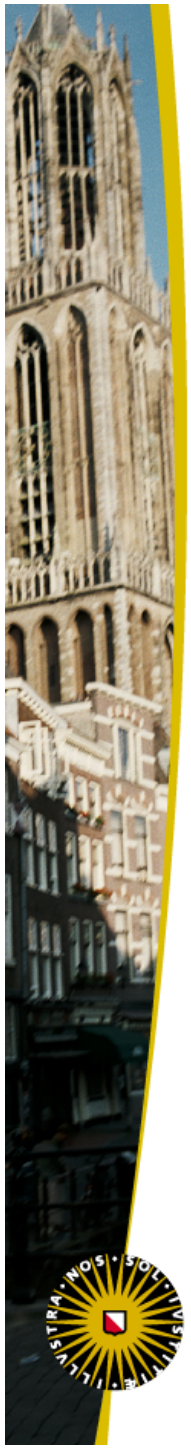


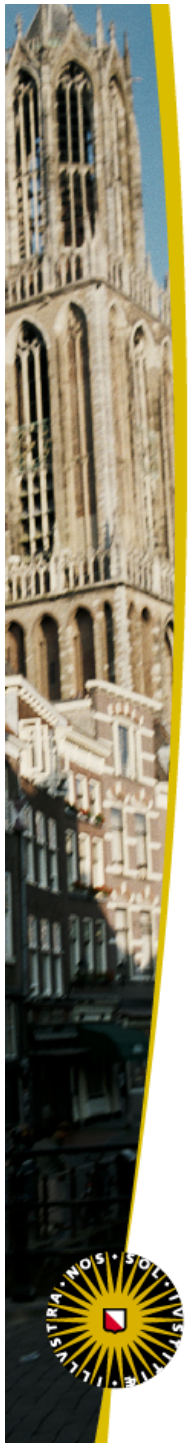
Automated Argumentation Analysis

Gijsbert Erkens

Department of Education
Utrecht University

April 15
Naples, webinar

Universiteit Utrecht



2. Setup of the webinar

1. Communicative markers in collaboration dialogues:
    1. Discourse markers
    2. Content markers
2. Automatic coding of communicative markers
3. Dialogue acts & argumentation
4. Reliability & validity in automatic coding
5. Use of automatic coding:
    1. Analysis
    2. Assessment
    3. (online) Feedback

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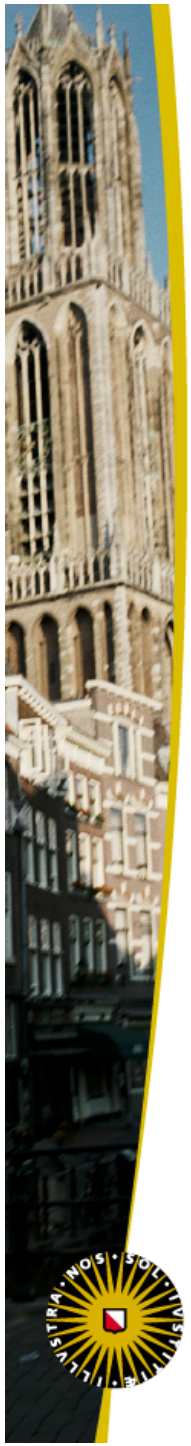
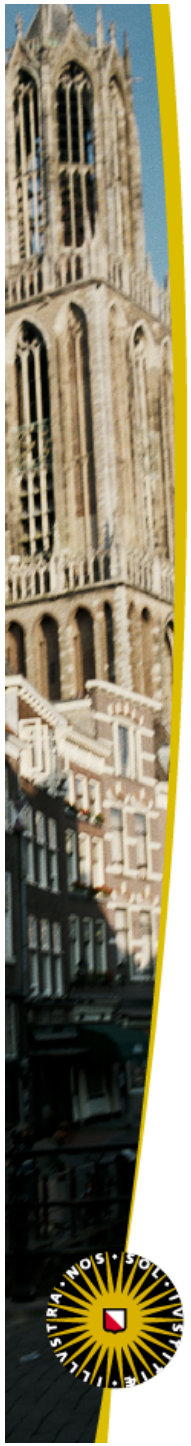


3. Communicative markers in dialogues

Discussion:

- How would you analyze the collaboration dialogue fragment on the next slide?
    - What is happening?
    - What is relevant for collaboration?
    - How is the process of collaboration?
    - Style of collaboration?
    - Etc.



4. Dialogue fragment (chat)

- 3 girls, history essay writing : "Strong women in Antiquity" (sources about Andromache, Electra, etc., & interviews with nowadays 'strong' women).

  They are working on sub question 1b: What did the 'strong' woman do?.

- 504: I didn't really find deeds, I have told about her dilemma
- 505: Oh, well…
- 506: No, I didn't either. But, would you guys please check what I have written? Because, maybe I'm fully wrong or whatever,..
- 505: No, girl, of course not
- 504: It is probably okay
- 505: I'll read it now
- 506: Ok, thnx
- 505: You did fine
- 504: It is good, I think. But, sorry to say so, first you write Hector with a c and later with a k!
- 506: Oops! I'll change the k!
- 506: But I think her deeds and her role in society are almost the same as far as I can describe it.
- 505: Yes, well we say: see also sub question 1d or something like that.
- 506: Yeah, okay

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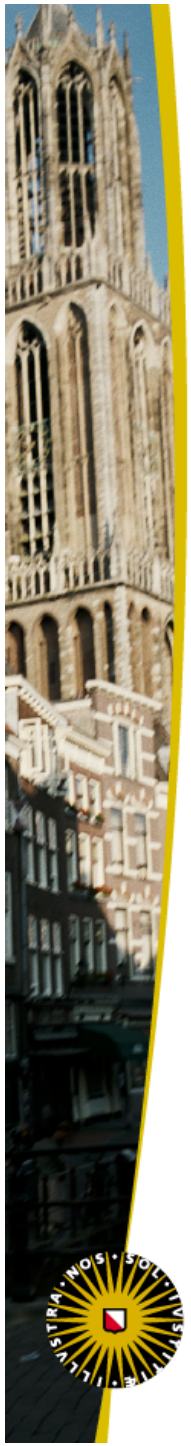


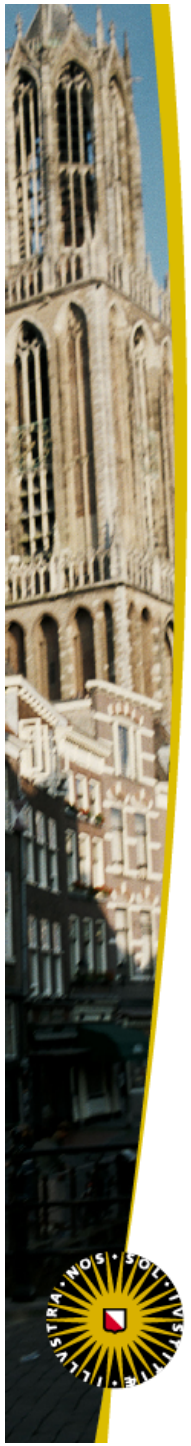
5. Coordination tasks in collaboration

On different layers:

- **Task content** (approach, strategy, knowledge)
- **Collaboration** (task division, negotiation, integration)
- **Communication** (understanding, grounding)
- **Social-relation** (sharing, communality)
- **Motivation** (persistence, interest)
- **Emotion** (frustration, coping)

Students coordinate and solve coordination problems on these different layers in a direct or a meta-cognitive way.

The coordination platform is the dialogue and multifunctionality of speech makes it possible.



6. Discourse and content markers

- **Task content** — content concepts; uncertainty (sort of, I think, etc.)
- **Collaboration** — task division (we should, you do, etc.); argumentation (dialogue acts)
- **Communication** — understanding (what? do you mean..)
- **Social-relation** — personal (I, me, you, your, we, our)
- **Motivation** — interest (boring, stupid, difficult)
- **Emotion** — frustration (smileys, exclamation marks)

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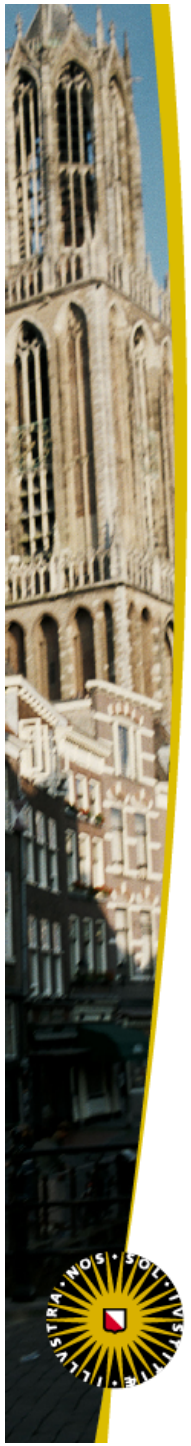

7. Automatic coding of communicative markers

- Two approaches on automatic coding:
  - Knowledge free (data mining, pattern mining)
  - Knowledge based (finding predefined patterns)

Discussion:

- Advantages & disadvantages of automatic coding?
- Advantages & disadvantages of both approaches ?

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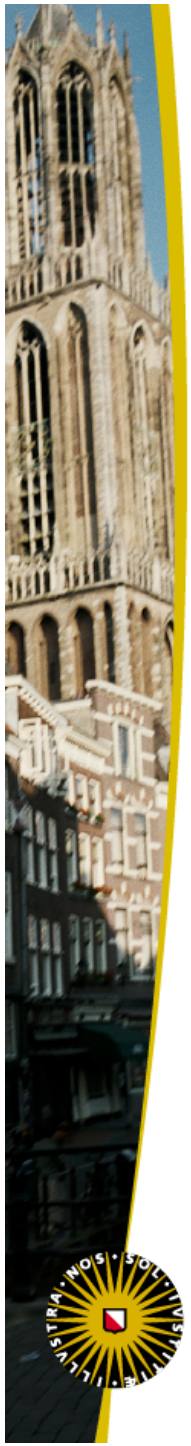
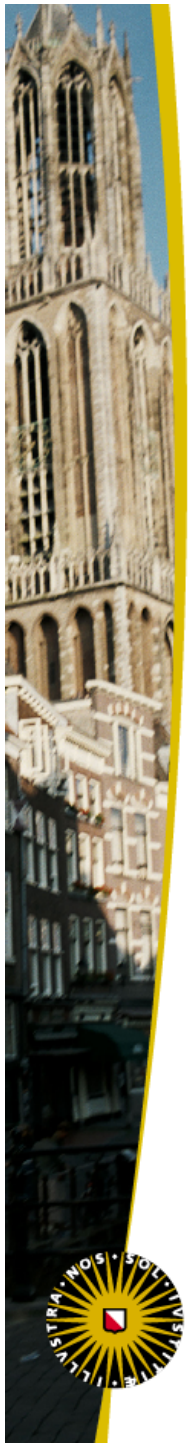


8. Analysis of collaboration dialogue protocols

- Qualitative, interpretative analysis of relevant phenomena & categories in the protocols
  - Necessary, but
  - Problem of subjectivity
  - Problem of biased searching,
- Development of systematic coding system
  - Problem of unit of coding, segmentation problem
  - Exhaustive, exclusive and independent coding
  - Reliability (interrater agreement, Cohen's kappa)
  - Validity problems (seldom addressed)
- Coding of protocols
  - Problem of robustness
  - Problem of reliability (stability)
  - Problem of tediousness, labor intensiveness

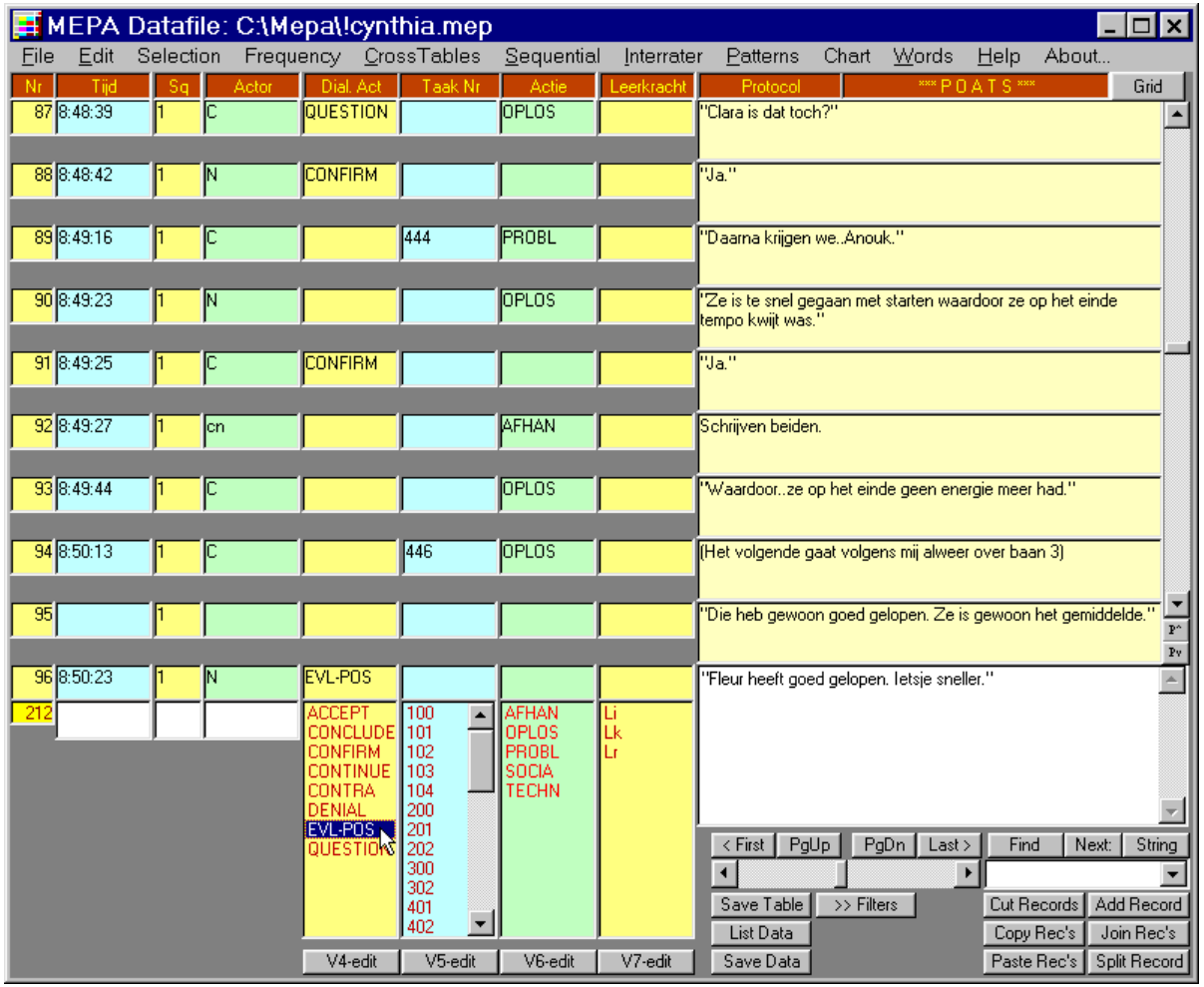


9. Automatic coding of communicative function

Assumptions:

- Every utterance has a communicative function, fulfills a pragmatic action (Taylor, 1990)
  - i.e. Searle (1969) Speech acts: Assertives, Directives, Commissives, Expressives, Declarations
- The communicative, pragmatic function of utterances are being signaled by language users by explicit 'discourse markers' (Schiffrin, 1987)
  - 'Oh', 'By the way,', 'Well', 'However,', So,'
- Discourse markers are used to support the coherence in discourse: they signal how the utterance should be interpreted in the context of the ongoing discourse.

10. MEPA, Multiple Episode Protocol Analysis



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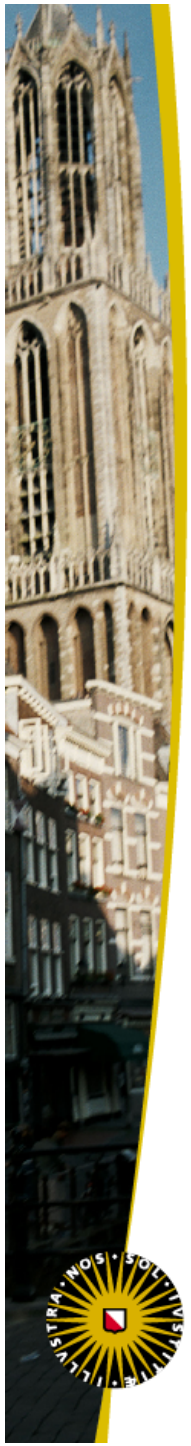
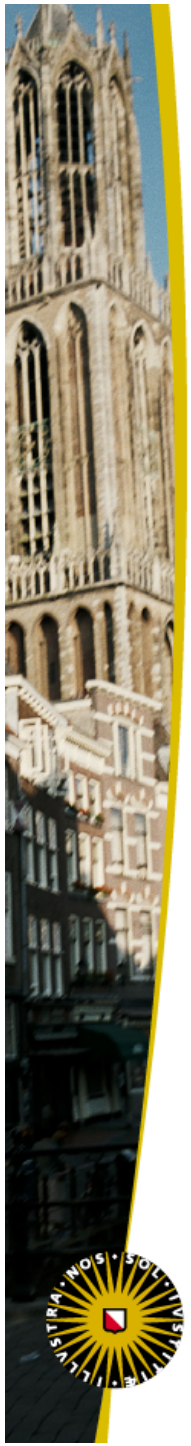


11. MEPA

- Protocol scripting, annotation & coding
- Dialogues, discussions or (inter)actions
    - dynamic verbal or nonverbal data
- Qualitative & statistical online analysis
    - Frequency, cross table, interrater, lag sequential, sorting, visual chart, word concordance, etc.
- Multidimensional / hierarchical
- Flexible, explorative environment
- (Semi)-automatic coding

- Free to use: G.Erkens@uu.nl



Dialogue acts and argumentation

- Communicative, pragmatic functions of dialogue utterances
  - **Argumentatives** **(convincing the other)**
  - **Informatives** **(information transfer to other)**
  - **Responsives** **(reacting to the other)**
  - **Elicitatives** **(eliciting reaction from other)**
  - **Imperatives** **(commanding the other)**

Discussion:

- Is every argumentative discourse marker (e.g. but, because) really meant to convince the other?

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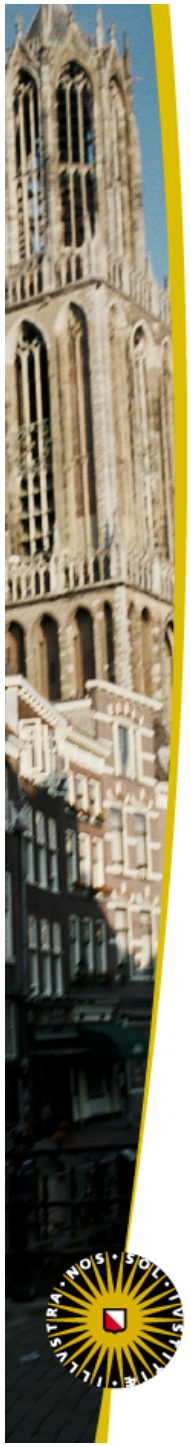
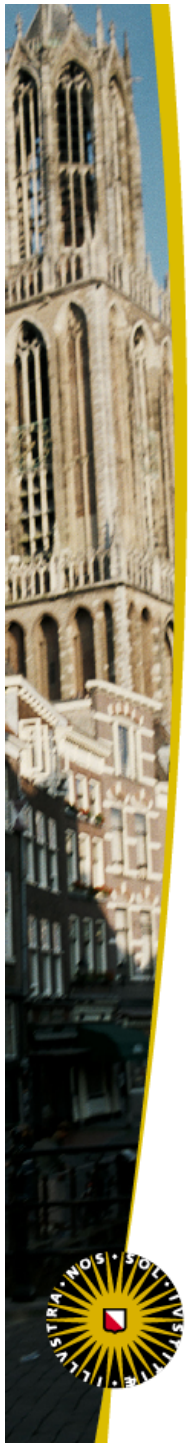


13. Dialogue Act Coding

Communicative function	Dialogue act	Specification	Code	Description	Discourse marker, i.e.
Argumentatives	Reason		ArgRsn	Reason, ground	"Because …"
	Contra		ArgCnt	Counterargument	"However, …"
Reasoning	Conditional		ArgCon	Condition	"If …"
	Then		ArgThn	Consequence	"Then …"
	Disjunctive		ArgDis	Disjunctive	"Or …"
	Conclusion		ArgCcl	Conclusion	"So, …"
	Elaboration		ArgEla	Continuation	"Furthermore, …"
Responsives	Confirmation		ResCfm	Confirmation of info	"Right"
	Deny		ResDen	Refutation of info	"No"
Reaction, or response to an utterance	Acceptation		ResAcc	Acceptance of info	"Oh"
	Reply	Confirm	ResRplCfm	Affirmative reply	"Sure"
		Deny	ResRplDen	Negative reply	"No way"
	to an elicitative	Accept	ResRplAcc	Accepting reply	"Okay"
		Statement	ResRplStm	Statement reply	" …"
		Performative	ResRplPer	Performative reply	"Thanks"



14. Dialogue Act Coding

Communicative function	Dialogue act	Specification	Code	Description	Discourse marker, i.e.
Informatives	Performative		InfPer	Action performed by saying it	"Hello"
Transfer of information	Evaluation	Neutral	InfEvlNeu	Neutral evaluation	"…easy …"
		Positive	InfEvlPos	Positive evaluation	"Nice!"
		Negative	InfEvlNeg	Negative evaluation	"Awful …"
	Statement		InfStm	Task information	" …"
		Action	InfStmAct	Announcement of actions	"I'll do …"
		Social	InfStmSoc	Social statement	"Love you …"
		Nonsense	InfStmNon	Nonsense statement	"grrumppphh"
Elicitatives	Question	Verify	EliQstVer	Yes/no question	"Agree?"
Utterances requiring a response		Set	EliQstSet	Set question/ multiple choice	"…. or….?"
		Open	EliQstOpn	Open question	"Why?"
	Proposal	Action	EliPrpAct	Proposal for action	"Let's change …"
Imperatives ***Commanding utterances***		Action	ImpAct	Order for action	"W8!"
		Focus	ImpFoc	Order for attention	"Watch!"

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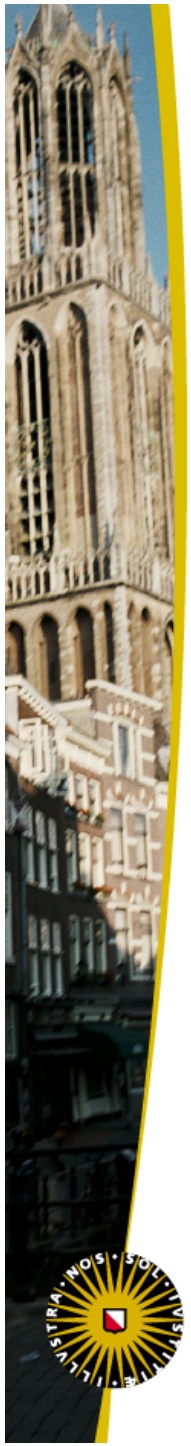

15. Automatic coding of dialogue acts in chats

- Segmentation filter (SEG filter): 300 production rules
  - punctuation characters (i.e. '?','!', '.')
  - connectives ('however,', 'so,', 'but')
  - starting discourse markers ('well', 'on the other hand')
  - Exception or restriction rules
  - Splitting in messages before or after marker

- Dialogue Act Coding (DAC filter): 1250 production rules
  - Coding messages on discourse markers of communicative, pragmatic function
  - InfStm? as default catch-all

  - **29 Dialogue Acts**

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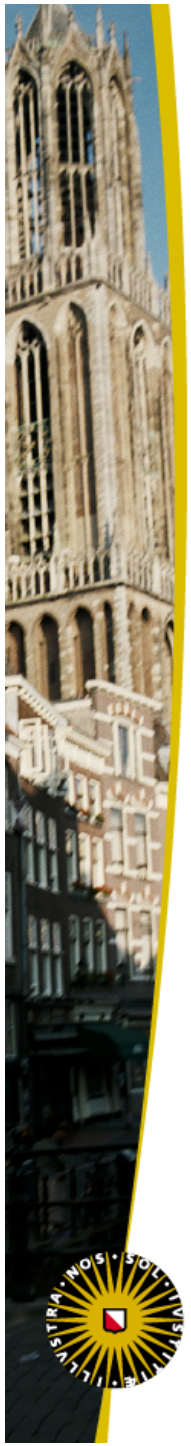

16. Reliability and validity of automatic coding

- Reliability
  - Is the automatic coding procedure reliable?
- Validity

  Rourke and Anderson (2004) validity of coding by: examination of group differences, examination of experimental intervention and correlational analyses:
  1. Can the automatic coding procedure be validated through examination of group differences?
  2. Can the automatic coding procedure be validated through examination of experimental intervention?
  3. Can the automatic coding procedure be validated through correlation analyses?

Discussion:

- The same reliability and validity questions to manual interpretative or systematic coding systems?

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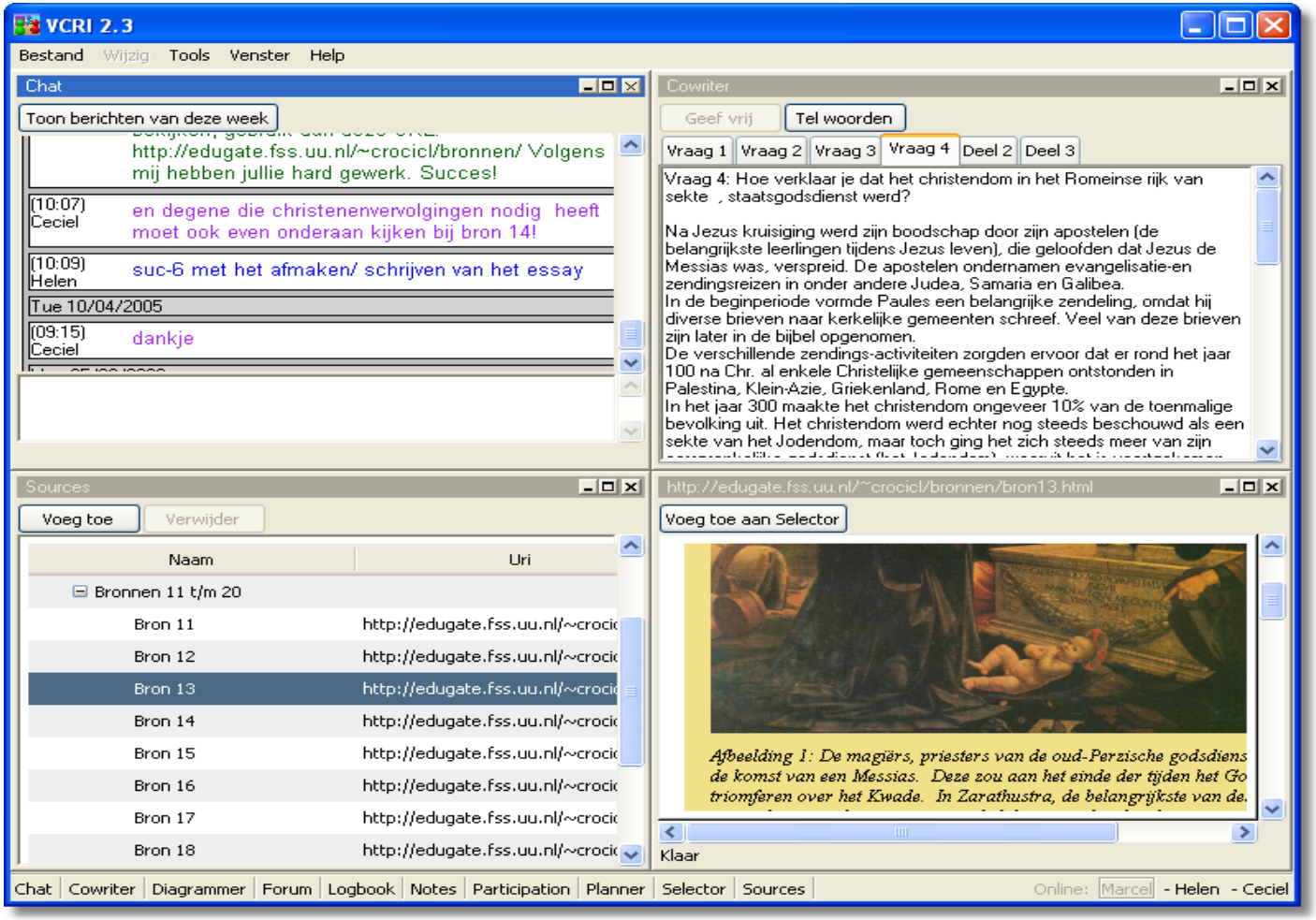
17. VCRI groupware environment



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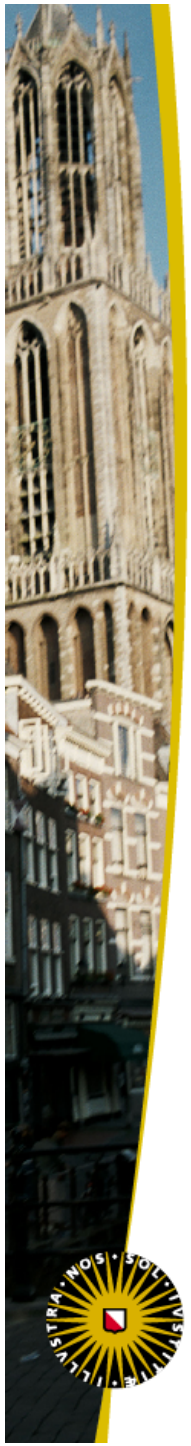

18. Reliability:

Is the automatic coding procedure reliable?

- *DAC* filter will apply the same rules in the same way every time over
- Error analysis:
  - Interrater reliability analysis comparing hand coding and automatic coding on dialogue acts of the same protocol.
- Over 500 messages:
  - Interrater agreement percentage (human–computer): 96 %
  - Cohen's kappa: .78

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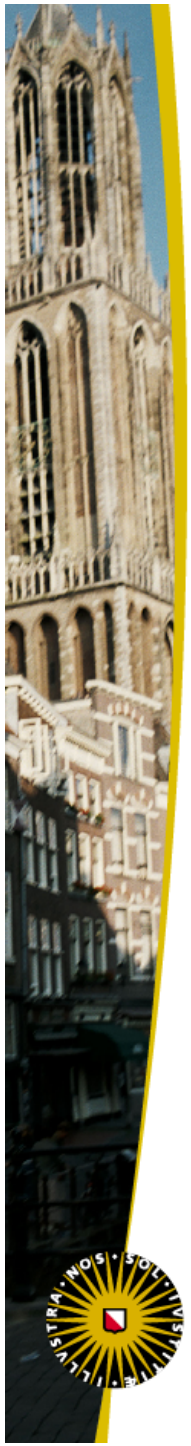
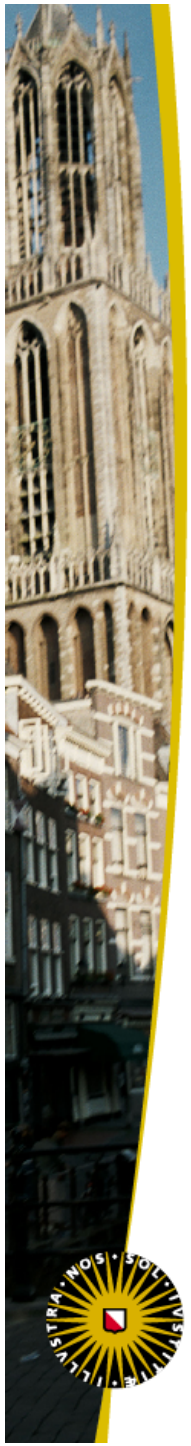


19. Validity 1 : gender differences

- Female students utter significantly more dialogue acts than male students
- Multilevel analysis (correcting for number of messages):
  - Female students: more argumentatives, especially reasons (ArgRsn) & conclusions (ArgCcl)
  - Female students: more responsives, especially confirmations (ResCfm & ResRplCfm)
  - Male students: more informatives, especially statements (InfStm) and nonsense (InfStmNon)
  - Male students: more negative evaluations (InfEvlNeg)
  - Male students: more imperatives, especially focusing attention imperatives (ImpFoc)

- **Expectations partly confirmed**
  (female students use more arguments)



20. Validity 2: experimental intervention

Participation tool:

- Visualizes group member's contribution to online communication
- May enhance motivation to participate
- May raise awareness of group processes and activities
- Can be used to evaluate group processes (group processing)

- **Expected**: more participation and more argumentation

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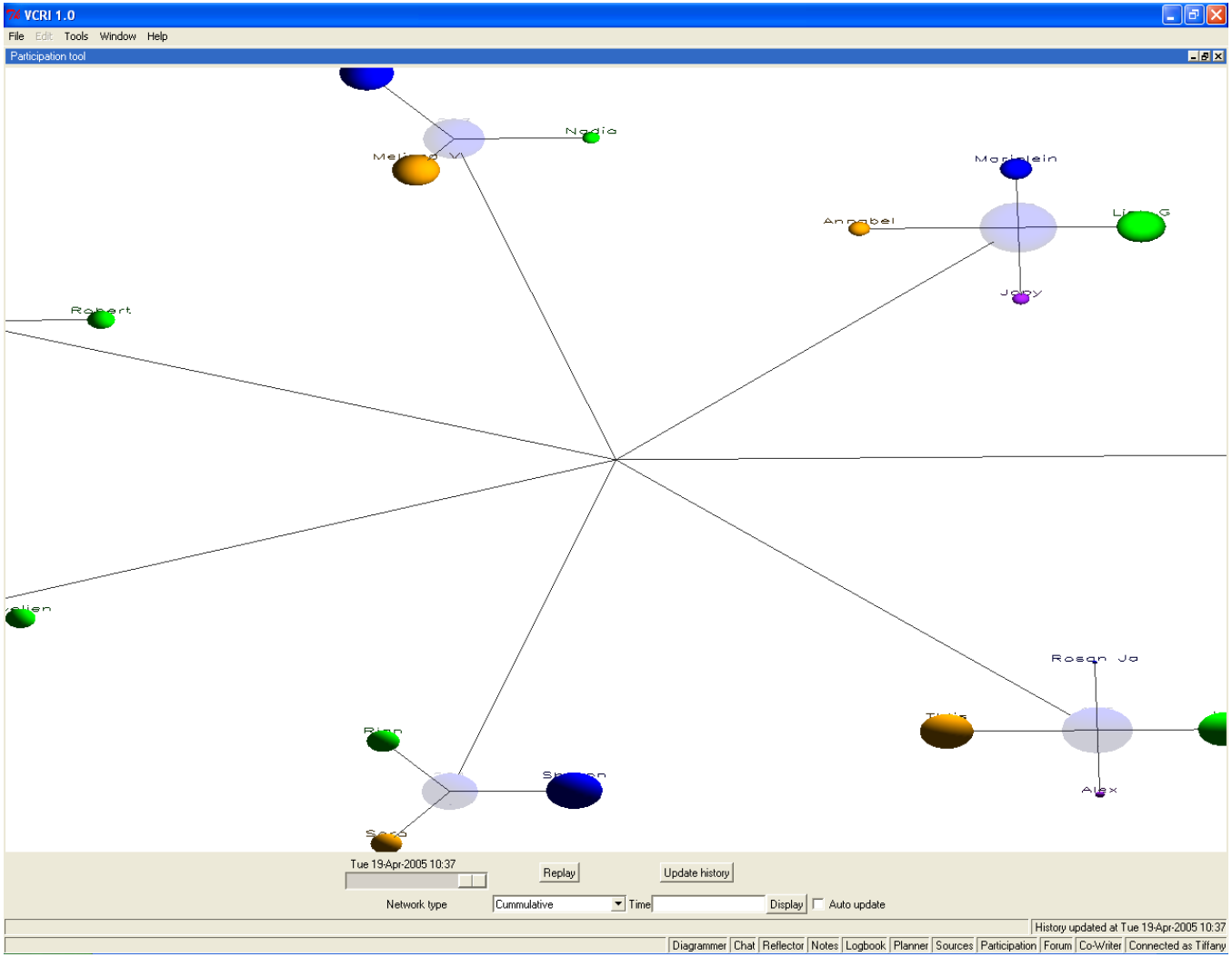
21. Participation tool



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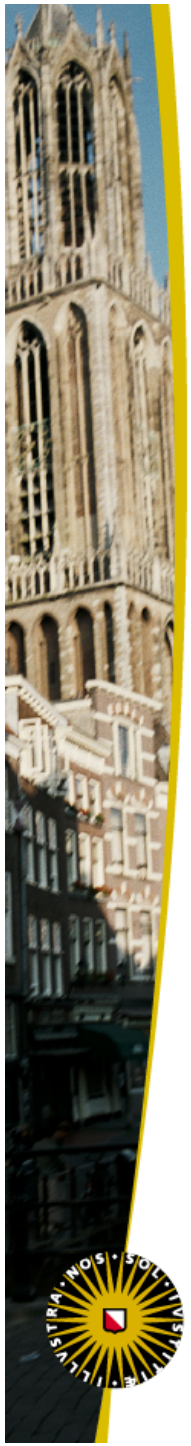
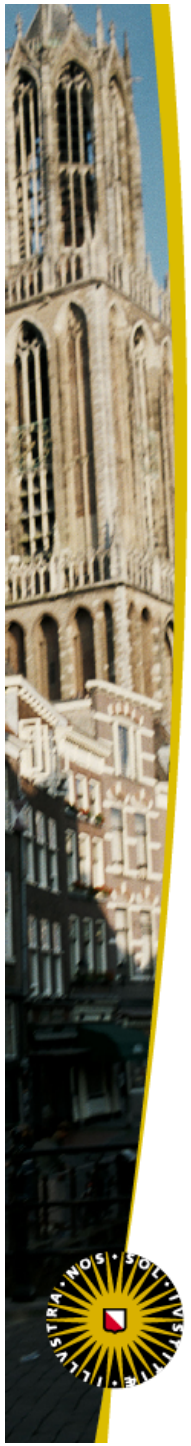


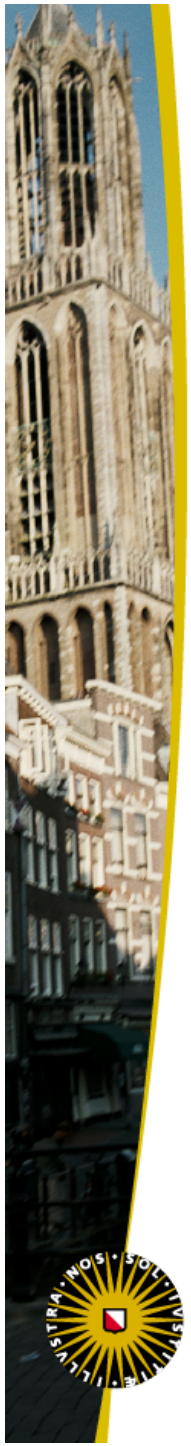
22. Validity 3 : results

- Multilevel analysis:
- Students with the Participation Tool participated more, and used
  - More conditional arguments (ArgCon) & contra arguments (ArgCnt)
  - More confirmative replies (ResRplCfm) and less answers (ResRplStm)
  - More performatives (InfPer), less informatives (InfStm) and less social remarks (InfStmSoc)
  - More imperatives (Imp)
  - More action proposals (EliPrpAct)
- **Expectations partly confirmed**



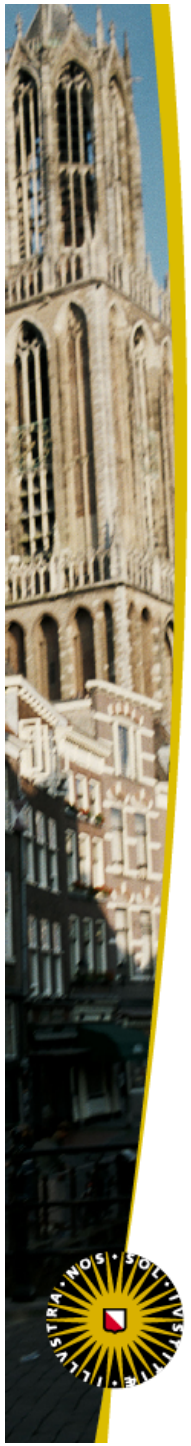
23. Validity 3: by correlational analysis

- To demonstrate that the results of automatic coding are consistent with measurements of the similar constructs through other methods.
- In order to so, the results of the automatic coding procedure are correlated with the results of a manual coding procedure.
- Collaborative activities:
  - Task versus group processing
  - Regulation versus executive performance



24. Collaboration Acts (manually coded)

	Task-related	Social
Performance	•Information exchange (TaskExch) •Questions (TaskQues)	•Greetings (SociGree) •Social support (SociSupp) •Social resistance (SociResi) •Mutual understanding (SociUnd +) •Loss of mutual understanding (SociUnd-)
Regulation	•Planning (MTaskPlan) •Monitoring (MTaskMoni) •Positive evaluation (MTaskEvl+) •Negative evaluation (MTaskEvl-)	•Planning (MSociPlan) •Monitoring (MSociMoni) •Positive evaluation (MSociEvl+) •Negative evaluation (MSociEvl-)



25. Validity 3: Expectations and results

- Task Exchange: information statements and arguments
- Task Questioning: questions
- Task planning: proposals
- Task evaluation: pos. & neg. evaluative dialogue acts

- Social greeting: performatives
- Social support: social information statements
- Social resistance: negative evaluative dialogue acts
- Social understanding (+ & -): confirmations, accepts, denials
- Social planning: proposals
- Social evaluation: pos. & neg. evaluative dialogue acts

60% of expected correlations were found, weak to moderate (.30 - .60)

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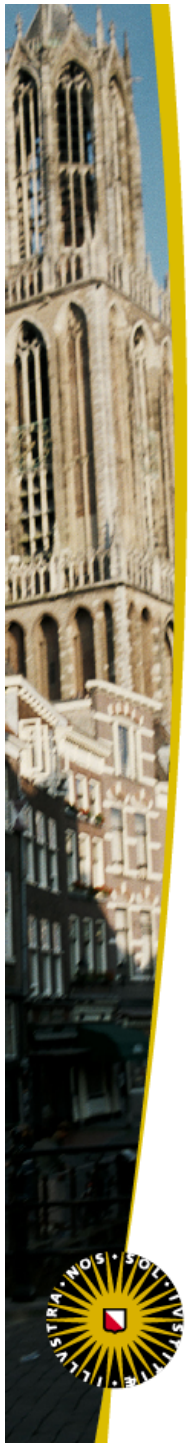

Use of automatic coding:

- Analysis
- Assessment
- (online) Feedback

Discussion:

- Other uses of automatic coding?

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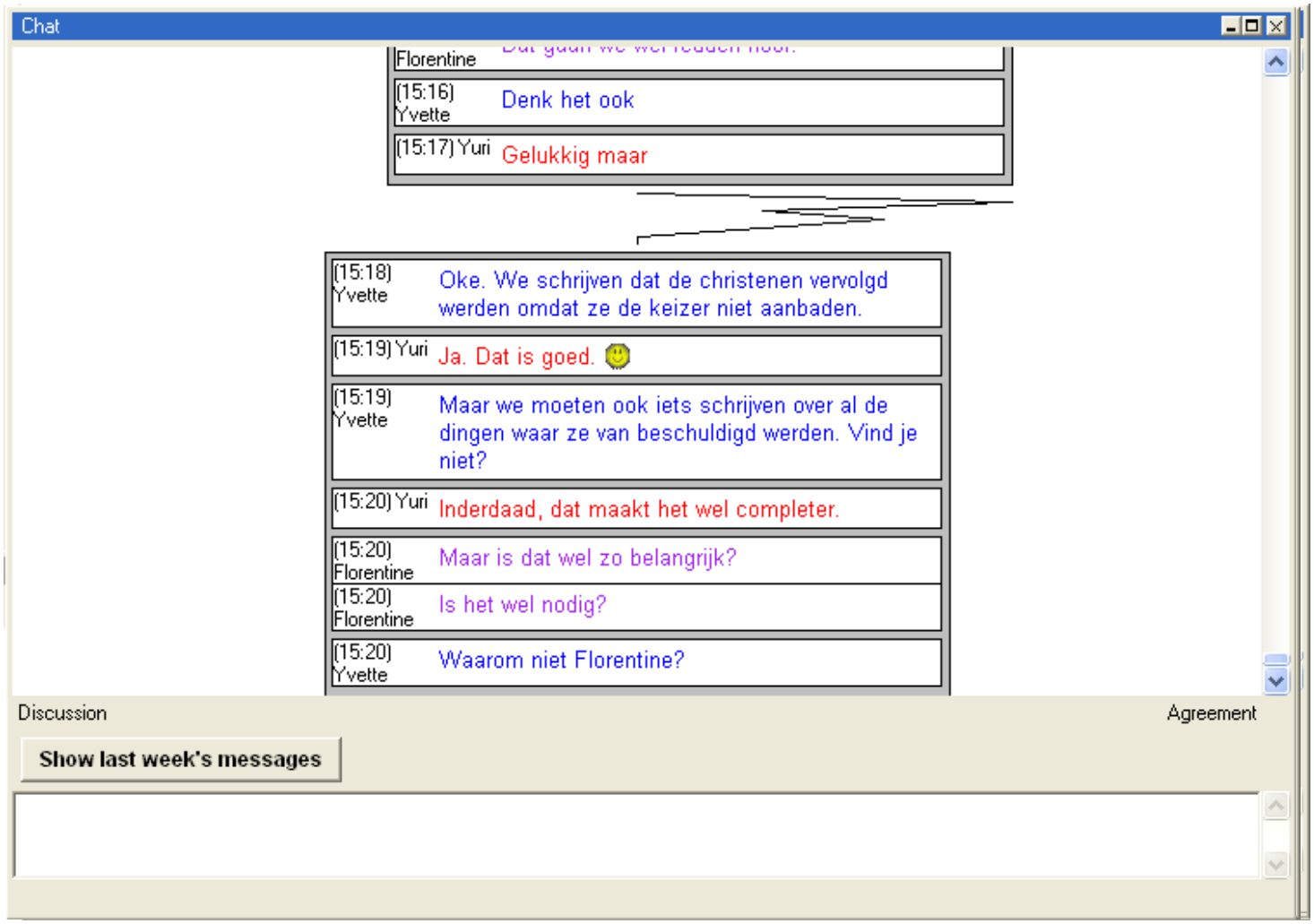
27. Online feedback: Shared Space tool: agreement vs discussion



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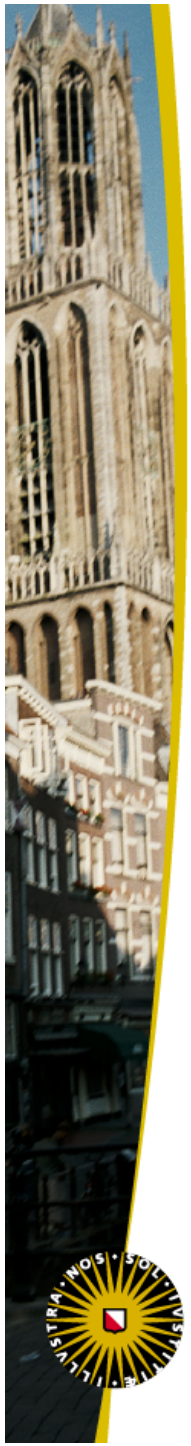
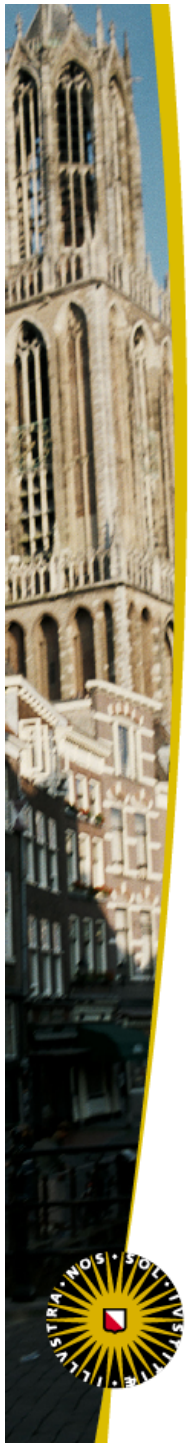


28. Results Shared Space experiment

- Students state that they communicate more easily with each other
- Students experience an explorative group norm (critical, but constructive)
- Students experience their collaboration more positively
- Students show less actions to reach shared understanding
- Small positive effect on the quality of group products



29. Questions?

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