Articulating Action and Dialogue in Synchronous Collaborative environments: during interaction and aposteriori

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Starting points…

- **Initial Consideration:**

  "It is needed to articulate dialogue and action"

  in order to: focus the discourse, maintain coherence, ……., support reflection,….

- **Focus on Synchronous Collaborative Learning Systems**

- **Focus on Design examples**

Two Dimensions

Components of

a needed articulation

Dialogue-Task/Action in

Synchronous CSCL systems

Communication Tools

embedded/linked to

Action/Task Space

during interaction

Interaction Analysis tools

supporting Users

aposteriori

I. Embedded communication tools

⇨ **Parallel :** **the shared artifacts and the discussion tools are on entirely separate windows**

⇨ **Embedded:** **the communication tools are 'embedded' in the action space (shared artifacts)**

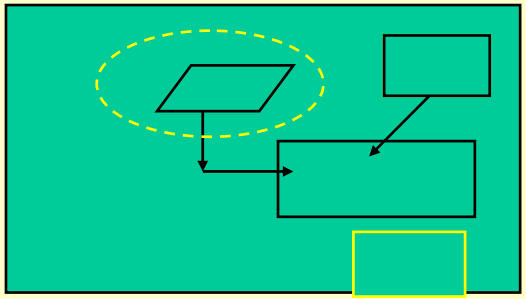
assuring coordination between the discourse and the artifacts of the shared workspace

{Suthers, 1999, Guzdial 1997, Wojahn, 1998}

↳ *Tools/Functions that contribute to the embedded approach*:

- **Annotation tools:** **e.g. sticky notes**
- **Drawings:** **enclosing a 'region'/'Gestural deixis'** *Suthers, 2003*
- **Highlighting:** **the parts on which users they discuss**

I. Embedded communication tools



[name1]: ok, I will do it
[name2] write on it
[name2] xxxx
[name1]xxxxx

discussion tools are on

action

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⇨ **These approaches** *pre-suppose that the actor has the control of the shared space (in case that there is a coordination protocol for the actors of the shared space)*

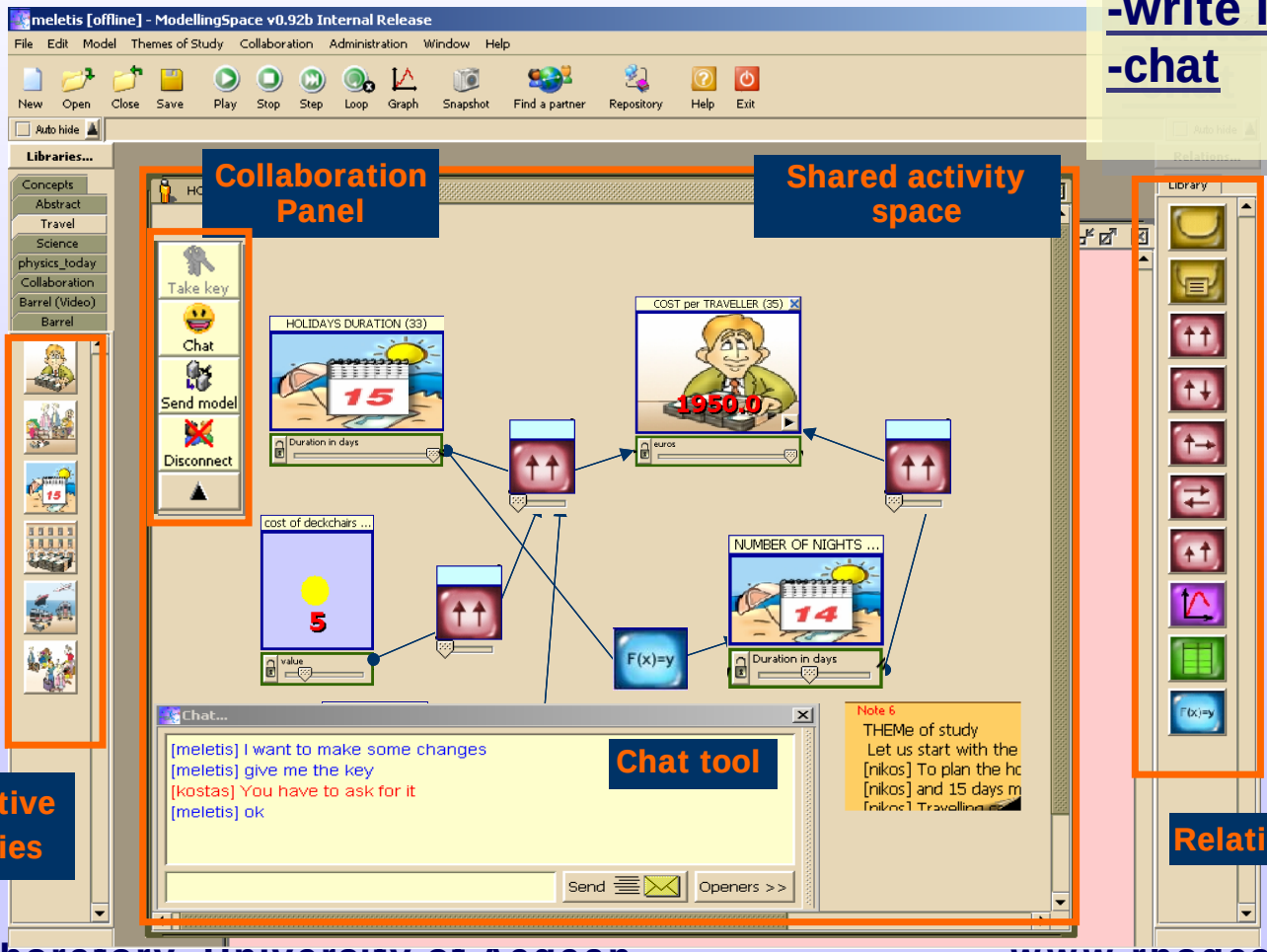
- *Tools/Functions that contribute to the embedded approach*:
  - **Annotation tools:** **e.g. sticky notes**
  - **Drawings:** **enclosing a 'region'/'Gestural deixis'** *Suthers, 2003*
  - **Highlighting:** **the parts on which users they discuss**

I. Embedded communication tools

- *Tools that contribute to the embedded*
  - **Annotation tools:** e.g. sticky notes

MS Write functions:

-write on the background
-write into a sticky note
-chat



I. Embedded communication tools

Approaches in ModellingSpace:

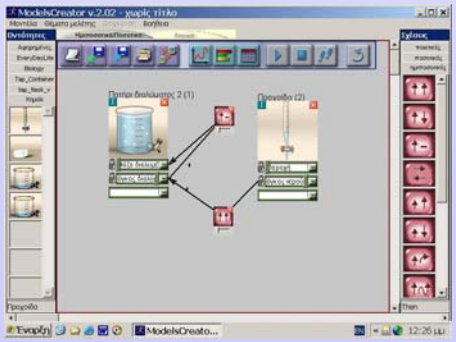
⇨ currently: embedded representations,

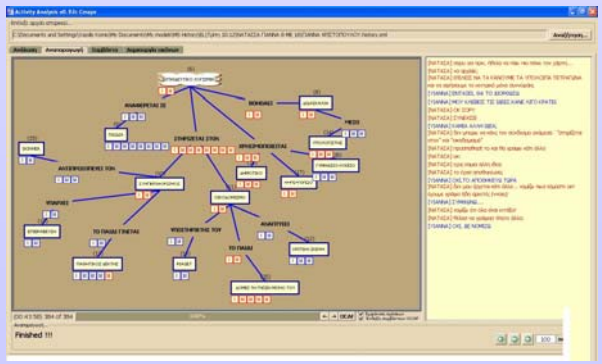
but not linked, during the activity

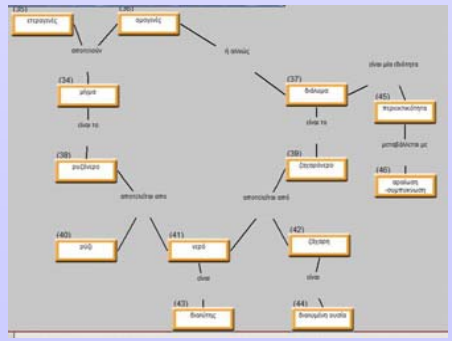
⇨ Informal case studies' results:

- **the embedded representations are mostly needed/necessary when users have an important number of 'entities'/objects to manipulate in the shared workspace**

- **Students do not use sticky notes only for deixis purposes, but also for other purposes (planning, clarification on a part of the model, humour, etc**







I. Embedded communication tools

- *Disadvantages to recover in case of embedded tools [1/2]:*
  - during the interaction [when annotations are used]
    - **the shared space/artifact becomes cluttered with comments**

Proposals:

(1) not clear positioning of comments

- - the annotation is linked to the 'object reference'/'anchor'

  & it is not just positioned near to the 'object'

(2) the space is occupied by the comments

- use open/close functions (of sticky notes)

I. Embedded communication tools

Disadvantages to recover in case of embedded tools (2/2):

⇨ during a short reflection process (*move the chat-slider*)

- **the record of discourse is fragmented across the artifact => 'drawback' of the functionality for students intended to reflect on (e.g. in case of sticky notes)**

Proposals to resolve the 'conflict':

- **Linked dialogue- action space allowing to switch between parallel and embedded : logical linkage between them**

(i) from shared space to chat (content & object dimension):

e.g. Inserting into the chat history, in a chronological order, the content of the sticky notes, with the info on the referred object

(ii) from chat to shared space (time dimension): going back to the previous utterances, the highlighting or the drawing is appearing to the shared space [it needs layers of events activated by the chat]

I. Embedded communication tools

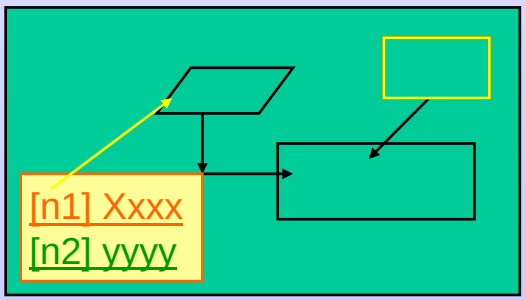
Dimensions

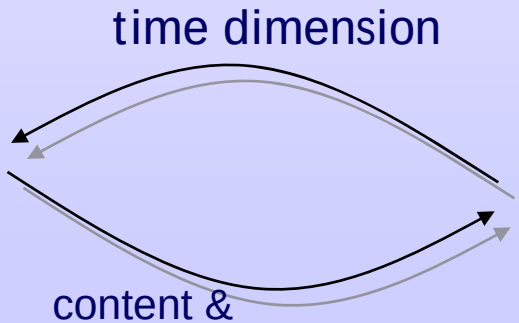
⇨ parallel spaces < - > embedded spaces

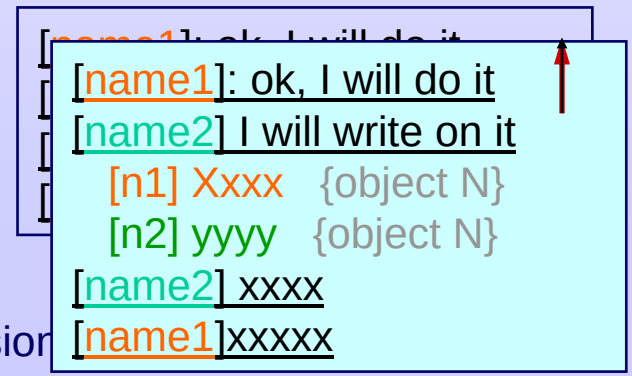
Linked embedded spaces

Allowing to switch between parallel and embedded spaces

⌧ To take into account two dimensions:







II.Interaction Analysis and articulation A-D

↳**Interaction Analysis based information**: provided to students in order to support: awareness, reflection, metacognitive mental activity, that could lead to the self-regulation of their collaborative activity.

II.Interaction Analysis and articulation A-D

⌦ *Articulating A-D, in order to support, reflection & metacognition, through Interaction Analysis Tools*

↳The articulation of action and dialogue in the frame of Interaction Analysis is an actual challenge, for the designers dealing with Interaction Analysis, either it is addressed to students, or to teachers and/or researchers.

↳It seems that in most of the cases (?) a significant articulation is needed more for teachers and researchers than for students that were the actors of a collaborative process.

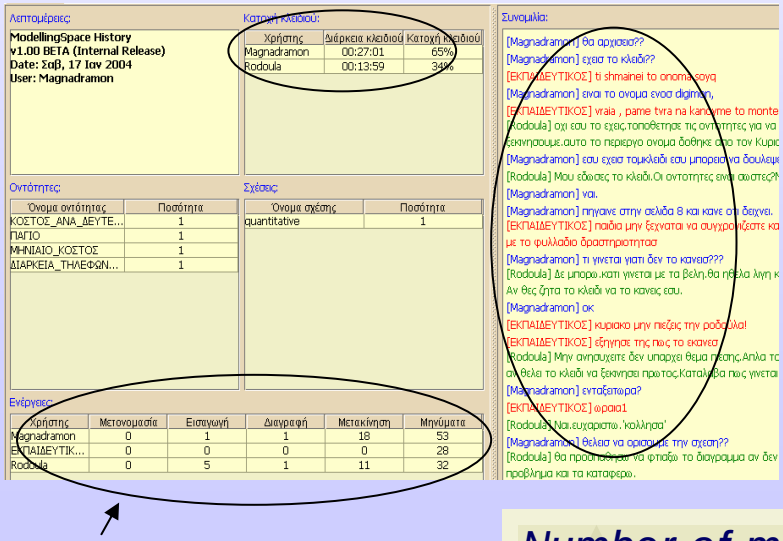
II.Interaction Analysis and articulation A-D

- Most of the interaction analysis tools or substantial indicators provide a kind of *parallel quantitative comparison* among dialogue messages and actions

Examples:

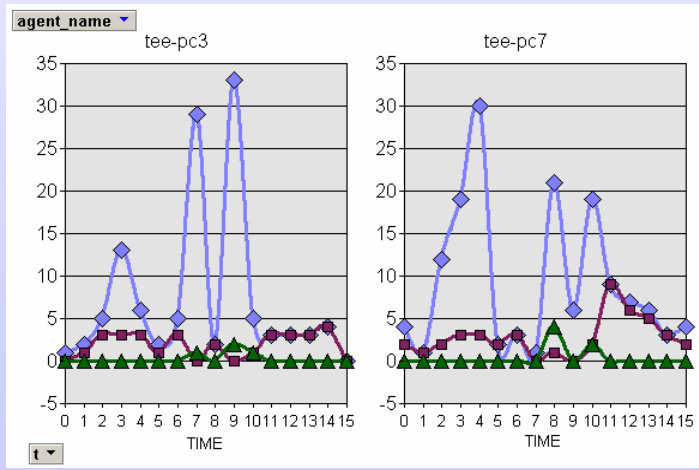
{*from ModellingSpace Interaction Analysis Tools*}

QUANTITATIVE OVERVIEW



Number of messages
Number of actions

COLLABORATIVE ACTIVITY FUNCTION

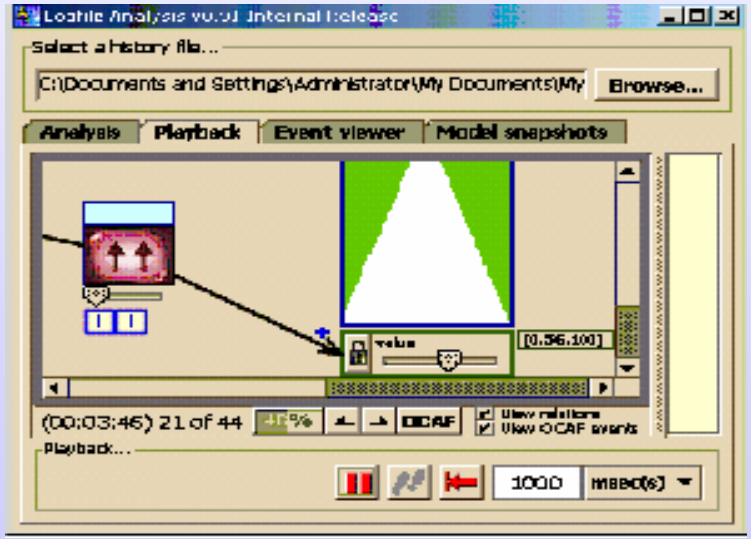


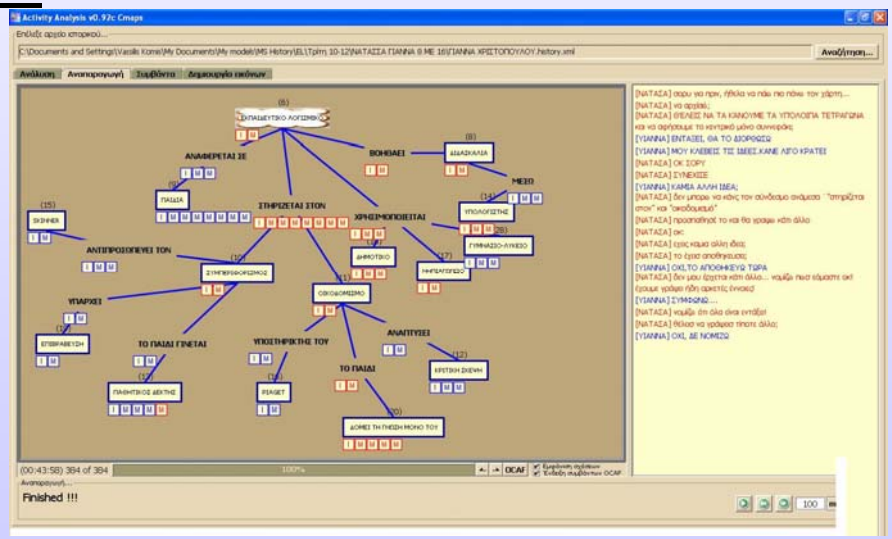
II.Interaction Analysis and articulation A-D

- "Linear Process" Memory Support:
  Chronological presentation of the process [playback]
  => Parallel presentation of actions and dialogue

Example: {*from ModellingSpace Interaction Analysis Tools*}

PLAYBACK





Results: It does not support students to identify 'critical moments' of solution/argumentation process or collaboration process

II.Interaction Analysis and articulation A-D

- In order to get sense of the collaborative process there is a need to:

(i) History(Playback): Divide the chronological process in episodes:

Clearly, identify the parts of the dialogue referring to each specific "state" of the artefact into the shared workspace

(e.g. COPRET tool, *Petrou & Dimitracopoulou, 2004*)

and/or

(ii) Apply a unified analysis of both dialogue and actions: related to the collaborative process and product, in order to analyze and evaluate collaborative activities

(e.g. OCAF framework, *Avouris, Dimitracopoulou, Komis, 2003*)

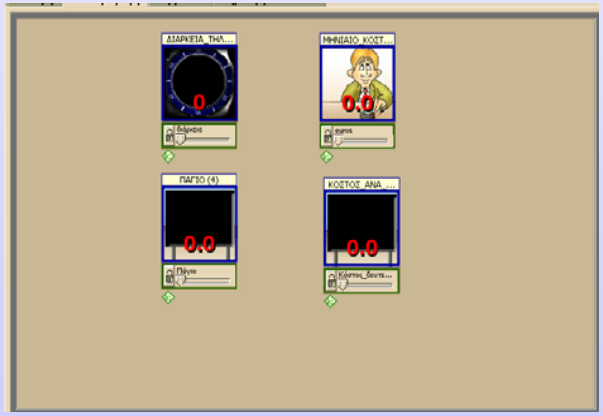
II.Interaction Analysis and articulation A-D

↳**1. Episodes based** Articulation of Dual Spaces (aposteriori): Instead of a parallel articulation, provide a clear identification of the parts of the dialogue referring to each specific state of the artefact into the shared workspace (COPRET tool)

Divide the process in episodes according to event based criteria:

Collaboration Progress Reproduction Tool

[00:06:23][Kyriakos] What's going on? Why you are doing nothing?
[00:07:18][Rodoula] I can't put the relationship, I would like some guidance. If you want ask for the key and do it.
[00:07:26][Kyriakos] ok
[KYRIAKOS TOOK THE KEY].
[00:07:38][Teacher] Kyriako please, don't push Rodoula!



II.Interaction Analysis and articulation A-D

↳**1. Episodes based** Articulation of Dual Spaces (aposteriori): Instead of a parallel artic
dialogue ref
shared work

Divide the

Divide the whole session, in episodes

[according to: each actor interventions' episodes, chat messages episodes per actor, significant modifications of the shared space (object inserted/deleted, etc.]

Collaboration Progress Reproduction Tool

[00:06:23][Kyriakos] What's going on? Why you are doing nothing?
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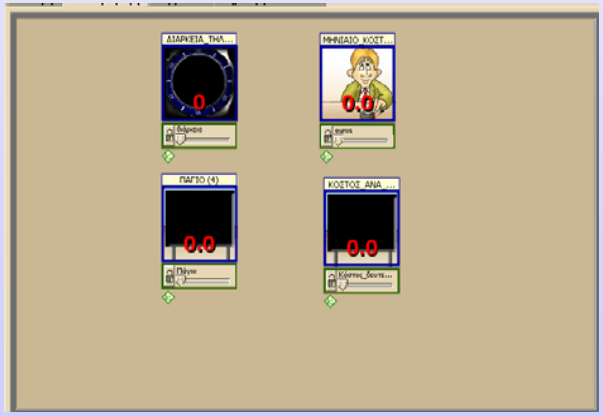
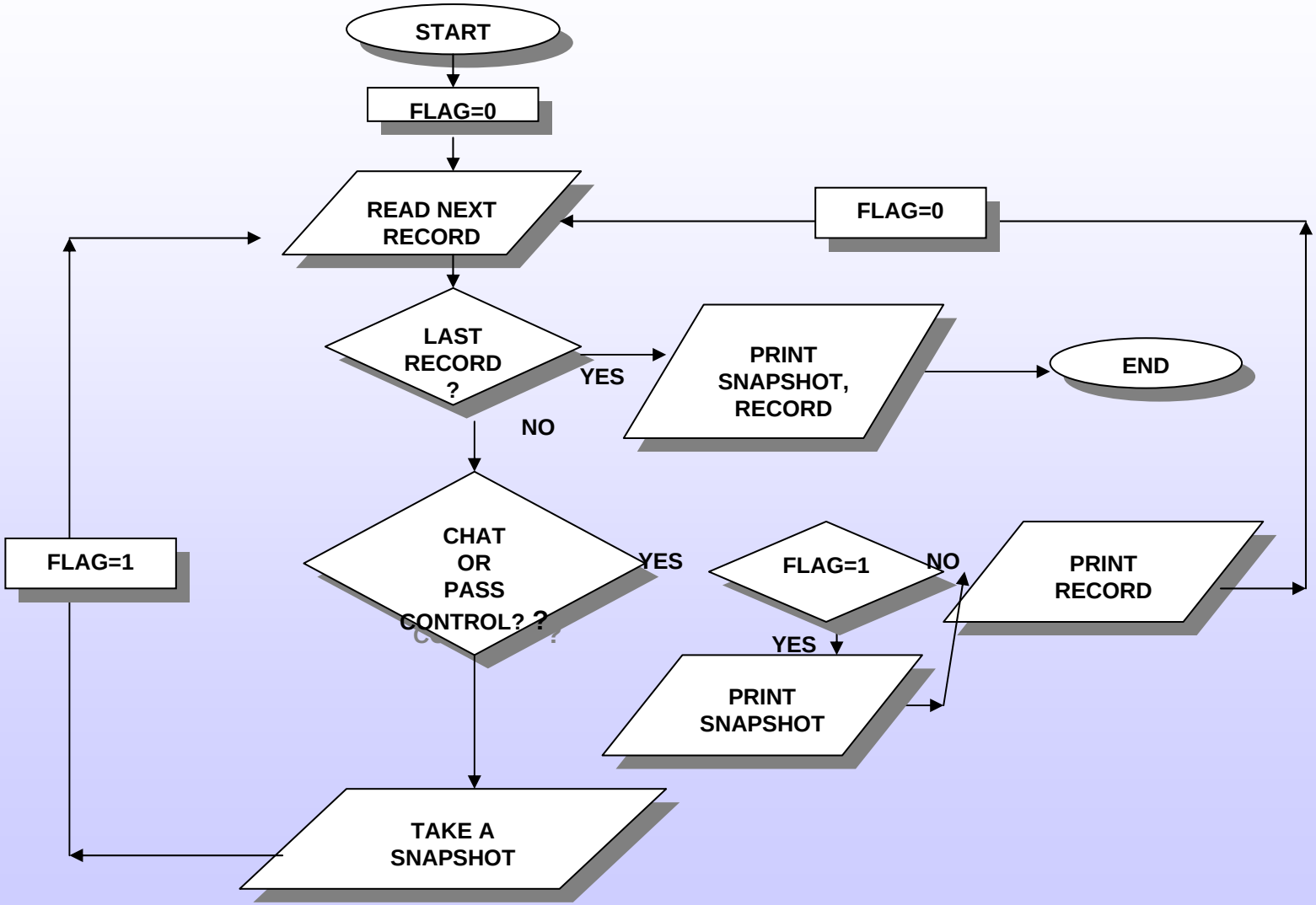


II.Interaction Analysis and articulation A-D



II.Interaction Analysis and articulation A-D

↳**2.** Apply a unified analysis and interpretation of both dialogue and actions related to the collaborative process and product, in order to analyze and evaluate collaborative activities

(e.g. *OCAF framework…..Avouris, Dimitracopoulou, Komis, 2003*)

II.Interaction Analysis and articulation A-D

Functional roles of human agents actions & utterances

ID	Functional Role	Derived from :	Example
I =	Insertion of the item in the shared space	*action analysis*	*Action:* 'Insertion' of Entity "Velo"
P=	Proposal of an item or proposal of a state of an item	*dialogue analysis*	*Message:* "I believe that one entity is the firm 'ABC'" or "let us put the value of entity flow to state *locked*"
C=	Contestation of the proposal	*dialogue analysis*	*Message: I think that this should be linked to the entity B by the "analogue to" relation*
R=	Rejection / refutation of the proposal	*action and/or dialogue analysis*	*Message:* "What their attributes will be ? I don't agree". Or *Action:* 'Delete' Entity "Velo"
X=	Acknowledgement/ acceptance of the proposal	*Action and / or dialogue analysis*	*Message:* "That's right" *or* *Action: Insertion of* a proposed enitity
M=	Modification of the initial proposal	*action & dialogue analyses*	*Message:* I suggest we put the state to "unlock" *Action:* "Modify"
A=	Argumentation on proposal	*dialogue analysis*	*Message:* "I believe that I am right because this is …"
T=	Test/Verify using tools or other means of an object or a construct (model)	*actions & dialogue analyses*	*Message:* Let us run this model to observe this part of the model behavior *Action:* Activate 'Graph Tool' , or 'Barchart Tool''

II.Interaction Analysis and articulation A-D

⌦ *Two main considerations for OCAF*

{Object Oriented Collaborative Analysis Framework}

⇨ **Object oriented view of collaborating actors' roles and contributions**

⇨ **Unified and coordinated analysis of dialogues and actions on objects**

'Object-oriented Collaboration Analysis Framework" (OCAF)

OCAF's corresponding analytic model identifies patterns of interaction and relates them to objects of the shared solution.

II.Interaction Analysis and articulation A-D

⊠ *Two main considerations for OCAF*

{Object Oriented Collaborative Analysis Framework}

⇨ **Object oriented view of collaborating actors' roles and contributions**

From a sequential analysis based on humans agents =>

Shift the center of attention to the 'objects' of the provided solution

⇨

Mutual understanding takes place via a combination of perception of graphical actions and communication,

specially for highly conceptual problem solving activities

OCAF's corresponding analytic model identifies patterns of interaction and relates them to objects of the shared solution.

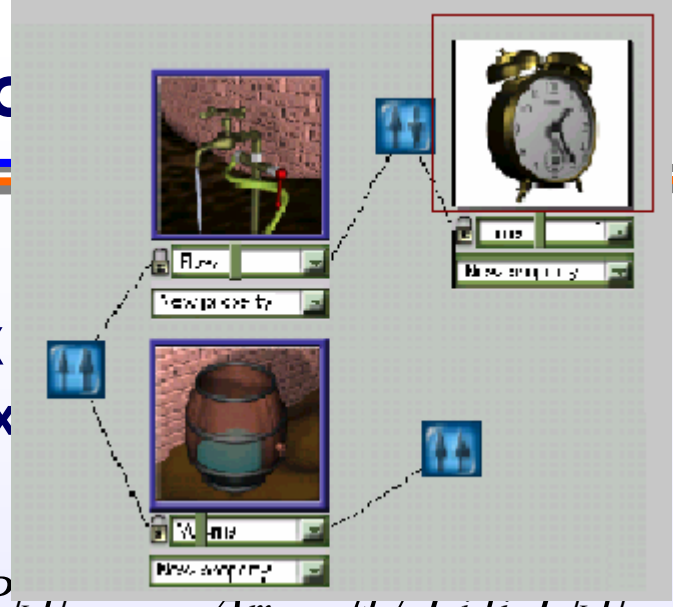
II.Interaction Analysis and articulation A-D

- Let a given Solution S of a problem X be: S(X) = { E_i , R_j, A_m,}
- OCAF model will be formalized in textual form:

$$M(S) = \{ E_i * \tau i / P_i f_j, P_k f_l, \ldots R_j * \tau i / P_i f_j, P_k f_l, \ldots, A_m * \tau i / P_i f_j, P_k f_l, \ldots$$
$$-E_i * \tau i / P_i f_j, P_k f_l, \ldots, -R_j * \tau i / P_i f_j, P_k f_l, \ldots, -A_m * \tau i / P_i f_j, P_k f_l, \ldots \}$$

- E, R, A, are the basic constructs -entities, relations and attributes or properties- of the final solution
- -E, -R, -A, are objects discussed but not appearing in the final solution
- τ_i is an index of the item in the timeline of the prob. solving process
- P_i f_j represents the human agent Pi (student, teacher) and his/her functional role f_j To each item a sequence of P_i f_j is associated.

II.Interaction Analysis and



- Let a given Solution S of a problem X
- OCAF model will be formalized in tex

$$M(S) = \{ E_i \ * \tau i / P_i f_j, P_k f_l, \ldots R_j \ * \tau i / P_i f_j, P_k f_l, \ldots, \ldots$$

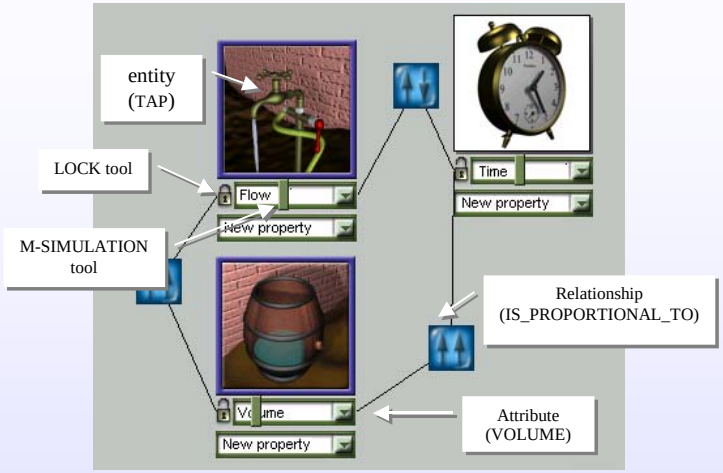
$$-E_i \ * \tau i / P_i f_j, P_k f_l, \ldots, -R_j \ * \tau i / P_i f_j$$

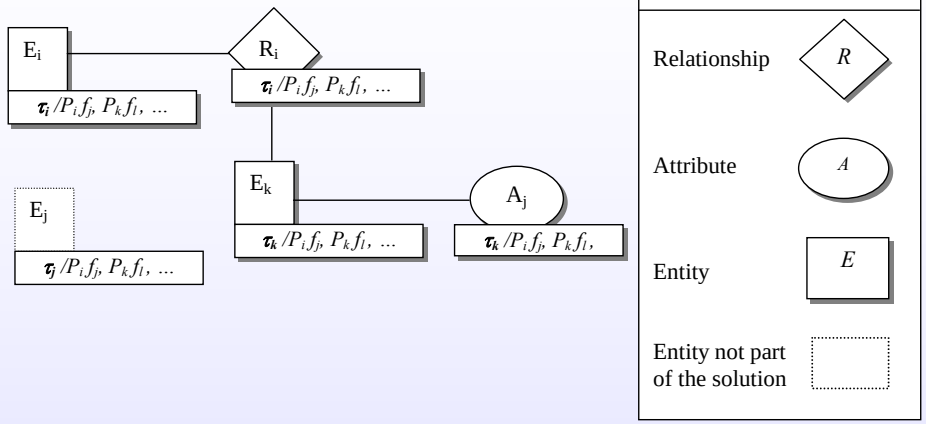
- E, R, A, are the basic constructs -enti properties- of the final solution
- -E, -R, -A, are objects discussed but n
- τ_i is an index of the item in the time
- P_i f_j represents the human agent P functional role f_j To each item a

[E (Clock)]=6*A_P B_M A_I

indicates that the Entity 'Clock' has been produced from interaction of Agents A and B. Agent A made the initial proposal (A_P), which was modified subsequently by Agent B (B_M), finally Agent A inserted the object in the shared Activity space (A_I).

II.Interaction Analysis and articulation A-D





$$M(S)= \{ E_i * \tau i /P_i f_j, P_k f_l, \ldots R_j * \tau i / P_i f_j, P_k f_l, \ldots, A_m * \tau i / P_i f_j, P_k f_l, \ldots;$$
$$-E_i * \tau i / P_i f_j, P_k f_l, \ldots, -R_j * \tau i / P_i f_j, P_k f_l, \ldots, -A_m * \tau i / P_i f_j, P_k f_l, \ldots \}$$

$M= \{$

Entities $E\,(TAP) = 2/A_I A_C F_C B_X A_X$

$E\,(BARREL) = 1/A_I$

$E\,(CLOCK) = 6/B_P A_X A_I$

Attributes $A(TAP.flow) = 4/A_P A_I F_{P=T} B_{P=T} A_{T=LOCK} A_P A_{T=LOCK} A_{T=M\text{-}SIMULATION}$

$A(BARREL.watervolume) = 5/B_P A_I A_A B_A A_A$

$A(CLOCK.time) = 7/A_P A_I A_A B_{P=T} A_{T=LOCK} A_{T=M\text{-}SIMULATION}$

Relationships $R\,(FLOW_{(tap)}$ -**Proportional- to** $\text{-}WATERVOLUME_{(barrel)} = 11/A_P A_P A_I F_{P=T} A_{T=BARCHART} A_A B_A$

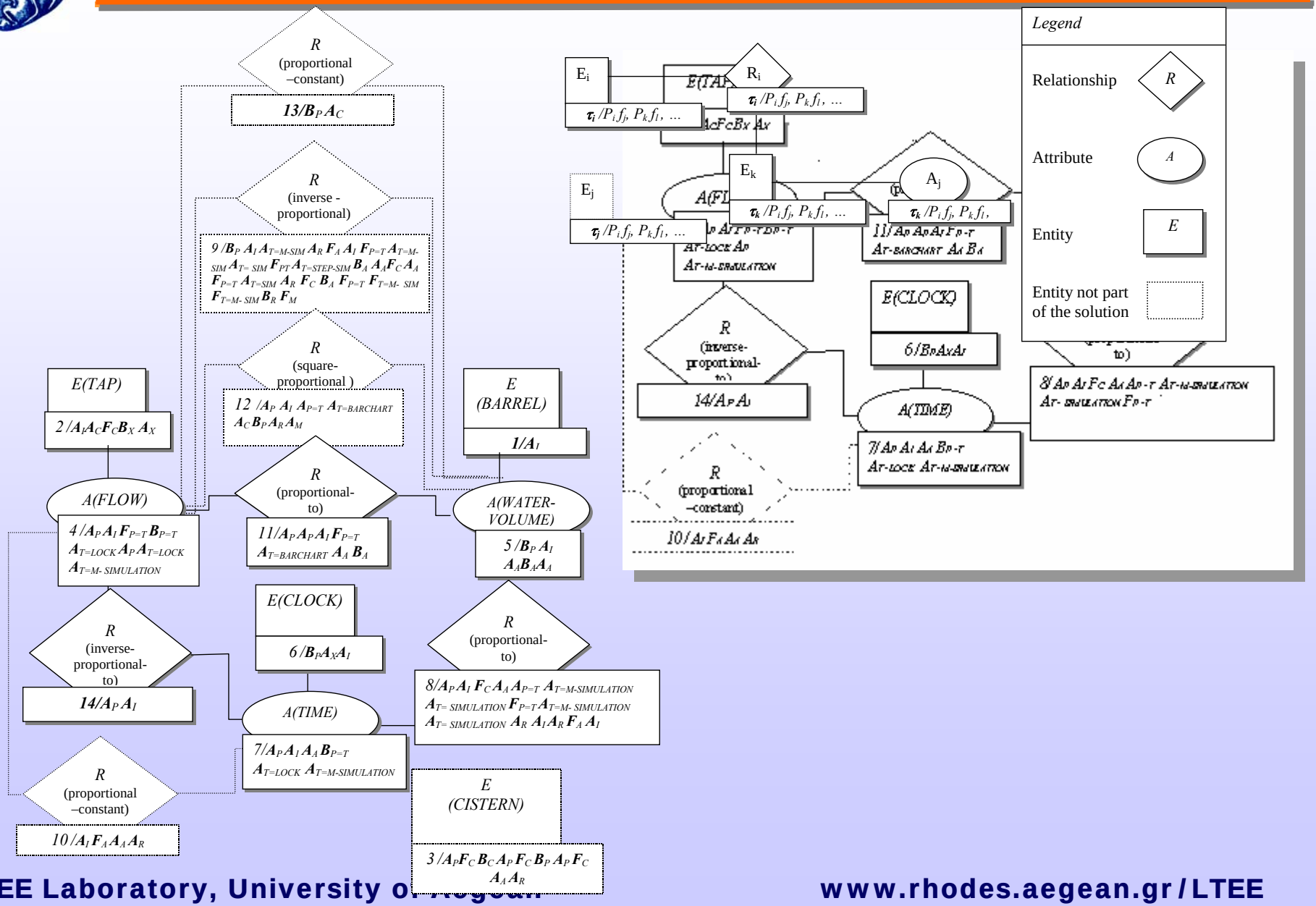
$R\,(FLOW_{(tap)}$ **–Inverse –Proportional- to** $– TIME_{(clock)} = 14/A_P A_I$

$R\,(WATERVOLUME_{(barrel)}$ –Proportional- to $\text{-}TIME_{(clock)}) = 8/A_P A_I F_C A_A A_{P=T} A_{T=M\text{-}SIMULATION} A_{T=SIMULATION} F_{P=T} A_{T=M\text{-}SIMULATION} A_{T=SIMULATION} A_R A_I A_R F_A A_I$

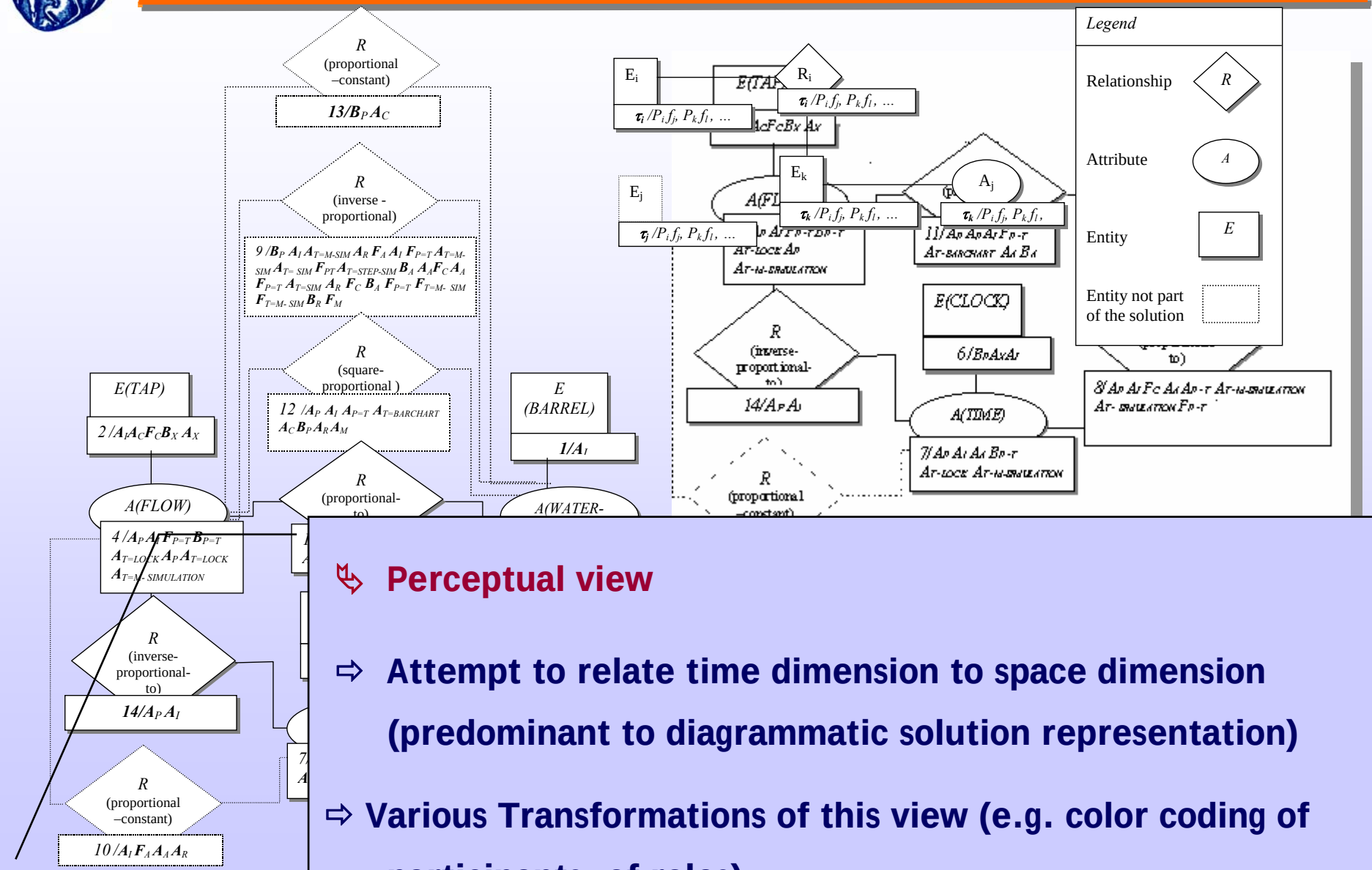
Items proposed and not inserted or finally rejected are:

- $E\,(cistern) = 3/A_P F_C B_C A_P F_C B_P A_P F_C A_A A_R$
- $R\,(FLOW_{(tap)}$ –**Inverse - Proportional- to** $\text{- }WATERVOLUME_{(barrel)}) = 9/B_P A_I A_{T=M\text{-}SIMULATION} A_R F_A A_I F_{P=T} A_{T=M\text{-}SIMULATION} A_{T=SIMULATION} F_{PT} A_{T=STEP\text{-}SIMULATION} B_A$
  $F_{P=T} A_{T=SIMULATION} A_R F_C B_A F_{P=T} F_{T=M\text{-}SIMULATION} F_{T=M\text{-}SIMULATION} B_R F_M$
- $R\,(FLOW_{(tap)}$ –**Proportional-constant - to** $– TIME_{(clock)}) = 10/A_I F_A A_A A_R$
- $R\,(FLOW_{(tap)}$ –**Proportional-square-to** $– WATERVOLUME_{(barrel)}) = 12/A_P A_I A_{P=T} A_{T=BARCHART} A_C B_P A_R A_M$
- $R\,(FLOW_{(tap)}$ –**Proportional-constant - to** $– WATERVOLUME_{(barrel)}) = 13/B_P A_C$ $\}$

II.Interaction Analysis and articulation A-D



II.Interaction Analysis and articulation A-D



- **Perceptual view**
- **Attempt to relate time dimension to space dimension (predominant to diagrammatic solution representation)**
- **Various Transformations of this view (e.g. color coding of participants, of roles)**

II.Interaction Analysis and articulation A-D

⌦ *Collaboration modes adopted (information derived from queries)*

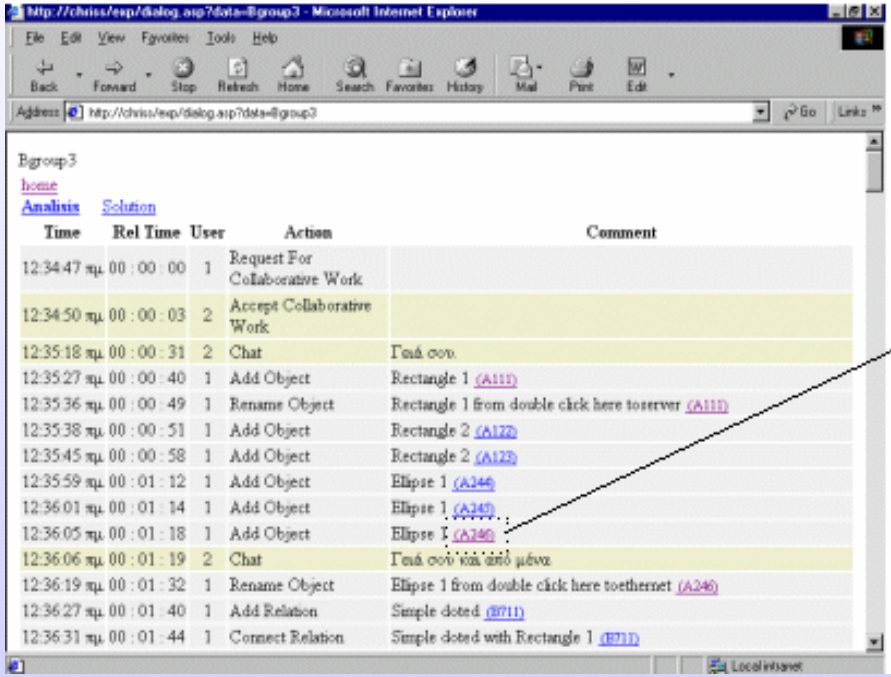
⇨ **Degree of participation (distribution of solution items per member)**
(e.g. distribution of items proposals (I,P):A=4 (20%) B=16 (80%)

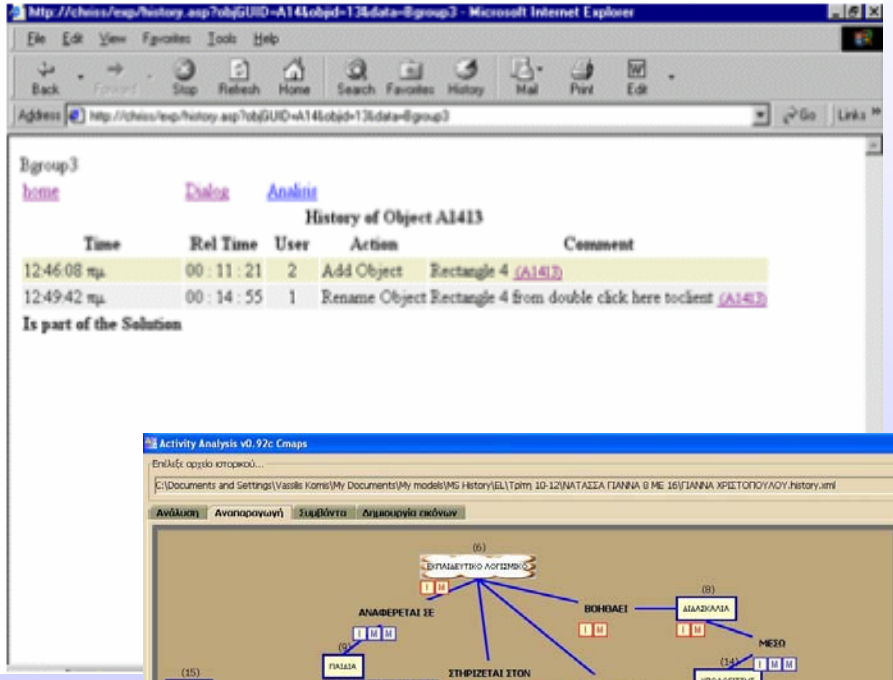
⇨ **Contribution of group members (determination of members' roles)**
(e.g. 'A' takes stronger action roles "Insertion"or 'Modification' while 'B' takes stronger verbal roles 'Argumentation, 'Contestation'

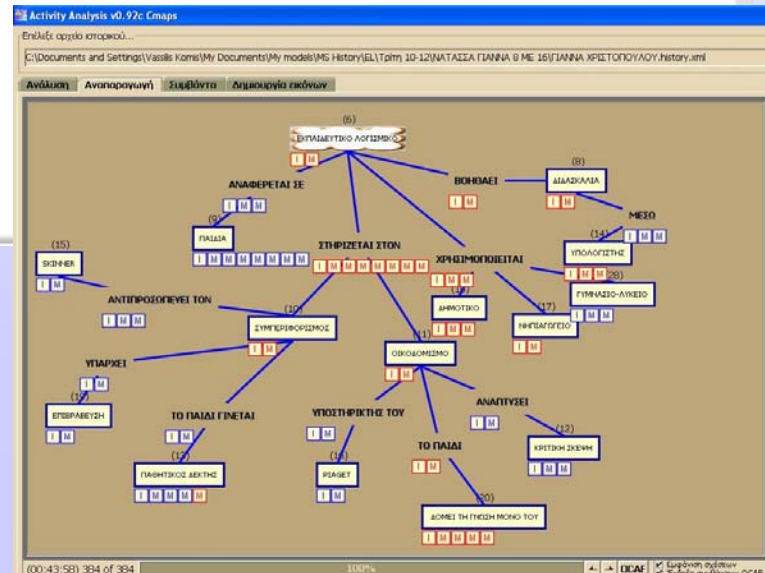
⇨ **Identification of Interaction patterns**
(e.g. (A_I, B_C, $A_{M,}$) or ($A_{T\{M\text{-}Simulation\}}$, $B_{\{RUN\}}$, $A_{M,}$))

II.Interaction Analysis and articulation A-D

Tools supporting OCAF models and further analysis







=> ....

Articulating Dialogue and Action:

During the interaction: basic interface

- embedded spaces

- embedded and linked spaces

- *Time Dimension*
- *Space & Content dimension*
- Direct *Links but also 'meaning' based links*

Afterwards Interaction:

- *Sequentional: Main episodes based articulations*
- *Multiple viewpoints: e.g. object oriented ones*