

Communication and cognitive strategies in a text-based virtual reality

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This research studies exclusively text-based interactions during a problem-solving task implemented in a computer supported environment. Interactions are studied to describe how the dynamic-context is built when communication is completely at a distance and based only on text.

The software used is known as Multi-User Dimension (Curtis 1993). MUDs accept multiple-connection, allows navigation through virtual space, construction and manipulation of virtual objects using an easy computing language, and exclusively text-based communication. This study has been conducted in a MUD called TecfaMoo (Dillendourg et al. 1996). Twenty-five university students were always matched with the same confederate and they were required to solve a mystery, working in pair. Mona Lisa has been killed in a virtual hotel and subjects have to find out the identify of the murder based on the motive and the opportunity.

The confederate alternates guided-interaction (asking precise questions) to free-interaction (spontaneous questions, reciprocating subjects attitude) (see Appendix A).

Data analysis combines action and speech while solving the mystery. Commands, actions, and statements are categorized on the base of specific events observed in the protocol and their frequency is observed.

Events are classified at a more general level in two types of indicators: communication and cognitive. This higher classification is useful in describing the dialogic nature of interactions (Mininni 1992; 1995; Slama-Cazacu 1994) and in particular the connections between cognitive and communication strategies implied in this type of task and environment.

Table n. 1 – Communication Indicators and Events

INDICATORS	EVENTS
Type of Involvement	a) Navigation style b) Pronoun Use
Context's Perception	a) Orientation Commands b) Social Marks b) Communication tone
Partner's perception	a) Communication to the researcher b) Debriefing Interlocutor

Table n. 2 – Cognitive Indicators and Events

INDICATORS	EVENTS
Performance Quality	a) Solutions reached b) Partner Influence
Creativity	Inferences
Leadership	Initiative
Collaboration	Collaboration Strategies

Communication Indicators. Communication indicators are: 1) type of involvement 2) context's perception 3) partner's perception.

1. Type of Involvement. How subjects are involved in the task is measured by: a) the navigation style (together versus separate), and b) the personal pronoun use («I» supremacy versus «We» supremacy).

The joint navigation and the supremacy of the pronoun «We» leads to an involvement as a team; the separated navigation and the «I» supremacy let infer an individual involvement.

2. Context's Perception. How subjects perceived the context can be assumed from three events: a) orientation commands (see Appendix B) (low frequency versus high frequency); b) use of social marks (low frequency versus high frequency), c) the general communication tone (critic tone = partner's idea are always discussed and subjects ask for more explanations, i. e. «*Why the colonel? I agree, but what made you pick him – just trying to follow your line of thinking*»; versus not critic tone = partner's ideas are accepted or refused with no discussion).

When high frequencies of orientation commands are observed can be inferred that subjects are sensitive to the context. High frequencies of social marks proof the will of establishing a personal relationship with the partner and the quality can be assumed by the tone used.

3. Partner's perception. Two indicators are studied: a) the communication to the researcher during the game; b) the choice of the interlocutor at the debriefing.

3.a Subjects can ask all the information to the partner versus ask rather to the researcher.

3.b At the debriefing subjects choose as interlocutor the confederate versus the researcher.

Cognitive Indicators. Cognitive indicators are relevant in searching the solution to the game. Four indicators are found: 1) Performance Quality, 2) Creativity, 3) Leadership, and 4) Collaboration.

1. Performance Quality. It is observed: a) whether the solution has been reached; b) whether the final solution proposed by the subjects is influenced by the partner contribute.

2. Creativity. Creativity synthesizes subjects contribute in terms of inferences produced (Parisi & Castelfranchi 1976).

I. e.: «*I think the motive is the picture; because Lisa Jones told Mona Lisa it was a fake one!*»
«*the jacket is a distraction in my opinion*»

3. Leadership. The leaderships is inferred by the frequency of initiatives taken by the subjects.

4. Collaboration. Two levels of collaboration strategies can be distinguished:

– lower strategies: a common informational background with the confederate is kept by sharing information and comments. Hypothesis are clearly individual («*my opinion... maybe hercule disagree*») but subjects are willing to expose the reasoning behind them. I. e.: «*did you see that about roll?*»... «*I think it's very interesting*» – «*do you want me to tell you what I think?*»

– higher strategies: solutions that would not exist on the base of individual work are generated. Some time there is a «negotiation» process, other times hypothesis validity are reciprocally assessed and modified as consequence of the interaction. I. e.: «*the weapon suppositively should be a ski pole...but u raised the issue of a gun...*» – «*and I suspect the husband 1st .. but i don't know what u find out on him?*»...

RESULTS

This research is a pilot study, thus results are presented as categories frequencies.

Table n. 3 – Frequency of the Indicators

a) Frequency of Communication Indicators

Together	«We»	Orientation Comands	Social Marks	Critic tone	Researcher source	Partner Interlocutor
64%	32%	52%	92%	92%	68%	64%

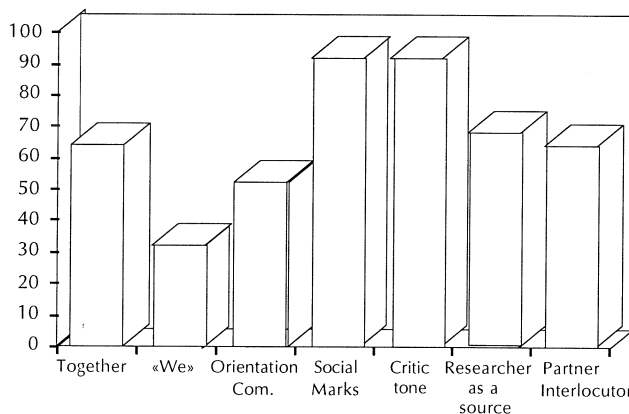
b) Frequency of Cognitive Indicators

Solution	P. Influence	Inferences	Initiatives	Higher Collaborative. Strategies
44%	52%	60%	92%	84%

Observing the communication indicators graphic (Graphic n. 1), the following considerations can be made:

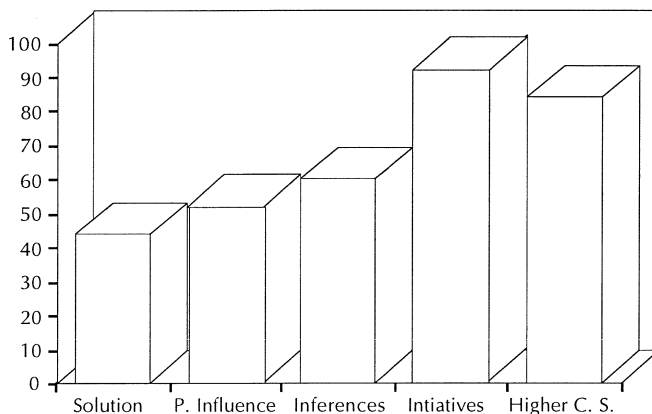
- Although from the navigation style can be assumed an involvement as a team, the pronoun more used is still «I»,
- new commands and symbols (as can be defined the social marks) are highly used demonstrating that the context is well shared, but the tone used with the partner is critic,
- a discrete percentage of subjects does not perceive the partner as the unique information source nor interlocutor.

Graphic n. 1 – Communication Indicator frequencies



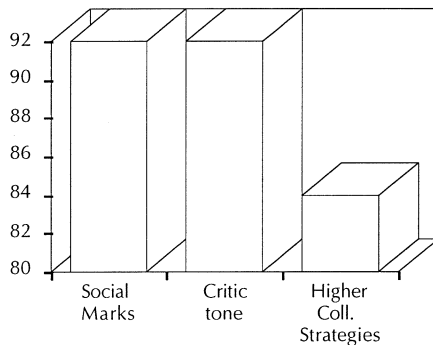
An interesting conclusion that can be drawn from the cognitive indicators graphic (see graphic n. 2) is that although subjects reach higher collaboration strategies, high percentage of initiatives, and take in consideration partner's ideas, Mona Lisa's killer is often not found.

Graphic N. 2 – Cognitive Indicators Frequencies



The most interesting phenomenon observed by comparing communication and cognitive indicators is the «Critic factor». Although higher collaborative strategies are reached and the context is shared, subjects are often critic towards the partner's idea and comments.

Graphic n. 3 – Critic Factor



This factor can be explained as an effect due to the specific features of computer mediated environments. Anonymity, distance and text-based interaction foster a less «personal» communication where ideas can be expressed without being evaluated on the base of physical features (Ligorio 1997). The dialogic model is confirmed by the complexity of the relationship between cognitive and communication strategies, that calls for deeper qualitative studies based on single protocols.

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APPENDIX A – THE SCRIPT

INSTRUCTION PHASE ————— before the game starts —————

The researcher gives information about the time allotted (40 minutes), the aim of the game (find the killer and his/her motive and opportunity to kill), reminds about the map, the virtual notebooks, and the commands available on Netscape.

PHASE 1 ————— Time 00:00

GUIDED INTERACTION – Initiative. The confederate asks the subject: *So, what's the plan?* Subjects have 2 possible responses:

- a) Subject takes the initiative and the confederate asks about the **Navigation**: *Do we want to go/do it together or do we want to split?* Subject can choose to:
 - 1) go together and the confederate asks: *Who goes /does it first?*
 - 2) split and the confederate can: follow the subject instructions or look for information.
- b) Subject does not take initiative and the confederate suggests to look at body and gun, and ask the colonel (which is owns the gun) about it. It way will be found out when the gun was stolen. Then questions about the navigation will be asked.

FREE INTERACTION (more o less 5 minutes). The confederate adequate the interaction style to that of the subjects, asking questions if the subject asks question, or working alone if the subject shows this tendency. In general, the confederate gives good hints and answers to the questions.

Information sharing. The confederate asks: *What do we want to do with the notebooks?* Subjects have 3 possible answers:

- a) The subject looks up the confederate's notebook and the confederate asks: *Can I look at your notebook?* If the subject agrees, notebooks are exchanged, otherwise notebooks are not exchanged.
- b) The subject looks up his own notebook and is not interested in the confederate's notebook.
- c) The subject doesn't want to use the notebooks at all.

FREE INTERACTION (more o less 5 minutes). See previous Free Interaction.

PHASE 2 ————— **more o less 15:00 minutes from the start**

GUIDED INTERACTION – Initiative. The Confederate asks the subject: *What we want to do next?*. See Guided Interaction Phase 1

FREE INTERACTION (more o less 5 minutes). See previous Free Interaction.

Information sharing. The confederate asks: *What do we want to do with the notebooks now?* See Information Sharing Phase 1.

FREE INTERACTION (more o less 5 minutes). See previous Free Interaction.

CONFLICT PHASE ————— **more o less 30:00 minutes from the start**

The researcher asks the subject to give a first personal guess about Mona Lisa's killer. The researcher says: *Sorry, to interrupt you, but I need your first personal guess. Who do you think killed Mona Lisa?.* After the subject's answer, the researcher says: *Thank you for your guess. Your partner thinks is (name of one suspect). Now please, go ahead because time is going to finish!*

PHASE 3 ————— **more o less 35 minutes from the start**

GUIDED INTERACTION – Initiative. The confederate asks: *Well, what do we want to do now?.* See Guided Interaction Phase 1 and 2.

FREE INTERACTION (more o less 5 minutes). See previous Free Interaction.

Information sharing. The confederate asks: *How about the notebooks?* See Information Sharing Phase 1 and 2.

FREE INTERACTION (more o less 5 minutes). See previous Free Interaction.

DEBRIEFING ————— **more o less 50 minutes from the start**

Researcher says: *time is over! Please tell me who do you think is guilty and why?*