

# E-Learning Research at Politehnica University of Bucharest and ICIA

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ROMANIA

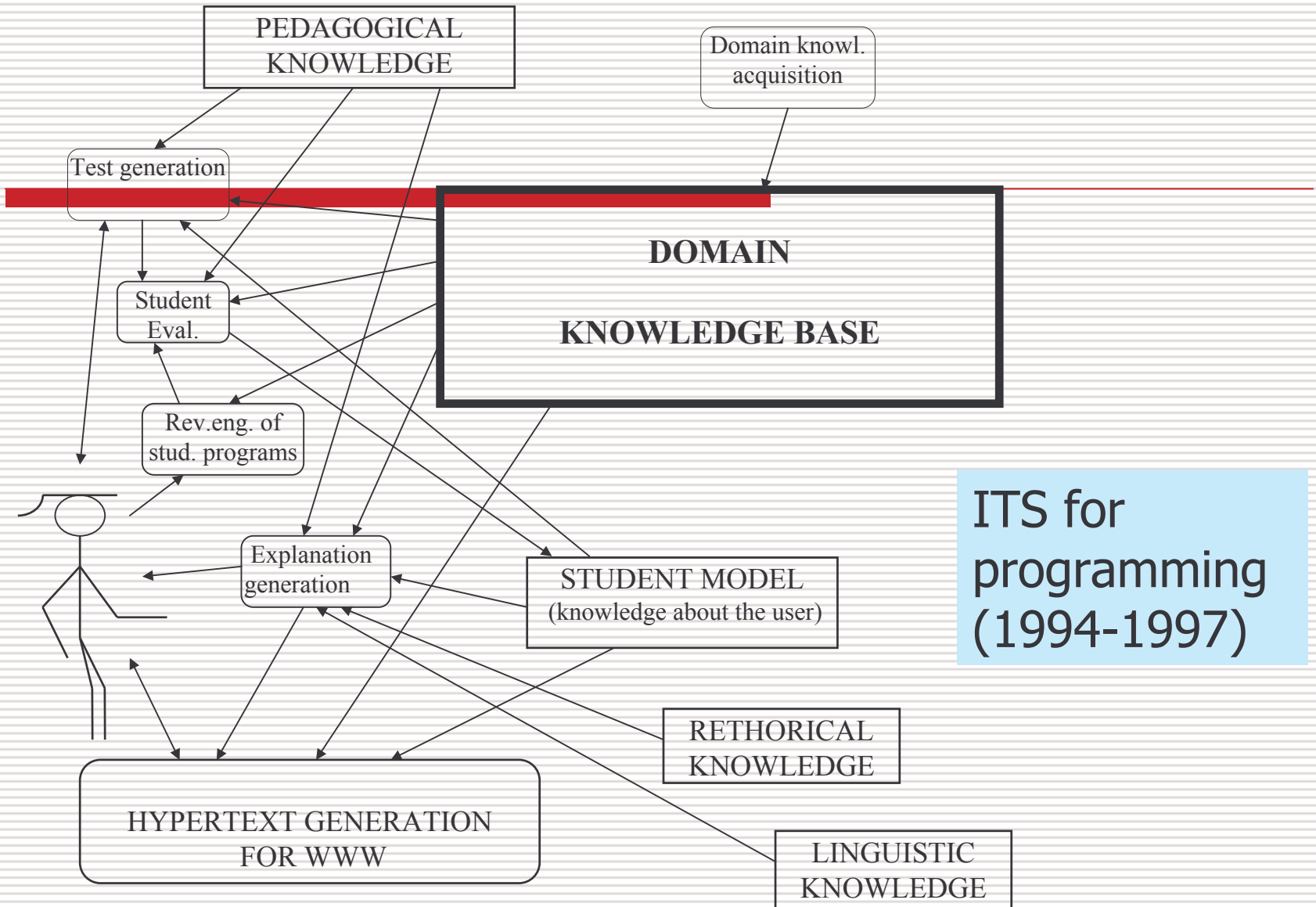
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# E-Learning Research Projects

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- Portable AI Lab
- ITS for programming
- WebGen
- LARFLAST
- IBM - EBA
- SINTEC
- Collaborative problem solving for CSCL
- EU-NCIT
- Cooper



ITS for programming (1994-1997)

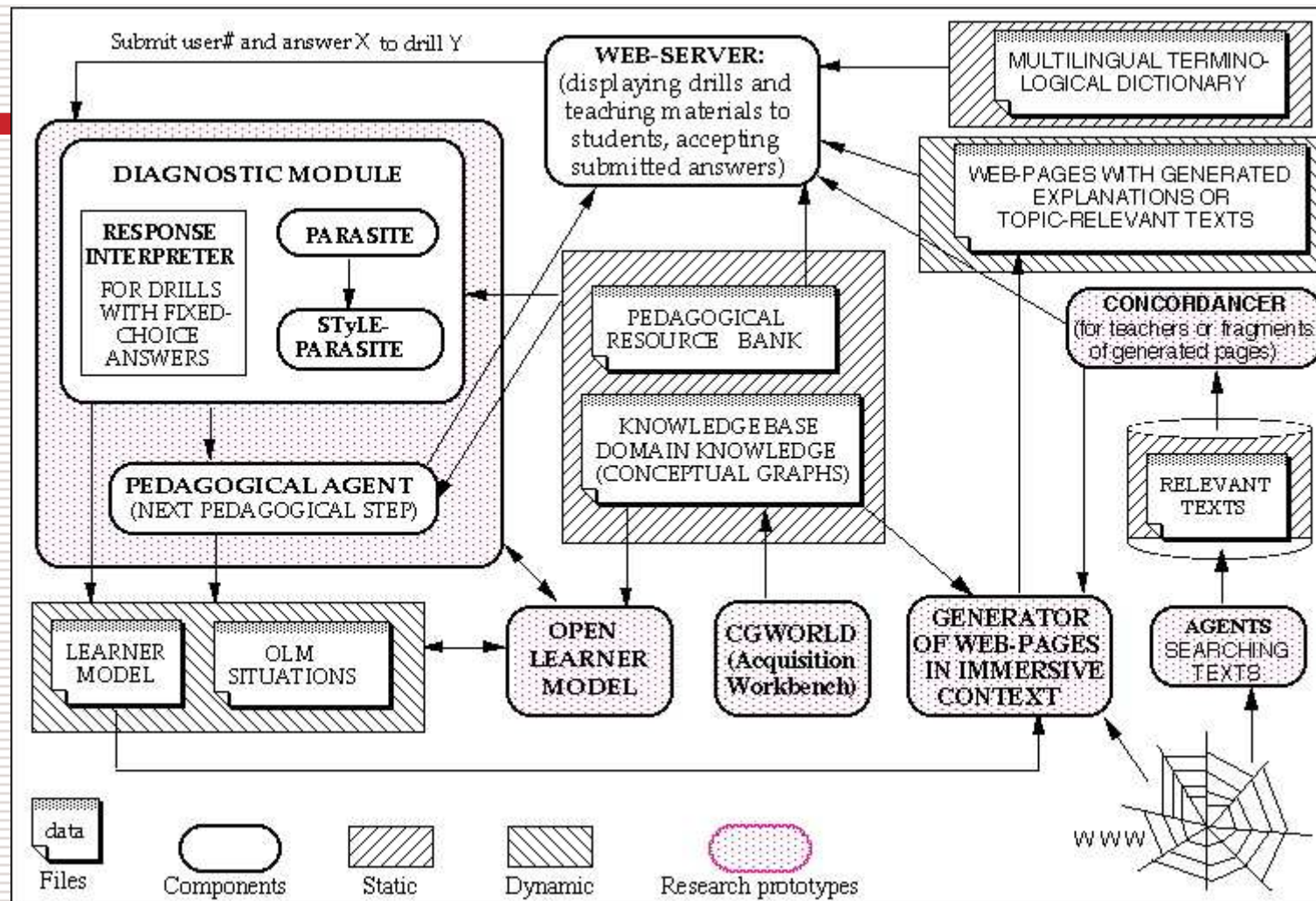
# LARFLAST

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## LeARning Foreign Language Scientific Terminology COPERNICUS EU project (1998-2001)

- Leeds University – UK,
- Manchester University - UK,
- Montpellier University - France,
- RACAI & Politehnica University – Romania,
- Sofia University - Bulgaria,
- Sinferopol University - Ukraine

Objective: To provide a set of tools, available on the web, for supporting the learning of foreign terminology in finance

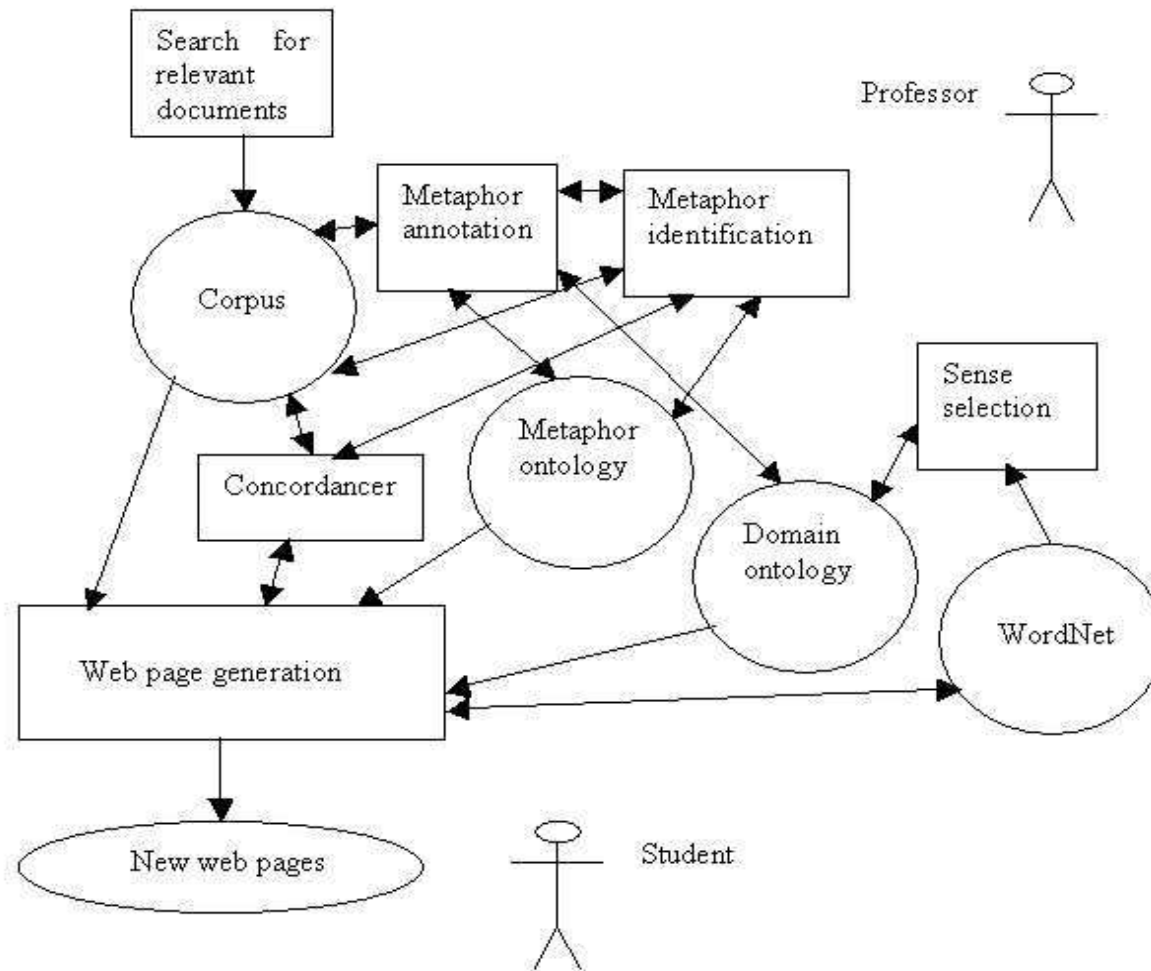


# LARFLAST

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Dynamic generation of personalized web pages

- ❑ Adapts to the learner's model, transferred from another web site
- ❑ Parameterized, easy to configure for new patterns of web pages and structures
- ❑ Includes relevant metaphors and texts from a corpus – Ontology based Text Mining

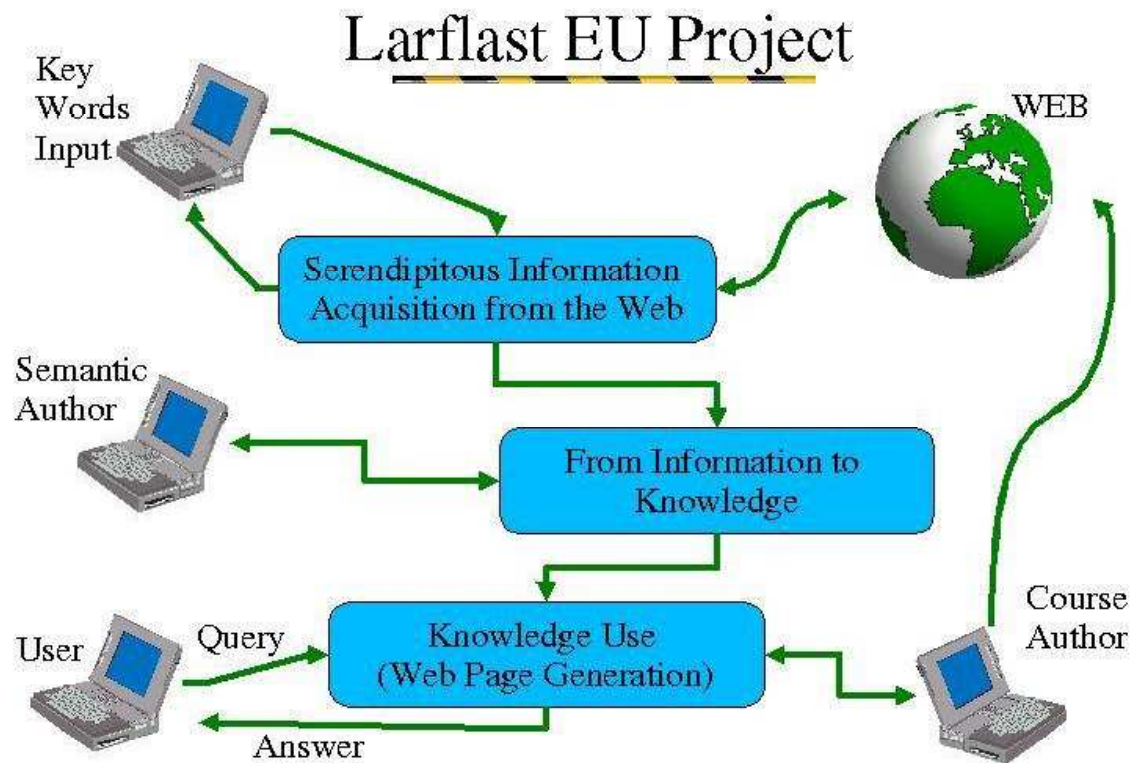


# LARFLAST

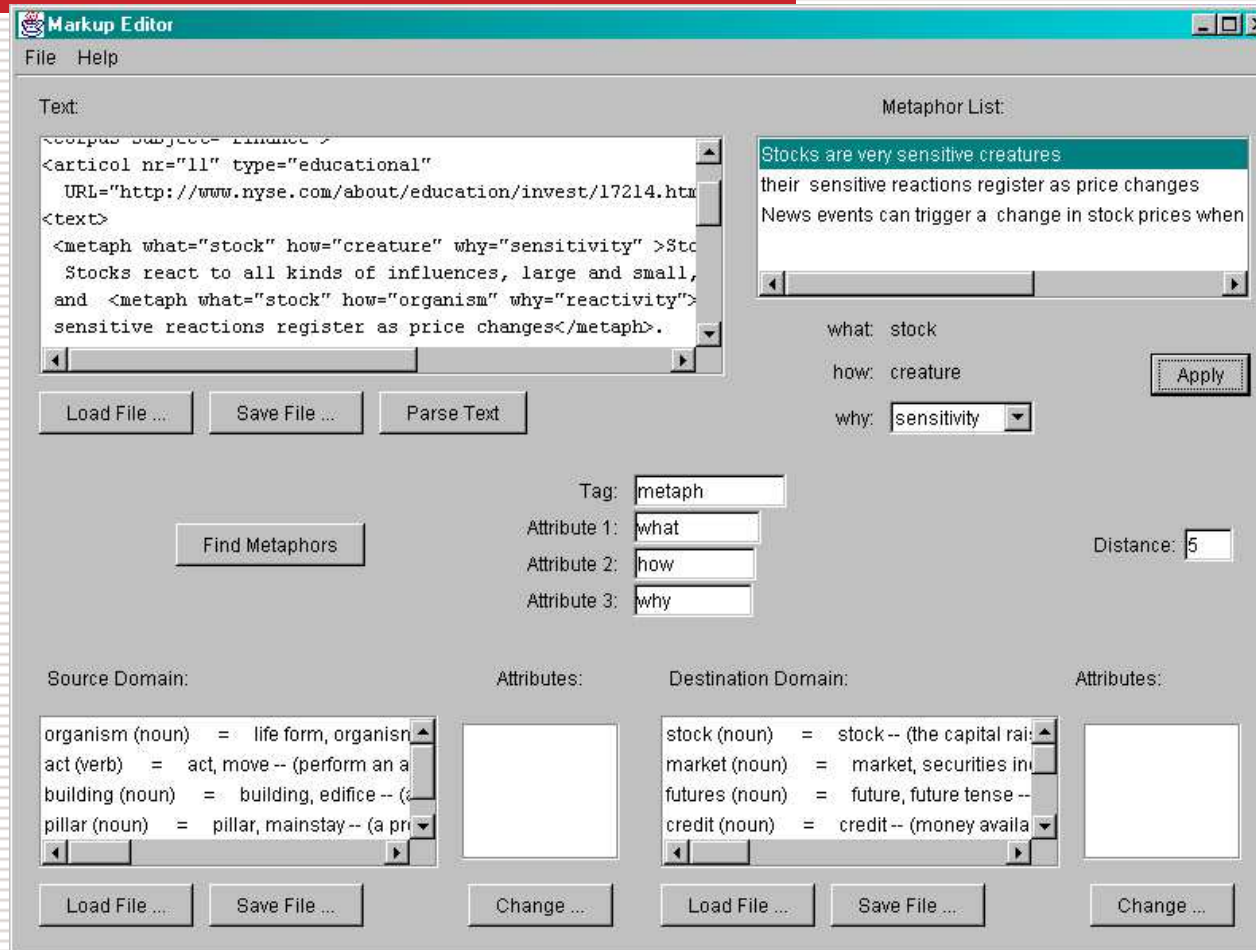
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- Adaptation of the content of the generated web pages to the incoming information from the web. New information is extracted, annotated and coherently integrated in the body of knowledge in order to keep the holistic character of the body of knowledge.

# Serendipitous information acquisition



# Semantic editing



- [RAINING CORPUS](#)
- [JURNAL ARTICLES](#)
- [TOOLS:CONCORDANCER](#)
- [TEST YOUR TERMINOLOGY](#)
- [User's Performance](#)
- [Financial Markets in Financial Systems](#)
- [Types of Financial Markets](#)
- [Characteristics of Financial Markets](#)
- [Classifying Financial Transactions](#)
- [Financial Instruments of Money and Capital](#)
- [Properties of Financial Markets](#)
- [Demanders and Suppliers of Funds](#)
- [Credit on The Financial Market](#)
- [Understanding Market Behaviour](#)
- [Securities on the Capital Market](#)
- [Buying and Selling Securities](#)

## Which of these statements, describing financial markets, are true, and which are false?

1. There is only one product traded on financial markets - financial claims.
2. The money market is a place where mainly individuals and institutions with long-term investment plans borrow funds.
3. A security or loan maturing within one year or less is a money market instrument.
4. The construction of factories, highways, schools and homes relies mainly on the trading of funds on the capital market.
5. In the open market some corporate bonds are sold under private contract and held to maturity.
6. In the negotiated market you can sell and buy corporate bonds a number of times before they mature.
7. The principal function of the primary market is to raise financial capital to support new investment in buildings, equipment and inventories.
8. The secondary market also supports new investment.
9. A rise in interest rates in the secondary market has no effect on rates of primary-market securities.
10. Investors are obliged to make a commitment - they cannot switch from one market to another in response to differences in price and yield.

[RAINING CORPUS](#)[JOURNAL ARTICLES](#)[IMMERSIVE TOOLS](#)[TEST YOUR TERMINOLOGY](#)

## Diagnostics

... Generated for Trausan ...

Trausan, you have correctly answered to some questions about: **financial\_market, secondary\_market, futures\_contract, option\_contract, primary\_market, investment, credit**, but it seems that you still do not correctly know the following concept(s):

1. [Credit](#)
2. [Futures contract](#)
3. [Investment](#)
4. [Primary market](#)
5. [Option contract](#)
6. [Money market](#)
7. [Open market](#)
8. [Negotiated market](#)

Please browse the web pages describing these concept(s).

Only the wrongly known and unknown concepts are detailed presented!



[Back to main page!](#)



[About LarFlast](#) Please send questions and remarks at:



[trausan@valhalla.racai.ro](mailto:trausan@valhalla.racai.ro)

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## Credit

... Generated for Trausan ...

### Definition :

A loan of funds in return for a promise of future payment.

### Some metaphorical phrases in which this concept appears :

- credit growth - compared to a/an organism, due to the development attribute
- recycling credit - compared to a/an resource
- one long chain of credit
- credit policy

### Relevant texts for this concept are:

- [Http://www.e-analytics.com/text22.htm](http://www.e-analytics.com/text22.htm); Relevance= 0.6

### Concordances

### Immerse into the following taxonomy

- Finance
  - Financial-system
  - [Financial market](#)
    - [Primary market](#)
    - [Secondary market](#)

# SINTEC

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- INFOSOC- Funded Project (2002-2003)
- Includes experience from ITS and LARFLAST
- Partners :
  - CS Dept., "Polytechnica" Univ. Bucharest
  - Romanian Academy Institute for AI
  - Romanian Academy Psychology Institute
  - SIVECO S.A. Romania

# SINTEC

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- ❑ Personalization according to cognitive and emotional profiles of the students
- ❑ Web services technology for distributed processing knowledge (ontologies) from the (Semantic) Web
- ❑ Content creation and reuse from the web, according to metadata standards for e-Learning like IMS, ARIADNE, SCORM, AICC
- ❑ ITS technology (student modelling and inference)
- ❑ Text Miming:
  - intelligent search of learning materials on the web
  - knowledge extraction
  - categorization
  - Summarization



# Research on Collaborative Problem Solving for CSCL

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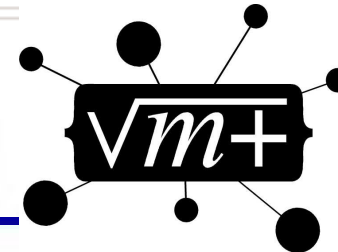
- The role of discourse in collaborative problem solving in virtual teams  
(Fulbright grant, Stefan Trausan-Matu, Drexel University, Philadelphia, 2005)
- Building, analysis and processing of corpora of chats for problem solving
- Online support for chat participants:
  - recommender system
  - summarization

# Virtual Math Teams (VMT)

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The Math Forum @ Drexel



VMT is a NSF Funded project designed to investigate small group collaborative learning in The Math Forum's popular "Problem of the Week" (POW) service.

Small groups of students are invited to collaborate online for solving math problems that require reflection and discussion.

Principal investigator: Prof. Gerry Stahl

# VMT research activities

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- ❑ Observe students in math classrooms in Philadelphia public schools working collaboratively on math problems & analyzing their collaborative learning process with an eye to creating Virtual Math Teams.
- ❑ Design mechanisms to bring together compatible online teams. Experiment on optimal groupings based on math skills, interests and backgrounds.
- ❑ Develop math problems structured for discussion, exploration and solution by small groups of students.
- ❑ **Design, implement and evaluate online support for small groups of students to collaborate on math problems.**
- ❑ Study the online collaborative learning process among student groups solving math problems.
- ❑ Scale up the online service for use in Philadelphia public schools and globally.

# POW example

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## **Making Triangles - April 19, 2004**

The lengths of three segments are represented by  $(n + 2)^2$ ,  $9$ , and  $n(n + 5)$ . Determine for what values of  $n$  these three segments can be used to form a triangle.

# Chat example

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.....  
(21:43:44) gabor\_vv: hello it's well what I told you  
(21:43:57) gabor\_vv: at a equilateral triangle  
(21:44:04) gabor\_vv: ?  
(21:44:05) marian96ro:  $r = l * \sqrt{3} / 2$   
(21:44:07) geomyc: Yes  
(21:44:15) sorin\_cocorada:  $r * (a+b+c) / 2 = \sqrt{p(p-a)(p-b)(p-c)} / 6$   
(21:44:24) geomyc: the radius of the circle it's r and the side of the triangle is l  
(21:44:30) gabor\_vv: Yes  
(21:44:35) gabor\_vv: I say that sorin\_cocorada has a good point  
(21:44:39) gabor\_vv: we can obtain r  
(21:44:43) geomyc: Yes this aproach is good  
(21:45:16) gabor\_vv: so like sorin\_cocorada we get r  
(21:45:20) sorin\_cocorada: is six under the square sign?  
.....

# Research at UPB related to VMT

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1. Summarization of a POWWOW
2. Recommender system
3. Automatic powwow annotation in DAMSL using:
  - a. Markov Models
  - b. Cue-phrases and heuristics

# EU-NCIT

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- EU Excellency Center in
  - E-Learning
  - Semantic Web
  - Collaborative work
  - Grid computing

# Evaluation in COOPER

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- Methodology for evaluation
  - Developed in parallel with
    - Requirements analysis
    - Design

# Scope of Evaluation in COOPER

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- Technically, of the platform
  - How many users
  - Response time
  - ...
- Usability evaluation
  - Logs of usage with real students
  - In Bucharest
- Considering users psychological profiles?
  - Questionnaires
  - Log analysis





# Phases of Markov Modelling

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- Build the “Hidden” Markov Model from statistics and smoothing
- Determine the most probable sequence of speech acts (input) that explains an output data sequence  
(with the Viterbi algorithm)

# DAMSL (Dialog Act Markup in Several Layers)

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- Allan and Core, 1997
- Dialog markup schema in XML
- Used in telephone speech processing
- Annotations:
  - Forward Looking Function
  - Backward Looking Function

# Forward Looking Function

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- Statement
  - Assert
  - Reassert
  - Other-statement
- Influencing-addressee-future-action
  - Open-option
  - Action-directive
- Info-request
- Committing-speaker-future-action
  - Offer
  - Commit
- Conventional Opening Closing
- Explicit-performative
- Exclamation
- Other-forward-function

# Backward Looking Function

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- Agreement
  - Accept, accept part, may be, reject, reject part, hold
- Understanding
  - Signal-non-understanding
  - Signal-understanding
    - Acknowledge
    - Repeat-rephrase
    - Completion
- Answer
- Information-Relations
- Antecedents
- Discussion

# Step 1

---

**Transformation of the powwow (chat) text file in a subset of DAMSL (in XML),** without speech acts information. In this step are annotated the utterances and turns. Attributes got empty strings.

For example, the following powwow:

*(10:01:39 AM) You have just entered room "powwow1."*

*(10:01:49 AM) klasher321 has entered the room.*

*klasher321 (10:01:59 AM): hi Gerry*

*(10:02:00 AM) stevriz has entered the room.*

*klasher321 (10:02:07 AM): Hi Riz*

*stevriz (10:02:14 AM): Hi all*

*gerrystahl (10:02:40 AM): welcome Riz and Kristina*

*klasher321 (10:02:48 AM): Or should I say, who is this stevriz person?*

*stevriz (10:02:51 AM): I'm entering this experience with new optimism now that I have this slick computer.*

*gerrystahl (10:03:15 AM): Shall we do some*

# Step 1 cont.

---

was transformed in:

```
- <Dialog Id="powwow" Date="">  
(10:01:39 AM) You have just entered room "powwow1."(10:01:49 AM) klasher321  
has entered the  
room.  
- <Turn Id="T1" Speaker="klasher321" time="10:01:59 AM">  
<Utt Id="Utt1" Info-level="" Conventional="" Time="10:01:59 AM" Influence-on-  
listener=""  
Influence-on-speaker="" Agreement="" Answer="">hi Gerry(10:02:00 AM) stevriz has  
entered the  
room.</Utt>  
</Turn>  
- <Turn Id="T2" Speaker="klasher321" time="10:02:07 AM">  
<Utt Id="Utt2" Info-level="" Conventional="" Time="10:02:07 AM" Influence-on-  
listener=""  
Influence-on-speaker="" Agreement="" Answer="">Hi Riz</Utt>  
</Turn>  
- <Turn Id="T3" Speaker="stevriz" time="10:02:14 AM">  
<Utt Id="Utt3" Info-level="" Conventional="" Time="10:02:14 AM" Influence-on-  
listener=""  
Influence-on-speaker="" Agreement="" Answer="">Hi all</Utt>  
</Turn>
```

# Step 2

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## Manual annotation of speech act data.

For example:

```
<Turn Id="T10" Speaker="klasher321" time="10:03:41 AM">
<Utt Id="Utt10" Info-level="Communication-management" Conventional=""
    Time="10:03:41 AM"
Influence-on-listener="" Influence-on-speaker="" Agreement="Accept"
    Answer="Utt9">ok!</Utt>
</Turn>
<Turn Id="T11" Speaker="gerrystahl" time="10:04:05 AM">
<Utt Id="Utt11" Info-level="Communication-management" Conventional=""
    Time="10:04:05 AM"
Influence-on-listener="Info-request-directive" Influence-on-speaker=""
    Agreement="None"
Answer="">do you know the powwow rules?</Utt>
</Turn>
<Turn Id="T12" Speaker="klasher321" time="10:04:24 AM">
<Utt Id="Utt12" Info-level="Communication-management" Conventional=""
    Time="10:04:24 AM"
Influence-on-listener="" Influence-on-speaker="" Agreement="Maybe"
    Answer="Utt11">maybe I
better read them again.</Utt>
</Turn>
16/2/2006 10:04:25 AM
```

# Step 3

---

## **Constructing the Hidden Markov Model from the annotated corpus.**

An example of tag statistics in a POW chat were:

*Total tag number=2235*

*Accept=391*

*Reject=71*

*Maybe=27*

*Accept part=8*

*Reject part=1*

# Speech act probabilities

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<i>Speech act</i>	<i>Typical cue phrases</i>	<i>Nr. of occurrences</i>	<i>Probability</i>
<i>PARTIAL ACCEPT</i>	ok, but; k, but;	8	0.003579
<i>PARTIAL REFUSE</i>	yeap, but; yes, but not really	1	4.47427E-4
<i>ACCEPT</i>	k, ok, yeap, yes, yup, right, yeah, ya, okay, true, exactly, alright, probably	391	0.174944
<i>REFUSE</i>	nope, no, nop, don't want, disagree, don't think, nah	71	0.031767
<i>MAYBE</i>	maybe, don't know, guess, whatever	27	0.012081
<i>Neadnotat</i>		1737	0.777181

# Speech act bigram probabilities

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<i>probability</i>	<i>PA</i>	<i>PR</i>	<i>A</i>	<i>R</i>	<i>M</i>	<i>N</i>
<i>PA</i>	0	0	0.25	0	0	0.75
<i>PR</i>	0	0	0	0	0	1
<i>A</i>	0.00767	0	0.25575	0.01279	0.01279	0.711
<i>R</i>	0	0	0.21127	0.15493	0	0.6338
<i>M</i>	0	0	0.22222	0.03704	0.03704	0.7037
<i>N</i>	0.00288	0.00058	0.15429	0.03109	0.01209	0.7985

# Step 4

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- Smoothing the model with the Katz method

# Step 5

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## Automatic setting of the “agreement” DAMSL attribute for a un-annotated file

```
<Turn Id="T272" Speaker="AvrilLR" time="8:52:46 PM">
  <Utt Id="Utt272" Info-level="" Conventional="" Time="8:52:46 PM"
    Influence-on-listener="" Influence-on-speaker="" Agreement="None"
    Answer="">I just ignored the other number</Utt> </Turn>
<Turn Id="T273" Speaker="SuperEvo88" time="8:52:56 PM">
  <Utt Id="Utt273" Info-level="" Conventional="" Time="8:52:56 PM"
    Influence-on-listener="" Influence-on-speaker="" Agreement="Accept"
    Answer="">my iq right now is like in the negatives</Utt> </Turn>
<Turn Id="T274" Speaker="AvrilLR" time="8:53:01 PM">
  <Utt Id="Utt274" Info-level="" Conventional="" Time="8:53:01 PM"
    Influence-on-listener="" Influence-on-speaker="" Agreement="None"
    Answer="">I had 10.39 instead of 10.392</Utt> </Turn>
<Turn Id="T275" Speaker="AvrilLR" time="8:53:11 PM">
  <Utt Id="Utt275" Info-level="" Conventional="" Time="8:53:11 PM"
    Influence-on-listener="" Influence-on-speaker="" Agreement="Reject
    Part" Answer="">My IQ is 206...not joking...but that's off topic</Utt>
</Turn>
```

.....

# Results analysis

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- We compared the manual annotation and the automatic annotation of the same powwow. The result of annotation contains 578 (from 715) corectly annotated tags, that means 81% from the total number of tags:
  - 60 Accept tags - 10%
  - 8 Reject tag - 1.4%
  - 1 Accept tags - 0.2%
  - 1 Maybe tags - 0.2%
  - 508 None tags - 88%

# Experiment 2.b.

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- Cue Phrases
- Heuristics
- WordNet

# Forward\_looking\_function heuristics

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- Statement
- Info\_request
- Action\_directive
- Conventional
- Other\_forward\_function

# Statement recognition heuristics

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First verb preceded by a pronoun, noun or adverb

Ex: I hope we can solve this.  
This problem is difficult.  
I already done that.

Short form of, e.g. pronoun + auxiliary verb

Ex: I'm new at that.  
There's one variable.  
That's why we are doing this.

Any other sentence that contains a verb and couldn't be classified elsewhere

Ex: Tried that.  
Checking...

# Info\_request heuristics

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Question mark at the end

Ex: Any other replies?

Auxiliar verb at beginning, followed by a pronoun or noun

Ex: Did you send the picture  
Can somebody help me

Specific adverb at the beginning (where, when etc.) or a contrasted form adverb + aux. verb.

Ex: How long is the segment  
Where's the picture

# Backward-looking heuristics

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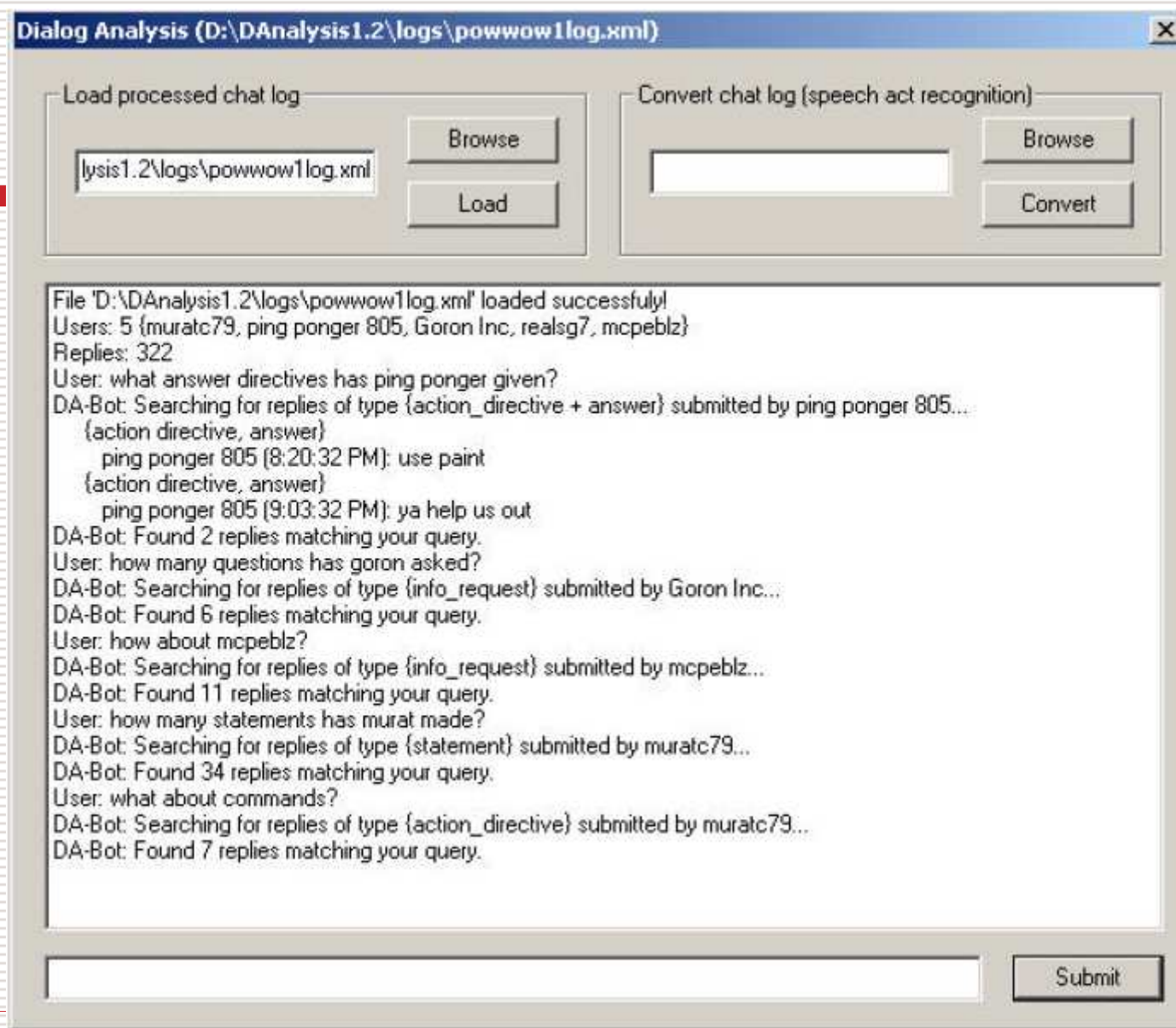
- Agreement (Accept, Maybe, Reject)
- Understanding (Acknowledge)
- Answer (raspuns)

List options

<p>Forward looking function</p> <p><input checked="" type="checkbox"/> Statement</p> <p><input type="checkbox"/> Info request</p> <p><input type="checkbox"/> Action directive</p> <p><input type="checkbox"/> Conventional</p> <p><input type="checkbox"/> Other</p>	<p>Backward looking function</p> <p><input type="checkbox"/> Agreement (accept, maybe, reject)</p> <p><input checked="" type="checkbox"/> Understanding (acknowledge)</p> <p><input type="checkbox"/> Answer</p>	<p>User:</p> <p>(all) ▼</p> <p>List</p>
---	--	---

{statement, acknowledge}  
mcpeblz (8:45:33 PM): Ok My diagram has B as a rather obtuse angle to match the bisect condition if that helps

{statement, acknowledge, answer}  
muratc79 (9:26:25 PM): OK guys I need to sign off now Our session is over Thank you once again for participating We will consider your input for our future service Take care



# Continuation of experiment 2.a

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- Usage of VMT coding scheme
- More speech acts

# VMT coding schema in XML

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```
□ <?xml version="1.0"?>
  <doc>
    <Turn Id="T0" Handle="" Time="08:10:48 am" Durat="" C-Thread=""
      Conversation="Nc" Social=""
      SysSupport="E" P-Thread="" PBSolving="" MathMove="" MathProgres="">
      You have just entered room "powow2."
    </Turn>
    <Turn Id="T1" Handle="" Time="08:14:16 am" Durat="12:03:28 am" C-
      Thread="" Conversation="Nc"
      Social="" SysSupport="E" P-Thread="" PBSolving="" MathMove=""
      MathProgres="">
      AVR has entered the room.
    </Turn>
    <Turn Id="T2" Handle="AVR" Time="08:14:18 am" Durat="12:00:02 am"
      C-Thread=""
      Conversation="S" Social="Gr" SysSupport="Cf" P-Thread="" PBSolving=""
      MathMove=""
      MathProgres="">
      hello
    </Turn>
```

# Bigram frequency

	Agre	Crit	Disa	Expl	Elab	Ext	Follo	Non	Offer	Reg	Resp	Req	Repa	Stat	Setu	p
Agree	0.00	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.11	0.11	0.11	0.11	0.11	0.11	0.11	
Critique	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.25	0.25	0.00	0.00	0.00	0.00	0.25	
Disagree	0.14	0.00	0.14	0.00	0.14	0.00	0.00	0.00	0.14	0.14	0.00	0.14	0.00	0.00	0.14	
Explain	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Elaborate	0.18	0.00	0.09	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.09	0.09	0.27	0.09	
Extend	0.05	0.00	0.05	0.10	0.00	0.00	0.05	0.00	0.05	0.10	0.15	0.10	0.00	0.15	0.15	
Follow	0.10	0.00	0.00	0.00	0.10	0.30	0.00	0.00	0.20	0.10	0.00	0.10	0.00	0.10	0.00	
No Code	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.63	0.00	0.00	0.13	0.00	0.00	0.19	0.00	
Offer	0.00	0.00	0.04	0.00	0.26	0.17	0.17	0.00	0.00	0.09	0.09	0.09	0.04	0.04	0.00	
Regulate	0.00	0.00	0.00	0.00	0.00	0.07	0.03	0.00	0.17	0.10	0.24	0.14	0.00	0.21	0.03	
Respond	0.00	0.02	0.00	0.00	0.00	0.05	0.00	0.02	0.05	0.19	0.23	0.09	0.00	0.19	0.16	
Request	0.00	0.00	0.11	0.00	0.00	0.28	0.06	0.06	0.00	0.06	0.28	0.00	0.00	0.06	0.11	
Repair	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.33	
State	0.02	0.02	0.00	0.00	0.00	0.05	0.00	0.05	0.05	0.16	0.16	0.05	0.00	0.36	0.09	
Setup	0.14	0.05	0.05	0.00	0.00	0.00	0.00	0.05	0.32	0.09	0.27	0.00	0.00	0.05	0.00	

# Trigram frequency

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	A	C	D	E	El	Et	F	Nc	O	Rg	Rp	Rq	Rt	S	Se
A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.50	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

# Conclusions - Results

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- ❑ Corpus of non-English native speaking pow chats
- ❑ Corpus of pow chats in Romanian
- ❑ Corpus of summaries of a pow chats + psychological profile  
<http://ie.hpc.pub.ro/teste/>
- ❑ Programs for partial automating coding

# Conclusions

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- Programs may partially automatically annotate pow chats with:
  - Adjacency pairs (e.g. agree/disagree)
  - Geometry, algebra (e.g. synonyms via WordNet of “triangle”)

using:

- Hidden Markov Models
- Heuristics
- Semantic distance
- LSA

# Similar work

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- Andreas Stolke et. al.

[www.colorado.edu/ling/jurafsky/ws97/CL-dialog.pdf](http://www.colorado.edu/ling/jurafsky/ws97/CL-dialog.pdf)

- Amy Soller

<http://sra.itc.it/people/soller>

# Problems

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- NLP ambiguity
- Shortcuts, idiom
- Discourse threading
- Context (CA...)
- Global problems:
  - Emotion
  - Sense of community
  - Atmosphere (irony, metaphors...)

# Research issues

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- Socio-emotional intelligence perspective
- Community sense
- Metaphors
- Hermenophorical tools
- Summarization