

RESEARCH REPORTS

A Method for a Quantitative Measure of Emotional Intelligence in Face-to-Face and Computer-Mediated Communication

Ruggero Rossi de Mio

Research Report 4/2002



Institute for Advanced
Management Systems Research

1. INTRODUCTION

In the past two decades as a response to the competitive challenges, enterprises are moving toward a rapid adoption of teamwork and virtual teamwork as main organisational frameworks, and in the 90' even researches have strongly focused on teamwork as a main research area [Lipnack and Stamps, 1997]. One of the main research questions is the identification of the factors that make teams effective and successful. According to Stott and Walker [1995] investigating team effectiveness is an unclear and fuzzy task. A brief literature review on team effectiveness and team performance is here presented highlighting the most relevant findings for the purpose of this research.

Different types of teams might be considered effective or non-effective depending on the applied criteria. The literature is filled with attempts to define team effectiveness [Anantaraman, 1984], to list the most crucial criteria [Margerison and McCann, 1985; Huszczo, 1990] or the attributes of a productive team [Hit, 1988]. Anantaraman [1984] proposed the following definition of team effectiveness: "An effective team would have clear cooperative goals to which every member is committed; *accurate and effective communication of ideas and feelings*; distributed participation and leadership; appropriate and effective decision making procedures; *productive controversies*; a high level of trust, acceptance and support among members; *a high level of cohesion*; constructive management of power and conflict; and adequate problem solving procedures". Many approaches are available in order to evaluate team performance as well [Francis and Young, 1979; Johnson and Johnson, 1991; Stott and Walker, 1992]. Hellriegel et al. [1989] identified the following factors that influence group performance: group size, member composition and roles, group norms, goals, *cohesiveness*, leadership and external environment. On the other hand, Thamhain [1990] focused more on: clear objectives, stimulating work, professional growth potential, direction and leadership, mutual trust and *good interpersonal relations*, proper plans, *good communication within and outside the team*, organizational stability and security, adequate resources, and management involvement. Group cohesion can be therefore chosen as a leading variable for the establishment of high-performance teams, but evaluating group cohesion is certainly a hard task. Many factors can be addressed as critical for achieving group cohesion. It is commonly accepted that group cohesion is achieved when group members create affective interactions with each other and these interactions are available through the disposable communication channels such as words, images, etc. [Scott and Townsend, 1994; Katzenbach and Smith, 1993; Druskat and Wolff, 2001].

According to Snyder [1988] "the ability of a group to accomplish its purpose depends largely on the capability of its members to communicate with each other effectively. Interpersonal communications are the cornerstone for effective team planning, problem solving, action, reflection, and evaluation". On the same track there are other studies stating that communication among members is the vital aspect for achieving group performance [Wynn and Guditus, 1984; Rees, 1988]. According to Guest [1962] the higher the lateral communication the better teams perform. Other studies tried to identify the most important factors [Ends and Page, 1977] or skills [Snyder, 1988; Adair, 1986;

Margerison and McCann, 1985] that lead toward the establishment of effective communication among members. Anantaraman [1984] proposed a few rules that should be followed in order to enhance communication: frank expression of feelings, *reconsider ideas and feelings when emotions are running high*, self-disclosing past experiences, giving support, listening and not evaluating, confronting, self-examine behaviour, making the past relevant to the present, and use examples. According to Stott and Walker [1995] the communication factors can be summarised by the following five main activities: listening, feedback, coaching, *interpersonal relationships*, trust and openness. But despite more or less importance that previous studies gave to the communication, interaction is an essential action in teamwork and group performance is strongly influenced by its nature and quality. According to DeSanctis and Gallupe [1987], for example, group decisions result from interpersonal communication among its members and the better the information is exchanged the more likely it is that the consequent decision is effective. Finally, according to Druskat and Wolff [2001] this status of positive synergy that may lead to a high level of group cohesion is summarised by the concept of emotional intelligence. They suggest that when teams are able to establish a high level of group emotional intelligence the previous successful factors are more likely to appear.

Moreover, in Rossi de Mio [2002a] the concept of group emotional intelligence has been extended to a virtual level. It is suggested that, due to the different disposable communication channels, the computer-mediated communication may lead toward different levels of emotional intelligence compared to the face-to-face communication. Investigating emotional intelligence is certainly a hard task [Cherniss and Goleman, 2001]. This paper includes the review of an exploratory experiment carried out in order to provide first inferences on this issue (see Appendix A for the population, instruments and laboratories used in the experiment). The data arising from the experiment has been analysed according to three different methods. The methods have been chosen according to their suitability in investigating the issue of emotional intelligence in groups as defined by the original authors [Goleman, 1995, 1998; Druskat and Wolff, 2001]. Finally, it is argued that the method here proposed (section 3.1) is more suitable to achieving a quantitative measure of emotional intelligence in face-to-face and computer-mediated groups.

In section 2 a brief description of emotional intelligence in virtual and face-to-face communication is presented. Section 3 includes the results of the experiment according to two ad hoc post session questionnaires, and a modified version of the Bales' method. Moreover, a method for measuring emotional intelligence in groups is proposed together with the results arising for the same laboratory experiment. Section 4 includes the conclusion and the implications for managers, section 5 the limitations and the directions for future research.

2. ON EMOTIONAL INTELLIGENCE IN ALLOCATED AND VIRTUAL TEAMS

According to Druskat and Wolff [2001] group cohesion is achieved when establishing a high level of group emotional intelligence. They define group emotional intelligence according to Goleman's [1995] original definition of emotional intelligence as follows: groups are aware of emotions and able to regulate them and this awareness and regulation both inward to and outward. Based on a cross-analysis of Druskat and Wolff [2001] and Goleman [1995, 1998] a few factors that influence the establishment of emotional intelligence in teams are identifiable. Each factor has been then used in order to build/adopt three different methods for investigating the issue of emotional intelligence in face-to-face and virtual groups (see section 3).

According to Goleman [1995] a high level of emotional intelligence is equal to being able to motivate yourself. Moreover, he claims that the ability of transferring effectively significant information is relevant for the establishment of informal networks among members. Informal networks form the basis for the creation of a positive emotional environment. Social harmony is considered a very important factor as well; the higher the social harmony, the more relaxed the meeting and the higher the level of emotional intelligence. According to Druskat and Wolff [2001] the ability of a team to evaluating its performance is considered relevant for the establishment of emotional intelligence on a group level. They identify group efficacy, group identity and the creation of an affirmative environment as essential factors for the establishment of creative and productive controversies. Consequently, productive controversies may trigger emotional intelligence on a group level. Moreover, they address confrontation and caring among members as essential for the establishment of conditions leading to a relaxed and creative environment. Finally, other factors are: building consensus, see things from others' perspective, and promoting cooperation.

Virtual emotional intelligence is a status achievable when perceiving the outer world via the virtual channels. Goleman's original definition of emotional intelligence is based on LeDoux findings on individuals' perceptions of emotions. According LeDoux [1986, 1996] individuals feel emotional when external factors stimulate the amygdala (an almond-shaped clustered structure of the brain perched above the brainstem near the bottom of the limbic ring). External stimulations of the amygdala trigger therefore emotional reactions. The ability to regulate and control these reactions determines different levels of emotional intelligence. This study aims to explore if the perception of external factors occurs differently when filtered through the technology. For example, the perception of a team member's rude answer may trigger emotions like rage, indifference, fear, etc. On the other hand, when the same rude answer is filtered though the technology each member may handle the resulting emotions differently. Another more extreme example may be the view of a snake when walking in the forest (fear, numbness, etc.) or when working with a computer interface (indifference, courage, etc.).

According to Carletta et al. [2000] there are two effects of communication technology related to group interaction: the social presence effect and the turn-taking effect. Social

presence theory regards social presence as quality inherent in a communication medium [Short et al., 1976]. In other words the theory claims that the more cues a communication medium provides the higher the level of the social presence. Therefore, rich virtual communication channels as video conferencing provide a higher level of social presence than lean channels as only-audio communication. On the other hand, the turn-taking effect is related to the possibility and freedom of replaying somebody's statement. In a conversation or debate the talkers have to be able to intervene whenever they feel it is appropriate in order to leave a relevant comment [Boden, 1994]. Using synchronous computer text conferencing, audio or video channels creates different levels of turn-taking effects.¹ A brief literature review of studies on the exchange of social emotional messages in face-to-face and computer-mediated communication is here presented.

Studies suggest that virtual groups take longer to develop norms and social relationships [Sudweeks and Albritton, 1996], that face-to-face interactions allow a higher exchange of socio-emotional communication [Daft and Lengel, 1986; Chidambaram et al., 1990; and Chidambaram and Jones, 1993], and that the technology may block social talks of the virtual members [Carletta et al., 2000]. According to McGrath and Arrow [1996]; Berdahl and Craig [1996]; Boudas and Arrow [1996]; Cummings, et al. [1996] and Lebie et al. [1996] the face-to-face groups there are more significant interactions on socio-emotional communication over time than in CMC (computer-mediated communication) groups. It appeared that cohesiveness in face-to-face groups remained high; whereas, CMC group cohesiveness increased after some time (8 weeks) from the beginning of the meetings. Huang et al. [1996] investigated the issue of social presence and media richness in face-to-face and CMC groups with or without social construct. They concluded that with no shared social construct face-to-face medium is richer than CMC. On the other hand, under a shared social construct CMC becomes a richer medium similar to the face-to-face interaction. Therefore, they suggested that media richness theory might hold for new or not established groups, but not for existing or established groups. Losada et al. [1990] stated that if GSS (Group Support System) is used without feedback there is a reduction of socio emotional interaction; whereas, if it is used with feedback the socio emotional interaction increases significantly. Moreover, if feedback is given without GSS there is a significant reduction in social emotional interaction. They finally concluded that technology and feedback have a significant effect on the socio emotional interaction, and the use of feedback may improve the group process in computer-mediated environments². Massey and Clapper [1995] stated that group members have stronger feelings; more negative feeling and they are more sensitive in a GSS environment. According to members' self reports GSS groups were significantly more comfortable in the GSS settings than in the face-to-face setting. According to Chidambaram et al. [1990] and Chidambaram and Bostrom [1993], the ability of managing conflicts was higher in face-to-face groups at the beginning of the sessions, but after 3 sessions there was a reversal. Rhee et al. [1995] showed that face-to-face groups

¹ Notice that in the experiment the Netmeeting 3.01 has been used because characterised by low social presence and high turn taking effect; whereas, the face-to-face meetings are characterised by high social presence and low turn taking effect (see Appendix A).

² None feedback was given neither during the face-to-face nor during the computer-mediated session in this experiment

were more concerned for other member's well being than CMC groups. Moreover, CMC groups handled conflict more strongly than face-to-face groups, which usually were more cooperative. Finally, they conclude that negotiation in CMC groups is viewed more as a win-lose situation, more confrontive remarks are exchanged and agreement takes longer to be reached than in face-to-face groups. According to Walther [1995, 1992] and Walther and Burgoon [1992], CMC groups adopt a pro-social behaviour over time and they disclose and probe more than face-to-face groups. They are more immediate, more similar, more composed, less formal, less task related, more social oriented and develop and evolve in positive directions over time. Finally, the authors suggest that there is less stress in the CMC groups and that adoption of pro-social behaviour occurs as a function of time. Galegher and Kraut [1994, 1990] concluded that CMC groups work harder, communicate more, are less committed to the group, less satisfied with their work but surprisingly have the same quality as face-to-face groups. Moreover, they suggested that in CMC groups as the due date becomes closer the coordination increases, that it takes them longer to finish their project and that they have greater difficulty in coordinating and understating their work.

Table 1. Classification of studies on social emotional interaction in face-to-face and CMC settings

Emotional Intelligence higher in F2F	Emotional Intelligence higher in CMC
1. Sudweeks and Albritton, 1996	1. Massey and Clapper, 1995
2. Daft and Lengel, 1986	2. Walther, 1992
3. Chidambaram and Jones, 1993	3. Walther, 1995
4. Carletta et al., 2000	4. Walther and Burgoon, 1992
5. McGrath and Arrow, 1996	
6. Berdahl and Craig, 1996	
7. Boudas and Arrow, 1996	
8. Cummings, et al., 1996	
9. Huang et al., 1996	
10. Losada et al., 1990	
11. Rhee et al., 1995	
12. Galegher and Kraut, 1990	
13. Galegher and Kraut, 1994	

In table 1 the previous studies are classified according to the accordance of their results. The first column includes the results that would lead to expect the establishment of emotional intelligence on a higher level in a face-to-face environment; whereas, the second in a computer-mediated environment. In particular, it appeared that 13 studies would lead towards a possible establishment of emotional intelligence on a higher level in the face-to-face mode and 4 in the computer-mediated environment.

Based on this studies, assumptions and hypotheses have been formulated and tested in a laboratory experiment (see Appendix A). The data has been analysed according to three different mode of analysis and the results are presented in the next section.

3. RESULTS FROM THE LABORATORY EXPERIMENT

The first analysis has been done using two ad hoc post session questionnaires (see Appendix B). The questionnaires have been built in order to investigate issues related to the social emotional status of the members in the two approaches. In particular, the

questions have been built according to the original definitions of the relevant factors for the establishment of emotional intelligence in groups. [Rossi de Mio, 2002b]

The results assessed emotional intelligence in the face-to-face and CMC on different levels. In particular, according to the statistical analysis (t-test and ANOVA test) the members felt significantly more comfortable in the face-to-face approach (A1)³. In particular, the statistical comparison of each group in regards to A1 resulted significant in four groups out of seven. Moreover, other assumptions were that the level of emotional intelligence would be higher in groups that first meet face-to-face (A2), that the face-to-face contact would be missing more in groups that first meet virtually (A3) and that emotional intelligence in the second meeting would be higher despite the nature of the first meeting (A4). They were all found statistically not significant. The reasons of these results were addressed to the fact that the meetings did not developed over time (A2 and A4) and that the participants of the experiments were mostly information systems majors (A3). In order to deepen the results of A1 the research focused more on the establishment of emotional intelligence conducting a content analysis of the exchanged messages.

Particularly, the comments of the members have been coded using a slightly modified version of the Bales' method [1950] (see Appendix C) for categorising group interaction (see Appendix D for methodology and mode of analysis). The task related areas of Bales' scheme have been summarised by only two variables (expertise network for attempted answers and expertise network for questions). The overall exchange of relevant messages (H1), the social emotional reactions (H2) and the level of positive social emotional reactions (H4) were found significantly higher in the face-to-face mode. On the other hand, no substantial differences were found with regard to the level of agreement (H3) in the two working approaches. [Rossi de Mio, 2002c] See table 2 for the summary of the results.

Table 2. Summary of the results

Assumptions /Hypothesis	Mode of analysis	Results
A1.The level of emotional intelligence will be higher in face-to-face communication.	Post session questionnaires	Supported
A2.Emotional intelligence in virtual groups will be higher if the groups first meet face-to-face.	Post session questionnaires	Not supported
A3.The face-to-face contact will be missing more in groups that first work virtually.	Post session questionnaires	Not supported
A4.Emotional intelligence in the second meeting will be higher no matter what was the nature of the first approach.	Post session questionnaires	Not supported
H1.The overall exchange of relevant messages is higher in the face-to-face communication	Content analysis (modified Bales')	Supported
H2.The socio emotional reactions are higher in the face-to-face communication	Content analysis (modified Bales')	Supported
H3.The level of agreement is higher in the face-to-face mode	Content analysis (modified Bales')	Not supported
H4.The level of positive emotional reactions is higher in the virtual mode	Content analysis (modified Bales')	Supported

³ Due to the explorative nature of the experiment the research questions have been formulated as general assumptions and not as hypothesis.

messages, but on their quality. Therefore, the more the content of messages can be categorised either in the positive social emotional area (Co, Pc, STP, BC, PT), in the task related area or in the goal oriented area and the less in the negative social emotional area (STP-, PC-, Co-), the higher the level of emotional intelligence (see section 4). In this section the method is presented together with the results of its application to the previous set of data.

According to Druskat and Wolff [2001] three levels of emotional intelligence contribute to create a general level of group emotional intelligence: the individual level (IEI), the group level (GEI) and the cross-boundary level. At this stage of the research only IEI and GEI are investigated. The level of IEI_i is defined as follows:

$$IEI_i = Pa_i / (Cg_j / k) \quad \begin{array}{l} i = 1, \dots, k \\ j = 1, \dots, n. \end{array}$$

Where i are the group members (with $i \geq 2$), j is the number of groups, k is the amount of the members of group j , Pa_i is the sum of the positive relevant comments subtracted by the sum of the negative relevant comments ($Pa_i = [(EN1)_i + (EN2)_i + (BC)_i + (STP)_i - (STP-)_i + (PC)_i - (PC-)_i + (TI)_i + (TSE)_i + (SM)_i + (PT)_i + (Co)_i - (Co-)_i]$), and Cg_j is the total amount of messages exchanged by the group j ($Cg_j = \sum(Cw)_i$, with $Cg_j \geq 1$). (see table 3)

The level of IEI is therefore calculated by the sum of the positive relevant comments (EN1, EN2, BC, STP, PC, TI, TSE, SM, PT, and Co) subtracted by the sum of the negative relevant comments (STP-, PC-, Co-) of one member divided by the average of the comments of the whole group (Cg_j/k). In this way the relevant comments of the member are weighted by the total amount of the exchanged messages of the group and by the amount of possible comments that the member could make hypothesising an equal contribution of each member to the group discussion (see example in section 3.2). This method allows avoiding the paradox of only one relevant comment leading to the highest level of IEI_i ($IEI_i = 1$) that would arise if dividing the total amount of the member relevant comments by the member's total amount of comments.

On the other hand, the level of GEI is defined as follows:

$$GEI_j = \Sigma(IEI_i) / k \quad \begin{array}{l} i = 1, \dots, k. \\ j = 1, \dots, n. \end{array}$$

The level of GEI of each group is therefore calculated by the average of the individual levels of emotional intelligence. In this way the total amount of the relevant comments made during the meeting are weighted by the total amount of the exchanged messages (see example in section 3.2).

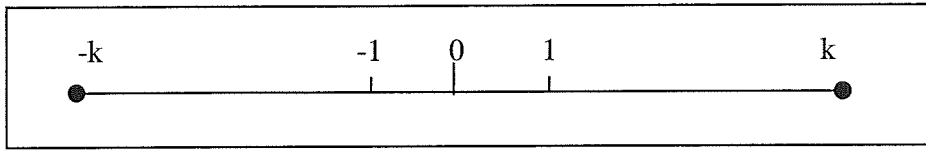
Finally, the levels of IEI_i , and GEI_j are calculated both for the virtual and the face-to-face meetings.

3.2 Example

The possible extreme levels of IEI and GEI are the following.

If $Pa_i = Cg_j$	then $IEI_i = Pa_i/(Cg_j/k) = Cg_j/(Cg_j/k) = k$
If $Pa_i = Cg_j/k$	then $IEI_i = Pa_i/(Cg_j/k) = (Cg_j/k)/(Cg_j/k) = 1$
If $Pa_i = 0$	then $IEI_i = Pa_i/(Cg_j/k) = 0$
If $Pa_i = -Cg_j/k$	then $IEI_i = Pa_i/(Cg_j/k) = (-Cg_j/k)/(Cg_j/k) = -1$
If $Pa_i = -Cg_j$	then $IEI_i = Pa_i/(Cg_j/k) = -Cg_j/(Cg_j/k) = -k.$

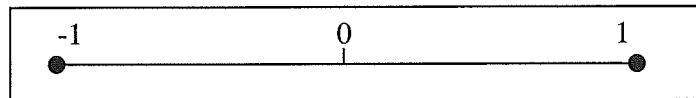
Figure 1. Extreme levels of IEI



In regard to GEI the following results are obtained:

If $IEI_1 = k$ and $IEI_2 = \dots = IEI_k = 0$	then $GEI = \Sigma(IEI_i)/k = k/k = 1$
If $IEI_1 = IEI_2 = \dots = IEI_k = 1$	then $GEI_j = \Sigma(IEI_i)/k = k/k = 1$
If $IEI_1 = IEI_2 = \dots = IEI_k = 0$	then $GEI_j = \Sigma(IEI_i)/k = 0$
If $IEI_i = -k$ and $IEI_2 = \dots = IEI_k = 0$	then $GEI_j = \Sigma(IEI_i)/k = -k/k = -1$
If $IEI_1 = IEI_2 = \dots = IEI_k = -1$	then $GEI_j = \Sigma(IEI_i)/k = -k/k = -1.$

Figure 2. Extreme levels of GEI



Let us now assume that group j is made of four members $i = 1, 2, 3, 4$ ($k = 4$) and that the total amount of messages exchanged during the meeting is $Cg_j = 80$. The previous extremes are calculated as follows.

If member i is the only speaker in the group and all his/her comments are relevant and positive ($Cw_i = Pa_i = 80$), his/her level of $IEI_i = (Pa_i)/(Cg_j/k) = 80/(80/4) = 4$. Whereas, if the same speaker makes all negative comments ($Pa_i = -Cg_j = -80$) his/her level of $IEI_i = -4$.

If member i comments are equal to the amount of possible comments that the member could make hypnotising an equal contribution of each member to the group discussion and the comments are all relevant and positive ($Pa_i = Cg_j/k = 80/4 = 20$), his/her level of $IEI_i = (Cg_j/k)/(Cg_j/k) = (80/4)/(80/4) = 1$. Whereas, if the same amount of member's comments are all negative ($Pa_i = -Cg_j/k = -80/4 = -20$) his/her level of $IEI_i = -1$.

Finally, if member i does not make any comments ($Cw_i = 0$) or his/her comments are irrelevant ($Pa_i = 0$) his/her level of $IEI_i = 0/(Cg_j/k) = 0$.

On the other hand, the effects of such scenario on the overall evaluation of the team through GEI are the following.

If member i obtains a level of $IEI_i = k = 4$ and consequently the other members obtain a level of $IEI_2 = \dots = IEI_k = 0$ then $GEI_j = \Sigma(IEI_i)/k = k/k = 4/4 = 1$. Whereas, if member i obtains a level of $IEI_i = -k = -4$ and consequently the others still obtain $IEI_2 = \dots = IEI_k = 0$ then $GEI_j = \Sigma(IEI_i)/k = -k/k = -4/4 = -1$.

Similarly, if all the members obtain $IEI_1 = IEI_2 = \dots = IEI_k = 1$ then $GEI_j = \Sigma(IEI_i)/k = k/k = 4/4 = 1$. Whereas, if all the members obtain $IEI_1 = IEI_2 = \dots = IEI_k = -1$ then $GEI_j = \Sigma(IEI_i)/k = -k/k = -4/4 = -1$.

Finally, if none of the members obtain a positive or negative value of $IEI_1 = IEI_2 = \dots = IEI_k = 0$ then $GEI_j = \Sigma(IEI_i)/k = 0$.

3.3 Results

As previously mentioned analysing the data according to the Bales' method assessed the exchange of socio emotional messages on a higher level in the face-to-face communication, but the overall amount of exchanged messages was not taken into consideration. Instead, the method here presented aims to compute the exchange of socio emotional, task related and goal related messages taking the overall messages exchanged into consideration. As a first application of the method, the research aimed to investigate only the following two general research questions.

- Is the level of IEI higher in face-to-face or computer-mediated communication?
- Is the level of GEI higher in face-to-face or computer-mediated communication?

The levels of IEI have been compared as follows. First, the members' IEI have been ranked in regard to the other group members in the two working modes. Second, IEI obtained in the face-to-face and in the CMC modes have been statistically analysed using the t-test. The same mode of analysis has been applied for the comparison of GEI. [Rossi de Mio, 2002d]

It was remarkable that the ranking of IEI was not always equal in the two working modes. Members with the lowest level of IEI in one working approach scored the lowest level of IEI in the other approach. Moreover, in three groups out of four who obtained the highest level of IEI in one approach scored best in the other approach as well. Finally, in relation to the second and third positions no regularities were found.⁴ This first result suggests that the same individual may be able to reach a higher or lower level of emotional intelligence in the two working approaches. However, who has the group lowest or highest level of IEI in one working approach is respectively likely to obtain the same result in the other approach. Finally, due to the small sample utilised the statistical

⁴ All the groups were made of four members.

comparison (t-test) of IEI in the 2 working modes resulted not quite significant (mean difference = -0.1297, $p = 0.0533$).⁵

One of the initial expectations concerning the group performance was that the face-to-face communication would create more significant levels of GEI than the virtual approach (see section 2). The results partially did not support this initial hypothesis. Based on this analysis the level of GEI was always found higher in the virtual communication. The comparison of IEI together with the results of GEI in the 2 working modes resulted statistically (t-test) significant (mean difference = -0.1338, $p = 0.0162$).

The reasons of these results are addressed to fact that the content of the messages exchanged in the CMC mode was more social emotionally, task or goal oriented. In fact, by applying the method here presented the level of IEI and consequently of GEI increase with the augmentation of the amount of the categorised messages weighted with the total amount of messages exchanged. In the face-to-face mode the average of the total exchanged messages was equal to 769; whereas, the relevant exchanged messages were 295. On the other hand, in the CMC mode the average of total messages exchanged was 255 and of the relevant ones 133. Therefore, in the face-to-face mode only 38.4 percent of the exchanged messages were considered relevant⁶; whereas, in the CMC mode they were 52.1 percent.

4. CONCLUSION AND IMPLICATIONS FOR MANAGERS

This paper summarises the first attempt to quantitatively measure emotional intelligence in the face-to-face and computer-mediated communication. As previously mentioned the analysis of the social emotional interactions according to the post session questionnaires and the Bales' scheme provided good insights on the issue of emotional intelligence in groups. The post session questionnaires allowed focusing the research on the overall exchange of socio emotional messages in the two working approaches [Rossi de Mio, 2002b] and the modified Bales' method provided first inferences on the exchange of socio emotional and task related messages [Rossi de Mio, 2002c]. Particularly, it appeared that the overall exchange of social emotional and task-oriented messages was significantly higher in the face-to-face communication. On the other hand, it was remarkable that the overall exchange of messages (relevant and non-relevant) was three times greater in the face-to-face interaction as well.

The model here proposed is based on the fact that the relevant exchanged messages should be evaluated based on the total amount of exchanged messages and that theoretically each member should be equally allowed to brake into the group discussion.

Weighting the amount of relevant exchanged messaged by the total amount of exchanged messages allows providing an insight on how the individuals and the group allocate the efforts. The higher the percentage of the relevant messages on the total exchanged

⁵ The coding of three groups out of four is being processed and will be included in the final paper.

⁶ A comment is considered relevant if it is possible to categorise it in one of the variable of the coding schemes (see Appendix C for the Bales' scheme and table 3 for the scheme here proposed)

Since the concept of emotional intelligence has been introduced in the groundbreaking book of Daniel Goleman it had a great success in the discipline of social psychology and among practitioners. But the attempts of defining and describing emotional intelligence are always been vague and mostly argumentative. The objective of this research is to give a quantitative measure of emotional intelligence in concern to the group interaction. Assessing a quantitative measure of emotional intelligence is considered potentially useful to achieving an additional understanding of the differences between the computer-mediated and the face-to-face environment. Assessing a measure of it and comparing the face-to-face and the computer-mediated communication may therefore provide good insights on the quest for a reliable measure of group effectiveness and performance. Moreover, emotional intelligence is a notion already very popular among practitioners and therefore this research could be allocated on an interesting position within the debate between relevance and rigour in the information systems research. Another problem of the information systems research is its strong dependency on the technology. As a basic research, this study can be useful in order to evaluate different information communication systems. For example, diverse results may be found when applying this model to different collaborative systems characterised by different levels of social presence and turn taking effects.

5. LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

Even though studies suggest that there are not substantial differences between the performance of undergraduates and professionals, a general limitation of studies conducted in an experimental setting is their restricted external validity. In order to overcome this obstacle, the research in progress consists in the establishment of field experiments with professionals from different industries and with different skills. In the experiments different communication channels characterised by different level of social presence and turn-taking effect will be used. The methods presented in this paper will be applied in order to investigate the same issue in a real business environment. Moreover, the experiments will aim to assess a comparison between the individual and group social emotional performance and the achievement of the group goals.

New emerging communication/collaboration technology, with particular concern to mobile CSCW (Computer Supported Collaborative Work), will be utilised in other multifactor experimental settings as well. The vision of Keen and Mackintosh [2001] of a "freedom economy" sees mobile technology becoming the daily routine of the networked communication. Mobile technology will be adopted and become the stepping stone of the freedom economy, "...it is absolutely inevitable that M-commerce at some point in the next two to five years becomes the mainstream of business: it is the step forward in the freedom economy" (p. 25). By extending this concept, the vision of the mobile society sees all the electronic devices connected to each other with the possibility to access information always and everywhere (Christer Carlsson, June 2002). On the other hand, other issues regarding this topic should be considered as well. In a panel discussion during ECIS2002 (panellists: Doug Vogel, Christer Carlsson and Lynne Markus), it has been argued that a continuous on-line connection with colleagues, team members or co-workers may lead to no-time for thinking. Condition that could lower personal or group performances. In such an environment the perception of external messages and the

cognitive processes may happen differently compared to the traditional allocated working environment. The research in progress will therefore pay a particular attention to network technologies enabling always on-line connections and their possible consequences from a social emotional perspective.

REFERENCES

- Adair, J. (1986). *Effective Teambuilding*. Gower, Aldershot.
- Anantaraman, V. (1984). Teambuilding. In *Human Resource Management: Concepts and Perspective*. Singapore University Press, Singapore.
- Bales R. (1950). A set of categories for the analysis of small group interaction. *American Sociological Review*, 15, 2, 257-263.
- Berdahl, J. L., and Craig, K. M. (1996). Equality of participation and influences in groups: the effects of communication medium and sex composition. *Computer Supported Cooperative Work*, 4, 2, 179-201.
- Boden, D. (1994). *The Business of Talk: Organizations in Action*. Oxford, London.
- Boudas, K. and Arrow, H. (1996). The development of group identity in computer and face-to-face groups with membership change. *Computer Supported Cooperative Work*, 4, 153-178.
- Carletta, J., A. H. Anderson and R. McEwan (2000). The effects of multimedia communication technology on non-collocated teams: a case study. *Ergonomics*, 43(8), 1237-1251.
- Cherniss, C., and D. Goleman (2001). *The Emotionally Intelligent Workplace*. Jossey-Bass, San Francisco.
- Chidambaram L. and B. Jones (1993). Impact of Communication Medium and Computer Support on group Perceptions and Performance: A Comparison of Face-to-Face and Dispersed Meetings. *MIS Quarterly*, 17 (December), 466-491.
- Chidambaram, L., and Bostrom, R. P. (1990). Evolution of group performance over time: a repeated measures study of GDSS effects. *Journal of Organizational Computing*, 3, 4, 443-469.
- Chidambaram, L., Bostrom, R. P., and Wynne, B. E. (1990). A longitudinal study of the impact of group decision support systems on group development. *Journal of management Information Systems*, 7, 3, 7-25.
- Chidambaram, L., Bostrom, R. P., and Wynne, B. E. (1990). An empirical investigation of the impact of computer-mediated support on group performance. *Proceedings of the 23rd Annual Hawaii International Conference on System Science*, 4, 3-12.
- Cummings, A., Schlosser, A., and Arrow, H. (1996). Developing complex group products: idea combination in computer-mediated and face-to-face groups. *Computer Supported Cooperative Work*, 4, 2, 229-251.
- Daft, R. L. and R. H. Lengel (1986). Organizational Informational requirements, Media Richness and Structural Design. *Management Science*, (7:3), May, 554-571.
- DeSanctis, G. and R. B. Gallupe (1987). A Foundation for the Study of Group Decision Support Systems. *Management Science*, 33(2), 589-609.
- Druskat, V.U. and S. B. Wolff (2001). Building the Emotional Intelligence of Groups. *Harvard Business Review*, March, 81-90.
- Ends, E. and C. Page (1977). *Organisational Team Building*. Winthrop, Cambridge.
- Francis, D. and D. Young (1979). *Improving Work Groups: A Practical Manual for Teambuilding*. University Associates, California.
- Galegher, J., and R. E. Kraut (1990). Computer-mediated communication for intellectual teamwork: a field experiment in group writing. *Proceedings of the Conference on Computer-Supported Cooperative Work*, 95-78.

- Galegher, J., and R. E. Kraut (1994). Computer-mediated communication for intellectual teamwork: an experiment in group writing. *Information Systems Research*, 5, 2, 110-138.
- Goleman, D. (1995). *Emotional Intelligence*. Bantam Books, New York.
- Goleman, D. (1998). *Working With Emotional Intelligence*. Bantam Books, New York.
- Guest, R. H. (1962). *Organizational Change: The Effect of Successful Leadership*. Tavistock Publications, New York.
- Hackman, R. and R. Wageman (2001). Top Teams: Why Some Work and Some Do Not. Five Things the Best CEOs Do To Create Outstanding Executive Teams. HayGroup, Inc.
- Hammer, M and S. A. Stanton (1995). *The Reengineering Revolution: A Handbook*. HarperBusiness, New York.
- Hare, A. P. (1973). Theories of group development and categories for interaction analysis. *Small Group behaviour*, 4, 3, 259-304.
- Hare, A. P. (1976). *Handbook of small group research* (2nd edition). The Free press of Glencoe, New York.
- Hellriegel, D., J. Slocum and R. Woodman (1989). *Organisational Behavior*. West, Minnesota.
- Hit, W. (1988). *The Leader-manager: Guidelines for Action*. Battelle, Columbus, Ohio.
- Huang, W., Wei, K. K., Lim, L. H., and Bostrom, R. (1996). Transforming a lean CMC medium into a rich one: an empirical investigation in small groups. *Proceedings of the 7th International Conference on Information Systems*, 265-277.
- Huszczko, G. (1990). Training for Team Building. *Training and Development Journal*, 44 (2), 37-43.
- Johnson, D. and F. Johnson (1991). *Joining Together: Group Theory and Group Skills*. Prentice Hall, New Jersey.
- Kaplan, M. F. and C. E. Miller (1987). Group decision making and normative versus informational influence: effects of type of issue and assigned decision rule. *Journal of Personality and Social Psychology*, 53, 2, 306-313.
- Katzenbach, J. R. and D. K. Smith (1993). The Discipline of Teams. *Harvard Business Review*, March/April, 111-120.
- Keen, P. G. W., and R. Mackintosh (2001). *The Freedom Economy: Gaining the M-commerce Edge in the Era of the Wireless Internet*. McGraw Hill, Berkeley.
- Krippendorff, K. (1980). *Content analysis: An introduction to its methodology*. Sage Publications, Beverly Hills.
- Lebie, L., Rhoades, J. A., and McGrath, J. E. (1996). Interaction process in computer-mediated and face-to-face groups. *Computer Supported Cooperative Work*, 4,2, 127-152
- LeDoux, J. E. (1986). Sensory systems and emotions. *Integrative Psychiatry*, 4, pp. 237-248.
- LeDoux, J. E. (1996). *The Emotional Brain*. Simon&Schuster, New York.
- Liebenau, J. (1990). *Understanding information: An introduction*. Macmillan, London.
- Lipnack, J. and J. Stamps (1997). *Virtual teams, Reaching Across Space, Time, and Organizations with Technology*. Wiley, New York.
- Losada, M., Sanchez. P., and Nobel, E. E. (1990). Collaborative technology and group process feedback: their impact on interactive sequences in meetings. *Proceedings of the Conference on Computer Supported Cooperative Work*, 53-64.
- Margerison, M. and D. McCann (1985). *How to Lead a Winning Team*. MCB University Press, Bradford, England.
- Massey, A. P., and Clapper, D. L. (1995). Element finding: the impact of a group support systems on a crucial phase of sense making. *Journal of Management Information Systems*, 11, 4, 149-176.
- Mc Grath, J. E. (1984). *Interaction and Performance*. Prentice Hall, Englewood Cliffs, NJ.
- McGrath, J. E., and Arrow, H. (1996). Introduction: the JEMCO 2 study of time, technology, and groups. *Computer Supported Cooperative Work*, 4, 2, 107-126.

- Orlikowski, W.J. and J.J. Baroudi (1991). Studying Information Technology in Organizations: Research Approaches and Assumptions". *Information Systems Research*, (2), pp. 1-28.
- Putnam, L.L. (1981). Procedural messages and small group work climates: a lag sequential analysis. In M. Burgoon, *Communication Yearbook 5*, New Brunswick, NJ: Transaction Books, 331-350.
- Rees, W. (1988). *The Skills of Management*. Routledge, London.
- Rhee, H. S., Pirkul, H., Jacob, V., and Barhki, R. (1995). Effects on computer-mediated communication on group negotiation: an empirical study. *Proceedings of the 28th Hawaii International Conference on System Science*, 4, 270-279.
- Rossi de Mio, R. (2002a). On Defining Virtual Emotional Intelligence. In *Proceeding of the 10th European Conference on Information Systems*, pp. 1124-1133, Gdnask.
- Rossi de Mio, R. (2002b). Emotional Intelligence in Virtual and Face-to-Face Communication: A Pilot Laboratory Experiment. In *Proceeding of European Conference on Information and Communication Technology Advances and Innovation in the Knowledge Society (eSMART2002)*, Manchester. (To appear)
- Rossi de Mio, R. (2002c) Assessing a Quantitative Measure of Emotional intelligence in Face-to-Face and Virtual Communication using the Bales' method. (Submitted to COLLECTer2002)
- Rossi de Mio, R. (2002d). Emotional Intelligence in Virtual and Face-to-Face Communication: An Explorative Laboratory Experiment. (Submitted to HICSS2003)
- Scott, D. and A. Townsend (1994). Teams: Why Some Succeed and Others Fail. *Human Resource Magazine*, (Yoder-Heneman Research award winner), 62-67.
- Short, J., E. Williams and B. Christie (1976). *The social psychology of telecommunications*. John Wiley, London.
- Snyder, K. (1988). *Competency Training for Managing Productive Schools*. Harcourt Brace Jovanovich, San Diego.
- Stott, K. and A. Walker (1992). *Making Management Work: A Practical Approach*. Prentice Hall, Singapore.
- Stott, K. and A. Walker (1995). *Teams, Teamwork and Teambuilding*. Prentice Hall, Singapore.
- Sudweeks F. and M. Albritton (1996). Working Together Apart: Communication and Collaboration in a Networked Group. In *Proceeding of the seventh Australian Conference on Information Systems*, 2, pp. 701-712, Tasmania.
- Sweetman, K. (2001). Don't Worry Be Happy When Members of a Top Team Share Outlook on Life, The Company's Bottom Line is Also Likely to be Positive. *MIT Sloan Management*, 43, 10.
- Thamhain, H. (1990). Managing together: A Practical Look at Teambuilding. *Management Solutions*, 31 (October).
- Walther, J. B. (1992). Longitudinal experiment on relational tone in computer-mediated and face to face interaction. *Proceedings of the 25th Hawaii International Conference on System Science*, 4, 220-231.
- Walther, J. B. (1995). Relational aspects of computer-mediated communication: experimental observation over time. *Organizational Science*, 6, 2, 186-203.
- Walther, J. B., and Burgoon, J. K. (1992). Relational communication in computer-mediated interaction. *Human Communication research*, 19, 1, 50-88.
- Watson, R., DeSanctis, G. and M. S. Poole (1988). Using a GDSS to Facilitate Group Consensus: Some Intended and Unintended Consequences. *MIS Quarterly*, 12:3, September, pp. 463-478.
- Wynn, R. and C. Guditus (1984). *Team Management: Leadership by Consensus*. Charles E Merrill, Ohio.
- Zigurs, I, M. S. Poole and G.DeSanctis (1988). A Study of Influence in Computer-Mediated Group Decision-Making. *MIS Quarterly*, 12:4, December, pp. 625-644.

Appendix A

POPULATION, TASK, INSTRUMENTS AND LABORATORIES

The experiment has been done with 26 Finnish and non-Finnish Master and Doctoral students in Information Systems (IS) and Business Administration (BA) in a 2x1 experimental design. The manipulated factor is the communication medium (face-to-face vs. computer mediated). A total of 5 groups of 4 students and 2 groups of 3 students were built and the working language was English. Note that according to previous studies no significant difference in behaviour has been identified between three and four person groups [Watson et al., 1988; Zigurs et al., 1988]. The groups were built randomly and each participant met the correspondent teammates only on the day of the meeting. The groups worked on two assignments (A1 and A2) with a time limit of three hours per assignment. The assignments were built in order to stimulate the debate within the team. To avoid the learning effect A1 and A2 were different to each other. Moreover, in order to relate the success or failure of the groups mainly to their emotional performance the chosen topic was rather unfamiliar for all the members. Both A1 and A2 were two obsolete and ineffective business processes and the given task was the elaboration of a Business Process Reengineering. These tasks are classifiable as two decision-making tasks with no right answers [McGrath, 1984]. A1 consisted in the reengineering of the business process of a manufacturing company of auto parts. The information about the company and its process given to the participants was: name, characteristics, key process, existent business process, actors involved in the business process, problems of the process with their consequences, and a graphical representation of the business process. A2 consisted in the reengineering of the business process of a company that repair and replace warehouse doors and the given information was of the same kind as in A1. In both cases the task consisted in the development of a new business process applying the criteria of the business process reengineering strategy proposed in "The Reengineering Revolution: A Handbook" by M. Hammer [1995]. Before the experiment a brief and general introduction to this topic was presented to the participants. However, the quality of the final assignments mainly depended on the group ability of understating and solving the problems of the existent business process and nevertheless of creating innovative and consistent proposals for the new business process. Before the experiment a brief and general introduction to this topic was presented to the participants. However, the quality of the final assignments mainly depended on the group ability of understating and solving the problems of the existent business process and nevertheless of creating innovative and consistent proposals for the new business process. The assignment gave study-credits to the students and additionally an award was put up for the best group performance. In a post-session questionnaire one question aimed to investigate whether the similarity of the two assignments created any learning effects. It appeared that the participants increased their knowledge on the topic after the first meeting. Therefore, the evaluation of the group performance in the virtual and the traditional environment will not be analysed in this study.

Figure 1. Logistics of the virtual (a) and face-to-face (b) meetings

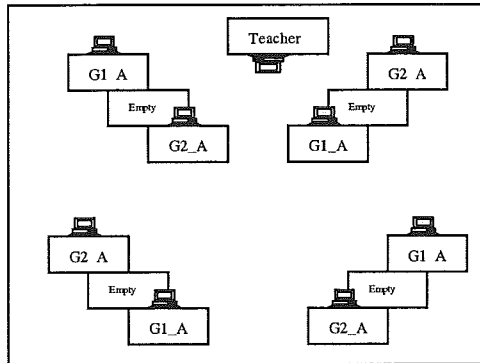


Figure 1a. Virtual meeting

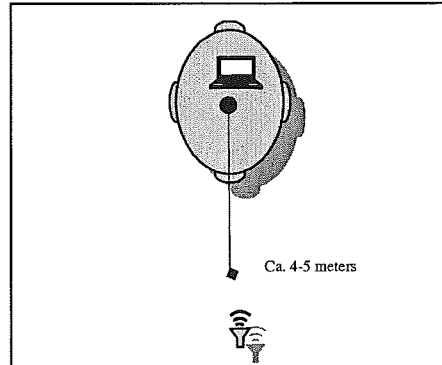


Figure 1b. Face-to-face meeting

The experiment has been carried out in two different rooms in order to allow the utilisation of the two working approaches. The face-to-face meetings were held in a meeting room on a round table. The members had at their disposal a laptop connected to a Local Area Network (100 Mb/s) for writing the report and seeking eventual information on the Internet. The meetings were monitored by a professional video camera located circa 4-5 meters apart from the participants. The audio has been recorded with a high quality microphone situated on the round table on an equal distance from each member (see figure 1b).

The treated meetings have been organised in a computer-lab provided with 12 PCs connected to a Local Area Network (100 Mb/s) for writing the report, seeking eventual information on the Internet and to enable the virtual communication. The chosen collaborative system was the Microsoft Windows NetMeeting 3.01. The NetMeeting allows instant exchange of messages through its chat window, simultaneous drawings on its shared whiteboard and the exchange of files through its file transfer window. A short introduction and training on the use of the system has been done before starting the experiment. Moreover, the software allows storing members' comments, drawings and exchanged files. Two groups interacted at the same time working respectively on A1 and A2 and they were located apart from each other in order to avoid any face-to-face communication (see figure 1a).

Appendix B

F2F Meeting⁷



Please answer the following questions ticking only one box.

Major study:..... Occupation (if you have one):.....
 Nationality:..... Education Level (year of study):.....
 Date of birth:..... Member of Group: 1...2...3...4...5...6...7...8
 Gender: ...M...F

Scale of preferences:

Strongly disagree	Disagree	Partly disagree	Partly agree	Agree	Strongly agree
-------------------	----------	-----------------	--------------	-------	----------------

Questions:

1. I was strongly motivated before starting the assignment	Strongly disagree <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> Strongly agree
2. I was strongly motivated at the end of the assignment	Strongly disagree <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> Strongly agree
3. I'm satisfied with the result of the assignment	Strongly disagree <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> Strongly agree
4. Before starting the assignment I had a good knowledge of the topic	Strongly disagree <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> Strongly agree
5. I feel like I have improved my knowledge about the topic	Strongly disagree <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> Strongly agree
6. The communication with my team-mates was very effective	Strongly disagree <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> Strongly agree
7. I felt very committed to the goal	Strongly disagree <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> Strongly agree
8. During the discussion it was very hard to brake in with a comment at the right time	Strongly disagree <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> Strongly agree
9. It was hard to win the attention of one member	Strongly disagree <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> Strongly agree
10. I felt very relaxed during the meeting	Strongly disagree <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> Strongly agree

⁷ Questions 8 and 9 were reverse-coded for the analysis.



Virtual Meeting⁸

Please answer the following questions ticking only one box.

Major study:..... Occupation:.....
 Nationality:..... Education Level (year of study):.....
 Date of birth:..... Familiarity with NetMeeting: Low.....Medium.....High
 Gender: ...M...F Member of Group: 1...2...3...4...5...6...7...8

Scale of preferences:

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Strongly disagree	Disagree	Partly disagree	Partly agree	Agree	Strongly agree

Questions:

1. I was strongly motivated before starting the assignment	Strongly disagree <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> Strongly agree
2. I was strongly motivated at the end of the assignment	Strongly disagree <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> Strongly agree
3. I'm satisfied with the result of the assignment	Strongly disagree <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> Strongly agree
4. Before starting the assignment I had a good knowledge of the topic	Strongly disagree <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> Strongly agree
5. I feel like I have improved my knowledge about the topic	Strongly disagree <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> Strongly agree
6. The communication with my team-mates was very effective	Strongly disagree <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> Strongly agree
7. I felt very committed to the goal	Strongly disagree <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> Strongly agree
8. During the discussion it was very hard to brake in with a comment at the right time	Strongly disagree <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> Strongly agree
9. It was hard to win the attention of one member	Strongly disagree <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> Strongly agree
10. I felt very relaxed during the meeting	Strongly disagree <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> Strongly agree
11. The face-to-face contact was strongly missing	Strongly disagree <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> Strongly agree

⁸ Questions 8 and 9 were reverse coded for the analysis.

1995

1. *Carlsson, C., Walden, P., On Fuzzy Hyperknowledge Support Systems*
2. *Brännback, M., DSS - A New Foundation for Strategic Thinking*
3. *Carlsson, C., Walden, P., More Effective Strategic Management with Hyperknowledge: The Woodstrat Case*
4. *Finne, T., Creating the Framework for an Information Security Analysis. Part I*
5. *Finne, T., Investigating the Information Security in Organisations: Crucial Factors in the Information Security. Part II*
6. *Finne, T., CBISA - a DSS for Information Security Analysis. Part III*
7. *Brännback, M., Spronk, J., Managing Critical Success Factors as Value-Focused Strategic Decision Making*
8. *Brännkärr, S., Carlsson, C., Westerholm, G. (eds), Institute for Advanced Management Systems Research. Three-Year Report 1992-1994*
9. *Carlsson, C., Hyperknowledge Support Systems as Instruments for Corporate Success*

1996

1. *Carlsson, C., Westerholm, G. (eds), Institute for Advanced Management Systems Research, Annual Report 1995*
2. *Brännback, M., Measuring Intelligence in Group Decision Making*
3. *Brännback, M., Tetard, F., Beijar, T., Structuring unknown realities using group support systems*
4. *Carlsson, C., Fuzzy Logic and Hyperknowledge. A New, Effective Paradigm for Active DSS*
5. *Finne, T., Computer-Based Information Security Analysor: A Tool in a Company's Risk Mangement*
6. *Finne, T., The Information Security Chain in a Company*
7. *Finne, T., Do Bank and Insurance Companies Emphasise Personnel Security More than Other Business?*
8. *Lindgren, N., A Structural Analysis of the Spread between an Interest Rate Swap and the Yield Curve Derived from Finnish Government Bonds*
9. *Finne, T., Passwords - a Crucial Link in the Information Security Chain*

1997

1. *Brännback, M., The Meaning of Globalisation of Business - on Knowledge and Customers*
2. *Carlsson, C., Nummila, S. (eds), Institute for Advanced Management Systems Research, Annual Report 1996*
3. *Carlsson, C., Aktive DSS: Pursuing some limits in decision support*
4. *Brännback, M., Is there a New Dominant Logic of Marketing in the Internet?*

1998

1. *Carlsson, C., Fullér, R., Nummila, S. (eds), Institute for Advanced Management Systems Research, Annual Report 1997*
2. *Walden, P., Turban, E., Working Anywhere, Anytime and with Anyone (Looks closer than it is)*

1999

1. Carlsson, C., Fullér, R., Lahtinen, M., (eds), Institute for Advanced Management Systems Research, Annual Report 1998
2. Kvassov, V., A Case Study of Business Transformation for Telecommunications of St. Petersburg
3. Tétard, F., Reengineering a Project Management Process: a Case Study
4. Tétard, F., The Changing Nature of Work and its Implications for Knowledge Management and Information Systems
5. Anckar, B., Virtual Travel Agencies - Tourist Value Through Travel Information Systems
6. Anckar, B., Walden, P., Destination Maui? Online Booking is no Bed of Roses
7. Carlsson, C., Fullér, R., Soft Computing and the Bullwhip Effect
8. Carlsson, C., Fullér, R., On Mean Value and Variance of Fuzzy Numbers
9. Tétard, F., On Fragmentation of Working Time: A Study of Causes and Effects of Work Interruptions
10. Walden, P., Turban, E., Virtual Team Work – Working Together in Abo and Long Beach
11. Walden, P., Carlsson C., Liu, S., Industry Foresight with Intelligent Agents
12. Carlsson C., Walden P., Intelligent Support Systems – The Next Few DSS Steps.

2000

1. Carlsson, C., Fullér, R., Isoniemi, H.,(eds.) Institute for Advanced Management Systems Research. Annual Report 1999
2. Carlsson C., Fullér R., Reducing the bullwhip effect by means of intelligent, soft computing methods
3. Anckar, B., Walden, P., Designing Internet Reservation and Management Software Systems for Small Peripheral Hospitality Organizations: The *HotMot* Solution
4. Carlsson, C., Mobile Commerce and Value-Added Services. The Impact of Intelligent IT
5. Anckar, B., Olofsson, S., Walden, P., Agents as Agents: A Virtual Assistant for Self-bookings in Travel

2001

- Carlsson, C., Fullér, R., Svennblad, M.,(eds.) Institute for Advanced Management Systems Research. Annual Report 2000
1. Kvassov, V., Personality Types of Managers in Development of Intelligent Systems
 2. Anckar, B., An Empirical Assesment of Consumers' Perceived Benefits of and Barriers to Internet Commerce: Implications in Terms of Offering *e*-Suitability
 3. Anckar, B., Walden, P., Jelassi, V., The Relationship Between Business Models and Customer Value in Electronic Grocery Shopping: The Case of Nettimarket.com
 4. Tetard, F., Improving Project Management with Web-based Information Systems: a Case Study
 5. Bozóki, S., An Analysis of the Hierarchy Process

6. *Carlsson, C.*, Decision Support in Virtual Organizations: The Case for Multi-Agent Support
7. *Turban, E., Lee, M., Walden, P., Westfall R.*, On Global Electronic Commerce: Hello California, Finland and Hong Kong

2002

1. *Carlsson, C., Fullér, R., Kataja, K.,(eds.)* Institute for Advanced Management Systems Research. Annual Report 2001
2. *Carlsson, C., Kjellman, A.*, Industry Foresight – Management beyond Forecasting and Scenario Planning
3. *Collan, M., Liu, S.*, Fuzzy Logic and Intelligent Agents: Towards the Next Step of Capital Budgeting Decision Support
4. *Rossi de Mio, R.*, A Method for a Quantitative Measure of Emotional Intelligence in Face-to Face and Computer-Mediated Communication