ Responses

- 47% of "share/share"
- 19% of "do not share/do not share"
- 34% of "share/do not share"



Postulate:
cooperation leads to a better
social and individual outcome
like it is usually observed in
the prisoner's dilemma

Transitivity results

❖ Comparison between declared and actual trust

it confirms our intuition of a correspondence between declared and actual trust levels.

it consolidates the reality of the notion of transitivity of trust.

less participation if trust level is not directly declared

- 76% of "share" among maximal trust level
- 42% of "share" among minimal trust level
- 62% of "share" among maximal transitive trust
- but increasing number of "not response" among maximal transitive trust

not a blind trust

distrust?

Declared trust is in line with actual trust during the challenges and the notion of transitivity of trust makes sense.

Reciprocity results

❖ Comparison between declared and actual trust

Its quite high even though the responses are anonymous and the game encourages the "treachery".

- 74% of participants decide to "share" when others "share"
- 45% of participants decide to "share" when others "do not share"

because the calculation of the % for actual trust is only based on the responses, while % for declared trust is based on all members regardless of whether they declared a trust

Obtained averages clearly show that the reciprocity of actual trust makes sense.

It doesn't make sense to compare the % of reciprocity between actual and declared trust.

Trust and recommendation

❖ Recommender systems drawbacks

- lack of data in the RS based on collaborative filtering

❖ Trust-aware recommender systems

- interest for trust and distrust relationships to move items closer to, respectively, away from the applicant (trust-aware algorithms)
- results on social graphs are more accepted than ordered lists

trust-aware recommender algorithms allow all explanation styles (human, features, items, and their combinations)

mutual trust is a significant criterion in the context of recruitment

The results of our study show that maximal trust is globally reciprocal and that minimal trust corresponds to a certain (negative) reciprocity.

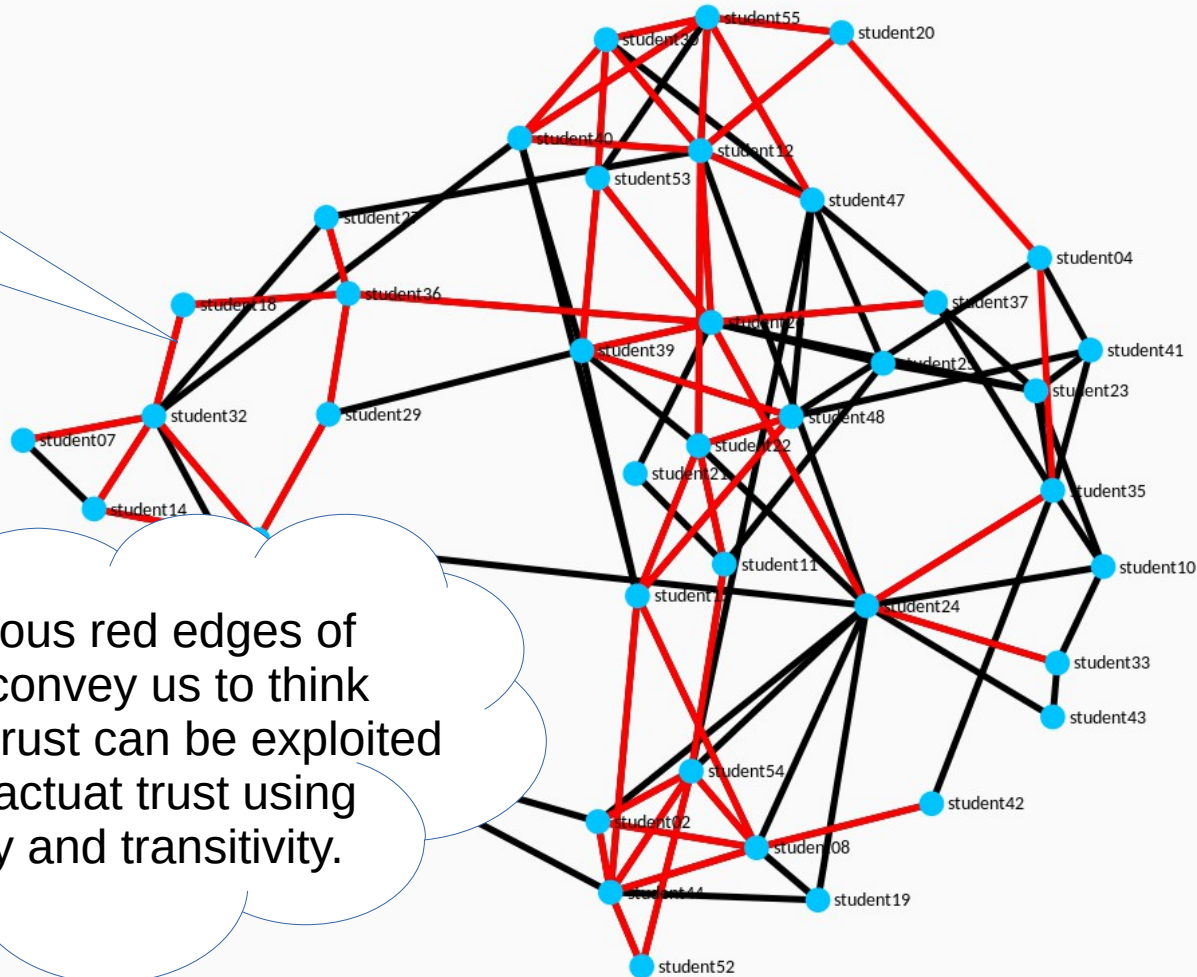


SYMME

Declared vs. actual trust

the edges are red when the maximal actual trust levels match the maximal declared ones.

the numerous red edges of the graph convey us to think that declared trust can be exploited to predict actual trust using reciprocity and transitivity.



Conclusion and perspectives

- the game allowed to explore the notion of trust and to highlight that declared trust is in line with actual trust
- the results illustrate the reality of the reciprocity and the transitivity for both declared and actual trusts
- the maximal and minimal trust levels may be easily interpreted
- the middle trust level has been ignored to avoid the problem of the threshold definition between trust and distrust
- trust will be used in a work in progress which is a recommender system about competencies for human resource manager

Thank you for your attention !

Any questions ?



SYMME

PROXYMA approach (1)

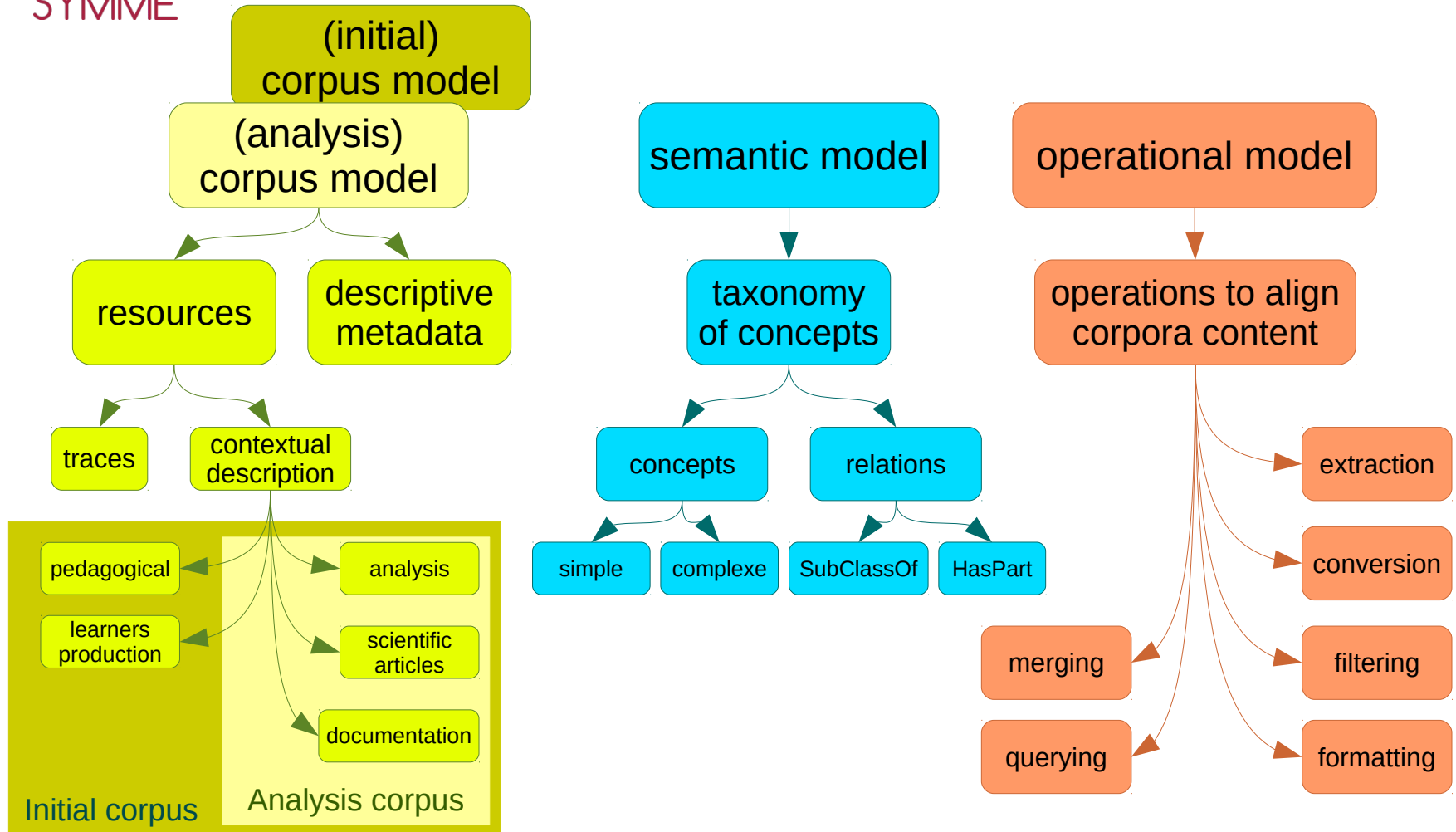
PROXY for Multiple Analyses

- ❖ Use of collected digital traces
- ❖ Online for personalization of learning environments
- ❖ Offline for reengineering of learning environments
- ❖ Build authentic experiments to validate research works by means of digital traces
 - is complex and time-consuming
 - does not allow analyses' replication and comparison
- ❖ Share and analyze contextualized corpora of traces



SYMME

PROXYMA approach (4)



BEATCORP platform (1)

BEenchmarking platform for Analysis of Trace CORPora

❖ Architecture with 5 components:

- 1) the corpus database to store shared corpora
- 2) an OWL ontology to formalize the 3 models
- 3) a script database to store the scripts relative to the 6 operations of the operational model to extract data for the analyses
- 4) a management engine to manipulate the various components of the platform
- 5) a client Web application for the user

Research focus

allows analyses **analysis** analyzing answer **approach**
categories collaboration collected corpora **corpus** correspond **data**
defined describe description **different** discussion enhanced
environments experiment format **forum** interactions
learning metadata **model** needed objectives ood-oop order performed pp proxy query
question representation **researchers** **resources**
scripts section semantic sharing **students** teacher tools
trace types used work