

# Interacțiunea socială om-calculator

Ștefan Trăușan-Matu

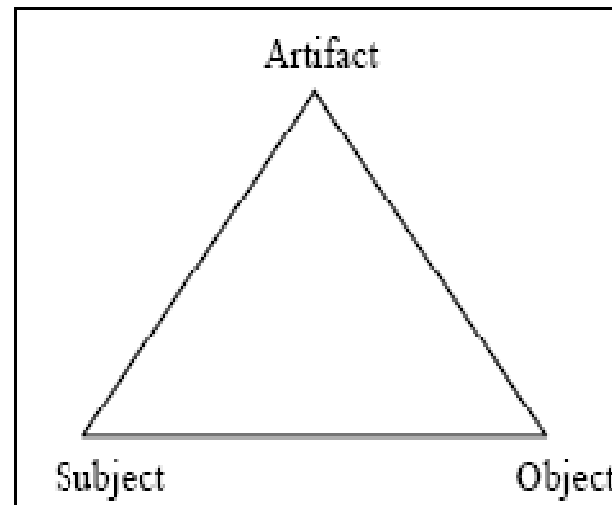
# Philosophical paradigms

- ◆ *Cognitive science*: “knowledge is in the mind of individual persons” (Cyc, WordNet, FrameNet, Mikrokosmos, Sowa ...)
- ◆ *Socio-cultural*: “knowledge is social, is in communities where people enter in dialogs” (Vygotsky, Engeström, Stahl ...)

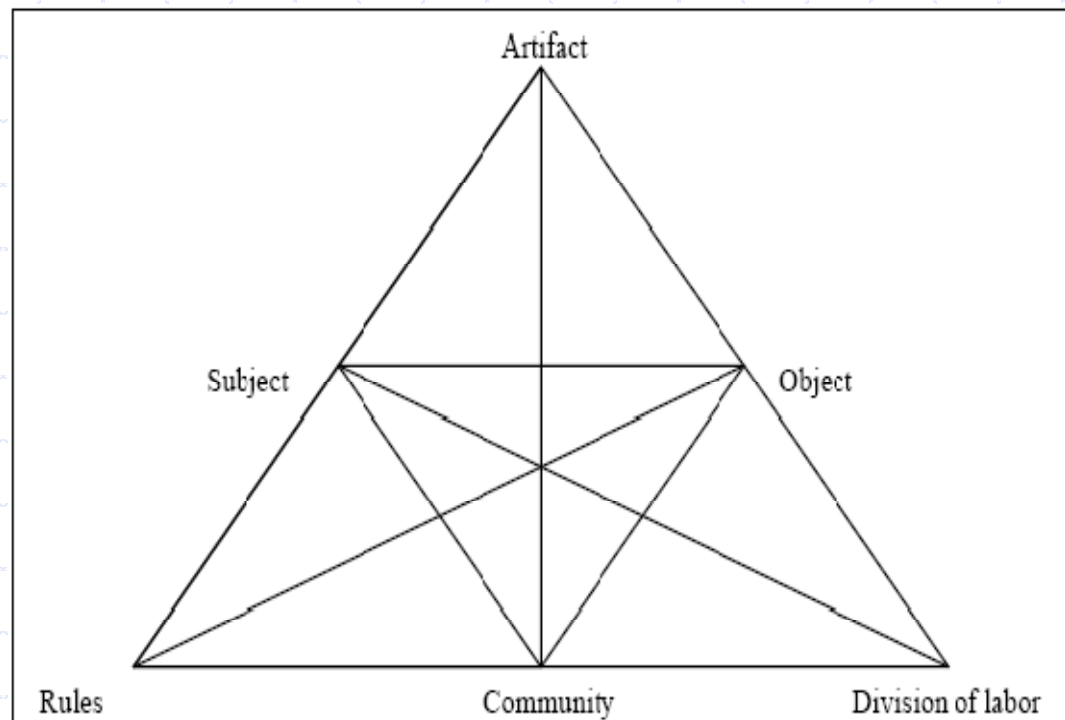
# Why a socio-cultural paradigm?

- ◆ Cognitive science and artificial intelligence problems
- ◆ Supporting dialogism
  - Group knowledge construction
  - Conflict resolution
  - Reaching common meaning through dialog

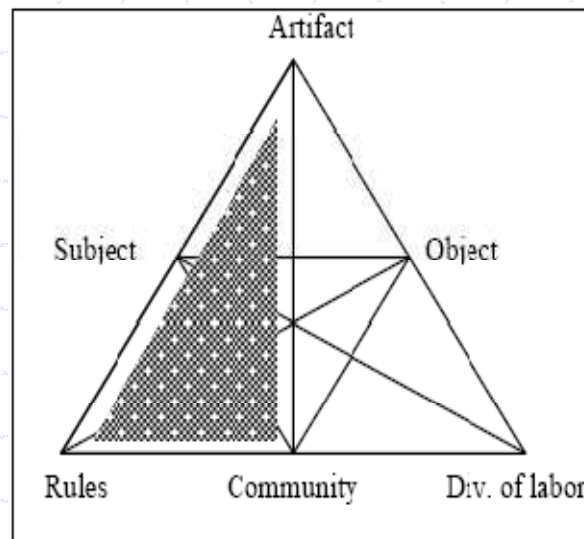
# Vygotsky's mediating triangle



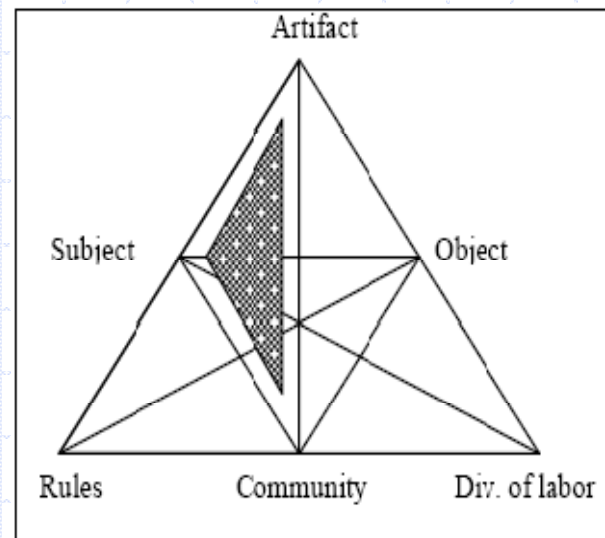
# The activity diagram of Engeström



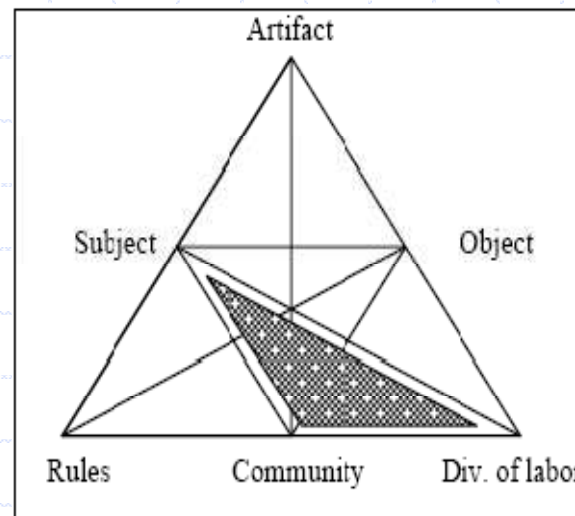
# Image of rules in communities



# Artifacts of subjects in communities

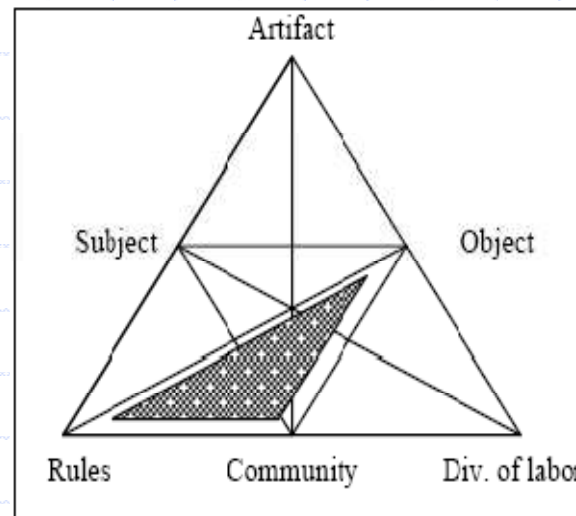


# Roles of individuals in a community

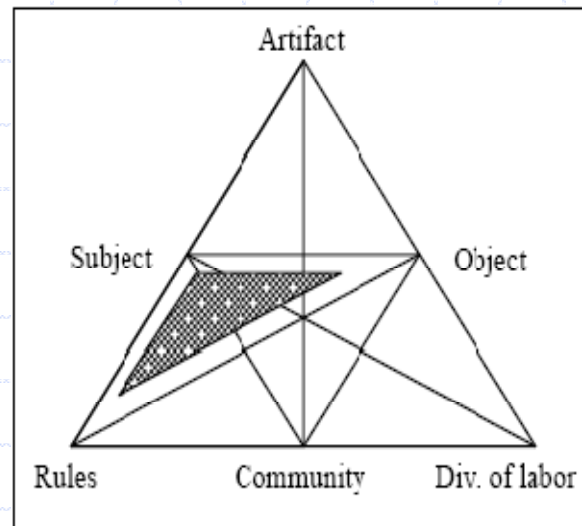




# Rules for objects' use in a community



# Rules (laws) that apply to an individual in relation to an object





# Social networks

# Folksonomy

- ◆ *"Ontology is a good way to organize objects, [...], but it is a terrible way to organize ideas, and in the period between the invention of the printing press and the invention of the symlink, we were forced to optimize for the storage and retrieval of objects, not ideas."* (Clay Shirky, 2005)

# Successful social applications

- ◆ eBay
- ◆ Wikipedia
- ◆ Amazon.com
- ◆ Slashdot
- ◆ Craigslist
- ◆ Bookmarking

# Social bookmarking

- ◆ del.icio.us.
- ◆ Flickr
- ◆ CiteULike
- ◆ Connotea
- ◆ Furl
- ◆ Simpy
- ◆ Spurl.net
- ◆ unalog

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17:53 by [LionKimbro](#) - [U.S. official: Chinese test missile obliterates satellite - CNN.com](#)  
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15:12 by [LionKimbro](#) - [Semantic Web & Data Integration](#)  
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10:41 by [LionKimbro](#) - [Everyday Wonderland Â» A practical guide to spiritual awakening](#)  
with tag [stress](#)

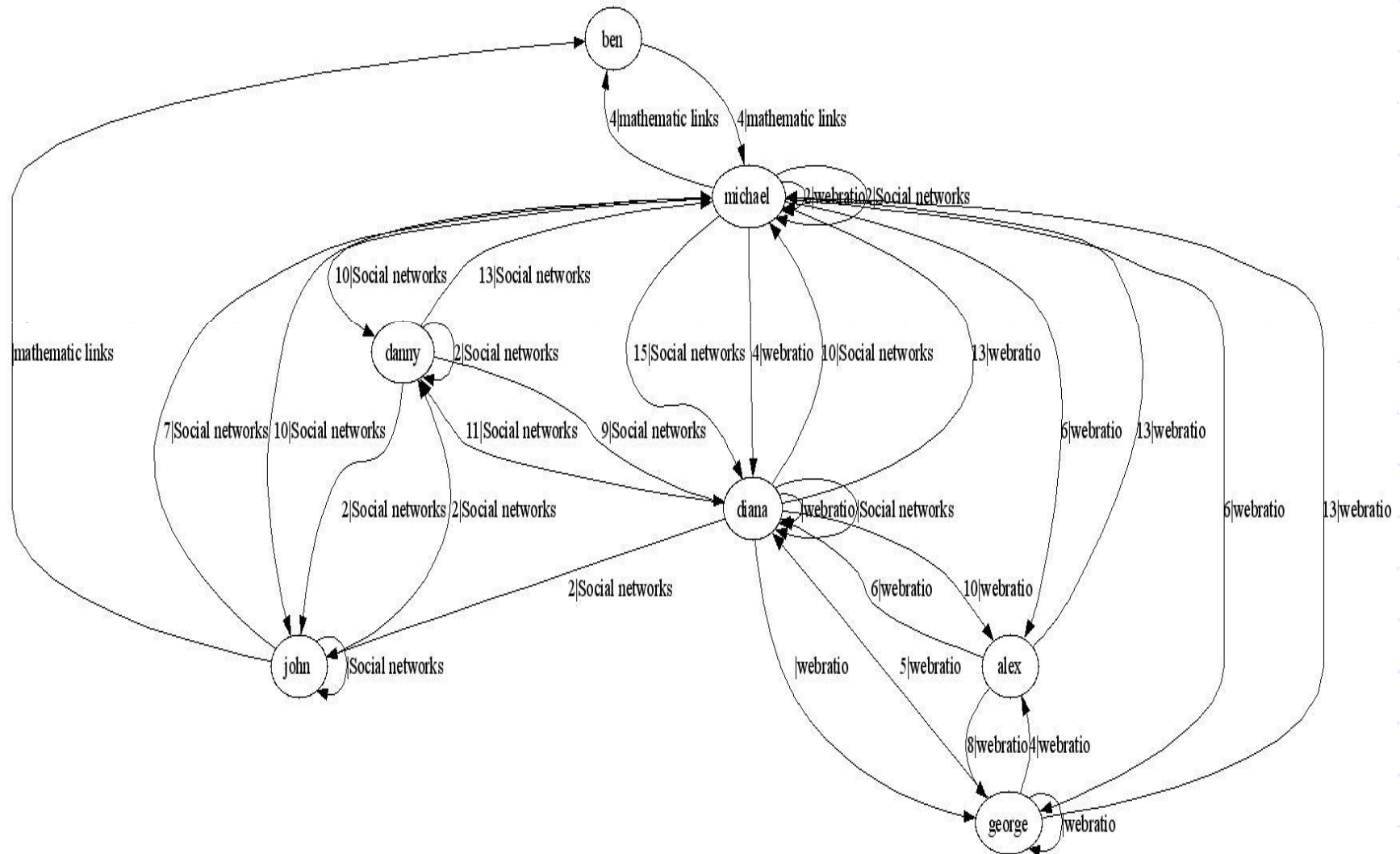
Personally, I think stress is good. What you want to avoid (in my book) is over-stress. But I think there's such a thing as under-stress, and I think it is just as bad: It means you're not participating.

09:52 by [patsy](#) - [Art Garfunkel](#)  
AG's reading list.

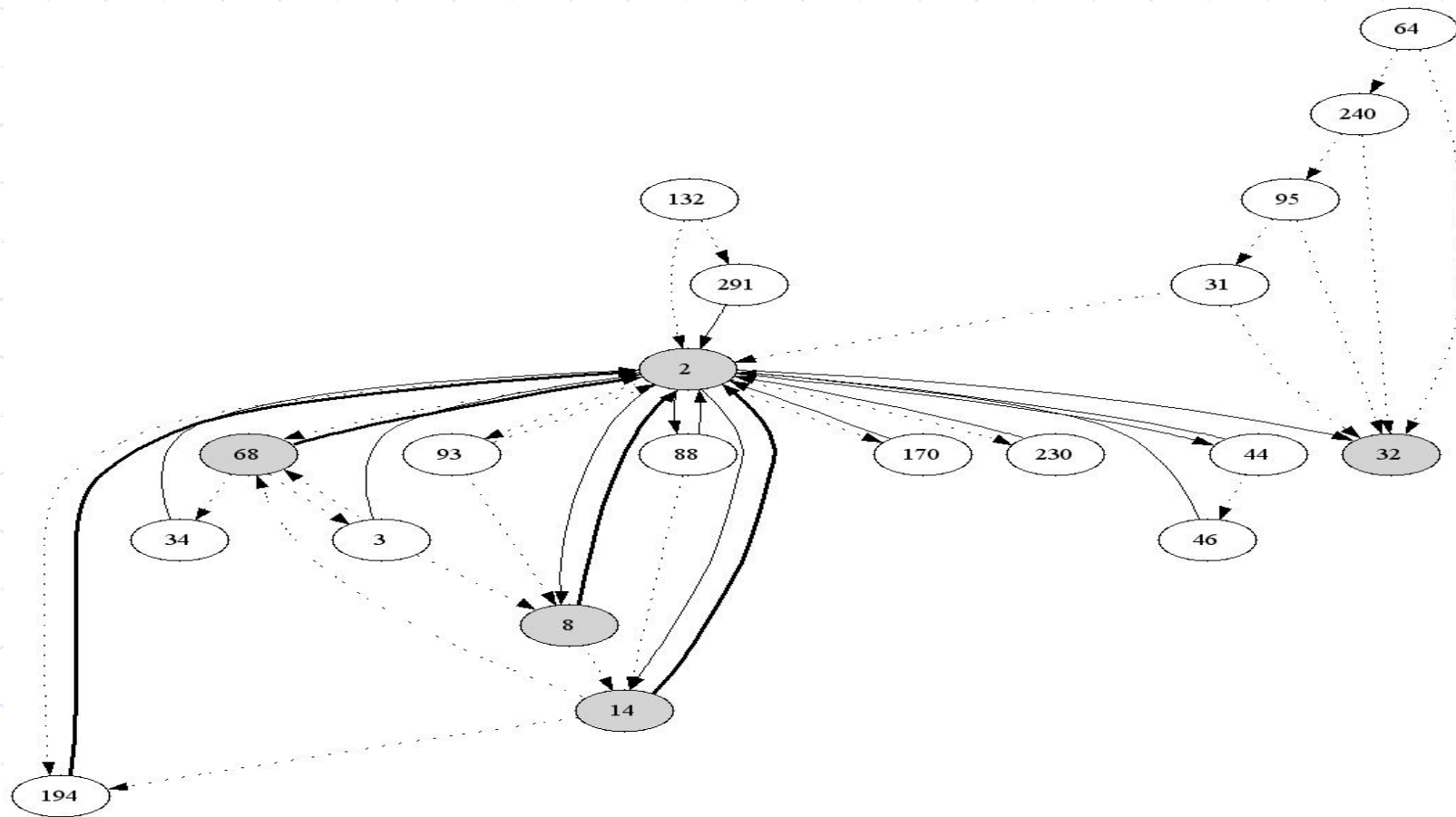
08:06 by [fawcett](#) - [The Fitful Flog](#)  
with tags [paper](#) [origami](#)

A delightful paper-folding blog, lyrically written: "Dr. Math tried to explain it to me, but he's a mathematician and I'm a diletante and we have trouble communicating. Every time I read the term 'radians,' a wee pixie comes in through the cat door and blows out my pilot light. The eyes glaze over and the frontal lobes grow cold and I wake up eight hours later, surrounded by empty 40 ounce malt liquor bottles and professional wrestling, blaring on the television."

# Social networks



# Social network



# Social analysis techniques

- ◆ Page rank
- ◆ Social networks analysis
- ◆ Browsing behavior analysis
- ◆ Recommender systems

# Page Rank

(Google - Sergey Brin and Lawrence Page)

$$\diamond PR(A) = (1-d) + d \left( \frac{PR(T1)}{C(T1)} + \dots + \frac{PR(Tn)}{C(Tn)} \right)$$

- $T1\dots Tn$  - citations,
- $d$  - damping factor between 0 and 1; typically,  $d$  is 0.85
- $C(A)$  - the number of links going out of page A.

# Page Ranks

- ◆ Probability distribution over web pages
- ◆ The sum of the PageRanks of all web pages = 1
- ◆ PageRank or  $PR(A)$  can be calculated using a simple iterative algorithm - corresponds to the principal eigenvector of the normalized link matrix of the web.
- ◆ PageRank for 26 million web pages can be computed in a few hours on a medium size workstation (in the nineties).



# Properties in social networks

## ◆ Local – related to a node:

- Centrality
- Centrality eigenvector
- Centrality Closeness
- Betweenness

## ◆ Global

- Centralization
- Cohesion
- Clustering Coefficient

# Centrality

- ◆ The total number of ties to other actors of the network (Anklam, 2003).

# Centrality eigenvector

- ◆ Similar with centrality except the fact that it also considers the importance of the neighbors, similar with the page rank in Google. It assigns relative ranks to all nodes in the network based on the principle that connections to nodes having a high rank contribute more to the rank of the node in question (Wikipedia, 2006)

# Centrality Closeness

- ◆ The degree an individual is near all other individuals in a network (directly or indirectly). It reflects the ability to access information through the "grapevine" of network members. Thus, closeness is the inverse of the sum of the shortest distances between each individual and every other person in the network (Wikipedia, 2006).

# Betweenness

- ◆ Degree an individual lies between other individuals in the network; the extent to which a node is directly connected only to those other nodes that are not directly connected to each other; an intermediary; liaisons; bridges.

# Centralization

- ◆ Many links concentrated around one or a few nodes
- ◆ For example, a centralized social network shows that project teams don't cooperate with each other, the links in the network being concentrated on teachers.

# Cohesion

- ◆ The degree actors are connected directly to each other by cohesive bonds (Wikipedia, 2006).

# Other metrics

- ◆ Clustering Coefficient
- ◆ Density
- ◆ Integration
- ◆ Path Length
- ◆ Radiality
- ◆ Reach
- ◆ Structural Equivalence
- ◆ Structural Hole





# Recommender systems

# IR vs. RS (Rocha, 2001)

◆ IR – pull

◆ RS – push – recognize users →  
conversation → adaptation

# Content-based Recommender Systems

- ◆ Similarity of users profiles and keywords
- ◆ Semantic distance – keywords and documents.
  - *InfoFinder* (Krulwich and Burkey, 1996)
  - *NewsWeeder* (Lang, 1995)
  - *TREC Conferences* (Harman, 1994)
  - *Fab* (Balabanovic and Shoham, 1997)
    - ◆ nearest-neighbor algorithm on user's set of positive examples.

# Collaborative recommendations

## Herlocker et al (1999)

- ◆ No description of the semantics or document content
- ◆ Comparison of users
- ◆ Distance between user profiles based on similar retrieved documents
  - *GroupLens* (Resnick et al, 1994; Kostan et al, 1997)
    - ◆ Pearson-r correlation of other users' ratings
  - *Bellcore Video Recommender* (Hill et al, 1995)
  - *Ringo* ( Shardanad and Maes, 1995)

# Collaborative recommendations (cont.)

- ◆ With user feedback
  - *Information Filtering* (Good et al, 1999)

# Collaborative filtering

- ◆ Tapestry (Goldberg et al, 1992) – e-mail filtering – annotations, comments for sharing
- ◆ Frequent bought items
- ◆ Model based (of user ratings)

# Collaborative filtering

- ◆ n items – i
- ◆ m users – u
  - I preferred items – ratings
    - ◆ score
    - ◆ Derived
- ◆ **Prediction** of the likeliness of another item
- ◆ **Recommendation** of a list of items not purchased → Top-N recommendations

# Structural recommendations

- ◆ Data mining on the relations among documents and keywords
- ◆ Analysis of the graph structure of Web Hyperlinks
  - *CLEVER Project* (Kleinberg, 1998; Chakrabarti et al, 1999)
  - *Small World graphs* (Watts, 1999)
- ◆ Latent Semantic Indexing
  - (Berry et al, 1994; Kannan and Vempala, 1999).

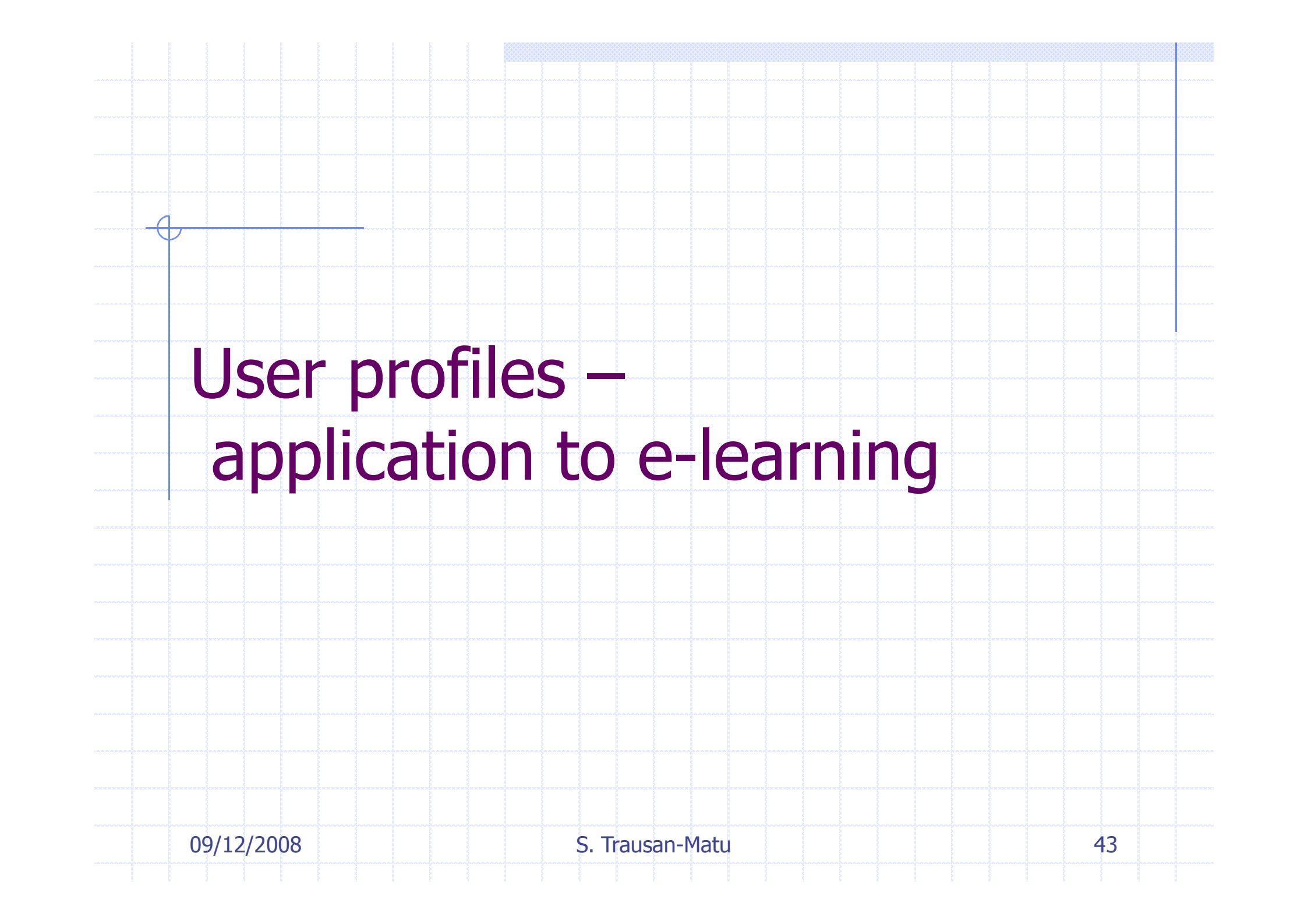


# Collective recommendations

- ◆ the tracks (behavior) of communities of users retrieving documents.
  - trails left behind by other insects in their colony (Rocha and Bollen, 2000)
  - Adaptive Hypertext systems (Brusilovsky et al, 1998; Bollen and Heylighen, 1998; Eklund, 1998),
  - Knowledge Self-Organization (Johnson et al, 1998; Heylighen, 1999)
  - the work on the collective discovery of linguistic categories (Rocha, 1997, 2000)

# Hybrid recommendations

- ◆ Collaborative and content
  - Quickstep
  - Foxtrot
- ◆  $k$ -Nearest Neighbor.
- ◆ naive Bayes
- ◆ C4.5 decision tree,
- ◆ boosted IBk classifier
- ◆ AdaBoostM1



# User profiles – application to e-learning

# Personalized web pages

Are adapted to each users':

- knowledge - student model
- learning style
- psychological profile
- goals (e.g. lists of concepts to be learned)
- level (novice, expert)
- preferences (e.g. style of web pages)
- context of interaction

# Student model

- ◆ Keeps track of the concepts known, unknown or wrongly known by the student (Dimitrova, Self, Brna, 2000)
- ◆ Inferred from results at tests or from interaction (visited web pages, topics searched etc.)
- ◆ Is usually defined in relation with the domain ontology (concept net, Bayesian net)

# Learning style

- ◆ Exploratory vs. interactional
- ◆ David Kolb's learning styles :
  - Accommodator
  - Diverger
  - Converger
  - Assimilator

# Psychological profile

- ◆ Inferred from results at psychological tests or from interaction (time of visiting different types of web pages)
- ◆ Personality types
- ◆ Intelligence
- ◆ Context dependence

# Psychological profile

- ◆ Self-confidence
- ◆ Motivation
- ◆ Concentration
- ◆ Social interaction
- ◆ Emotional profile



# Profile

- ◆ Cognitiv
- ◆ Emotional
- ◆ Conativ

# Preferences

- ◆ Explicitly chosen by the learner
- ◆ Inferred from behavior
- ◆ Inferred from the psychological style