The "coach" metaphor in CSCW decision making system design

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Abstract

Is the expression "virtual team" an oxymoron? Or is it a platitude?
In CSCW, most metaphors used have a flavour of neutrality, "equilibrium", "reciprocity", "harmony", "positive mutual understanding", and so on. Individuals *co*ordinate, *co*ncur, *co*operate, *co*mmunicate; here the prefix "co" suggests the synergetic of patterns. Unfortunately, such patterns are predominantly rigid, organisational, and static. In such a "*co*-work" environment, the current approach in CSCW focuses on a shared space that should promote flexibility, adaptability and intelligent system behaviour, where the human involved feel that the "team" is made up somewhat artificial, not emerging from the real world and the task at hand. According to actual approaches, in CSCW, decision making is rather "organisation-driven" and humans are constraint to "live" in an artificial environment managing it in a predefined manner (static, pattern and custom oriented). This paper tries to define the "coach" metaphor emphasising the following issues: 1) team selection - is carried out in a task-driven manner (ad-hoc, dynamic, tailored to the specific problem and its environment); 2) training the

team; 3) monitoring it during the "match". Therefore, the group constellation is not any longer determined by human decision-makers but the task itself. Thus, the problem and its resource environment become the "coach" of the team designed to solve it. Because of the shift in the approach, the paper also addresses the impact of the proposed metaphor on human-computer interfacing.

Keywords
DSS, HCI, human factors, interfaces, virtual enterprise, virtual teams

1 INTRODUCTION

The current business promote the attention paid to the integration of engineering, production and management activities, emphasising human factors, technological issues, production and business aspects of virtual enterprises. Due to current developments such as increased competition and dramatic changes in technology, society and client behaviour, modern manufacturing tends to become global, knowledge-based and client-driven (Filip, Neagu and Donciulescu, 1996).

In the light of the fifth generation approaches to management (Savage, 1990) - trying to integrate enterprises through human networking - cooperation and coordination, are increasingly seen as determinants of success in a wide variety of endeavours. Moreover, because of the complexity and limited knowledge of individuals and organisations, cooperation appears as unavoidable. In order to be prepared for their own dynamic development, organisations have to be flexible in respect to environment requirements.

"Intelligent" and anthropocentric **Decision Support Systems** (DSS) (Filip, 1995) and **Active Management Information System** (AMIS) (Martens, e.a., 1996) delegate more responsibility to the system and stimulate users in acquiring new skills, adopting new working styles and deploying their talents and creativity. In such complex situations, the weight of the human factor increases significantly because no single person can know all criteria and constraints and, thus, decision solutions must be evaluated from multiple, and sometimes conflicting points of view. Various users with diverging or even conflicting interests should have the opportunity to work out such conflicts by choosing between different functional alternatives. Therefore, groupware applications should offer negotiability and group oriented configurability where the system must be an active participant in helping users to carry out and improve the desired configuration.

Human computer cooperation systems provide collaboration means for spatially/temporally separated people/organisation working on complex tasks. A major step toward this goal is to regard machines and software not only as communication facilitators but also as active participants in problem solving.

The remainder of this paper is organised as follows. Section 2 summarises the rationale of the "coach" metaphor. The third section describes the current level of CSCW decision systems commercially available, presenting the modern technological features supporting them. In addition, we try to find some

distinguishing features suggested by the proposed metaphor: AMIS support and osmotic involvement of the human factor in the information system environment. The architecture and its components are described in section 4. Some concluding remarks are given in the final section.

2 WHY A NEW METAPHOR

In "real world" settings characterised by dispersed, distributed, and dynamic cooperative work arrangements and involving a large, varying, or indeterminate number of participants, the intuitive modes of work articulation do not reflect effectively the everyday social life. Hence, work articulation becomes extremely complex and demanding. Unfortunately, those issues are not adequately dealt with. After some general remarks on current approaches (2.1) specific drawbacks are elaborated upon (2.2-2.5).

2.1 Still unsolved problems

Distributed problem solving can be defined as the cooperative activity of several decentralised and loosely coupled problem-solvers acting in distinct environments. The current approaches to decisional structure hierarchy are limited to the identification of the decision support requirements at the system definition level. In fact, CSCW systems have often failed to meet the requirements of actual cooperative work settings. They do not adequately support the fluent transitions between formal and informal interaction and the inextricable interweaving of individual and cooperative work characterising every day practice (Schimidt and Rodden, 1996). Largely, this deficiency can be attributed to conceptual problems yet unsolved by current architectures.

Cooperative work in natural settings, has several features that must be taken into account in order to make CSCW decision systems acceptable to decision makers: 1) cooperative systems are either large themselves, or embedded within larger ones; 2) they are often transient formations, made up to handle a particular situation - and are dismantled afterwards; 3) the membership relation of cooperative sets is not stable and often even fuzzy; 4) the pattern of interaction in cooperative work changes accordingly to the requirements and constraints of the situation; 5) cooperative work is physically distributed, in time and space; 6) cooperative work is also logically distributed; 7) in natural settings of cooperative work there are no omniscient agents.

This observation applies to mechanisms of interaction in general. To be made to work, they themselves need to be managed (developed, interpreted, applied, maintained, adapted, represented, negotiated, modified, and executed). Therefore, the CSCW system should make the incorporated mechanism of interaction accessible to users, and indeed, should support users in interpreting the mechanism and evaluating its rationale and implications.

2.2 Inadequate work articulation

The actual approaches use interactions mechanisms aiming at reducing complexity and, hence, the overhead cost of cooperative work articulation. Examples: 1) organisational structure in explicit (statutory, legally enforceable) and implicit (traditional, customary) form allocation of resources, rights, and responsibilities within the cooperative ensemble; 2) planning in manufacturing enterprises; 3) standard operating procedures; 4) conceptual schemes (e.g. thesauruses, taxonomies) for classifying informal objects so as to organise distributed insertion and retrieval of objects in “public” repositories, archives, libraries, databases etc. maintained by many persons. This relates to a specific domain and is not adequate to the actual dynamism of flexible enterprises.

2.3 Simplistic interfaces

In a collaborative media the interfaces go beyond the implicit view of a single user with a desktop computer. The human has to communicate with the environment in general and with the information system in particular. So, in a collaborative environment the interface to the system becomes global and therefore osmotic - it is not a formal one. It has to allow filtering of the communication formalism by the human himself. Neither technological relationships nor social ones can supplant each other; both are necessary, being practically inseparable. This interdependence requires a flexible coupling between the two related systems, so that the same mechanism can be adapted for different users. The person is immersed in the osmotic interface in the sense that the system can not remain a purely technological one but has to take into account the sociological dimension, too.

On the other hand, the human involved must be able to engage in many different kinds of interaction. So, the interface becomes the “gateway” for the "social system", where the human actors and agents are parts of the system too. The interface must support roles, styles, policies, and profiles with related help facilities and effective graphical facilities, dynamically adapted to de facto standards in the domain.

2.4 Ignoring human-related aspect due to different cultures

Practically all systems influence and are influenced by the groups and social situations they are placed in. Spatial boundaries determine social interactions and the development of social networks. A successful communication must permit flexible and complementary coupling between technological and social elements (Mynatt, Adler and Ito, 1997). On the other hand, it has to provide both technical mechanism and social practices to allow learning and culture transfer. That implies that the systems should make available resources and mechanisms for new workers to feel welcome, so they should be able to cooperate with experienced members. The related problems belong to the fields of the psychology and education or even anthropological ethnography.

The current research paradigms that emphasise the individual agent and individual quantifiable variables that could be subjected to a statistical hypothesis testing do not seem to work well anymore. There is another dimension that needs to be explored; i.e. the kind of knowledge that is not only group-based but also tacit, implicit, embodied, and not articulated (Jordan, 1996). The emphasis shifts toward paying more attention to the human actors in the system and the manner how they function as a community (expecting that CSCW technologies shall enhance the community's practices).

2.5 Minor weight of ethical imperatives

When the principles of ethics are applied, the essential concept of a DSS is considerably changed taking the decisions models far beyond the basic quantitative and economic variables customarily employed (Figure 1). Although the ethic is based on social norms, human relationship transcends it toward a morality, specific to a human community (country, region, religion group, and so on). So, within the overall task of being ethical at least five topics must be taken into account (McCosh, 1996): fairness, self-love, obligation, humanness and universal law.

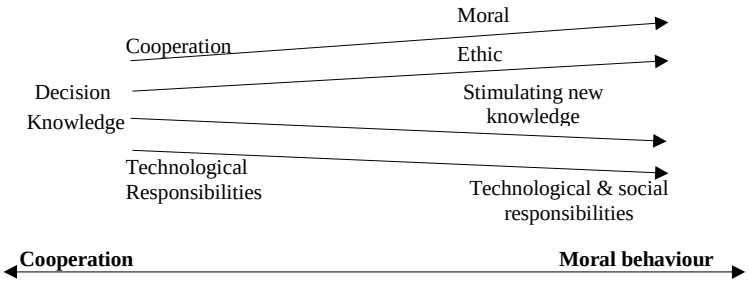

Figure 1 Limitations vs. needs.

The usual approach focuses on the functionality and the internal self-monitoring of the system regarding only the self-love and obligation aspects. In the case that the system becomes an active participant, the surrounding sensors must accomplish the remainder needs also: fairness, humanness and universal low. That aspect must not be only an external part of the system, but should be an active component in stimulating users to respect ethical imperatives. Beyond these, there are aspects of morality that are a fundamental aspects of community although seeming less likely to impinge on DSS's problems (McCosh, 1996).

All of that implies the need of another approach, differing enough from the current ones to be expressed through a metaphor.

3 THE COACH METAPHOR

Cooperating workers need to articulate their partial activities. Different pertinent characteristics of cooperative work can be highlighted as being of prime importance for the communication requirements. Schimidt and Rodden (1996) asserts that the facilities offered by the CSCW should be organised in terms of requirements rather than in terms of medium peculiarities: 1) the degree and nature of contingency between the members of the cooperating organisations as determined by the field of their work; 2) the extent to which the field of work requires instantaneous reactions to events and, hence, rapid articulation of activities; 3) the extent to which the field of work is characterised by incomplete, ambiguous, erroneous, and/or contradictory information.

All of these require an active "brain" with the declared goal of maintaining the team's spirit "alive" in all circumstances, which we have crystallised conceptually in the "coach" metaphor. Like in a competition, the coach must select, train and monitor the team. These aspects of the "coach" are described in sequel below.

3.1 Selecting the team

Helps executives to communicate more efficiently with more relevant people and organisations. The system should support dynamic roles of actors. Dynamic roles, in particular, expand one of the central themes in CSCW: by bringing information about users and their environments into the system, we can make computer-augmented collaboration more responsive, and we can free the users of many of the burdens implicit in working with today's collaborative systems. The coach must schedule meetings by choosing group representatives.

Automating the team selection eliminates the interminable meetings and the time lost to find the most appropriate organisations and members to achieve the desired goal. In addition, the coach must take into account, in the selection process, the overhead time spent during the synergetic work - if sociological communication aspects are omitted.

3.2 Training the team

The presence of different users, their own goals and background, generate uncertainty, unpredictability, and surprise into collaborative sessions. Intelligence in responding to particular occurrences in collaborative situations is called policy. This concentrates mainly in reducing system unpredictability to a "manageable" level. That characteristic corresponds in principle with the knowledge tool ("how-type") that has been defined to manage the problem-solving expertise according to specific needs of different actors in the decision process (Filip, Neagu and Donciulescu, 1996). The coach must also identify problems and find opportunities as they emerge. In the above-mentioned sense, a "training manager" tool that interacts with the actors and emits policy specifications according to user desires

should be provided too. This would help to find out how the actors think about the policies and to capture those concepts in a tool designed for the end-users.

Another aspect of training consists in providing awareness-oriented collaboration: informal awareness of work community (where are the actors located in space and time), group-structuring awareness (actor's role responsibilities, position, and status), social awareness (information that a person maintains about others in a social context) and workspace awareness (knowledge required by an actor about another in various instances of their cooperation). Therefore, this approach provides a more convenient communication channel between several management levels. On the other hand, the "training" role of the coach supports meeting scheduling automation and allows assigning priorities based on pooled and normalised features.

The final goal of these developments is to stimulate users in acquiring an appropriate communication style, based on sociological aspects, and in eliminating all the overhead time lost in adapting to the environment.

3.3 Monitoring

This characteristic emphasis enriches on older one, namely meta-management. In addition to that, monitoring must take into account social and awareness information filtering. The coach must also support providing explanation facilities to justify decision to the users and learning their preferences by observing how users choose between alternative solutions. That allows the coach to initiate the appropriate action "on-the-fly" during the "match". So, the "coach" can become the core of social systemic research. To be able to function simultaneously as observer and participant, the coach himself requires training, experience and continuous reflection on the process.

4 ARCHITECTURE

Simon (1981) observes that complexity is not innate, but it is the result of adapting the artefacts to the environment complexities. Absolutely, nowhere is this adaptation to the environment more prevalent and complexity-inducing then where human space is involved.

Because the combinatorial complexity of decision motivation beyond logic judgement and learning, is depending also on the human's state (inspiration, emotion, will) it would be anodyne to try a projection on the information system space - not only due to the difficulties of "partitioning" the implied knowledge but, first of all, due to the lack of the feature of "being alive", specific to human communication. Multi-modal, multi-media system offer a great potential for producing more involving, realistic interactive experiences (Figure 2).

Computer vision theories impose that the system shall recognise its users and shall tailor itself according to its perception of their requirements.

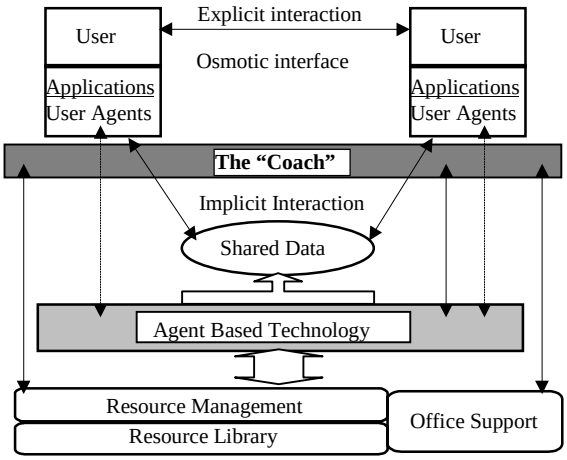

Figure 2 Sketch Map of "coach" Integrated Architecture.

Thus, a component is needed, that should stay "in expectation", waiting to grasp the whole human personality by means of the agentification level and multimedia space. Negotiability cannot be used to solve fundamental problems. These must be discussed and solved by less structured communication among users. The system must be able to support the ephemeral styles of interaction that make human-to-human communication so rich. Therefore, the essential role of the media space is to create a common area for interaction among decision-makers.

The coach metaphor aims at providing the most accurate manner of multimedia communication, improving alternative communication styles that ensure the flexibility requirements. The shift in designing *interfaces* will trace closely the one in the approach itself. So, each team member will work with three kinds of interfaces: a) his or her "own" when initiating a dialogue session or playing some chief-role in the interaction; b) the protagonist's interface when accepting such a session or playing a background role; c) some interface proposed and managed by the system when "listening to the coach". The "coach"-type interface has to replace smoothly – but unambiguously – the user's one (at least, partially) whenever the system takes over. Whenever the specific interface "instances" should be allowed to exhibit a certain degree of diversity – according to personal preferences – has to be settled later, mostly on empirical basis. Of course, differences should be as small as possible from both points of view: style and overall functionality. The general look will be strongly dependent on the features of the "post-mouse" generation of human-computer interfaces and will reflect the requirements of uncertain knowledge processing (Bărbat and Filip, 1997).

The middlware is based on the *agent-based blackboard* approaches. Along with design data, tactical control knowledge can be represented in the shared repository, enabling reasoning about how to proceed with the design process to share the same

status and priority as reasoning about the design itself. Thus, the coach becomes the "proxy" and high-level manager of the meddle layer.

Office Supported capabilities have proved to be very useful in organisational management especially in increasing its facilities via more structured communication (electronic mail, news service and word processing). Here in the system, the coach provides some of the modern automated and intelligent scheduling technologies. Organisations tools enable the executives to pay more attention to details whenever necessary, and to follow up more effectively.

Resource Library is made up from “traditional” categories: data base, knowledge base, model base and agents library based on geographical area and social norms. The higher level provides the management engine with the ability to create, update, store, recall, operate and control component units, and to construct and modify these units.

5 CONCLUSIONS

Although the separated features of the “coach” metaphor have been treated separately by the current approaches, the trends of economical environment impose the need of an osmotic approach that can take full advantage of the highlighted features only if treated in a global manner. Another aspect that must be taken into account is the shift of anthropological features to the system itself. They focus on the system behaviour as a whole, not only reported as a relationship with human operators.

Compared with traditional DSSs, the “coach” metaphor has a more anthropocentric orientation, more powerful data access and communication ability. Compared with older approaches, it greatly enhances the decision support capability, reaches more extensive problem domains, more component problem-solving capability, better support business performance and is spreading to the whole organisations.

At the end of this paper we wish to emphasise the anthropocentric orientation of the proposed metaphor - compared with current metaphors like "desktop”, “room”, etc -, outlining and suggesting the flexibility and dynamism of human beings. And it is so, because the relationship among persons have not an overall abstract and uniform character, but an “alive” one, continuous, changeable in a unique manner;... continuous, at ad infinitum.

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