

# **An Experimental Study to Compute Co-Writing Relevance of Couples of Users Working in Different Conditions of Network Communication**

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## **Keywords**

Co-writing, desktop processing, human performance, mediated communication, non verbal communication, outcome evaluation, relevance, text analysis.

## **Introduction**

Real-time co-writing is basically founded on the concept of co-operation developed and shared inside a group of individuals (working dyads in this study). The action of co-operating as well as the co-writing can be assumed to have enough time duration to enable individuals in getting a consistent reciprocal exchange of information (Olson et al., 1992). First of all, they transfer each other their own models of knowledge, that is what each one knows about the others, the own thought, ideas, experiences, belonging to an organisation or to a social class, esteem, style, friendliness, and so on.

In their communication there can be identified elements of consistency as well as elements of inconsistency, which can be found in agreement or in disagreement, hidden or manifest as well (Whittaker, 1995). These elements can foster or handicap the process to come to a result in the co-operation, as the way they interact may depend on the action type developed by people in a time and in a space. In other words, joined performance comes to depend on the situated action (Suchman, 1994), which is influenced by the active elements of the relationships context.

Furthermore, whereas in the traditional workplace settings people can both engage in rich interpersonal communications and have intense exchanges of information, the quantitative and qualitative level of human communication rapidly decreases in a workplace equipped by electronic media. In these settings, the achievement of a quantitative measure on how much the mediated communication influences the joined performance over the outcomes produced may be of some use.

This study is part of a wider experiment (Cornacchia, 1988) which was carried out to observe how technological factors may introduce a constraint for people to achieve specified goals with effectiveness, efficiency and satisfaction in a workplace setting. In particular, this paper is focussed to compute a relevance function on the experimental outcomes, that are the co-written documents produced by subjects, as well as to link this result to the conditions of mediated co-operation and communication.

## **Method**

A laboratory experiment was carried out to study those factors involved with the real time network co-writing. A multimedia workstation was given to the subjects and three conditions of network communication had to vary among each one of three repeated trials. A multimedia workstation (SUN sparc 20) was set up for each subject with a teleprocessing system, fully equipped for co-operation with a shared desktop and word processor (by running MAE, the Macintosh environment emulator) as well as a desktop digital videoconference (ShowMe Video and a digital camera).

### Subjects

Subjects were 12 working dyads (index  $i$ , from 1 to 12) of randomly chosen end-users of the system, with different capabilities, preferences and skills. They provided repeated performances in workplace tasks (McGrath, 1984) for 3 different conditions of communication (index  $j$ , from 1 to 3), in the order:

- traditional face-to-face (comm.1 in Fig.1),
- hands free audio conference (comm.2 in Fig.1),
- desktop audio-video conference (comm.3 in Fig.1).

### Task Outcomes

Each working dyad engaged in the experimental task co-operatively produced 2 kinds of document:

- the assembled  $D(i,j)$  – a journal article about topical subjects;
- the processed  $T(i,j)$  – a co-written commentary on the assembled article.

### Definition of Relevance

The documents  $T(i,j)$  and  $D(i,j)$ , respectively containing  $NT(i,j)$  and  $ND(i,j)$  terms or words, are sets used to compute a relevance function as defined in (Van Rijsbergen, 1980), a theory of IR about the automatic text analysis and document representatives. This theory defines the relevance of a document written in co-operation (with respect to a reference) by assuming that the entropy achieves the goal to measure its informative content.

The relevance value  $r(i,j)$  so computed gives a probabilistic measure of how much the co-written commentary set of terms  $T(i,j)$  matches with the set of terms contained in the reference document  $D(i,j)$ . It is understood within this definition that the concept of relevance introduced leaves out of consideration any kind of judgement about the quality of the script, as well as the semantic, lexical and grammatical structure of the content.

### Computing

In practice, the mathematical expression used in this study to compute the relevance  $r(i,j)$ , alias the probability of the intersection  $T \cap D$ , is defined as  $\sum_{t \in T} \log(f_D(t)+1)$ ,

where  $f_D(t)$  states the frequency of the term  $t \in T$  in the reference set  $D$ . By computing the relevance all over the  $2 \times 12 \times 3$  sets of documents collected in the experiment and normalising by  $N_{T \cap D} = \bar{f}_D(t)$ , a  $12 \times 3$  matrix  $R(i,j)$  is then obtained where, for each

working dyad ( $i$ ), the relevance value of the outcome (co-written commentary) is given dependent upon the condition of communication ( $j$ ).

## Results

Fig. 1 displays the relevance matrix  $R(i,j)$  of the co-written outcomes, as computed by the mathematical expression previously defined.

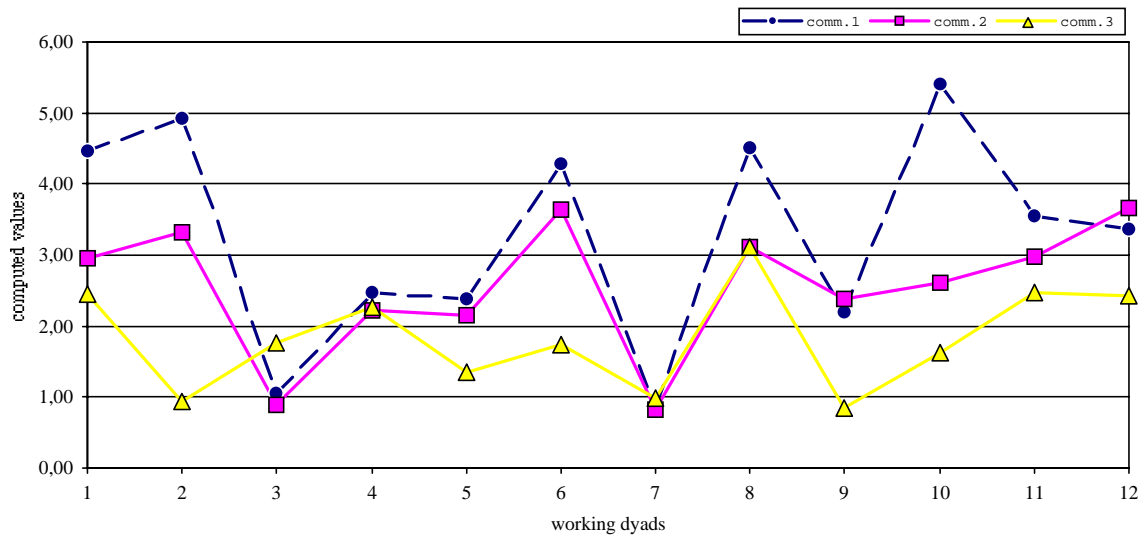


Fig. 1 - Relevance  $R(i,j)$  of the outcomes dependent upon the conditions of communication.

The above graph essentially shows the following two main results:

- there are well spaced scores (along y axis) for each working dyad (i) which point out with clear evidence that the relevant co-writing performance is affected by the condition of mediated communication;
- on the whole, the traditional face-to-face interpersonal communication takes the highest values of relevance (as well as of performance), then the hands free audio conference and desktop audio-video conference come in decreasing order of relevance.

## Conclusions

Results obtained in this study lead us to conclude that the relevance, defined as objective measure of human performance over the task outcomes, is clearly dependent upon the technology equipment provided to convey the interpersonal communication of working dyads. This kind of measure seems to be useful to integrate others widely diffused set of tools generally applied to assess where and how mediated communication affects human co-operation. For instance, the standard questionnaires used in this same experiment to assess others variables like telepresence or visual contact turned out less sensitive than the measure of relevance to the changes in communication technology settings.

Finally, whenever in the future the concept of relevance could be applied to evaluate the outcomes of people co-operatively writing, it could give an objective, clear and not biased measure of the human performance.

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