

COST-14 CoTech  
1994–96  
*Final Report*

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**Abstract.** This report documents the work and achievements of the COST-14 Action on Cooperation Technology (CoTech), 1994–1996.

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## Preface

This report describes the activities and achievements of COST-14 CoTech and of the COST-14 Coordinating Agency (contract number COST-CT94-0082-DK).

On behalf of the more than one hundred researchers who have been active in COST-14 CoTech, I'd like to thank the European Commission's DGXIII, the COST Senior Officials, and the COST program for supporting the CoTech network's effort to ensure and strengthen the Europe's already strong position in the strategic area of CSCW, groupware, workflow systems, and coordination technology.

At a more personal level, I'd like to use the opportunity to express publicly the gratitude of the European CSCW community towards Rolf Speth and Peter Wintlev-Jensen of the European Commission for a commitment to European CSCW well beyond the call of duty.

Among the many participants in CoTech who have been working very hard, I'd like to mention especially Albert Kündig, the first chairman of the Management Committee, and Giorgio De Michelis, who replaced Albert in 1994. Without their ungratifying effort, the European CSCW community would never have reached the recognized position it now has.

Finally, this report could not have been produced without the contributions from the project coordinators and helpful ideas and comments from Giorgio De Michelis. Thanks to all.

Kjeld Schmidt  
COST-14 Coordinating Agency

# 1. The COST-14 CoTech action: objectives and achievements

Since its inception in 1989, COST-14 CoTech has played a significant role in fostering the development of the CSCW (Computer-Supported Cooperative work) community in Europe.

The general purpose of CoTech is to promote research into the field of Cooperation Technology, i.e., the theory and practice of how people, computers and communication systems should interact so that optimum support is given for cooperative work in a distributed systems context using advanced technologies. CoTech aims to develop, through interdisciplinary research, a more comprehensive understanding of the interaction patterns associated with computer and (tele)communication supported cooperative work, to derive generic models therefrom, thus giving guidance for the conceptual design of future systems, and to identify the functional requirements for the underlying infrastructure.

More specifically, the following goals have been set:

Overall scientific goals:

- (a) To create a theoretical basis for the emerging discipline of Cooperation Technology.
- (b) To establish for the participating scientific communities a common framework for research in Cooperation Technology.

Specific goals:

- (c) To propose to designers of Cooperation Technology systems appropriate methodologies and techniques for design, as well as methods for the evaluation and assessment of such systems.
- (d) To contribute to improved human/machine interfaces and to improved work conditions in general, thus supporting end-users of Cooperation Technology systems.
- (e) To derive guidance for planners and decision makers, based on an improved understanding of Cooperation Technology systems and their theoretical basis.
- (f) To influence standards bodies so that emerging standards in the Cooperation Technology area taken due account of the research results.
- (g) To disseminate scientific and technical results through appropriate media (i.e. scientific journals, conferences, etc.) so as to make the European CSCW efforts visible on an international level.

Political goal:

- (h) To make Europe a leader in the emerging field of Cooperation Technology.

## **History of the CoTech network**

The COST-14 Action was initiated in 1989. The COST-14 Memorandum of Understanding was eventually signed by 16 European countries (of which four are not

members of the European Union): Austria, Belgium, Denmark, Finland, Germany, Ireland, Italy, Norway, The Netherlands, Poland, Portugal, Slovenia, Spain, Sweden, Switzerland, and the United Kingdom, and by the Commission of the European Union as a participating entity.

In the first phase of the COST-14 Action, spanning the period from 1989 until mid-1993, research undertaken in some 40 institutions was coordinated and compiled by seven active working groups under the direction of the Management Committee. Three plenary workshops were held, and the results were presented at various international scientific conferences or published in scientific journals. Comprehensive reports have been published by the different working groups.

At a plenary workshop in May 1993, an assessment of the first phase was made and new directions for further research were proposed. Based on these proposals, the Management Committee defined a new structure for the COST-14 Action, with seven projects:

- (1) Virtual and Augmented Environments for CSCW.
- (2) Collaborative Information Spaces.
- (3) Practical Assessment of Multimedia Wide Area CSCW.
- (4) CSCW and Software Engineering
- (5) Computer Supported Collaborative Process Management.
- (6) Interdisciplinary Practice and Design for Cooperation Technology.<sup>1</sup>
- (7) Communication and Distributed System Support for CSCW.<sup>2</sup>

Based on a budget prepared by the Management Committee for this second phase, the COST Senior Officials Committee 11 June 1993 voted favorably for financial support for a period until such support could possibly be allocated under the provisions of the Fourth Framework Programme of the European Commission. Furthermore, in order to ensure efficient management and technical coordination, the Senior Officials requested that CoTech as a whole should be managed by a Coordinating Agency. After delays caused by various legal concerns, a public call for tenders was in the Spring of 1994 and as a result of this Risø National Laboratory was given the task in June 1994. After further delays, again caused by various legal and administrative concerns, the contract with the coordinating agency was finally signed by the Commission in March 1995.

After the initial appointment of a coordinating agency in June 1994, COST-14 CoTech was revitalized successfully during the Autumn of 1994. The groups have been working enthusiastically and have been publishing prolifically (around 200 publications can be attributed to CoTech activities, see section 3). The activities and achievements of the groups are described in detail in the body of this report (section 2, 3, and appendix C and F).

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<sup>1</sup> This project was *de facto* split into two projects: 'Interdisciplinary Practice and Design for Cooperation Technology: Design' and 'Interdisciplinary Practice and Design for Cooperation Technology: Practice'.

<sup>2</sup> This project was never activated due to the uncertainties faced by CoTech.

## Overall achievements of the CoTech network

COST-14 CoTech has been seminal in forming a European CSCW research community of approximately 60 participating institutions<sup>3</sup> from 17 countries,<sup>4</sup> bringing together more than one hundred active CSCW researchers in Europe, including almost all of the leading CSCW researchers in Europe (see Appendix A).

The participants to the seven COST-14 projects constitute a real and wide multi-disciplinary research community comprising: computer scientists (from various sub-disciplines: office automation, distributed computing, data bases, information systems, etc.), tele-communications engineers, psychologists, anthropologists, sociologists, and so forth.

COST-14 CoTech therefore has provided a very fertile and supportive environment for young and new researchers in CSCW and for promoting European research in the CSCW field. For instance, the highly successful Esprit Basic Research project COMIC (Esprit BRA Action 6225) was conceived and formed among participants to the first phase of CoTech.

Likewise, CoTech has served as an umbrella for a large number of different CSCW research activities funded by diverse sponsors such as national research programmes as well as by different European Commission programmes (see Appendix D). By providing such an umbrella, CoTech has played an important role in fostering mutual inspiration and critique between the various projects.

As a result, European CSCW research has established itself prominently on the international CSCW scene. A significant indication of the marked increase in international recognition, is the biennial North American CSCW conference, the major international forum for research in Computer Supported Cooperative Work. In previous years, European representation at this conference has been quite low: 7 % of the papers at the first CSCW conference in 1986, 6 % in 1988, 3 % in 1990, and 10 % in 1992. At the fifth CSCW conference in Chapel Hill, North Carolina, October 1994, the European representation reached 32 %, and with 29% of the papers at the sixth CSCW conference in Boston, Mass., the European representation remains at the same general level.

At the same time, the connections and relationships between the European CSCW community and CSCW communities in North America and elsewhere have multiplied and intensified. Thus, the European CSCW conference has developed into a highly recognized international conference. From 1989 the European conference on CSCW (ECSCW) which is held every odd year has been interleaving with the North American conference (CSCW) which is held every even year to serve as the main forum of the international research community on CSCW. All of the ECSCW conferences have been organized by institutions participating to the COST-14 Action.

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<sup>3</sup> Some of the institutions participate to more than one project with different research units.

<sup>4</sup> Three French institutions are now among the institutions in the CoTech network.

Similarly, participants to the COST-14 projects participate in the Program Committees of the American CSCW conferences as well as to those of other American related conferences and workshops. International workshops have been organized involving the participants to the COST-14 projects and American researchers (e.g., the Dagstuhl Seminar on Interdisciplinary Foundations of System Design and Evaluation, September 1994) and collaborative research initiatives have been launched between CSCW participants and American researchers, for instance the Euro-Canadian Cooperative Information Systems (CIS) project.<sup>5</sup>

Altogether, these developments are strong indications of the significant increase in quality of European CSCW research which has resulted from the pooling of effort on a European scale that has been made possible due to the research network that have grown within the framework of CoTech.

### **Issues of supporting CSCW research in Europe**

The area of Cooperation Technology is of crucial strategic importance for the IT industry by offering explosive market prospects: According to the International Information Management Congress (IMC) report on imaging and document management in Europe, the overall American and European document management, groupware, workflow and imaging market is predicted to reach almost \$9 billion in products and services by 1998. These technologies eventually will comprise 20% of the information technology market as the shift away from micrographics continues. Similarly, BIS Strategic Decisions (Norwell, MA) predicts dramatic increases for the workflow market. According to Connie Moore, director of BIS's Workflow, Document and Imaging Strategies Services (WDIS), revenue from the combined American and European workflow markets is predicted to rise from \$235 million in 1994 to \$1.1 billion in 1998 -- a 47% compound annual growth rate for workflow. The European workflow software market is expected to increase from \$68 millions in 1994 to \$543 millions in 1998.<sup>6</sup>

At the same time, the area of Cooperation Technology is characterized by turbulent technological change. For European IT industry to be able to play a leading role in such a field, requires a very intensive and flexible collaboration among European researchers so that new ideas are disseminated instantly and outdated approaches are identified and left behind. CoTech was therefore from the very start conceived of as a large, loosely coupled research action encompassing a variety of activity types and collaboration forms, such as focused working groups, group meetings, plenary meetings, a communication network, a publicly available document and information repository etc. This conception was also reflected in the reorganization of CoTech in May 1993 and in the proposal which was supported by the COST Senior Officials Committee 11 June 1993.

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<sup>5</sup> Participating institutions: Canada: Universities of British Columbia (Vancouver) and Toronto; Europe: Universities of Aachen, Hamburg, Milano, and Namur

<sup>6</sup> Keith E. Bulford: "Workflow in Europe: on the rise", *IMC Journal*, vol. 31, no. 4, 1995, p. 35.

Since then, however, the rules and regulations of the COST program have evolved in a way that does not fit with that conception of CoTech. As it is, in view of the complex decision procedures enforced even for simple things and the rigorous rules for meetings (rigid planning, restricted participation, etc.), the COST program seems to be rather exclusively devoted to supporting small international coordination committees with with no need for flexibility and adaptability.

Accordingly, the COST-14 Management Committee decided not to apply for continued funding for COST-14 CoTech under the COST program. Instead, it has been decided to attempt to transform CoTech into a Network of Excellence and initiatives have been take to that effect and the same time to encourage CoTech groups to seek support from other EU programs, including, of course, the COST program for smaller COST-like proposals.

The objective of the proposed CoTech Network of Excellence is to maintain and strengthen the European research collaboration in the area of Groupware and CSCW that has been provided by the CoTech framework under the COST-program. More specifically, the CoTech Network of Excellence aims at achieving the following:

- (1) Provide a forum for European R&D activities in the area of Groupware and CSCW which otherwise would be fragmented due to the plethora of R&D programmes at the European and national levels.
- (2) Provide an organized framework supporting young researchers in becoming cognizant of and involved in state-of-the-art research in Cooperation Technology and develop professional relationships with colleagues in other European countries.
- (3) Provide a framework in which novel research and development ideas and approaches can be fostered and matured to a stage where they can be turned into operational and industrially interesting R&D projects.

## 2. Research activities: objectives and achievements

### 2.1. Virtual and Augmented Environments for CSCW (VAR)

*Coordinators: Vandamme (Ghent) and Benford (Nottingham).*

The primary objectives of the working group were to:

- explore the relationship between CSCW and emerging technologies in the areas of virtual and augmented reality
- produce a research framework of key issues
- propose concepts and models to be discussed within the context of a number of real-world CSCW scenarios
- influence and share the results of prototyping work from related projects

There already exists a history of experimentation with spatial metaphors within CSCW and related disciplines, such as virtual meeting rooms, rooms interfaces (both visual and aural), social browsing in virtual worlds, recreational environments and collaborative three-dimensional design. In addition, a range of exciting new computer technologies is emerging under the general labels of Virtual Reality (VR) and Augmented Reality (AR). These technologies allow users to inhabit and explore computer generated virtual worlds through novel interface devices such as head mounted displays, datagloves, wands, force-feedback joy-sticks, space-balls, data suits and many others. The link between the two is that these new technologies promise to enable the CSCW metaphors in ways not previously possible, allowing the production of collaborative virtual environments within a few years. Vendors of VR systems are already offering early networked products to support multi-users access. As CSCW researchers, we recognize that there is a great difference between basic multi-user access and systems that actively support cooperative work. The work of the group was therefore to explore the relationship between CSCW and the new VR/AR technologies with the aim of identifying key issues and developing concepts and models to enable future virtual environments to actively enable cooperation.

The first six months to one year were spent formulating a research framework. This involved familiarization of group members with each others work; further development of the issues list outlined above; review of existing developments in VR and AR technologies and finally categorization of research issues. The second year was spent on exploring the issues identified; developing models and concepts; disseminating results.

In its work, the group primarily addressed the following problem areas:

#### 1. Subjectivity in VAR environments:

- subjective navigation tools such as personal landmarks;
- awareness area's in var-environments;
- subjective interpretation of abstract/concrete var-objects.

2. Virtual Electronic document spaces:
  - 3D document spaces with shadow semantics;
  - 3D thesaurus browsers;
  - virtual annotation threads;
3. Speech Interaction in VAR environments:
  - VAR solutions for solving anaphora problems;
  - co-operating speech agents.
4. Hybrid cooperation modes:
  - filtered co-ordination through persistence and obtrusiveness ;
  - virtual embodiments for multiple parallel co-operation modes.

## 2.2. Collaborative Information Spaces (CIS-OrgMem)

*Coordinator: Bannon (University of Limerick)*

Project 2 CIS-ORGMEM has achieved a considerable amount in its relatively short life span. Project 2 has a relatively recent history as in the first 9 months of its existence a number of factors prevented a clear theme and its organization from development. Changes in personnel and interests thereafter lead to a re-shaping of the focus of the group under themes of organizational memory and common information spaces, with Liam Bannon as coordinator. The group then began its work in earnest and has accomplished quite a lot in the shortened time frame within which it has been active, due to the enthusiasm of its members and their interest in the topic. Indeed, the group has encouraged a large number of papers, reports and topics for panels and workshops in its lifetime, some of which are noted below (the list is not exhaustive, but indicative of the range of work of the group members). It has helped to focus research within Europe on the at times confusing themes of common information spaces and organizational memory, two issues that have become increasingly important within the field of CSCW, yet which have suffered from a lack of both conceptual and empirical work. This group has been the stimulus to recent work on these topics that is now appearing in a variety of international fora. The group has achieved international recognition for its work, and evidenced by the interest of a number of non EU researchers in the work of the group. This is a tribute to the interest and enthusiasm of the members of the group, who in at times difficult circumstances, due to administrative and other problems, have managed to produce quality work and share experiences and insights. In the space of less than a year the group has been able to develop a significant corpus of material that has progressed the state-of-the-art (see references below). As well as papers, a number of prototype systems were demonstrated and tested. Also, the group formed an internal newsgroup for electronic discussions and has developed a Web site for its members, thanks to the efforts of Dick Bentley, of GMD, where documents are accessible. A further contribution by Magnus Ramage of Lancaster University has been the compilation of a bibliography in the area of organizational memory - not a simple task, as the area is diffuse and crosses many disciplinary boundaries. The bibliography is organized into several categories:-

- organizational theory / management analyses of organizational memory;
- sociological and psychological analyses of collective and organizational memory;
- computer science and information systems perspectives on organizational memory;
- technical solutions to the support of organizational memory and descriptions of computer systems;
- perspectives from the humanities (particularly history) on collective memory;
- case studies of organizational memory at work (technological or not);
- organizational learning.

We are also very pleased at the inclusion of several eminent French research groups within the international CoTech group, which was initiated by the coordinator after the INRIA/France Telecom sponsored conference COOP 95 in France. This has added additional breadth and depth to the group. The CoTech group have also been active in related research projects and in proposals, at both national and international levels. Given the late start of the group, the progress has been indeed remarkable. In this short report, the following section provides some background on the scope of the CIS-ORGMEM group, before listing some of the outputs of the group.

### **Project Concerns**

There is increasing interest among developers, end-users, and researchers in the problems of sharing information among distributed work groups in organizations - providing some form of shared or common information “space”, and how to “grow” some form of “organizational memory” over time as a common resource for people in organizations. However, while there have been a number of attempts to clarify exactly what is involved in the “sharing” of information, and in the concept of “organizational memory” within the CSCW field, neither of these topics have been dealt with in a coherent or comprehensive fashion. The intent of this work-group is to provide some coherence to the underlying discussion as well as to utilize these richer conceptualizations in the subsequent implementation of such concepts in prototype CSCW systems. The issues addressed by the work of the group include:

- investigation of current conceptions of organizational memory and information spaces
- analysis of existing systems that have support for such concepts
- development of new conceptual frameworks
- prototype development or augmentation of existing models

In their programmatic paper on CSCW, Schmidt & Bannon (1992) describe how the support of a common information space (CIS) between people engaged in cooperative work is a core problem for the field. They note that cooperative work is not facilitated simply by the provision of a shared database, but requires the active construction by the participants of a common information space where the meanings of the shared objects are debated and resolved, at least locally and temporarily. A common information space encompasses the artifacts that are accessible to a cooperative ensemble as well as the meaning attributed to these artifacts by the actors. Objects must thus be interpreted and assigned meaning, meanings that are achieved by specific actors on specific occasions of use. Computer support for this aspect of cooperative work raises a host of interesting and difficult issues that have not been fully addressed within the field to date. While the above account may appear rather academic, the underlying point is one with immense practical significance for work in many areas such as survey design, as well as in building systems. Witness the number of accounts where authors note the difficulties of cooperative work in situations where there is confusion over the nature of supposedly common or shared

concepts and artifacts. For example, Davenport (1994) notes how the concept of “farm” within the U.S. Dept. of Agriculture has a myriad of different meanings, which it turns out cannot be easily reduced to some core.

The issues that arise here link in to another body of work, which while produced in several different traditions, also faces some of the same problems and contradictions, namely, how to support “organizational memory”. In both cases, the problem resides in the fact that information does not simply exist “out there”, but is produced by specific people in specific contexts for specific purposes. While this does not imply that it is bound solely to that whole context, it does mean that one cannot in any straightforward way extract and abstract from this web of signification items of “information” which can be stored in some central resource for later use without having some conception of this whole “context” question. What is good information changes depending on the time, the originator, the context, etc.....and without these cues, the relevance of items of “information” becomes deeply problematic.

While it is important not to reify this concept of “organizational memory”, the label can still serve as a useful heuristic to describe a set of concerns about how information is collated, stored, accessed, accreted, updated, and used in organizations. This topic is closely allied to that of organizational learning, as discussed by Argyris and others, while it has a somewhat more circumscribed focus. While a large part of the work in CSCW, especially software development, has to date focused on synchronous interactions, it is likely that in the long term, support for various forms of information gathering and dissemination activities will come to be seen as having a much greater impact on organizational functioning.

There have been some attempts to grapple with these issues, both conceptually and pragmatically, but much work still needs to be done, and the different treatments of these issues in different fields need to be assessed and collated. For example, on a conceptual level, apart from the work already mentioned, “organizational memory” has been treated in the organizational literature in a number of ways (cf. Walsh & Ungson, 1991). A number of social science researchers have been investigating the role of “war stories” (Orr, 1986) and talk among work communities (Middleton, 1994) and their importance in group and organizational development. Within the computing community, a number of pilot and even some commercial systems have been developed to provide some form of what has been termed organizational memory (cf. the pioneering work of Engelbart and the NLS team on the NLS Journal system and “community handbook” Engelbart, 1963, Engelbart & Lehman, 1992). Also, there is work in engineering design concerning shared memory (Konda et al., 1992), while others have tried to develop systems to support the software development process (Conklin & Begeman, 1988, Terveen et al, 1993) or more general systems support (Ackerman, 1994) and organizational support (Fuchs & Prinz, 1993).

There are wide disparities in the nature of these contributions, the conceptual frameworks employed, and the empirical evidence in support of the systems developed, yet undoubtedly, these researchers have tapped a rich vein, as they all are of the opinion that some form of shared memory is of importance to organizational de-

velopment, even if there is still profound disagreement and confusion about exactly what kind of computer support might be possible to enhance this process. For example, note that both ECSCW'91 and CSCW'94 had panels on the concept of organizational memory, both of which, in the opinions of most of the audience, generated more questions than answers. Just to give a flavor of the disputes that arise, the very notion of whether an organization can be regarded as having a "memory" is rejected by many, who state that while one may be able to store items of information, the notion that one can in some sense capture the rationale for the earlier production of that information, and its interpretation, cannot be "frozen" in any real sense, into a computer-based artifact. Others disagree. This research group has helped to analyze the various pieces of work that have been done in a variety of fields and see what form of synthesis can be achieved. As a result of our work, a number of papers by our group are now appearing or have appeared at international meetings in the areas of shared information spaces and organizational memory. Also, members of the group have been active in developing early prototypes for supporting these concepts, as witnessed by the GMD contributions to the group. Such activity shows the utility and productiveness of this group. The group have submitted and presented papers at a number of important conferences, including IEEE HICSS, INRIA COOP'96, IRIS, & ACM CSCW.

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### 2.3. Practical Assessment of Multimedia Wide Area CSCW (PAMWAC)

*Coordinator: Anderson (Glasgow)*

The emphasis of this project was on the practical assessment of the impact of communications technology on distributed group tasks. This assessment was done through a number of field trials using CSCW software and communication services available over the existing European Internet. There were three closely-linked strands of work, as follows: establishment of a CSCW infrastructure between sub-groups of sites and feasibility study; identification of suitable application areas and group tasks for field trials; selection of appropriate measures, methods and tools for assessment of field trials, conduct pilot field trials between selected sites.

A particular feature of the PAMWAC project is that it is itself an example of a real-world distributed group. We used the CSCW tools and services available at our various sites to aid our work, and observed the impact on our interactions, comparing face-to-face meetings with those held by conferencing over the Internet.

Our objectives as outlined in the PAMWAC proposal were as follows:

(1) establishment of an infrastructure providing application-level connectivity among a sub-set of sites participating in project 3, based on available multimedia applications and services for asynchronous and/or synchronous group communication. The feasibility of conducting experiments in different communication modes over existing European networks was studied.

This objective was achieved through sharing of expertise and five of the participating sites held a number of video conferences as part of the PAMWAC activities. For a report of some of these experiences, see Johannsen & Lewe (1996). Public domain conferencing tools were used and successful connections were achieved among the participating sites.

The quality of the Internet link was found to be variable with some European connections providing better quality connections than others. The public domain tools are obviously very useful to researchers in providing multimedia links at no additional cost but required expert support to ensure successful operation. The interdisciplinary nature of the PAMWAC project meant that social scientists, interested in exploring the nature of multimedia conferencing and its potential impact on users, had access to just that technical expertise from their computing colleagues at other sites. This was a very valuable outcome of the PAMWAC project.

(2) development of a taxonomy of a range of group tasks which could be practically assessed over this infrastructure, based on available CSCW software, and domains of interest within the project. As well as publishing papers on this topic, see for example, Andriessen, (1996), a great deal of valuable information on this topic was mounted on our PAMWAC WWW server.<sup>7</sup>

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<sup>7</sup> <http://www.nr.no/home/stein/PAMWAC- WWW>

The development of this WWW server where all the PAMWAC information was lodged as well as the establishment of a general information resource about CSCW and multimedia for the research community, was another valuable outcome of the PAMWAC project.

The general information includes HCI bibliography, CSCW system survey, HCI archive, survey of distributed multimedia research, standards and products, unified computer science index. Under information about applications there are links to information about MBONE multimedia conferencing software and tools, MICE support centers, desktop video-conferencing product survey.

(3) selection of measures, methods and tools for assessment of the selected tasks. This was done and evaluation techniques were developed for both field studies, video-conferencing and face-to-face meetings.

The evaluation approach to CSCW developed through the PAMWAC project is a multidimensional one. When assessing the impact of technology on users we need to consider their task performance, their communication process and various aspects of their satisfaction with the technology and task outcome. For details of these techniques see Anderson et al, (in press).

Andriessen (1995), also developed a multidimensional approach to evaluation based in part on the work of PAWAC. He outlines the importance in evaluating interaction technology of adopting a four level approach which includes: the analysis of human computer interaction, the analysis of communicative behavior, the analysis of group interaction, and the analysis of organizational effectiveness.

(4) pilot field trials between selected sites. The main field study which we conducted was a study of distance collaboration using multimedia links over the Internet between Glasgow and Delft. The results of this unique study are described in Anderson et al (1996).

In summary we found that the European Internet could support the multimedia link between UK and the Netherlands. Of 24 sessions only 1 had to be rescheduled due to difficulties with the network. In the study we simulated a remote travel agency, where 'customers' had to plan an itinerary and book flights by communicating with a remote 'travel agent'. In half the trials the customer and agent were linked by video while in the other trials there was only an audio connection. We gathered data on the task performance and conducted detailed analysis of the task dialogues and decision making of participants. In addition a fairly extensive questionnaire on the users attitude to the technology, outcome and its acceptability in comparison with alternatives. Video did not lead to better task performance but did show some subjective benefits. Users were more aware of the travel agent when they could see him, and less frequently worried that they had lost contact with him.

Hohenheim and Jyväskylä investigated linking their electronic meeting rooms for long distance CSCW but the cost implications of additional software and connections charges meant that this could not be done as no COST 14 funds were available for this kind of expenditure.

## 2.4. CSCW and Software Engineering

*Coordinator: Newman (Caledonian, Glasgow)*

The field of CSCW is investigating computer support for arbitrary, distributed co-operative work. Usually, this work relates to human group activities. Software Engineering (SE) activities are strictly about team work. Accordingly, SE requires very often distribution of the involved team members and data.

Thus, supporting cooperative SE encircles the accomplishment of the necessary conditions for a successful teamwork during the live cycle of a related software project, being people workspaces (workstations) located in the same room or geographically distributed.

Most of the times the SE process involves the participation of software designers, programmers, engineers, reviewers, end-users and experts of several scientific and technical areas. These people are commonly not located at the same place, especially when considering large software projects including different companies and countries. Therefore, the support of cooperation in context of SE becomes to be of a remarkable usefulness.

Cooperative SE systems have to solve problems such as:

- maintaining the coherence of the software project through the distributed system by managing possible conflicts between local versions;
- co-ordinate information flow coming from different active team members (on-line or off-line contributions);
- maintain history database;
- promote the necessary mechanisms for the inter-group awareness and integrity;
- support group co-ordination

The work in traditional SE development cycles integrates individual tasks as also group assignments. Usually, different specific sub-groups are assembled following each one its own procedure. However, a process of information exchange as well as of co-ordination of intermediate results must exist. Some global meetings can periodically occur.

In spite of the existence of several software development models, they usually integrate all or part of the following activities:

**Specification:** The services which the system must support must be set out along with the constraints under which the system must operate.

**Cooperative Support:** A tele-conferencing plus cooperative editing environment fits more or less the needs of supporting together the discussion of the involved team members.

**Design and implementation:** A software system that can provide these services must be designed and implemented. The implementation phase can be divided in two sub-activities:

Conceptualization and Engineering: After receive the global system design decisions, the next step consists of finding the best technical solutions to implement it.

Implementation Cycle: Represents properly the software source code implementation.

Cooperative Support: Tele-conferencing, cooperative editing, application-sharing and annotation tools are the feasible enabling environments.

**Verification and validation:** The system quality must be controlled and tested in order to provide the set of expected results meeting the initial requirements. Features for code inspection and integrated testing must be contemplated allowing experts to work together looking for an optimal set of results. Also forms of automatic demonstrations, exploring information expressiveness (as using multimedia) and showing the software package characteristics, must be available for potential buyers.

**Evolution:** This phase represents the cyclical characteristic of the SD process. If the system environment changes then the whole cycle must be re-started to fulfill new requirements. Again features for inspection, review or for more general studies of the software sources must be supported. The exchange of ideas/expertise among the involved team members plays a critical role to a successful re-done and improvement of the related software project.

Usually, specification is essentially supported by real face-to-face meetings or well defined tele-conferencing environments allowing the interested parts to describe together the future software product requirements. The specification documents are subsequently used by the technical team as input for the design/implementation of the software product. This sub-cycle of the development process begins with a general meeting of the entire group to design/conceptualize and decide guidelines and strategies to be used during the process, and also divide implementation tasks and responsibilities among themselves. Next, each developer or sub-group of developers will concentrate on his/their own tasks, and starts the development cycle (whatever it is).

Finally, an important requirement for a CSE system is the support of a history database. This database must store not only the previous executed activities (actions) but above all emphasize the information concerning about the involved developers. A hybrid architecture should be adequate to fulfill the requirements of the hypothetical CSE system.

In conclusion, today's available CSCW technology has involved a tremendous evolution covering a considerable range of the human "computationable" team activities. Some of this technology has originated concrete systems for different industrial applications. Software Engineering is about team work. The development of a cooperative system to support Software Engineering is positively feasible through the today's CSCW technology. Critical points are the support of the consistency of the involved software project among the distributed user workspaces as also maintain a high awareness within the team members.

## 2.5. Computer Supported Collaborative Process Management (COPROM)

*Coordinator: Waern (Linköping)*

### **Topic**

Situations where people have to manage complex processes are increasingly being mediated by Information Technology. Examples of situations where cooperation between people, computers and machines are actualized are emergency management, military command and control, traffic control (air, rail, road, water), rescue services, stock exchange, dealing rooms, grid control, intensive care and industrial plant control.

The above situations are demanding both on people and on machines. The strength of human-computer-machine interaction is said to be equal to its weakest link. However, when the whole system of people, machines and computers is considered, the dangers come not only from individual weak links (single failures), but from combinations. Single failure accidents are neither the worst nor the most surprising. Furthermore, the weakest link is usually seen in isolation, but it may in actual fact be even weaker when seen as part of an interaction or a coupled system. The embedding in an interaction or coupling may add the effects of latent conditions, short-cuts, etc., which both may determine initial (triggering) conditions and weaken defenses and barriers. The consequences of such failures include uncontrolled releases, injuries, poisoning, and single deaths, all of which are highly desirable to prevent.

Because of their importance, these situations have for some time been focused in research, both from technical and from human points of view. As always, new technological developments necessitate new research. The emerging complexity of the systems to be controlled, as well as the controlling systems, force new organizations of the systems. The indispensability of human beings in situations which could not be predicted by designers of automated systems has been acknowledged. Therefore, the adaptation of automated system characteristics to human requirements is accepted as an important way to increase the total system's safety. In particular, two new requirements on the human part of the chain are increasingly stressed: complex cognitive functioning and collaboration.

### **Objective**

The complexity of the present problem requires several disciplines to collaborate. Design disciplines, human disciplines, as well as experts within the different particular fields, have to contribute their knowledge. Within the design approach, problems of multi-modal input and output have to be analyzed and solved, as well as problems of knowledge representation. Within the human approach, problems of organizational and task analysis have to be attacked, as well as problems related to cognitive, communicative and collaborative functioning.

The aim of the present project was to have people with different backgrounds and different approaches meet to discuss issues related to human cooperation in dynamic situations, with a particular emphasis on existing or possible computer support. The perspectives covered by the present project are the following: human factors, field studies, computer and information science.

### **Impact in the field**

Each of the involved partners has got impact circles around their own approach. These are easy to assess through the publications and quotations. The impacts which are only concerned with the collaborative effort are somewhat less tangible.

*Mutual influence between partners.* The first is concerned with mutual influence between the partners involved and knowledge transfer effects. All partners have had the opportunity to partake of one another's' ideas and opinions. The project has opened up communication between approaches which do not often communicate (i.e. human factors and ethnography). More time and effort would however be needed to transform the communication into a collaboration.

*Knowledge transfer.* The second impact is related to knowledge transfer effect. The project has to some extent involved graduate students. They have been confronted with a multi-disciplinary situation at the meetings, which sometimes may have confused them, sometimes inspired them. Graduate students involved in the project are: Henrik Artman, Peter Svenmarck, Rego Granlund and Mikko Kovalainen.

*Outside impacts.* The third impact is related to people outside of the project. The COPROM project has had three open workshops, two at CSCW conferences and one in a more constrained setting. The two CSCW-workshops have been reported in the SIGCHI Bulletin. It seems that the impact here mostly relates to graduate students. Two of the outside participants have recently presented their theses, where issues related to COPROM problems are discussed and handled. Some others are still working with their graduate theses.

### **Problems identified and approaches developed.**

The main research problems identified and their corresponding approaches are the following:

*Task and/or situation analysis.* For an understanding of the situation, the requirements of the situation as well as the actions of the actors have to be described, analyzed and interpreted. The different approaches from ethnography and human factors lead to different views on task and/or situation analysis. The main difference lies in the normative approach, combined with experimental studies, taken by human factors and the descriptive approach, derived from field studies. It has to some extent been possible to reconcile these different views, by working with field studies of simulations, close to reality and relating these to experimental studies in a microworld situation.

*Crucial factors in the situation.* For the analysis of the situation, some central concepts have emerged. These relate to properties and factors which are crucial for success as well as failure in task performance. The following are examples: task allocation, social organization, situation assessment, co-operative learning, collective memory, cognitive empathy, team mind, collaborative problem solving, co-ordination and co-ordination mechanisms, resource allocation, communication structure and responsibility structure. These concepts and the effect of varying the factors are further elaborated in the final report from the project.

It is obvious that there are no simple solutions to handling dynamic processes. The situational requirements conflict in that they demand independence between tasks as well as redundancy in people handling the tasks. They demand pre-planning as well as immediate situation assessment, and call for registration of actions as well as for immediate actions. Further, the social aspects of the situation can be handled in different ways which may lead to disastrous “team mind” consequences, as well as to reflected (but not always effective) collective situation assessment and decision making.

*Training aspects.* A central problem relates to education and training for handling these situations. Since it is not quite clear, how the various factors exemplified above interact in affecting the efficiency of a team handling a dynamic situation, training has to proceed in an intuitive way. For learning purposes, a record of situations as well as of actions is central. The learners should get feedback as to consequences, related to the situations they have experienced themselves. They should also have the opportunity to study other “cases”, with other situations, actions and consequences as well as reflections upon these cases. Here the computer supports discussed below emerge as obvious aids.

*Problems related to computer support.* For the design of computer systems, the idea of a “collective memory” has received most attention. Three different approaches have been discussed: 1) a hypermedia approach for knowledge transfer in a paper and pulp industry 2) a knowledge system approach for knowledge management in general and 3) a knowledge graph approach, also appropriate for knowledge management. These approaches are also further elaborated in the final report from the project.

## **Conclusions**

We cannot claim that we have solved the problem of computer support for co-operative management of dynamic systems. However, we have identified some central problems both in the cross-disciplinary work and in the field itself. These mainly relate to the following:

*Different scientific approaches.* It is obvious that a normative and hypothesis-testing approach differs from a purely descriptive one. It might be possible to get some more out of the conflict and complementarity of the various perspectives through approaching similar problems.

*Interaction between factors.* It is obvious that the field still contains a lot of “blank spots” with regard to important factors and their interactions. The overview provided in this project might serve as a starting point for systematic studies, both in the field and in the laboratory or micro worlds.

*Learning and training issues.* The complex and dangerous situations call for education in simulated environments. It is obvious that the simulation environments as well as their use call for better situational analysis as well as better feedback.

*Computer support.* Computer support may be offered both in the immediate situation and in the planning and follow up situation. In the immediate situation, it is obvious that it has to be integrated into the task organization to be as little interfering as possible. In the planning and following up situation, aspects of collective remembering should be considered. There is still much discussion around this topic, which is reported for instance from project No. 2: Common Information Spaces & Organizational Memory (CIS-ORGMEM).

## 2.6. Interdisciplinary Practice and Design for Cooperation Technology (IMPACT): Design

*Coordinator: Van der Veer (Vrije Universiteit Amsterdam)*

In the course of the COST-14 action Project 6 was divided into two teams, focusing on two aspects of interdisciplinary research on cooperation technology: ‘practice’ and ‘design’ respectively.

The ‘design’ team of project 6 focused on investigating design approaches for groupware, and in the end came up with a proposal to integrate various design methods. Also, this approach was illustrated with several examples. The task analysis part of the approach is now published under the acronym GTA (groupware task analysis), and a tool for GTA (on PC platform) is under construction. Several prototype versions of this are now being used in design classes. The tool will be available as public domain tool. Also, the design group investigated the societal and political aspects of providers and of the control over public domain networks. A first paper has been published (SIGCHI bulletin).

## 2.7. Interdisciplinary Practice and Design for Cooperation Technology (IMPACT): Practice

*Coordinator: Dan Shapiro (Lancaster University)*

The organizational adequacy of information systems depends on the ability of differing approaches to attend to the complexity of the issues involved. Towards this aim, interdisciplinary collaboration is increasingly sought within the CSCW research community as a means to system design. However, the potential of interdisciplinary combination opens up an, at times, bewildering array of possibilities. As yet, no systematic overview has been completed.

This working group took as its starting 'heuristic' a set of 'core propositions' for practical interdisciplinary CSCW. These were:

- (1) Activities are socially organized and flexibly situated in context
- (2) Organizations make deliberate and strategic changes; these engage highly differentiated interests.
- (3) The information and data must be modelled in ways which are practical, robust, consistent and maintainable.
- (4) Users can easily be alienated from a system for reasons of presentation, interface and usability.
- (5) Using a system imposes a variety of (situated) cognitive loads.
- (6) Socio-technical systems are mutually constitutive and adaptive.
- (7) Users are the ultimate custodians of and experts in their own practice.
- (8) Organizations and activities are continuously evolving.
- (9) The cost-benefit of systems should be optimized (not necessarily in financial terms alone).

The working group has sought, within the imposed constraints of budget and organizational form, to develop some of the implications of these through reviewing a range of CSCW project experience in which its participants are involved.

The group was initially proposed in May 1993 and held its first meeting in January 1994. At an early stage, the members of the working group decided that its objectives could best be furthered by subdividing into two working sub-groups, one concentrating on interdisciplinary design for cooperation technology, the other concentrating on interdisciplinary practice for cooperation technology. This report concerns the activities of the latter, interdisciplinary practice, subgroup.

The subgroup has been very productive, and since mid-1994 its members have written 47 papers and other works which have been influenced by their participation in the subgroup. A list of these is attached, and the long report from the subgroup which is being prepared reproduces a selection of them. Members of the subgroup are involved in a range of CSCW research projects with national and European funding, and a list of the principal ones is attached. Some of the more recent research proposals have also been significantly informed by the work of the subgroup.

The papers in the long report reflect the broad range of the subgroup's work on interdisciplinarity in CSCW and include, among other topics, the analysis of empir-

ical studies of systems design for radio producers, for business processes, for landscape architecture and for teleworking. Issues addressed include the globalisation of economic and information spaces, the combination of ethnographic and participatory techniques, different forms of representation of work and of systems, communication versus exposure in virtual spaces, pressures deriving from the context within which systems design takes place, and other aspects of the practicalities of interdisciplinary design. They also address the development of architectural principles and prototypes of a CSCW system. This draws on the results of anthropological, sociological and organizational research, and on feedback from the use of the CSCW systems which are now proliferating. Some of the important issues which such a system must cover are openness, contextualization, conversations and plans.

The subgroup has also considered a future agenda for interdisciplinary practice in cooperation technology, and this comprises the final chapter of the long report. It has four main elements.

*Theoretically*, we identify a crucial difference between people and machines-software, that people are members of Wittgensteinian language games, while machines-software cannot be. This means that, despite interesting issues of ‘cyborgs’ and person-machine merger, people and information systems differ irreconcilably in the resources available to them for working together and connecting their practices. Hence interdisciplinary CSCW faces the paradox that, in some ways and for some purposes, we must assume that aspects or sequences of people’s practices can be ‘modelled’, even though we know this is not true.

*Methodologically*, there is a need to communicate more clearly and effectively the difference between cooperation technology and ‘groupware’: the latter provides certain networking and communication facilities, whereas the former is concerned to relate technical support to the social organization of work.

*Substantively*, we identify a need to relate cooperation technology more closely to issues of organizational learning and the knowledge-creating organization, and to devise an informatics for the ‘practice-creating’ organization.

And in terms of *training*, we identify a need to make available in a systematic way to the next generation of researchers the substantial body of knowledge and perspectives from different disciplines which have now been established in CSCW. We propose that the opportunities for an appropriate summer school or workshop format for this at a European level should be explored.

### 3. Publications

Publications by members of the CoTech network which have been influenced by their participation in CoTech activities:

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## Appendix A: COST-14 participating institutions

### **Virtual and Augmented Environments for CSCW**

*Coordinators: Vandamme (Ghent) and Benford (Nottingham).*

Steve Benford, Dept. of Computer Science, University of Nottingham  
Mirco Bolzoni, LABAMBINT - Interactive Systems Lab, Dept. of General Psychology, University of Padova  
Wolfgang Broll, GMD (German National Research Laboratory for Computer Science) Germany  
David England, GMD (F.I.T.C.S.C.W.), Germany  
Lennart Fahlen, SICS, Sweden  
Ludwin Fuchs, GMD, Germany  
Chris Greenhalgh, Dept. of Computer Science, University of Nottingham  
Roland Hjerpe, LIBLAB - IDA, Linkoping University, Sweden  
Kai-Mikael Jaa-Aro, KTH, Sweden  
Erland Jungert, FOA, Sweden  
John Mariani, Dept. of Computer Science, Lancaster University  
Revital Marom, THESEUS Institut, France  
Pierre Nugues, ISMRA, France  
Mike Robinson, Sageforce Ltd., UK  
Tom Rodden, Dept. of Computer Science, Lancaster University  
Arindra Sehmi, Sharp Laboratories of Europe, UK  
Carsten Sorensen, Risoe National Laboratory, Denmark  
Dave Snowdon, Dept. of Computer Science, University of Nottingham  
Olov Stahl, SICS, Sweden  
Anja Syri, GMD, Germany  
Fernand Vandamme, BIKIT Belgium  
Mike Vandamme, VARTEC NV, Belgium  
Robert Van Craen, LAE / VARTEC, Belgium

### **Collaborative Information Spaces (CIS-OrgMem)**

*Coordinator: Bannon (University of Limerick)*

University of Limerick: Liam Bannon (Coordinator), Karen Young  
University of Lancaster, UK: John Hughes, Jon O'Brien, Marc Rouncefield, Steinar Kristofferson, Magnus Ramage  
University of Sussex, UK: Yvonne Rogers, Ian Rogers, Lydia Plowman  
University of Linkoping (S): Per Arne Persson  
Royal Institute of Technology (S): Hans Marmolin, Kristina Groth  
Risoe, Denmark: Kjeld Schmidt, Peter Carstensen  
GMD, Germany: Dick Bentley  
Aramihs, France: Laurence Rognin, Francois Decortis, Bernard Pavard

Univ. of Oulu, Finland: Kari Kuutti  
EURISCO, France: Markus Durstewitz, Laurent Karsenty (now at Aramihs)  
Lab d'ergonomie, France: Pierre Falzon, Catherine Sauvagnac  
University of Manchester: James Pycock  
Univ of Oslo: Eevi Beck, Tone Bratteteig  
University of California, San Diego: Christine Halverson (guest)

### **Practical Assessment of Multimedia Wide Area CSCW (PAMWAC)**

*Coordinator: Anderson (Glasgow)*

University of Glasgow, UK (Anne H. Anderson, Anne Marie Fleming, Jim Mullin)  
Delft University of Technology, NL. (Erik Andriessen, Jeroen Van der Velden)  
University of Jyvaskyla, Finland (Petri Maaranen)  
University of Hohenheim, Stuttgart, Germany. (Henrik Lewe, Gerard Schwabe)  
J. Stefan Inst, Ljubljana, Slovenia.(Joze Rugel)  
University of Oslo, Computer Centre, Norway.(Stein Myrseth)  
University of London., UK (Sylvia Wilbur, Angela Sasse)

### **CSCW and Software Engineering**

*Coordinator: Newman (Caledonian, Glasgow)*

Julian Newman, Glasgow Caledonian University, Dept of Computer Studies  
Edwin Gray, Glasgow Caledonian University, Dept of Computer Studies  
Aderito Marcos, Fraunhofer Institute for Computer Graphics  
Joao Nuno Oliveira, Dept de Informatica, Universidade do Minho, Portugal  
Gundula Heintz, Fakultat Wirtschaftsinformatik, insbes. Systementwicklung,  
Technische Universitaet Dresden  
Peter Carstensen, Systems Analysis Dept., Risø National Laboratory, Denmark  
Jacob Nørbjerg, Datalogisk Institut, Univ Kobenhavn, Denmark  
Ilkka Tervonen, Dr., Department of Information Processing Science, University of  
Oulu, Finland  
Zsolt Haag, Glasgow Caledonian University, Dept of Computer Studies, Informatics  
Research Unit, Cowcaddens Road,  
Hans Strassl, Research Students, University of Durham, Dept of Computer Science  
Warren Smith, Research Students, Glasgow Caledonian University, Dept of  
Computer Studies  
Cornelia Boldyreff, University of Durham, Department of Computer Science

### **Computer Supported Collaborative Process Management (COPROM)**

*Coordinator: Waern (Linköping)*

Yvonne Wærn, (Coordinator), Department of Communication Studies,, Linköping  
University, Sweden.

Henrik Artman, Department of Communication Studies, Linköping University, Sweden.

Rego Granlund, Department of Computer Science, Linköping University, Sweden.

Erik Hollnagel, Ph.D., Principal Advisor, OECD Halden Reactor Project, Norway.

Sture Hägglund, Department of Computer Science, Linköping University, Sweden.

Christian Heath, School of Social Studies, University of Nottingham, U.K.

Mikko Kovalainen, Dept of Computer Science and Information Systems, University of Jyväskylä, Finland.

Esa Auramäki, Dept. of Computer Science and Information Systems, University of Jyväskylä, Finland.

Leena Norros, Technical Research Centre of Finland, Espoo, Finland.

Roel Popping, Social Science Information Technology, University of Groningen, The Netherlands.

Rob Stammers, Aston Business School, Aston Triangle, Birmingham, U.K.

Peter Svenmarck, Department of Industrial Engineering, Linköping University,

### **Interdisciplinary Practice and Design for Cooperation Technology**

*Coordinator: Van der Veer (Vrije Universiteit Amsterdam)*

Roland Traunmueller, Vienna, Austria

Tom Gross, Linz, Austria

Michael Tauber, Paderborn, Germany

Steve Guest, Loughborough, UK

Melissa Schofield, Loughborough, UK

Peter Johnson, London, UK

Elly Lammers, Amsterdam, NL

Gerrit van der Veer, Amsterdam, NL

Bert Lenting, Enschede, NL

Roel Vertegaal, Enschede, NL

Ton van Engers, Dutch Tax office, NL

Dick Ottevangers, Dutch PTT, NL

### **Interdisciplinary Practice and Design for Cooperation Technology**

*Coordinator: Dan Shapiro (Lancaster University)*

Gro Bjerknes, Oslo University, Norway

Susanne Bødker, Århus University, Denmark

Giorgio De Michelis, Milan University, Italy

Antonietta Grasso, Milan University, Italy

Reinhard Keil-Slawik, Paderborn University, Germany

Finn Kensing, Roskilde University, Denmark

Kari Kuutti, Oulu University, Sweden

Preben Mogensen, Lancaster University, UK

Torbjörn Näslund, Linköping University, Sweden

Thomas Schäl, RSO Milan/Rome, Italy  
Dan Shapiro, Lancaster University, UK (convenor)  
Pål Sørgaard, Oslo University, Norway  
Hilda Telioglu, Technical University, Vienna, Austria  
Ina Wagner, Technical University, Vienna, Austria

## Appendix B: COST-14 Management Committee

### **Austria**

Roland Traunmüller  
M. Tauber

### **Belgium**

F. Vandamme

### **Denmark**

Susanne Bødker

### **Finland**

Kalle Lyytinen  
Jari Veijalainen

### **Germany**

Wolfgang Prinz

### **Ireland**

Ahmed Patel

### **Italy**

Giorgio De Michelis (Chairman)

### **Netherlands**

Gerrit Van Der Veer  
Herman J. Weegenaar

### **Norway**

Kjell Age Bringsrud

### **Poland**

Krzysztof Badzmirowski

### **Portugal**

Adelino Santos

### **Spain**

Encarna Pastor

### **Sweden**

Yvonne Waern

### **Switzerland**

Albert T. Kündig

### **United Kingdom**

David Hutchison  
Derek Barber

### **European Commission**

Peter Wintlev-Jensen

### **COST-14 Coordinating Agency**

Kjeld Schmidt

## Appendix C: COST-14 meetings

### **Plenary meetings**

17-19 May 1993, Brussels

19-20 June, 1996

### **Virtual and Augmented Environments for CSCW**

*Coordinators: Vandamme (Ghent) and Benford (Nottingham).*

9-10 January, 1995, Nottingham

20-21 April, 1995, Stockholm

22-23 September 1995, Ghent and Namen

9-10 November 1995, Bonn

### **Collaborative Information Spaces (CIS-OrgMem)**

*Coordinator: Bannon (University of Limerick)*

23-24 February 1995, Limerick, Ireland

10-11 April 1995, Brighton, Sussex.

15-16 June 1995, Copenhagen, Denmark

17-18 November 1995, Toulouse, France

### **Practical Assessment of Multimedia Wide Area CSCW (PAMWAC)**

*Coordinator: Anderson (Glasgow)*

6-7 December, 1994., University of Glasgow

8-12 March, 1995, Bled, Slovenia

15-16 September, 1995, University of Oslo, Norway

### **CSCW and Software Engineering**

*Coordinator: Newman (Caledonian, Glasgow)*

22/23 May 1995, TU Dresden

7-9 Sept 1995, Copenhagen University

13/14 Nov 1995, Universida do Minho

Jun 5-8 1996. Fraunhofer Institute of Computer Graphics, Darmstadt, Germany

## **Computer Supported Collaborative Process Management (COPROM)**

*Coordinator: Waern (Linköping)*

February 25-26th, 1994, Stockholm, Sweden

June 10-11th, 1994, Kendall, U.K.

November 11-12th, 1994, Hilversum, Netherlands

March 6-7, 1995, Paris

September, 11, 1995. Stockholm, Sweden

Moreover, two open workshops have been organized:

CSCW 94: October 22nd, 1994, Chapel Hill, North Carolina, USA: Collaborative realtime process management

ECSCW 95: September 10th, 1995, Stockholm, Sweden: Collective learning and collective memory for coping with dynamic complexity

## **Interdisciplinary Practice and Design for Cooperation Technology: Design**

*Coordinator: Van der Veer (Vrije Universiteit Amsterdam)*

23-26 November 1994, Vienna

24-27 November 1994, Amsterdam

15-18 December 1994, Amsterdam

6-9 June 1995, Schärding

28 May-1 June, 1996, Schärding

25-29 June, 1996, Bad Leonfelden

## **Interdisciplinary Practice and Design for Cooperation Technology: Practice**

*Coordinator: Dan Shapiro (Lancaster University)*

20 - 22 January 1994, Brussels

19 - 23 September 1994, Dagstuhl, Germany

24 - 26 November 1994, Vienna

8 - 12 March 1995, Milan

20 - 23 June 1995, Vienna

10 - 13 December 1995, Rome

21 - 24 March 1996, Limerick

## Appendix D: Related national and international projects

### Virtual and Augmented Environments for CSCW

Data not available.

### Collaborative Information Spaces (CIS-OrgMem)

#### European Union

- Human Capital & Mobility Program - ENACT (1994-1996) (Lancaster, Risoe, Limerick, Oulu,
- Training & Mobility Programme - COTCOS (1996-1998) (Aramihs, Oulu, Risoe, Sussex, Limerick)
- Basic Research Action 6225 - COMIC (1993-95) (Lancaster, Manchester, Risoe, Oulu, Limerick)
- Telematics Engineering program, TE 20003 'CoopWWW: Interoperable Tools for Cooperation Support using the World-Wide Web' (GMD)
- Telematics INFOPOLIS (Limerick)
- Telematics ADVISER (Limerick)

#### United Kingdom

- Dept of Trade & Industry & EPSRC: SYCOMT CSCW Project (Manchester and Lancaster)
- DTI/EPSC project: VIRTUOSI CSCW Project (Manchester and Lancaster)
- ESRC funded Cognitive Engineering Initiative project entitled 'Explaining Cognition for Designing and Engineering Interactivity (Eco-i)' (Sussex)

#### Ireland

- Multimedia Browsing in Heterogeneous Information Spaces - BROWSE, Forbairt Strategic Research Programme (1995-97)

#### Norway

- Basic Infrastructural Information Technologies - BIITs Norwegian Research Council, 1st April - 31st August 1996, Univ. of Oslo, Norway (Proj. Leader)

### Practical Assessment of Multimedia Wide Area CSCW (PAMWAC)

- A1. The PAMWAC members from Delft and Glasgow are participating in two new EC funded projects: Methods and Guidelines for the Assessment of Telematics Applications Quality (MEGATAQ)(Telematics Applications). The coordinating partner is Technical University of Delft.
- A2. Glasgow is participating in an EC funded project Development of European Service for Information on Research and Education (DESIRE), under the Telematics for Research Sector, coordinating partner Surfnet, NL. Delft hopes to be involved if phase two funding is awarded.

B) Nationally (or EC) funded CSCW related projects funded at the individual participating sites include the following projects.

University of Glasgow:

- **ATM LAN Pilot:** The UK Education and Research Network Association, fund this project to investigate ATM (Asynchronous Transmission Mode) as a high speed multiservice campus backbone.
- **COGNITIVE ENGINEERING:** The UK Economic and Social Research Council have appointed Anne Anderson to direct a new 2.6 million pound research programme on Cognitive Engineering. She coordinates the activities of 15 UK projects investigating how interactive systems can be designed to help individuals and groups work effectively.
- **HUMAN COMMUNICATION RESEARCH CENTRE:** The UK Economic and Social Research Council has funded this centre since 1989. In the area of multimedia CSCW Anne Anderson is a principal investigator and Anne Marie Fleming is a research associate.
- **IMPACT:** High Performance Parallel Computing using Clydenet SHEFC, the Scottish Higher Education Funding Council, fund IMPACT to exploit Clydenet, the local ATM based Metropolitan Area Network (MAN) to demonstrate the ability to create an affordable high performance computing environment using low cost workstations.
- **MICE-NSC:** Multimedia Integrated Conferencing in Europe - National Support Centre for Scotland. Following from the ESPRIT MICE project the UK Education and Research Network Association (UKERNA) agreed to fund MICE National Support Centres in the UK to provide support for desktop multimedia conferencing in the academic community. There is a MICE NSC for each of England, Wales and Scotland.
- **RUNATM:** Real User Needs on Asynchronous Transfer Mode. British Telecom fund this project. RUNATM focuses on how network bandwidth and performance affects useability in the delivery of multimedia applications.
- **TASCMAD:** Training And Support for Communication using Multimedia Applications from the Desktop. The Scottish Higher Education Funding Council, fund this project to adapt software, establish an information service and run a multimedia conferencing helpdesk and training service on Clydenet, the ATM based local Metropolitan Area Network.

University of Hohenheim: Computer Aided Team Research.

University of Jyvaskyla: EC ESPRIT Accompanying Measures Multimedia Action Groups Network (MAGNET) and Multimedia Action Groups Planning Information for Europe (MAGPIE).

University of London:

- EC ESPRIT funded Multimedia Integrated Conferencing in Europe (MICE)
- Nationally funded (UKERNA (with Glasgow) MICE Support Centres

### **CSCW and Software Engineering**

- University of Durham: Esprit 8156 AMES (Application Management Environments and Support)
- Glasgow Caledonian University: ISO SPICE Universidade do Minho: COLABORA
- Fraunhofer Institute of Computer Graphics: COBRA-3 CSP (Cooperative Software)

### **Production)Computer Supported Collaborative Process Management (COPROM)**

- Auramäki E., and Kovalainen, M. SHAMAN-project (SHaring and MANaging expertise in process industries). It is a national project funded by the Finnish Technology Development Centre, Valmet Printing Papers, and Valmet Automation. This project continues to the end of 1996 (at least).
- Roel Popping: ITSforGK, (Information Technology Support for Group Knowledge Building).
- Yvonne Waern: SAMS (Studies of cooperation in management of dynamic systems). Started 1994, continues until 1997 (at least).

### **Interdisciplinary Practice and Design for Cooperation Technology: Design**

Data not available

### **Interdisciplinary Practice and Design for Cooperation Technology: Practice**

- AT - a cooperation project with the Danish National Labour Services. Funded by Århus University, Aalborg University and the Århus University Research Fund, Denmark.
- CIS - Cooperative Information Systems. EC sponsored Euro-Canadian project.
- COCIS - Communication and Coordination in Iterative Systems Development. Supported by the information systems research programme of the Swedish National Board for Industrial and Technical Development (NUTEK). Project leader: Torbjörn Näslund.
- COMIC - COmputer-based Mechanisms of Interaction for Cooperative work. EC ESPRIT Basic Research Project 6225. Project Coordinator: Tom Rodden, Lancaster University, UK
- DESARTE - Computer-Supported Design of Artefacts and Spaces. EC ESPRIT Open Long Term Research. Project Co-ordinator: Ina Wagner, Technical University, Vienna.
- DEVISE center, funded by Danish national PIFT program.

- ENACT - European Network for Appropriate Cooperation Technology. EC Human Capital and Mobility Research Network. Network Co-ordinator: Dan Shapiro, Lancaster University, UK.
- Environments for Supporting the Design of Information Systems. Italian national research funding (CNR).
- Ethnography in Support of Aesthetic Production. Funded by the UK Economic and Social Research Council under the Cognitive Engineering Programme. Project Co-ordinator: Dan Shapiro, Lancaster University, UK.
- EuroCODE - EC Esprit Project 6155, CSCW Open Development Environment.
- FLEXSTAND: Flexible Standardisierung. Möglichkeiten der computerunterstützten Integration von Design und Produktion am Beispiel Architektur und Einrichtungsdesign. Funded by the Austrian Ministry of Science, Research and the Arts, Forthcoming. Project Co-ordinator: Ina Wagner, Technical University, Vienna.
- INTERNET project. At the Department of Informatics, School of Economics, Gothenburg University, financed by Swedish Transport & Communications Research Board (Kommunikationsforskningsberedningen). Research on how companies adopt Internet technology.
- MUST - Research on theories of and methods for design in systems development, funded by The Danish Research Academy, The Danish Research Councils, and the participating companies.
- OCTUPUS, EC ESPRIT 4 preparatory action
- OTELLO - A project at Norsk Regnesentral (the Norwegian Computing Center) financed by the Research Council of Norway on the use of computing and communications technology in Norwegian public administration.
- QUALIT - Quality Assessment of Living with Information Technology. EC ESPRIT Project 8162
- SOCU: Software Cultures. The influence of work organization, management style and occupational culture on systems designers' approaches in a cross-cultural perspective. A COST A4 project funded by the Austrian Ministry of Science, Research and the Arts, 1993-95. Project-Coordinator: Ina Wagner, Technical University, Vienna.
- TECHKUL: Informationstechnik in künstlerisch-kreativen Berufen. Eine Pilotstudie zur Veränderung von Produktionsformen und Berufskulturen (Uses of computer systems in and for architectural practice, film-making, and the theatre). Funded by the Austrian Fonds zur Förderung der wissenschaftlichen Forschung - FWF Project No. P09268-SOZ, 1993-95. Project Co-ordinator: Ina Wagner, Technical University, Vienna.
- Telaararbeit in der Großstadt. Wissenschaftliche Begleituntersuchung zu einem Pilotversuch der IBM Österreich. Funded by IBM Austria, 1994-1996. Project Co-ordinator: Ina Wagner, Technical University, Vienna.

## Appendix E: FTP and WWW access

### **COST-14 Coordinating Agency, Risø**

<http://cscw.risoe.dk/www/CoTech.html>

### **Virtual and Augmented Environments for CSCW**

<http://www.crg.cs.nott.ac.uk/crg/Projects/CoTech/>

### **Collaborative Information Spaces (CIS-OrgMem)**

<ftp://ftp.gmd.de/gmd/mavis/>

### **Practical Assessment of Multimedia Wide Area CSCW (PAMWAC)**

<http://www.nr.no/home/stein/PAMWAC-WWW>

### **CSCW and Software Engineering**

<http://wiseweb.wiwi.tu-dresden.de/wwwise/cotech/home.html>

### **Computer Supported Collaborative Process Management (COPROM)**

<http://klio.tema.liu.se/projects/hit/>

<http://www.cs.jyu.fi/~esa/>

### **Interdisciplinary Practice and Design for Cooperation Technology: Design**

Data not available

### **Interdisciplinary Practice and Design for Cooperation Technology: Practice**

Data not available

## Appendix F: Selected papers

Can be obtained at <http://cscw.risoe.dk/www/CoTech.html>.

Shifting Perspectives on Organizational Memory: From Storage to Active Remembering, by Liam J. Bannon and Kari Kuutti

Ethnographers and system designers: handing over the results or joining forces?, by K. Kuutti, H. Karasti

The impact of videomediated communication on simulated service encounters. Interacting with Computers, by A.H. Anderson, A. Newlands, J. Mullin, A. M. Fleming, G. Doherty-Sneddon, and J. Van der Velden

The effectiveness of interaction technology: A four level evaluation approach, by J.H. Erik Andriessen

Analysis of a generic dynamic situation, by Yvonne Wærn.

In search of organizational memory in process control, by Esa Auramäki and Mikko Kovalainen

Visualised coordination support in distributed decision making, by Peter Svenmarck  
GTA: Groupware Task Analysis - Modeling Complexity, by Gerrit C. van der Veer, Bert F. Lenting, and Bas A.J. Bergevoet

Network Issues In The Growth And Adoption Of Networked CSCW Services, by Roel Vertegaal and Steve Guest

Fragmented Exchange: Disarticulation and the Need for Regionalized Communication Spaces, by Andrew Clement and Ina Wagner

Designing With Cooperating Communities, by Finn Kensing, Jesper Simonsen, and Keld Bødker

Landscapes of Practice, by Monika Büscher, Satinder Gill, Preben Mogensen, and Dan Shapiro

Understanding representation in design, by Susanne Bødker

