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A Model of Social, Emotional and Symbolic Aspects of Computer-Mediated Communication within Organizations

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Abstract. Little work has as yet been undertaken into the modelling and formalizing of group, collaborative and cooperative work using computers. This paper sets out to describe and model the social, emotional, and symbolic aspects of computer-based communication within an organization. A descriptive model is developed which relates elements together and an example is given to illustrate some of the elements.

Key words. Computer-supported cooperative work (CSCW), emotion, script, symbol, user interface

1. Introduction

One view of computer systems is that the dominant organizational needs which they satisfy are efficiency and productivity. This has been called systems rationalism (Kling, 1980), which claims that computer-mediated communication increases productivity by filtering out socio-emotional elements of communication to leave the required information content (Johansen et al., 1978; Murrel, 1983). By this means there is an increase in the total amount of useful information exchanged relative to irrelevant interpersonal socio-emotional 'noise' (Rice, 1984).

However, this approach has been increasingly criticised. For example, a significant proportion of the information domain comprises not "facts" or material derived from the substantive nature of work done but instead concerns other users and other matters internal to the organization. A more specific example is given by the fact that information content does not explain differences in use of electronic mail, telephone, and post. Electronic mail and telephoning are distinguishable from letter-writing in terms of spontaneity, a socio-emotional dimension which explains the substitution of electronic mail for letters and not for telephoning (Lea, 1991). Studies using a rationalist approach fail to include features such as message ambiguity and symbolic cues (Trevino et al., 1987). Yet experienced users' ability to express their own identity using system features and by combining different media, shows how important such cues are (Myers, 1987). These considerations suggest that priority should be given to providing flexible support

for conversational aspects of communication and for the socio-emotional features of interaction (Lea, 1991).

In broad terms, this suggests that the rationalist, information processing model of organizations should be supplemented by a symbol-creating model. Organizations have information processing attributes of speed, precision, lack of equivocation, knowledge of the documentary record, continuity and sense of direction, and employ rules about values of discretion, uniformity of operation, subordination, and reduction of friction which expedite information processing (Bendix, 1956). Yet this should not detract from the recognition that organizations also create meanings, and that these meanings are made through the use of symbols and the reliance on cognitive scripts (Gioia, 1986).

The most obvious way in which this information processing view has failed to fully understand the implications of computer systems is in the resistance often expressed by users. For example, despite predictions about the rapid spread of CSCW within organizations, only a small minority of organizations work to any sort of flexible work times and places (Anon, 1988), and the prevalent attitude of managers to such systems is an ambiguous one. For example, there is no way for managers to distinguish between corporate CSCW workers who are working at home and those who are moonlighting or running a business from home. Such concerns have led to many managers at Hewlett Packard avoiding using the company's electronic mail and conferencing systems (Fanning and Raphael, 1986). Currently CSCW has no organizational presence – it is not represented on organization charts, for example. This lack of visibility suggests to managers that CSCW transcends organizational discipline and control, and that it challenges hierarchical organizational forms (Perin, 1991 a).

These problems suggest that further investigation of non-informational aspects of organizational systems, and in particular a model of how these non-informational aspects (of social-emotional-symbolic expressiveness) can be specified, would be advantageous. This model should attempt to balance sometimes conflicting goals of individuals within virtual organizations, such as privacy and visibility. Olson et al., (1993) have suggested that general theories of coordination in CSCW "are needed for understanding how the technology can fit into human, social, organizational and cultural practices". A similar prescription for virtual environments has been made by Barfield and Weghorst (1993). Current models (e.g. Treu, 1992) are concerned more with "internal structure" interface matters (developing data structures for supporting the user interface, and seeing the user and the interface as the only two significant elements), than with the need to model the social world with whom the user communicates and the communication act itself.

The underlying assumption adopted in this paper will be that the social psychological mechanisms that exist and which have been found to work well in real organizations should be put to use in virtual organizations. This assumption is political, since some believe that computing systems will alter current organizational

hierarchical relationships – from some it has been a prescription (for example, Eveland and Bikson, 1986) while from others it has been a warning (for example, Kiesler, 1986).

In reality, organizational communication is not so segmented into informational and symbolic components as it appears from the treatment of the problem in this paper. Such a segmentation was dictated by space considerations which have led to exclusion of informational matters.

2. Types of communication

Baskin and Aronson (1981) define communication as the exchange of messages for the purpose of constructing shared meanings. Only when a shared understanding exists can symbols be communicated. Adapting Edelman (1966) we can distinguish four types of communication within organizations: these are appeals, ideals, rules, and deals.

2.1. APPEALS

Appeals are requests to an organizational audience in support of a policy. Appeals enable the organizational audience to feel a sense of participation and thus appeals promote acceptance of policy. Appeals are expressed as four types of speech act (Searle, 1979): (a) Expressives express how the speaker feels regarding something specified in the message – for example, a Managing Director saying at a company dinner how good being in the company makes him feel. (b) Declarations change how their object is viewed – either an announcement of a symbolic action such as a factory closure or a statement of intent such as an organizational leader saying he or she wants the organization to become "the best in its field". (c) Intangible commissives are promises of an intangible nature: e.g., promising to "turn the company around". (d) Directives with emotive persuasion are emotional arguments: e.g., a statement such as "We must be best on quality or we are dead", which uses fear. Within organizations appeals are used in the collaborative strategies of developing champions, building consensus, and framing perspectives, and in the competitive strategies of agenda controlling, coalition building and cooptation (Frost, 1987). The persuasive strategies (Kipnis, Schmidt and Wilkinson, 1980) used to make appeals include charisma (when a leader is perceived to possess this quality), assertiveness (use of a direct and forceful approach), coalition (mobilising other people in the organization), ingratiation (use of impression management, flattery, and goodwill), and appeals to altruism. Such methods are more likely to be used by superiors in downward communication (Yukl and Tracey, 1992).

Appeals are characterised by recurring themes, which are a direct result of the instability and ambiguity of their content. The phrases commonly used, such as "if quality goes then we are finished" do not have any operational meaning and so do not change anything. Appeals consist of premises, inferences and conclusions. The conclusions are usually in the form of promises and threats and amount to appeals for widespread support. The style's most useful feature is generality of appeal created by the use of cliche and generalisation.

2.2. IDEALS

Ideals are pieces of general advice designed for a wide variety of situations. They are justified by policies, plans, and strategies. They use directives with rational persuasion, (by a reference to a policy or by connecting the commended action to a goal). Within organizations ideals are decided using the competitive strategies of using outside experts, managing committees, and selective use of objective criteria (Frost, 1987). The persuasive strategies (Kipnis et al., 1980) used to make ideals are higher authority (gaining support of upper levels of the organization) and reason (use of facts, goals or policy as grounds for commending an action). This may involve "integrative" (Follett, 1941) bargaining (aimed at maximizing joint gains). Such methods are more likely to be used by subordinates in upward communication (Yukl and Tracey, 1992).

Ideals are commands accompanied by justifications and definitions. An example of an ideal is "Aim for niche markets". The advice does not define which niche markets, and anyway no amount of definition can prepare the implementer for the details and novelty of particular cases, nor for the changes of mind by those responsible for strategy. Thus although ideals give a reassuring impression of strategy in control of destiny, those charged with implementing those ideals treat them as inherently ambiguous.

2.3. RULES

Rules are standard operating procedures and regulations which are decided by middle management, applied in specific cases, and justified by concrete incidents in the past or imagined future. They are often the most visible part of any change strategy. They are in the form of directives without persuasion, and they are narrower and more insistent on compliance than are ideals. They therefore contain instructions which must be complied with. Within organizations rules are used in the competitive strategies of scapegoating and defaming (Frost, 1987). The persuasive strategies (Kipnis et al., 1980) used to make rules are higher authority (gaining support of upper levels of the organization) and sanctions (organizationally derived rewards or punishments).

2.4. DEALS

Deals are aimed competitively and divisively at maximizing gains between competing individuals or organizations. They are what Follett (1941) has described as "distributive" (Follett, 1941) bargains. They are ubiquitous within organizations (Putnam, 1985). Rational or impartial ideals or justifiable strategy are not referred to. For this reason deals have connotations of excluding particular groups and therefore give rise to suspicion (Prandy, 1979). This is one reason why secrecy is sought when deals take place (Pfeffer and Salancik, 1977). Another reason is that those involved find it advantageous not to show their cards too soon. Because the audience addressed is very specific and because the platform is private, the parties can say what they like in attempting to gain common ground. They will therefore use as speech acts assertives, committing themselves to the truth of expressed propositions. They will also use tangible commissives: promises or threats of concrete artifacts or actions. The influence strategies (Kipnis et al., 1980) used to make deals are bargaining (use of negotiation by exchanging benefits and favours) and deceit. Within organizations deals are used in the competitive strategies of exchanging threats and promises, leaking information, and withholding support (Frost, 1987).

2.5. ATTRIBUTES OF COMMUNICATION MEDIA

Several attributes of communication media are relevant to these types of communication.

(1) **Interactivity**. This is the degree to which the medium enables individuals to engage in a conversation (Dutton et al., 1987). Interactive media have the properties that individuals cannot be prevented from enjoying access (i.e. being members of an audience) even if they are not speakers, and also that individuals' enjoyment is affected by what later, as well as earlier, speakers say. These two properties make an inter-active medium vulnerable to poor performance when an insufficient number of individuals in an organization make use of it (Grudin, 1988; Markus, 1987).

(2) **Destination unpredictability**. Messages posted on bulletin boards have the ability to pass among a new and previously uninvolved audience (Feldman, 1987), in an unpredictable pattern. On the other hand a legal document such as a warrant, contract or a sub poena is specific to named individuals.

(3) **Recordability**. This is the extent to which the message resists decay or distortion (Huber and Daft, 1987) in the form in which it is sent. Face to face messages are notoriously prone to degradation down the line as they are recounted second hand. Complete recordability of social interaction such as meetings is an attribute uniquely possessed by electronic media, because for example electronic

conferencing transcripts are complete and less biased or selective than written minutes (Culnan and Markus, 1987).

For an appeal to have general force there must be a strong admixture of cliche and generalisation. This weakens the argumentational strength, so that speakers must seek non-interactive and unrecordable media which do not enable questioning or criticism. Although an appeal can be criticised by an "answering" document, the "answer", because it is in another medium, is put at a distance and therefore lacks the emotional effect of the original message. Also appeals are most effective when they demonstrate intimate knowledge of the audience, therefore a medium must be chosen where destination is predictable. Thus appeals generally occur on *non-interactive, unrecordable* media where *destination is predictable.*

The widest possible audience is sought for feedback when ideals are used. This is because ideals are influenced by strategy, and so are expressed in media with an *unpredictable destination* and which are *interactive*, such as publicly available documents. Because ideals are supposed to be fixed, at least for a certain period of time, and because several people may wish to use the same ideal and will require identical versions, they must be in *recordable form*, i.e. written down.

Rules seem to be applied mechanically and automatically, with the associated connotations of rationality and impartiality. Rules also seem to be orderly and smoothly functioning, and so there is no need for concealment. Rules are sometimes made public (e.g. quality management procedures) to outside audiences in order to give such an impression. Therefore they are transmitted via a medium which gives an *unpredictable destination.* Neither criticism nor negotiation are possible with rules, and so they use a medium which is *non-interactive.* Rules must endure over time in order to ensure consistent behaviour and expectations, and they must exist in identical versions for several individuals, and so they must be in *recordable* form.

Deals are secret and this means that negotiation uses a *non-recordable* medium (even though the agreement itself is recorded), and the private nature of the audience means that messages have a *predictable destination.* The negotiation process requires that the medium is *interactive.* For these reasons negotiations are usually conducted face to face, although when issues are simple (e.g. price is the only dimension), or where there is an asymmetry (e.g. urgency – one party wants a quicker resolution than the other; or dominance of personality), then other media may be used.

3. Model

Figure 1 shows a model of organizational communication. Appeals, ideals, rules and deals are at the centre of this model. Its main components besides the **Speaker** and her Audience (which comprise part or all of an **Organization**) are

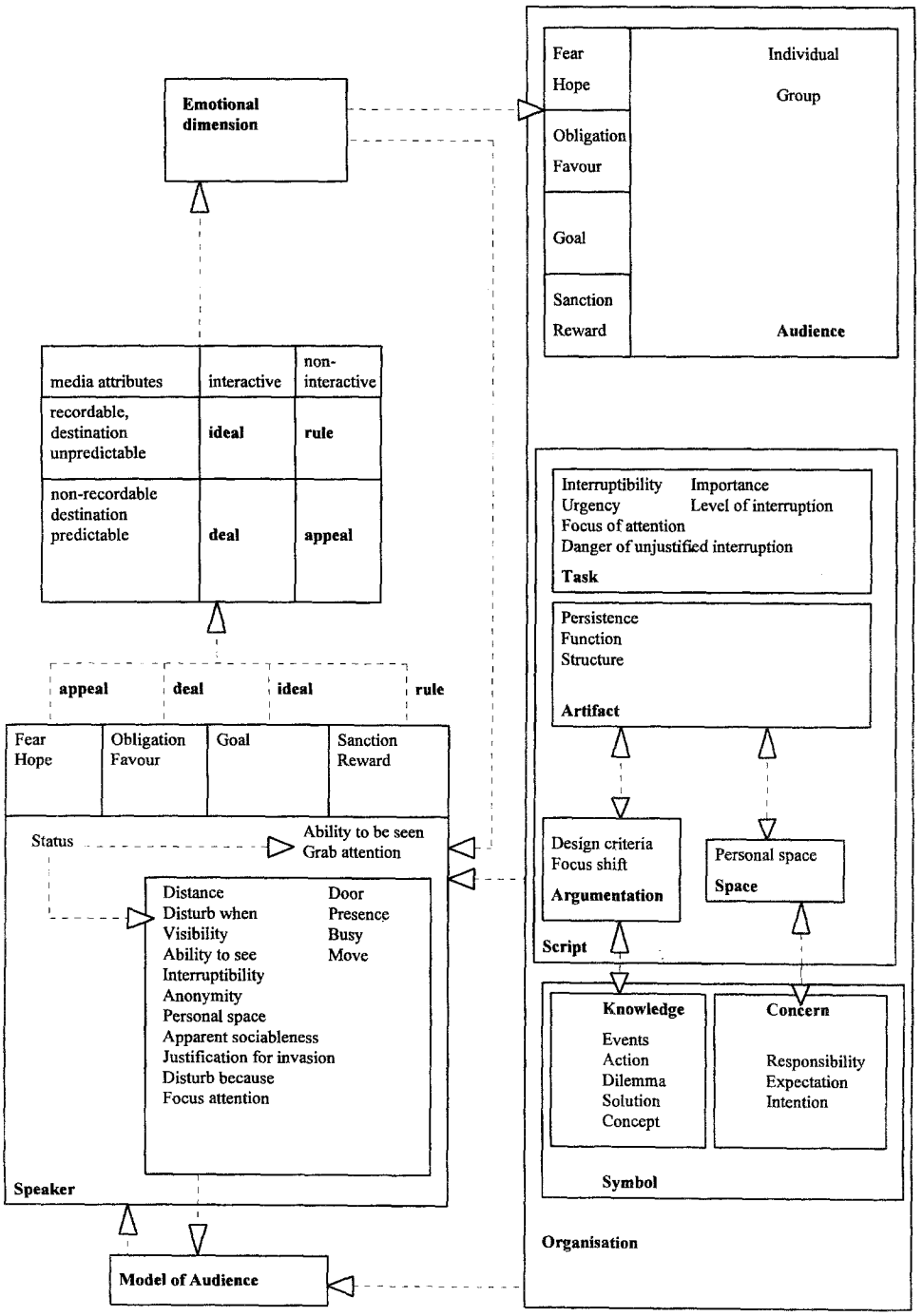

Fig. 1. Communication Model.

Scripts, Spaces and **Symbols**. Shared meanings are constructed by means of a feedback process between the Speaker and her Audience by means of appeals, ideals, rules and deals. Appeals change **Fears** and **Hopes,** Deals change **Obligations** and **Favours,** Ideals change **Goals,** and Rules change **Sanctions** and **Rewards**. These emotional aspects of the four types of communication are possessed by both Speakers and Organizations.

Organizations contain Audiences comprising Speakers and **Groups** (influenced by what **Tasks** are **Important,**) Spaces, Symbols and Scripts.

Scripts are chronologically structured sequences of stereotypical actions. They are amenable to knowledge-based and rule-based modeling. They comprise **Argumentation** (some are premise-inference-conclusion, or symptom-diagnosis-problem-solution, or question-answer, or hypothesis-test-theory, or conflict-resolution), Space (a sequence is outside-enter-inside), **Artifact** (a sequence is requirement-design-build-test-evaluate), and Task (a sequence is objective-choice-review). Artifacts (designs, documents, drawings, machines) and Tasks (plans) enable the consideration of objects that persist beyond the current Argumentation and so Argumentation and Artifacts/Tasks become linked together in chains (Kaplan and Carroll, 1992). In such chains they alter each other's state. Argumentation can result in modification of an Artifact (a car battery is argued to be flat so it is recharged). And the attributes of an Artifact can alter the state of Argumentation (we accept that faulty planes should be grounded, and a plane is shown to be faulty and so we argue it should not fly). Also, examples of one type can occur in another type: e.g., Argumentation may be the goal of a Task (for example, in the form of writing a statement of justification) or an Argumentation-Artifact chain may be a Task plan (a Task may be to show that the plane should not fly). Designs, statements, documents, drawings, machines, and plans all comprise potential elements of Argumentation, Artifact, and Task in arbitrary combinations and amounts. Even more remarkable, all of these elements can be recursively constructed: e.g., Argumentation comprises subparts such as premises which can contain whole chains of other Argumentation (Sillince, 1994; Stein and Maier, 1995). The flexibility of this arrangement will become important later in the paper when current conversation models are criticised for their inflexibility.

Artifacts enable the representation and consideration of that part of the world that is not intentional and that is not expressible in speech act terms (Kaplan and Carroll, 1992). Tasks draw on **Knowledge** and **Concerns.** Knowledge includes **Events**, **Actions**, **Dilemmas**, **Solutions**, and **Concepts**. Concerns include **Responsibilities**, **Expectations**, and **Intentions**. The likelihood of conflict is a Task related factor, since when people depend on each other to complete a Task, conflict is much more likely (Dutton and Walton, 1972).

As task groups form and disband, a Speaker' **Status** goes with her – status outside any new group influences status within the new group (Fox and Moore,

Door	Presence	Busy	Interruptability
Closed	Out	-	Low
Closed	In	Yes	Fairly low
Closed	In	No	Medium
Open	In	Yes	Fairly high
Open	In	No	High

Fig. 2. Degrees of interruptability.

Can see others	Can be seen	Knows he or she can be seen
No	Yes	No
No	Yes	Yes
No	No	-
Yes	Yes	Yes
Yes	Yes	No
Yes	No	-

Fig. 3. Degrees of visibility and ability to see others.

1979). Moreover, some dimensions of **Diffuse** status (age and sex) are more stable than task-related or **specific** status (Berger et al., 1977). Status is both **Formal** (rank in the Organization), and **informal**. This is gradually acquired, as people exchange messages about the Speaker. (This might be electronically simulated by a cumulative averaging of the emotional aspects of communications about her). Status is conveyed, among other ways, by nonverbal behaviour. For example, lower status individuals display a more tense body posture when superiors are present (Mehrabian, 1971). The variety of social status codes, the centrality of hierarchy within organizations, and the importance of status even in primates' social behaviour, suggests that **Display** of status (Specific and diffuse, Formal and informal, **By-subject** and **by-audience**, **With** and **without** the subject's awareness) is important.

Rumour has some functional aspects. Its accuracy is high on noncontraversial topics (Walton, 1961), it is fast, and a large proportion of individuals regard rumours as their central source of information about organizational events (St. John, 1981). However, most managers regard rumour as dysfunctional (Vecchio, 1991). The problem of complaining behind someone's back is analogous to rumour-mongering and is regarded as inevitable within organizations by theorists (Davis, 1977). This might be taken to suggest a group message identifier "everybody except X". This would vent frustration, but speaker **Anonymity** might be too dangerous – there would be no sanctioning of criticisms, leading to damaging of reputation needlessly. Most tittle-tattle is forgotten and so any virtual **Gossip** might need to degrade over time.

An **Individual** has a range of degrees of **Interruptability**, ranging from being out, to being in and not busy (see Figure 2). Fish et al., (1992) have described a system which allows quick glances into people's offices to see if they are there and/or interruptible. Interruptibility is influenced by Status and Task. Someone doing an **Important** Task is less Interruptible than someone doing an unimportant Task. There are several **Levels of interruption**, including sending a (paper) letter or memo, "putting" mail into a "letterbox", "knocking" on a "door", "handing" a person a message, "talking face to face", and face to face video/sound contact (enabling the most invasive kind of interruption, eye contact, as well as facial expression and body language). These must depend on the speaker's sense of **Urgency**, and his or her calculation of the **Dangers of unjustified interruption**. Added to this, someone with more personal space is less easilly interruptible (see below). Also, whether or not someone should be interrupted might need to be the subject of negotiation (see below). Root (1988) reports a social interaction system which brings up several of these issues of graceful interruption and disengagement: some of which are easier to simulate in the less structured medium of informal interaction.

An Individual (depending on his or her Status) has a range of degrees of **Visibility** and **Ability to see others** (see Figure 3). His or her ability to see others is determined by his or her **Focus of attention**, which is a function of the Individual's Task. The more an object is within a person's Focus of attention, the more he or she is aware of it. Also a person can grab attention to varying degrees by a bell, by proximity, by being in a dialogue with somebody. This is termed nimbus (Benford and Fahlen, 1993) but shall here simply be called **Ability to be seen**. It is influenced by Status, and in turn influences attributes of **Space**. The more an object is within an Individual's nimbus, the more it is aware of that Individual. A persistent and manipulable sense of presence enables the Individual to subconsciously identify the source of contributions and to experience a sense of "copresence".

The ability to get close to other Individuals is influenced by Status: usually higher Status persons demand more **Personal Space** than lower Status persons (Ardrey, 1966). Low Status Individuals who demand too much Personal space are probably viewed as anti-social (Hall, 1966) and thus are low on **Apparent sociableness**. A feature of Personal space is that one's Status determines how personal space can be invaded. An Individual low in Status can demand fewer types of **Justification for invasion**, whereas an Individual high in Status can demand that he or she only be disturbed for a particular Individual or Task (Whyte, 1949). Conversely, the higher an Individual is in Status the more types of Justification for invasion he or she can offer. Levels of disturbance do seriously affect work: e.g., a survey of open plan offices found concentration and confidentiality difficult (Steelcase, 1978). Significantly, managerial and professional workers view open plan offices less favourably than do clerical workers

(Zalesny and Farace, 1987). Moreover, people who work on complex and difficult tasks prefer very private and closed environments (Block and Stokes, 1989). Individuals require features such as **Disturb when** (higher Status Individuals would have more options to exclude), **Disturb because** (justifications for disturbing someone), **Focus attention** (increase or reduce one's own awareness), **Grab attention**, **Move** (move self within virtual space), and **Distance** (increase or reduce it to some object). Some of these features already exist in a prototype multi-user virtual reality system (Fahlen, 1991; Carlsson and Hagsand, 1992), and in a text conferencing system (Benford et al., 1993).

Body language and facial expressions are features of face to face communication which add expressive power to the information exchanged. Mehrabian and Wiener (1967) suggest that feeling is mainly conveyed by facial and vocal feeling, with language content taking the least expressive role in the communication of emotion. Such features offer serious challenges to computer-mediated communication to either include them (as in video and audio augmentations in which emotional communication is involuntary and implicit) or to match their expressiveness voluntarilly and explicitly by other means. This area has almost limitless subtleties and difficulties. For example, every evaluative or emotional word which occupied an important place in a computer-mediated communication system would require considerable consensus. Jablin (1979) has found that a difference in the interpretation of codes by superiors and subordinates is one of the most consistent causes of communication breakdown. Triandis (1959) elicited interpretations by superiors and their subordinates on evaluative probe words such as power, God and money, and found that communication was more effective when consensus existed on these probe words.

Moreover, explicitness has its detractors. People may wish to be tactful, or to avoid commitment, or to delay position-taking, or not to seem to be exerting pressure, or to seem not to have an opinion on a topic. In many cases people do not wish to make their intentions known. Constantly having to make intentions explicit would decrease organization members' autonomy (Suchman, 1994).

In the case of voluntary and explicit stating of **Emotional dimensions** of communication, a common, simplified communication method or pidgin language is required. Part of the emotional force of communication will come from its type. As suggested above, Appeals involve Fears and Hopes, Deals involve Obligations and Favours, Ideals involve Goals, and Rules involve Sanctions and Rewards. Variation along a **Certain-uncertain** Emotional dimension will move a Rule towards being an Ideal. Variation along an Emotional dimension **Calm-emotional** will increase the force of an Appeal. Variation along an Emotional dimension **Unselfish-selfish** will increase the force of a Deal. An emotional dimension may be **Permanent** (e.g. career aspirations) or **temporary** (e.g. annoyance at being disturbed).

Clarity-ambiguity would summarise a state where some of a communication's expected content was missing. Ambiguity does not reduce a messages's value – it may even increase it. Certainly it is not a cause of communication breakdowns such as those in conflict situations (Putnam and Poole, 1987). Ambiguity often means that a speaker reserves her position and so it is often a cue for the audience to seek clarification (Rogers and Farson, 1984). A sign that ambiguity is not dysfunctional is the fact that much body language is ambiguous (Baskin and Aronoff, 1981), despite its important role in expressing emotion.

Medium	**Constraints**	**Level of interruption**
Send paper letter/memo	Reviewability; Revisability;	Can be ignored.
'Put' mail in 'letterbox'	Cotemporality; Reviewability; Revisability;	Can be ignored.
'Knock door'	Cotemporality; Simultaneity; Negotiability	Length of interruption as yet unknown.
'Hand a message'	Cotemporality; Simultaneity; Reviewability; Revisability; Speaker'sMood; Negotiability	Contracts only to make short interruption for specific purpose.
Short 'talk face to face'	Cotemporality; Simultaneity; Negotiability; Speaker'sMood; Audience'sMood; Modelability	Cannot ignore, but can shorten.
Long 'talk face to face' (e.g. 'meeting').	Cotemporality; Simultaneity; Negotiability Speaker'sMood; Audience'sMood; Adjustability	Cannot ignore and cannot shorten.
Face to face voice/video	Copresence; Visibility; Audibility; Cotemporality; Simultaneity; Sequentiality; Negotiability; EyeContact; FacialExpression; Body language; Adjustability	Highest level of interruption.

Fig. 4. Some virtual media and their associated constraints.

One aspect of ambiguity is that a speaker may wish her contribution not to be taken out of context, and only to be used in conformance with her wishes. A criticism to the boss may have to be more softly couched than a criticism of a subordinate. One aspect of disclaiming ("only my opinion", "strictly off the record") is that there is an expectation that others will not hold the speaker to account for a statement. Yet electronic statements are a problem here because they can be read by audiences unintended by their original authors. Moreover, people often use formalities, formulas, and other means of social hedging to delay the meaning of a message's performative effect as long as possible. Ambiguity therefore sometimes protects speakers and encourages them to be open and honest.

Type	**Territorial examples**	**Functional examples**	**Temporal examples**
Path	Corridor; computer network; discussion group	Information flow; audit trail	Scripts (critical path; information processing; decision steps; manufacturing process; product life cycle)
Edge	Boundary of organization, department, division.	Change of profession; rank; status	Past-to-present; present-to-future; before merger; after flotation; on hold-current; back burner-urgent; background-foreground
District	Shop floor; sales area; management suite	Accounts receivable; logistics; planning; sales	Similarity on current/ urgent/ real time/ strongly coupled/ on hold/ back burner
Node	Office; doorway; drawer; file; sheet; memo; person; team; group; committee; desk; diary; CV	Manager; controller; leader; supervisor	Script (meeting; visit; report; news briefing; sales presentation; data retrieval; crisis)
Landmark	Heavilly used corridor or office; corridor intersection; target; constraint	Status symbol; functional image	Deadline; strong coupling; urgent item

Fig. 5. Examples of virtual cognitive organizational map.

Emotional dimensions may be about the Speaker, the Audience, the Organization, or the Task. We associate the Emotional dimension ascribed by an Individual with one of these, until we are able to build a more complex **Model** of that Indi-

Metaphor	Slot	Example.
Game	Coach	Strategist (price, market share, product range etc)
	Captain	Sales and Marketting Director
	Players	Sales reps
	Team	Us, competitiors
	Rules	Sales are a function of price, quality, service, etc
	Goal	Maximise sales
	Atmosphere	Consensus over rules; strong sense of belonging
Machine	Purpose	Maximise product flow
	Performance	Cost and management accounting system; low waste; high machine utilization; audit trail
	Process	Hot press; paint shop
	Potential	Maximum capacity; extra shift; overtime; subcontract; bottlenecks
	Transmission	Line manager-supervisor-operator
	Lubrication	Reward system; quality culture; trust
	Designer	Production planner
	Inputs	Raw materials
	Outputs	Finished goods
Journey	Pilot	Product development manager
	Crew	R&D team
	Pitfalls	Cost escalation; market failure
	Destination	New product success
	Map	Idea-patent-experiment-prototype-market test-launch
	Navigation	Consensus over product development
Jungle	Goal	Survive as independent stock market entity
	Rule	Reduce ratio of asset value to profitability
	Threat	Predatory takeover
	Atmosphere	Competition between companies
	Predator	Company seeking acquisitions
	Prey	Company with low share price
Family	Relationship	Support based on member's need
	Member's role	Organizational task
	Goal	Sacrifice for needy member; Cohesion despite individual differences
	Rule	Contributions should be constructive
	Family head	Personnel Director
	Sibling Rivalry	Conflict between members
Zoo	Keeper	Chief accountant
	Feeding time	Budget
	Distribution	Competition between projects
	Cage	Ring fenced funds
	Fun for public	Investment justification
Society	Head of state	Managing Director
	Democracy	Empowerment
	Tension	Conflict between departments
	Class	Manager-rep-secretary
	Ritual	Annual dinner
	Taboo	Disloyalty

Fig. 6. Examples of organizational metaphors.

vidual. Such a Model would include a list of past Emotional dimensions and what they related to. For example, a particular Individual may always have negative evaluations of the Organization but positive evaluations of the Task. The Model would therefore help us to interpret that Individual's current message.

Metaphor	Slot	Example
War	General	Boss
	Soldiers	Employees
	Goal	Market share; maximise profits
	Enemy	Competitors
	Engagement	Product launch
	Disengagement	Withdraw product from market
	Attack	Sales
	Retreat	Divestment
	Prisoners	Head hunting
	Intelligence	Industrial spying
	Strategy	Differentiation; focus; price cutting; niche
	Threats	Rivals; buyers; complements; suppliers; new entrants
	Propaganda	Marketting
	Booty	Commission
	Lay waste	Asset stripping
Organism	DNA plan	Bill of materials
	Drought	Recession
	Creator	Product engineer
	Shelter	Patent
	Feed	Investment
	Pollinate	Diffusion of innovation
	Seed	Business idea; product idea; invention
	Adaptation	Reposition
	Function	Sales, production, accounts
Theatre	Audience	Customers
	Actors	Sales staff
	Script	Standard operating procedures
	Backstage	Production
	Programme	Catalogue
	Repertoire	Product range
Body	Diet	Cost cutting
	Cure	Turnaround
	Sick	Inefficient
	Starve	Lack of investment
	Head	CEO
	Eyes	Competitor analysis
	Memory	Database
Benchmark	Exemplar	Sainsburys PLC
	Definition	Top UK food retailer
	Attributes	Quality, service, range
Prophesy	Omen	Financial results
	Prophet	Stock exchange analyst
	Prophesy	Prediction of share prices
	Apocalypse	Stock market crash

Note: Some of the above metaphors are described in Kendall & Kendall (1993).

Some Emotional dimensions of messages are more difficult to explicitly indicate than others: e.g., when an Appeal is made using charisma or assertiveness. Some Emotional dimensions are **Provisional** or open to negotiation. This means that the Speaker expects to be able to "see" some Emotional dimension of the Audience. In face to face conversation the Audience can choose to negotiate (exchange, use logical argument, etc), to reassure, or to smoke-screen (change of subject, excuse for rushing away). Communication between a Speaker and an Audience needs to allow users to be ambiguous and unclear, and to partially mask their intentions since this activity often serves social and organizational goals (Reder and Schwab, 1988). One important question to ask about communication systems is the extent to which the number of communication slots is sufficient to allow Speakers to leave some slots unfilled (thus simulating purposeful ambiguity) and yet to seem to be sending worthwhile responses. This suggests that every message or its response is accompanied by Emotional dimensions. Some of these aspects of informal communication are included in Figure 4.

In a virtual organization **Rooms** can be **Private** or **Public**. Public rooms can be entered uninvited without any effect. Private rooms can be invited into or invaded with effects (the occupant becoming angry). Rooms can be protected by being nested (an outer room occupied by another Individual e.g. a secretary). The implications of this are seen in Figure 3, where another person can be seen by us but cannot see us if he or she is in a public room, and if we are in a private room.

A cognitive map of the virtual organization contains **Paths,** (routes between spaces), **Edges** (boundaries of spaces), **Districts** (aggregations of spaces of a particular type), **Nodes** (spaces and sub-spaces), and **Landmarks** (easilly remembered items in the map) (see Figure 5.). The map contains significant elements such as Individuals' "offices" and "meeting rooms" and so requires **Zoomin** support. Paths form networks and so require **Trace** (give a route history), **Plan** (given a node, find a path to it), and **Look ahead** (anticipate next node) support.

Another way to add expressiveness is to include built-in and buildable Symbols. Examples of symbols are **Logos, Slogans**, **Stories**, **Rituals**, **Actions**, **Non-actions**, **Visual images**, and **Metaphors.** A brief message referring metaphorically to the organization as a battlefield will be read differently from one referring to the organization as a community. Although the desktop metaphor has been a successful metaphor, a single metaphor cannot solve the communication challenge of future interface users (Marcus, 1993). Figure 6 suggests some built-in metaphors which would be relevant for messages within organizations.

Organizations enable meaning to be socially constructed, negotiated, and consensually validated (Weick, 1969). "...because symbols are a primary vehicle for understanding, they can be construed as the unifying force that facilitates the construction of consensual scripts for action. Through the development and structuring of shared meaning and understanding, cycles of interlocked behaviour become sensible. The storehouse of knowledge about 'cycles of interlocked behaviour' are the individual and consensual scripts held by organization members. They are the

symbolic, meaning-oriented cognitive frameworks that are used . . . to make sense of experience" (Gioia, 1986).

Thus the main aim of organizational members' communication is to compare their own with others' symbols and to attempt to form or influence the creation of shared meanings. This suggests several actions, such as **Comparison**, **Negotiation**, **Creation**, and **Application** of symbols. Figure 7 gives some dialogue management steps for organizational handling of metaphors. Such algorithms could be the basis of a dialogue management system. Negotiate Metaphor involves finding disparities between Individuals' views and finding common metaphors. One example of the importance of shared meanings is in ensuring information exchange. Information may be hoarded (it could lead to promotion, Blau, 1954) or it may be degraded by carelessness (if the Individual does not consider the information to be sufficiently her responsibility). Another example of the importance of shared meanings is when departments or organizations with different cultures attempt to collaborate – say a sales department with a short time horizon and Game and War metaphors, and a research department with a long time horizon and Journey or Zoo metaphors. Such understanding is essential to reducing conflict (Lawrence and Lorsch, 1967).

Compare Metaphor.
if interaction reveals symbolic knowledge (e.g. other's metaphor)
then compare with one's own symbolic knowledge.

Negotiate Metaphor.
if disparity exists
then direct interaction at comparing slot by slot;
engage in negotiation to reduce disparity.

Apply Metaphor.
if knowledge fits into a metaphor
then label that knowledge,
otherwise if it partly fits metaphor then Adjust Metaphor,
otherwise Create Metaphor.

Create Metaphor.
describe knowledge on list of slots;
find another object with largest number of similar slot descriptions.

Adjust Metaphor.
alter slot descriptions in metaphor;
give new name to metaphor.

Fig. 7. Dialogue management steps for organization metaphors.

Situation	Trigger	Script
Formal Meeting	Agenda exists; Long negotiation needed; Decision needed	Read agenda item; Choose decision option; Give belief strength; Justify decision option; Choose other's argument; Criticise other's argument; Support other's argument; Suggest new agenda item; Justify new agenda item; Exit
Informal Meeting	Opportunity exists; Partner has similar interests	Greeting; Exchange symbolic information; Quick first message; Message body; Quick last message; Exchange symbolic information; Sign off
Decision	Problem, threat or opportunity exists	Identify problem, threat, or opportunity; List alternatives; Evaluate alternatives; Choose; Review; Monitor
Product	Existence of artifact which contributes value to organization	Business idea; Scientific idea; Timescale; Decision to test feasibility; Feasibility stage; Decision to prototype; Prototype stage; Decision to produce; Promotion stage; Promotion evaluation; Full production stage; Product withdrawal
Project	Existence of long term action with problems of control and internal complexity	Allocation of responsibilities; Timetable; Resourcing; Decisions; Termination
Sabotage	Conflict and individual goal blocked	Identify weakness; Publicise weakness; Criticise weakness; Gossip; Spread rumour; Withdraw support; Oppose
Gossip	Gossip exists; Audience interested; Informal conversation	Gossip; Feedback; Modify
Rumour	Rumour is believable to Audience; Rumour serves Speaker's interest	Give rumour; Feedback; Modify
Arbitrate	Conflict exists in one's own team;	Identify source of conflict; Enable negotiation; Act as peacemaker; Witness agreement; Sign off
Complain	Rule broken; Audience sympathetic	Make complaint; Link to request; Feedback; Modify; Thanks; Sign off
Negotiate	Conflict exists between Speaker and Audience	Get Audience's views; Give own views; Identify common ground; Make demand; Modify views provisionally; Make agreement; Sign off
Request	Audience has something that Speaker wants	Make request; Feedback; Negotiate; Modify request; Thanks; Sign off
Vote	Absence of consensus	Topic announcement; Vote; Sign off

Fig. 8. Examples of organizational scripts.

```
begin
      get existing list of metaphors;
      for all existing metaphors
        begin {for all}
                  Compare Metaphor;
                  agree on which metaphors are relevant;
                  Negotiate Metaphor;
                  agree on which actions, priorities, models and theories are relevant;
                  Apply Metaphor;
                  re-work and re-express them consensually;
                  develop metaphors as operational (action-oriented) metaphors;
        end {for all};
      if sufficient metaphorical material does not exist then Create or Adjust Metaphor;
      go through Create-Negotiate-Apply-Adjust-Compare sequence with chosen metaphor;
end.
```

Fig. 9. Dialogue management steps.

What is the relationship between organizational symbols and scripts? Once symbols have been identified, the same actions of Comparison, Negotiation, Creation, and Application are used. For example, if the "Organism" metaphor was found to be applicable, then this would trigger "Create business idea" or "Create reposition statement" (see Figure 6). Figure 8 shows that scripts also have their own inbuilt triggers. Unpredictable events give rise to the need to create scripts, whereas predictable events lead to a need to apply scripts. Figure 9 shows how scripts enter into the management of dialogue.

Scripts can be represented as transformations as in Figure 10. Appeals change Knowledge or Concerns into Fear or Hope. Ideals change Knowledge or Concerns into Goals. Rules change Knowledge or Concerns into Sanctions and Rewards. Deals change Knowledge or Concerns into Obligations and Favours. A **Meeting** begins with a Group together with Dilemmas and together with the function Negotiate (a list of previous negotiations which resulted in Decisions or Knowledge). Results in shared Concerns and Knowledge in the form of Solutions and Concepts. **Sabotage** occurs when an Individual experiences invalidated Expectations, and creates a Dilemma. A **Decision** is a transformation from Dilemmas to Solutions. Gossip involves a Group together with shared Concerns and Knowledge and results in consensual Concerns and Knowledge. Rumour is similar but may only involve a single initiating Individual. **Arbitrate** involves a Group and its Concerns and Knowledge and sees them as Dilemmas, and results in consensual Concerns or Knowledge seen as Solutions. **Complain** begins with a group of Individuals and broken Rules (aspects of Scripts) and leads either to Actions or a **Request**. A Request may involve several requesting and requested Individuals, and either Actions or Concerns or Rules are invoked (both as starting points, and as things to change) in some way. **Compare Metaphor** involves comparing available Symbols with one's own Symbols, and results in a newly moulded Symbol.

Script	Before script used	After script used
Appeal	Knowledge,Concern	Fear, Hope
Ideal	Knowledge, Concern	Goal
Rule	Knowledge, Concern	Sanction, Reward
Deal	Knowledge, Concern	Obligation, Favour
Meeting	Group, Public Dilemma, Negotiate	Solution, Concept, Concern, Knowledge
Sabotage	False Expectations, Individual	Dilemma
Decision	Dilemma	Solution
Gossip	Group, Knowledge, Concern	Group, Knowledge, Concern
Rumour	Individual, Knowledge, Concern	Group, Knowledge, Concern
Arbitrate	Group, Dilemma	Solution
Complain	Group, Rule	Action, Request
Negotiate	Group, Organization	Decision, Deal
Request	Group, Action, Rule, Concern	Action, Rule, Concern
Compare metaphor	Symbols	Symbol
Negotiate metaphor	Symbols, Negotiate	Symbol
Apply metaphor	Knowledge, Concern, Symbol	Knowledge, Concern,
Create metaphor	Knowledge, Concern	Symbol
Adjust metaphor	Knowledge, Concern, Symbol	Symbol

Fig. 10. Organizational scripts as transformations.

Negotiate Metaphor involves comparing two instances of a Symbol, using Negotiate, and resulting in a newly moulded Symbol. **Apply Metaphor** is the application of a Symbol to Concerns and Knowledge in order to change them (not to change the Symbol). **Adjust Metaphor** compares a Symbol with either Knowledge or Concerns and adjusts a Symbol as a result.

4. Example

Ghoshal and Bartlett (1994) have described the process of "turnaround" whereby a large company, Semco made an operating loss in 1989 and then was turned around to become a profitable company once more. They describe a process whereby the company re-learned its goals and the means for achieving them. This process

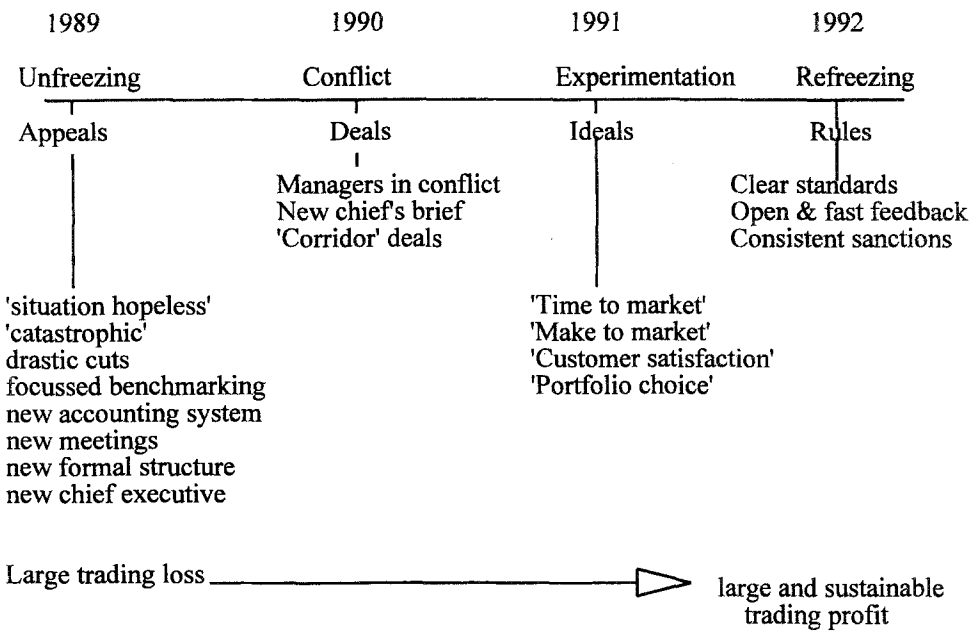

Fig. 11. Event at Semco.

of re-learning has been conjectured by Johnson (1990) to be a four stage one: (1) old ideas and ways of doing things are "unfrozen" by means of questioning and destruction of old ideas; (2) a "dialectic of conflict" in which degradation and conflict occur, in which information is built up, and searching for answers to questions continues; (3) experimentation, where a new paradigm is tested, and renewal and encouragement of new practices are symbolised; and (4) "re-freezing" and paradigm adoption, with integration and conflict reduction symbolised. These stages are similar to the stages (forming, storming, norming, performing, adjourning) identified in the group formation or maturity theory of Tuckman (1965) and Maples (1988). Figure 11 shows the events at Semco in terms of this multistage model and suggests that some attributes are more relevant at some stages than at others. For example, anonymity is useful during the "storming" or "conflict" stage to bring issues out into the open (Jessup et al., 1991), expressing emotions is important when defensive boundaries are collapsing during "storming" or "conflict" stage (Gemmill and Wynkoop, 1991) and consensus-building methods are needed during experimentation or "norming".

Although particular communication forms predominate at particular stages of the Semco example (see Figure 11) each significant action during the process comprised material relevant to all four types of communication (see Figure 12).

There were large numbers of symbols used (see Figure 13). Metaphors identified in Figure 6 include Game, Machine, War, Organism, Body, and Benchmark. Figure 14 shows instances of Map metaphors at Semco.

	Appeals	Ideals	Rules	Deals
Composition of a task force	State mission, why important	Terms of reference	Fair allocation of work	Resolve inter-group disputes
Handling of lay-off process	Justify need for layoffs	Outline the flexibility in payments and timetable	Non-victimisation	Compensation payments
Gathering competitor information	Emphasise threats	Specify main items needed	Legality of methods used	Payment by results

Fig. 12. Communication aspects of three significant actions at Semco.

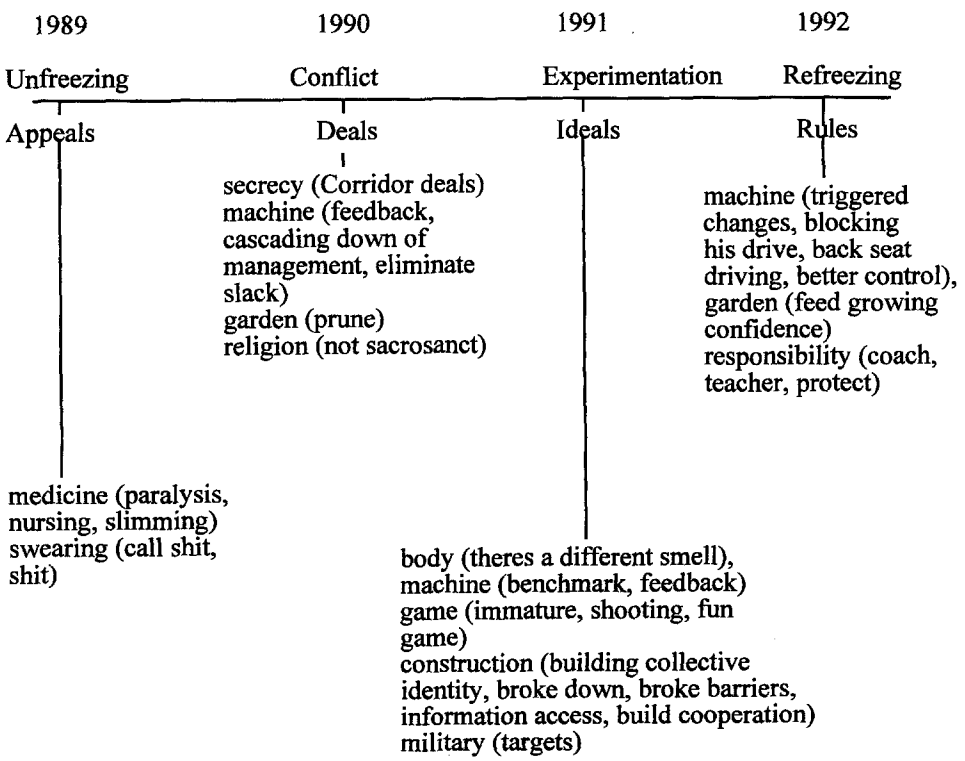

Fig. 13. Symbols at Semco.

	Example at Semco
Path	Recovery trajectory; downward cascade effect of upper level meetings
Edge	6% market share needed for breakeven
District	Semco and its parent group; business units within Semco
Landmark	Market leader; use turnaround example to other group companies

Fig. 14. Map Metaphors at Semco.

1. **Create Script** CultureChange (Discipline; Stretch; Trust; Support).
2. **Create Subscript** Discipline (Drastic cuts; Shock and fear; Clarity of performance gap; Open discussions on progress; Implementation of consistent sanctions)
3. **Create Subscript** Stretch (Commitment to non-incremental improvements; Establishment and acceptance of clear performance standards)
4. **Create Subscript** Trust (System of quarterly meetings of managers; Preparatory meetings at lower levels; Focus on specialized knowledge at lower levels; Collective definition of problems and solutions)
5. **Create Subscript** Support (New CEO; Removal of some senior managers; Visible signal for the need to change management style; Changing role of management and staff; Greater autonomy at lower levels)
6. **Apply Script** CultureChange.

Fig. 15. Scripts for cultural change in the Semco case.

The last step of Figure 9 is to go through the actions of Create, Negotiate, Adjust, Compare and Apply to the slots of the chosen metaphor. Some of these slots for "Game" are "Coach" (new business unit manager), "Captain" (new chief executive), "Atmosphere" ("I now enjoy coming to work") (see Figure 6). Some of the dialogue management aspects of scripts for cultural change are shown in Figure 15. The details of Discipline, Stretch, Trust and Support are taken from Ghoshal and Bartlett (1994).

5. Unsolved problems

5.1. INCOMPLETE MODELS OF CONVERSATION

Interface metaphors have evoked much interest in the literature. Marcus (1993) investigated noun-object, collection, and verb-action metaphors in interfaces, and

showed how our thinking about graphical user interfaces resembles our reaction to films. Norman and Chin (1989) explored and extended the menu metaphor. Nonogaki (1991) described the Friend21 Project for developing metaphor-based software, and Ueda (1991) raised the possibility of relating interface metaphors with developments in multi-agent programming. Marcus (1993) showed how metaphors change with the interface technology and suggested that virtual reality, with its enabling of "flying", "pointing", and "touching", necessitates new metaphors. For example, power station managers currently can "fly" over a representation of information flows around a control room (Cahill, 1993). Again, the increasing availability and quality of video and sound is influencing the ability of interfaces to reflect socio-emotional-symbolic aspects of communication. Faces can appear on screen (Mantei et al., 1991) and even can appear on either side of a discussed object, as if seen from the side through a window (Ishii and Kobayashi, 1992).

One implication of virtual reality explored in an investigation of virtual sheets and virtual office furniture (Mitsumori, 1992) is that it enables the user to manage data storage and retrieval without explicitly defining the data structures or the operations on them. This task of enabling the user to decide about aspects which hitherto have been done by inflexible programs coded prior to execution time is an important quality of newer interfaces. For example, some email systems allow users to organize by topic (e.g. Malone et al., 1987). Developments in machine learning research are enabling the design of interfaces in which users can generalise their manipulations, pointing to what they want to achieve or avoid by a simple example.

One source of current difficulty with the conversation metaphor in interface design is the lack of a realistic model of conversation. This can be seen in the reactions to a groupware product called The Coordinator (Johnson et al., 1986). This software requires users to fill slots such as "declare", "promise", "commit" and "satisfaction conditions" of a "request". The main problem seems to be in "conversations for possibilities", because although the software dictates a top-down pattern to the dialogue, users need more freedom when investigating possibilities (i.e. unstructured ideas). Another module, "conversation for action" is more successful because action does seem to follow a set of rules – a two-way flow of demand and response. A similar approach has been taken by Lun and MacLeod (1992) who suggested a number of distributed "agent interactions" such as "query", "request", "complain", "negotiate", "arbitrate", "elect", and "synchronise". For example, "query" requires receiving agents to give their purposes and goals, their capabilities, limitations, and responsibilities, their contributions to the problem-solving process, and their expectations and intentions.

These systems demonstrate the difficulties in finding a clear, expressive, yet flexible navigation system for the conversational partner. A statement and its response can be modelled by means of an adjacency pair, with interruptions leading to nestings within adjacency pairs. Some conversation managers (e.g. Reichman-Adar, 1984) schedule the different "stages" of conversation (greeting, question, answer,

assertion, counter example, etc) using some kind of transition network. However, such a mechanistic approach is inflexible and it is likely that real conversations are much more opportunistic and are cued by changeable elements such as users' goals (Blandford, 1993). For this reason, many of the current generation of group decision support tools (e.g. Nunamaker et al., 1991) are probably too inflexible (Olson et al., 1993) and mechanistic (Greenberg, 1991).

The problems come when users wish to interrupt or deviate from the prescribed route, and the question arises of how one enables continuations of previously interrupted dialogue and how one determines the relevance of scope and focus shifts in order to justify them. One of the important components here seems to be the expectations which users have acquired by a particular point in the dialogue. Another is the notion of a plan (even a "sketchy" plan), or a forward route map, which conversational partners collaborate to construct.

One problem is that users may find it difficult to explicitly name each speech act they are making. Another is that some aspects of communication cannot be formalised. One partial solution is to structure only a part of each message (Malone et al., 1987; Kaplan and Carroll, 1992). The structured parts enable conversational tracking, context-sensitive help and interruption recovery. However, there is no guarantee that this will not leave the most important dimensions of communication hidden in informal sections of messages. Another partial solution is to seek only to support collaboration (passing and sharing of information, task scheduling, assigning role responsibilities, allocating resources, tracking progress) rather than mediating it. However, this represents a reduction in the level of ambition (see for example Hennessy, Kreifelts and Ehrlich, 1992).

The most ambitious attempt to construct a conversational tool which is flexible is Conversation Builder (Kaplan and Carroll, 1992). Significantly, collaboration is of central importance within their model of conversation. Collaborative processes are viewed as open (no fixed way to achieve desired results), open ended (no clear completion and achievement criteria), asynchronous, done by groups, and focussed on shared information which provides an anchor. Kaplan and Carroll's system is based on large numbers of miniature speech act based scripts or "protocols". These are small and specifically directed at well defined purposes such as "Wait for request" or "Wait for teller" in a bank conversation. They are so numerous that whenever one protocol does not work, it is possible to use another. Each protocol is hierarchical; it can be generalised (the examples are both instances of Waiting), and it can be specialised ("Wait for request" can include "Be idle", "Carry out backburner tasks" and "Prepare for customer"). The protocols are designed to be combinable "on the fly" – either by concatenation and thus forming a string of protocols, or by invoking one protocol from inside another protocol, or by adding a list of tasks to a protocol when a condition is fulfilled (for example "Try to sell life insurance if customer is friendly"). Because significant actions may not always include speech acts, Conversation Builder includes artifacts as an important second element in conversations. Protocols alter the state of artifacts: e.g., a request for

a revised withdrawal amount (a protocol) leads to the teller changing the amount of cash to be dispensed (an artifact). Because protocols are potentially frame-like, with slots for attributes of artifacts, and because these attributes could change, artifacts can alter the state of protocols too.

The incompleteness of existing models is indicated also by another neglected dimension. This is the influence of focus shift on the direction and flow of a conversation. It is clear that some contributions are more focal and hence more influential than others. In textual analysis for example, some subtexts are nucleic and others satelitic (Mann and Thompson, 1987) and in argumentation, some contributions become foci for subsequent contributions in a way which helps maintain the overall coherence of the dialogue; turns reference earlier turns usually in a non-overlapping way, except when major foci of disagreement are concerned (Sillince, 1995). These references to other contributions have been modeled in a system by Stein and Maier (1987). Their system is a database front end and the script-like reference sequences are used by the system to infer whether the user is interested in solving a problem, evaluating a proposition, seeking background facts, etc.

5.2. ORGANISATIONAL ACCEPTANCE

CSCW is regarded by managers as (1) *a back region* and therefore transcending organizational discipline and control; (2) *self-managing* and thus challenging hierarchical and rule-bound nature of organizational work; (3) *invisible* on organizational charts and therefore suspicious and subversive; and (4) *inefficent* due to its inability to deliver the benefits of organizational routines (Perin, 1991a). We believe that several influences will cause these four attitudes to disappear. One of the important influences will be the extent to which such attitudes can be moderated by means of more subtle models of organizations as communication contexts. We shall consider these attitudes one at a time.

(1) CSCW is a back region. On a cognitive map of a virtual organization, of course, an executive in Tokyo can have an "adjacent room" to an executive in New York if they frequently exchange messages with one another. This virtual proximity can then become the basis for easilly available mutual knowledge (knowing whether the virtual neighbour is in her office) and virtual contact of a planned or an unplanned nature. Thus to the extent that the virtual view becomes taken for granted, so will the view of CSCW as a back region disappear. Moreover, there is a great potential for more subtle strategies for providing managers with an overview of what their distant subordinates are doing, for simulating in virtual space the informal and "soft" information of close up face to face encounters (which managers seem to need to be reassured that their subordinates are not avoiding work commitments), and for protecting oneself from too invasive monitoring or too frequent or too intrusive interruption. Some suggestions on these latter points have

been made above. Another development which is likely to moderate the problem is the gradual diffusion of CSCW into all aspects of organizational work.

(2) CSCW is self-managing. Although this perception may be an accurate one, it is likely that such an organizational pattern of behaviour is becoming the norm. Research is increasingly questioning the assumption that large organizations are stable, consensual and hierarchical (for example, Sproull and Kiesler, 1992). In reality there is no one single archetypal organizational form. Rather, many types exist, many of which are not hierarchical, and many of which devolve discretion down to the level at which decisions are made (Feeny et al., 1989). For example, a prominent trend is for some kind of federated structure (Hodgkinson, 1990). The persuasive ability of organizational models, and their useability for managers (probably such models would be embedded in successful groupware which managers came to implicitly accept merely by using), will be critical in moderating managers' current attitudes.

(3) CSCW is invisible on organizational charts. At present, those not working in a central office tend to be regarded as quasi employees (Rohlen, 1974) and feel extra pressure to justify themselves in terms of "deliverables" such as formal reports (Perin, 1991b). However, this construct is relevant only to the extent that CSCW is seen as marking off a group of users from a group of non-users. Yet although this is an accurate reflection of current patterns of CSCW use, it is unlikely to remain one, as CSCW pervades more of the qualitative and strategic domains of management. It is also likely to be moderated by means of reassuring managers by enabling them to "see" their subordinates at work.

(4) CSCW is inefficient. This criticism could be extended to include not only informational but also social-emotional and symbolic communication. The criticism is based on the small range of abilities offered by CSCW compared with the wide functional range of mature organizations. One important aspect of the comparison relates to the time consuming nature and low social-emotional-symbolic expressiveness of interaction using current technology compared with face to face interaction. Although it is pointless to predict, it seems likely (if current research is any guide) that facial expression, body language, voice and other features will get included rather than excluded in any future products. For this reason alone it is important that models of computer-mediated communication go beyond mere information transactions.

Conclusion

Much motivation for the improvement of interfaces has been claimed under the assumption that the interface should be made compatible with the user's model of the domain. Yet in a multi-user, indeed organizational, environment, who is the "user" and what is the domain? A significant proportion of any user's communications are dominated by matters of etiquette, tact, persuasion, and stage-

management. The domain is in this case the organization, including other users. Much of that domain is represented symbolically: e.g., deference to the boss's opinion has in the past been signalled by eye contact and facial expression. The fact that facial expression only stands for a (perhaps false) feeling of respect means that other, computer-mediated, symbols are potentially useable. Much of the resistance to computer-mediated communication arises because the model of what it does is too narrowly specified, with the result that influential individuals at one remove from the keyboard such as strategists and supervisors are excluded. Any model should therefore seek to include rather than exclude social, emotional and symbolic elements of organizational reality. In a similar way computer-mediated communication has been narrowly defined by some as an informational medium, so that other aspects were excluded. One of these excluded aspects has been the organisational use of metaphors. Metaphors underlie much of language use and hence their use would make computer-mediated communication more vivid and understandable. Again, any effective model should attempt to include such important dimensions.

References

Anon, (1988): The Gordon Report. Analysis of data from national survey, *Telecommuting Review*, February 1, 12–17.

Ardrey R., (1966): *The territorial imperative*, Atheneum, New York:

Barfield W., and Weghorst S., (1993): The sense of presence within virtual environments: a conceptual framework, 699–704. In Salvendy G. and Smith M.J., *Human-computer interaction: software and hardware interfaces. Vol. 19B, Proceedings of the Fifth International Conference on Human-Computer Interaction, (HCI International'93), Orlando, Florida, August 8–13*, Volume 2, Elsevier, Amsterdam.

Baskin O.W., and Aronoff C.E., (1980): *Interpersonal communication in organizations*, Scott Foresman, Glenview.

Bendix R., (1956): Work and authority in industry: ideologies of management in the course of industrialization, *University of Berkeley Press*, Berkeley, California.

Benford S., and Fahlen L.E., (1993): Awareness, focus, and aura: a spatial model of interaction in virtual worlds, 693–698. In Salvendy G., and Smith M.J. (eds.), *Human-computer interaction: software and hardware interfaces. Proceedings of the Fifth International Conference on Human-Computer Interaction, (HCI International'93), Orlando, Florida, August 8–13.* Volume 2, Elsevier, Amsterdam.

Benford S., Bullock A., Cook N., Harvey P., Ingram R., and Lee O-K., (1993): A spatial model of cooperation for virtual worlds, *Proceedings of Informatique '93, Interface to Real and Virtual Worlds*, March 22–26, Montpellier, France.

Berger J., Fizek M.H., Norman R.Z., and Zelditch M., Jr., (1977): *Status characteristics and social interaction*, Elsevier, New York.

Blandford A.E., (1993): An agent-theoretic approach to computer participation in dialogue, *International Journal of Man-Machine Studies*, 39, 965–998.

Blau P.M., (1954): Cooperation and competition in a bureaucracy, *American Journal of Sociology*, 59, 530–535.

Block L. and Stokes G., (1989): Performance and Satisfaction in private versus nonprivate work settings, *Environment and Behaviour*, 21, 277–297.

Cahill P., (1993): Management accountants and virtual reality', *Management Accounting*, September, 46–47.

Carlsson C., and Hagsand O., (1992): The MultiG distributed interactive virtual environment, *Proceedings of the 5th MultiG Workshop*, Stockholm, December.

Clark H.H., and Brennan S.E., (1991): Grounding in communication, 127–149. In Resnick L., Levine J.M., and Teasley S.D., (eds.) *Perspectives on socially shared cognition*, APA, Washington, DC.

Culnan M.J. and Markus M.L, (1987): Information technologies, 420–443. In Jablin F.M., Putnam L.L., Roberts K.H., and Porter L.W., *Handbook of organizational communication*, Sage, Newbury Park.

Davis K.E., (1977): *Human behaviour at work*, McGraw Hill, New York.

Dutton W.H., Rogers E.M., and Jun S-H., (1987): Diffusion and social impacts of personal computers, *Communication Research*, 14 (2), 219–250.

Edelman M., (1966): *The symbolic uses of politics*, Harper and Row, New York.

Eveland J.D., and Bikson T.K., (1986): Evolving electronic communication networks: an empirical assessment, 91–101. In *MCC Proceedings, Conference on Computer-Supported Cooperative Work*, Austin, Texas.

Fahlen L.E., (1991): The MultiG TelePresence system, *3rd MultiG Workshop*, December, Stockholm, 33–57.

Feeny D., Earl M., and Edwards B., (1984): *IS arrangements to suit complex organisations, (1) an effective IS structure*, RDP 89/4, OXIIM, Templeton College, Oxford.

Feldman M.S., (1987): Electronic mail and weak ties in organizations, *Office: Technology and People*, 3, 83–101.

Fish R.S., Kraut R.E., Root R.W., and Rice R.E., (1992): Evaluating video as a technology for informal communication, 37–48. In Bauersfeld P., Bennett J., and Lynch G., (eds.), *CHI'92: Human Factors in Computing Systems*, ACM, New York.

Follett M.P., (1941): Constructive conflict, 30–49. In Metcalf H.C., and Urwick L. (eds), *Dynamic administration: the collected papers of Mary Parker Follett*, Harper and Row, New York.

Fox J., and Moore J.C., Jr., (1979): Status characteristics and expectation states: fitting and testing a recent model, *Social Psychology Quarterly*, 42, 126–134.

Frost P.J., (1987): Power, politics and influence, 503–548. In Jablin F.M., Putnam L.L., Roberts K.H., Porter L.W., *Handbook of organizational communication*, Sage, Newbury Park.

Gemmill G., and Wynkoop C., (1991): The psychodynamics of small group transformation, *Small Group Research*, 22 (1), 4–23.

Ghoshal S., and Bartlett C.A., (1994): Linking organizational context and managerial action: the dimensions of quality of management, *Strategic Management Journal*, 15, 91–112.

Gioia D.A., (1986): Symbols, scripts, and sense-making: creating meaning in the organizational experience, 49–74. In Sims H.P. and Gioia D.A., (eds.) *The thinking organization*, Jossey-Bass, San Fransisco.

Greenberg S., (1991): Computer-supported cooperative work and groupware: an introduction to the special issues, *International Journal of Man-Machine Studies*, 34, 133–141.

Grudin J., (1988): Why CSCW applications fail: problems in the design and evaluation of organizational interfaces, 85–93. In Suchman L., (ed) *Proceedings of the Conference on Computer Supported Cooperative Work (CSCW-88), ACM*, New York.

Hall E.T., (1966): *The hidden dimension*, Doubleday, New York.

Hennessy P., Kreifelts T., and Ehrlich U., (1992): Distributed work management: activity coordination within the EuroCoOp project, *Computer Communications*, 15 (8), 477–488.

Hodgkinson S.L., (1990): *Distribution of responsibility for IT activities in large companies: a survey*, RDP 90/5 OXIIM, Templeton College, Oxford.

Huber G.P., and Daft R.L., (1987): The information environments of organizations, 130–164. In Jablin F.M., Putnam L.L., Roberts K.H., and Porter L.W., *Handbook of organizational communication*, Sage, Newbury Park.

Ishii H., and Kobayashi M., (1992): Clearboard: a seamless medium for shared drawing and conversation with eye contact, 525–532. In Bauersfeld P., Bennett J., and Lynch G., (eds.) *CHI'92: Human Factors in Computing Systems*, ACM, New York.

Jablin F.M., (1979): Superior-subordinate communication: the state of the art, *Psychological Bulletin*, 86, 1201–1222.

Jessup L.M., Connolly T., and Tansik D.A., (1990): Toward a theory of automated group work: the de-individuating effects of anonymity, *Small Group Research*, 21 (3), 333–348.

Johansen R., DeGrasse J.R., and Wilson T., (1978): *Group communication through computers, Volume 5: Effects on working patterns (R-41)*, Institute for the Future, Menlo Park, CA.

Johnson B., Olson M.H., Weaver G., and Dunham R., (1986): Using a computer-based tool to support collaboration: a field experiment, 343–352. In *MCC Proceedings, Conference on Computer-Supported Cooperative Work*, Austin, Texas.

Johnson G., (1990): Managing strategic change: the role of symbolic action, *British Journal of Management*, 1, 183–200.

Kaplan S.M., and Carroll A.M., (1992): Supporting collaborative processes with Conversation Builder, *Computer Communications*, 15 (8), 489–501.

Kendall J.E., and Kendall K.E., (1993): Metaphors and methodologies: beyond the systems machine, *MIS Quarterly*, June, 149–171.

Kiesler S., (1986): The hidden messages in computer networks, *Harvard Business Review*, January-February, 44–60.

Kipnis D., Schmidt S., and Wilkinson I., (1980): Intra-organizational influence tactics: explorations in getting one's way, *Journal of Applied Psychology*, 65, 440–452.

Kling R., (1990): Social analyses of computing: theoretical perspectives in recent empirical research, *Computing Surveys*, 12, 61–110.

Lawrence P.R., and Lorsch J.W., (1967): *Organization and environment: managing differentiation and integration*, Harvard University Graduate School of Business, Boston.

Lea M., (1991): Rationalist assumptions in cross-media comparisons of computer-mediated communication, *Behaviour and Information Technology*, 10, (2), 153–172.

Lun V., and MacLeod I.M., (1992): Strategies for real-time dialogue and interaction in multiagent systems, *IEEE Transactions on Systems, Man, and Cybernetics*, 22, (4), 671–680.

Malone T.W., Grant K.R., Lai K-Y., Rao R, and Rosenblitt D., (1987): Semi-structured messages are surprisingly useful for computer-supported coordination, *ACM Transactions on Office Systems*, 5, 115–131.

Mann W.C., and Thompson S.A., (1987): Rhetorical structure theory: a theory of text organization, 85–96. In Polanyi L., (ed) *Discourse structure*, Ablex.

Mantei M.M., Baecker R.M., Sellen A.J., Buxton W.A.S., and Mulligan T., (1991): Experiences in the use of media space, 203–208 in Robertson S., Olson G.M., and Olson J.S., (eds) *CHI'91: Human Factors in Computing Systems*, ACM, New York.

Maples M.F., (1988): Group development: extending Tuckman's theory, *Journal for Specialists in Group Work*, 13 (1), 17–23.

Markus M.L., (1987): Toward a "critical mass" theory of interactive media: universal access, interdependence, and diffusion, *Communication Research*, 14, (5) 491–511.

Markus M.L., (1992): Asynchronous technologies in small face to face groups, *Information Technology and People*, 6 (1), 29–48.

Marcus A., (1993): Metaphor design and cultural diversity in advanced user interfaces, 469–473 in Smith M.J. and Salvendy G., *Human-computer interaction: applications and case studies. Proceedings of the Fifth International Conference on Human-Computer Interaction (HCI International '93), Orlando, Florida, August 8–13.* Volume 1, Elsevier, Amsterdam.

Marting B., (1969): *A study of informal communication patterns in a manufacturing organization*, PhD Thesis, Arizona State University.

Mehrabian A., and Wiener M., (1967): Decoding of inconsistent communications, *Journal of Personality and Social Psychology*, 6, 109–114.

Mehrabian A., (1971): Significance of posture and position in the communication of attitude and status relationships, *Psychological Bulletin*, 71, 359–372.

Mitsumori S., (1992): Corporate information systems and information technologies, *IEEE Transactions on Systems, Man and Cybernetics*, 22, 6, 1323–1330.

Murrel S., (1983): Computer communications system design affects group decision making. In Janda A., (ed.) *Human Factors in Computing Systems: Proceedings of the CHI'83 Conference* Boston, 12–15 December, North Holland, Amsterdam.

Myers D., (1987): Anonymity is part of the magic: manipulation of computer-mediated contexts, *Qualitative Sociology*, 10, 251–266.

Nonogaki H., (1991): Metaware, 1–10, Section 2B. In *Proceedings International Symposium on Next generation Human Interface,* Tokyo, Japan, 25–27 November, Institute for Personalized Environment, Tokyo, Japan.

Norman K.L., and Chin J.P., (1989): The menu metaphor: food for thought, *Behaviour and Information Technology*, 8, (2), 125–134.

Nunamaker J.F., Dennis A.R., Valacic J.S., Vogel D.R., and George J.F., (1991): Electronic meeting systems to support group work, *Communications of the ACM*, 34, (7), 40–61.

Olson J.S., Card S.K., Landauer T.K., Olson G.M., Malone T., and Leggett J., (1993): Computer-supported co-operative work: research issues for the 90s, *Behaviour and Information Technology*, 12, (2), 115–129.

Perin C., (1991a): Electronic social fields in bureaucracies, *Communications of the ACM*, 34, (12), 75–82.

Perin C., (1991b): The moral fabric of the office: Panopticon discourse and schedule flexibility, 243–270. In Tolbert P.S., and Barley S.R., (eds.) *Research in the sociology of organizations*, JAI Press, Greenwich, Conn.

Pfeffer J., and Salancik G.R., (1977): Administrator effectiveness: the effects of advocacy and information on resource allocations, *Human Relations*, 30, 641–656.

Prandy K., (1979): Alienation and interests in the analysis of social cognitions, *British Journal of Sociology*, 30 (4), 442–474.

Putnam L.L., (1985): Bargaining as organizational communication, 129–148. In McPhee R.D., and Tompkins P.K. (eds) *Organizational communication: traditional themes and new directions*, Sage, New York.

Putnam L.L., and Poole M.S., (1987): Conflict and negotiation, 549–599. In Porter L.W., (ed) *Handbook of organizational communications: an interdisciplinary perspective*, Sage, Beverley Hills.

Reder S., and Schwab R.G., (1988): The communicative economy of the workgroup: multi channel genres of communication, 354–368. In Suchman L. (ed) *Proceedings of the Conference on Computer Supported Cooperative Work, Portland, Oregon*, ACM, New York.

Reichman-Adar R., (1984): Extended person-machine interface, *Artificial Intelligence*, 22, 157–218.

Rice R.E., (1984): Mediated group communication. In Rice R.E. and Associates, (eds) *The new media: communication, research and technology*, Sage, Beverley Hills.

Rogers C.R., and Farson R.F., (1984): Active listening, 255–267. In Kolb D., Rubin I., and McIntyre J., *Organizational psychology: readings on human behaviour in organizations*, Prentice Hall, Englewood Cliffs.

Rohlen T.P., (1974): *For harmony and strength: Japanese white-collar organizations in anthropological perspective*, University of california Press, Berkeley, CA.

Root R.W., (1988): Design of a multi-media vehicle for social browsing, 25–38. In Suchman L., (ed) *Proceedings of the Conference on Computer Supported Cooperative Work, Portland, Oregon*, ACM, New York.

Searle J.R., (1979): *Expression and meaning: studies in the theory of speech acts*, Cambridge University Press, Cambridge.

Sillince J.A.A., (1994): Multi-agent conflict resolution: a computational framework for an intelligent argumentation program, *Knowledge-Based Systems*, 7 (2), 75–90

Sillince J.A.A., (1995): Shifts in focus and scope during argumentation, *Journal of Pragmatics*, 25, (in press).

Sproull L., and Kiesler S., (1992): *Connections: new ways of working in the networked organization*, MIT Press, Cambridge, Mass.

Steelcase, (1978): *The Steelcase national survey of office environments: do they work?* Steelcase Inc., Grand Rapids.

Stein A., and Maier E., (1995): Structuring collaborative information-seeking dialogues, *Knowledge-Based Systems*, 8 (2–3), 82–93.

St.John W., (1981): In house communication guidelines, *Personnel Journal*, 877.

Suchman L., (1994): Do categories have politics?: the language/action perspective reconsidered, *Computer Supported Cooperative Work, (CSCW)* 2, 177–190.

Treu S., (1992): Interface structures: conceptual, logical, and physical patterns applicable to human-computer interaction, *International Journal of Man-Machine Studies*, 37, 565–593.

Trevino L.K., Lengel R.H., and Daft R.L., (1987): Media symbolism, media richness, and media choice in organizations: a symbolic interactionist perspective, *Communication Research*, 14, 553–574.

Triandis H., (1959): Cognitive similarity and inetrpersonal communication in industry, *Journal of Applied Psychology*, 43, 321–326.

Tuckman B.W., (1965): Development sequence in small groups, *Psychological Bulletin*, 64, 384–399.

Ueda H., (1991): Agency model, 1–7, Section 2C. In *Proceedings International Symposium on Next generation Human Interface,* Tokyo, Japan, 25–27 *November*, Institute for Personalized Environment, Tokyo, Japan.

Vecchio R.P., (1991): *Organizational behaviour*, Dryden Press, Chicago.

Whyte W.F., (1949): The social structure of the restaurant, *American Journal of Sociology*, 54, 302–308.

Yukl G., and Tracey J.B., (1992): Consequences of influence tactics used with subordinates, peers and the boss, *Journal of Applied Psychology*, 77, 525–535.

Zalesny M.D., and Farace R., (1987): Traditional versus open offices: a comparison of sociotechnical social relations, and symbolic meaning perspectives, *Academy of Management Journal*, 30, 240–259.