

Computer-Supported Co-operative Work

Human Computer Interaction

Computer Supported Co-operative Work

CSCW removes bias of single user/single computer system

Can no longer neglect the social aspects

Electronic mail, text messaging, video- conferencing,
shared calendars, shared documents systems, workflow
systems, support trackers, shared file storage, electronic
health records, revision control systems ...

The field of study that examines the design, adoption and
use of groupware

NOT restricted to "cooperation" or "work" but also examines
competition, socialising and play

Understanding CSCW

- Involves understanding groups and how people behave in groups
- Also involves understanding networking technology and how aspects of that technology (e.g., delays in synchronising views) affect a user's experience
- All issues related to traditional user interface design remain relevant, since the technology still involves people
- Ease-of-use must be better for groupware than for single-user systems because the pace of use of an application is often driven by the pace of a conversation
- Million-person groups behave differently from 5-person groups

Motivations for groupware

- To facilitate communication: make it faster, clearer, more persuasive
- To enable communication where it wouldn't otherwise be possible
- To mediate work on the same task.
- To enable telecommuting
- To cut down on travel costs
- To bring together multiple perspectives and expertise

Motivations for groupware

- To form groups with common interests where it wouldn't be possible to gather a sufficient number of people face-to-face
- To save time and cost in coordinating group work
- To facilitate group problem-solving
- To enable new modes of communication, such as anonymous interchanges or structured interactions

Time and space

- Groupware can be classified according to where and when the participants are performing the cooperative work.
- Summarised by time/space matrix.

	Same place	Different place
Same time	Face-to-face conversation	Telephone
Different time	Post-it note	Letter

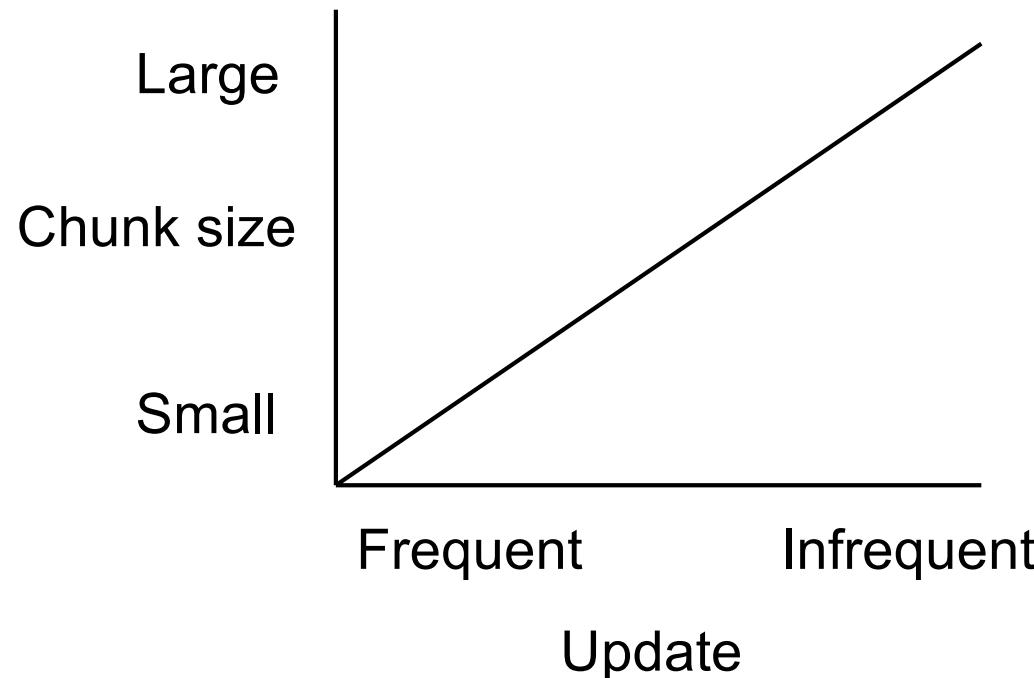
- Another classification is by function of system.

Time and space (cont.)

	Co-located	Remote
Synchronous	Meeting rooms Shared work surfaces and editors. Shared PC's and windows.	Video conferences
Asynchronous	Shared whiteboard/no whiteboard	Email and electronic conferences
	Co-authoring systems, shared calendars.	

Shared information

- Granularity of sharing varies according to object chunk size and frequency of update.



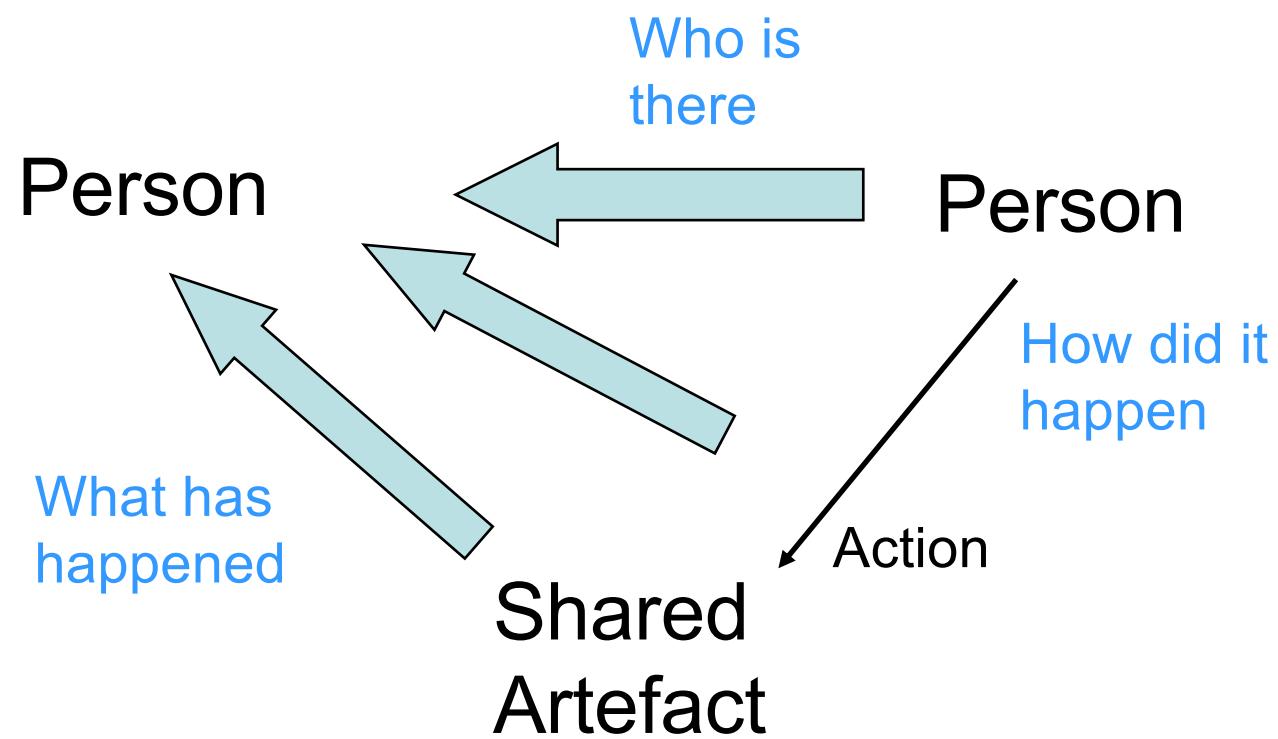
Levels of sharing

- As well as varying in terms of how much is shared, systems vary in what is shared.
- WYSIWIS systems one extreme - shared window systems, some meeting rooms.
- By contrast, shared editors may be displaying different parts of a document.
- Shared data - could be sharing a view but not presentation of that view - eg. graph vs. table.

Awareness

- An important issue in groupware and collaborative systems is awareness.
- Knowing or having basic idea of what other people are doing or have been doing.
- Refers to aspects that demand little conscious effort or attention as opposed to something that allows you to explicitly find out what others are doing.

Awareness



ATC flight strips



eg 2001

ATC environment



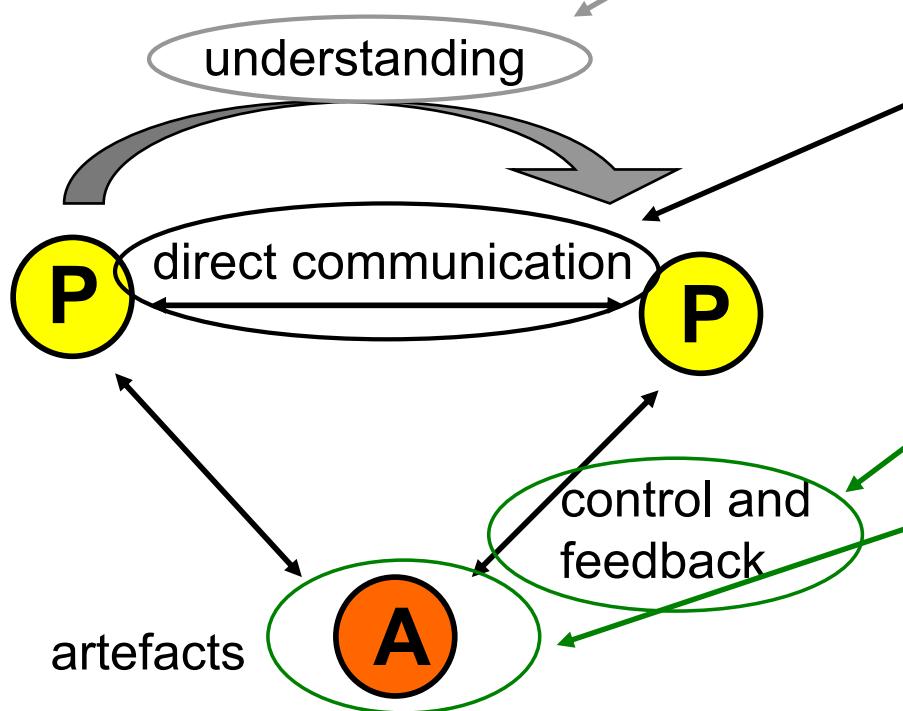
cg 2001

Tool Interaction Support

Cooperative work involves:

Participants who are working

Artefacts upon which they work



meeting and decision support systems

- common understanding

computer-mediated communication

- direct communication between participants

shared applications and artefacts

- control and feedback with shared work objects

CS4051 Human Factors

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Duration: 60 Minutes
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Attendance: 743 Here
Attentive: 94%
Questions: 3 Polls Given: 2/3

Attendee List (75 | Max 201)

	Names - Alphabetically
	Karen Thompson (Organizer, Pres)
	Allison Smith
	Chris Coleman
	Cedric Davies
	Donna McKenzie
	Elizabeth Bonner

Mute All All Invite Others

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Talking: Karen Thompson (Organizer, Presenter)

Questions

Show Answered Questions

Question	Asker
How do I follow up w...	Chris Coleman
Does this apply to di...	Fred Jones
Which of the two do ...	Sarah Chase

CSCW Issues and Theory

- All computer systems have group impact
 - not just groupware!
- Ignoring this leads to system failure
- We look at several levels from minutiae to large-scale
 - face-to-face communication
 - conversation
 - text-based communication
 - group working and co-ordination mechanisms
 - organisational issues

Face-to-face communication

- Most basic and subtle form of communication
- Often seen as paradigm for computer mediated communication
- Transfer effects
 - Carry expectations into electronic media, sometimes with negative results. May interpret failure as rudeness.

- Eye contact
 - To convey interest and establish social presence.
 - Video may spoil direct eye contact.
 - Poor quality video better than audio only.
- Gestures and body language
 - Much of our communication
 - Gesture (and eye gaze) used for deictic reference.
 - Head and shoulders video loses this.
 - Deictic: specifying identity or spatial or temporal location from the perspective of a speaker or hearer in the context in which the communication occurs
 - Close focus for eye contact, or wide focus for body language?

Back channels

Communication is not just the words:

Alison: Do you fancy that film...(1) *er...*“Lord of”
... (2) *um ...it starts at eight.*

Brian: Great!

Back channel responses from Brian at two points, quizzical at 1, affirmative at 2.

Utterance begins vague, then sharpens up *just enough.*

Back channels

- Restricting media restricts back channels.
- Back channels used for turn-taking:
 - Speaker offers the floor (fraction of second gap).
 - Listener requests the floor (facial expression, small noise).
- Grunts, ‘um’s, ‘ah’s can be used by the
 - Listener to claim the floor
 - Speaker to hold the floor
 - But often too quiet for half-duplex channels.
- If lag exceeds turn taking gap, monologues..

Basic conversational structure

- Smallest unit is the utterance.
- Turn taking -> utterances usually alternate.
- Simplest structure - adjacency pair.
Question/answer, statement/agreement.
- Adjacency pairs may nest. Inner pairs often for clarification.

Brian: Do you want some cake?

Alison: Is it very fattening?

Brian: Yes, very.

Alison: Lot's of chocolate?

Brian: Masses.

Alison: I'll have a big slice then.

B-x,A-y,B-y,A-z,B-z,A-x.

Context in conversation

- Utterances are highly ambiguous.
- We use context to disambiguate.
 - Brian: [points] that post is leaning a bit.
 - Alison: that's the one you put in.
- Two types of context:

External context

Reference to the environment (thing pointed to).

Internal context.

reference to the previous conversation “that”

Common ground

- Resolving context depends on meaning
 - Participants must share meaning, so must have shared knowledge.
 - Conversation constantly negotiates meaning.
 - Process called grounding.
 - Alison: So you turn right beside the river
 - Brian: past the pub
 - Alison: yeah, ...
- Each utterance is assumed to be
 - Relevant - furthers the current topic
 - Helpful - comprehensible to listener.

Breakdown and repair

Alison: Isn't that beautiful [points to a stag beside a large tree; Brian sees the tree].

Brian: The symmetry of the branches.

Alison: How some people can dislike them I can't understand.

Brian: Yes, the rangers ought to cull those deer; they strip the bark terribly in winter.

Alison: (Silence).

- Began with confused gesture, but led to a divergence of dialogue focus.
- Reduced redundancy, reduced frequency of turn taking lead to a reduced ability to recover.

Speech Act theory

- A specific form of conversational analysis.
- Utterances characterised by what they do - they are *acts*.
- Eg. “I’m hungry” propositional meaning - hungry. Intended effect: “get me some food”.
- Basic conversational act, the illocutionary point: promises, requests, declarations.
- Speech acts need not be spoken - silence often interpreted as acceptance.
- Generic patterns of acts can be identified. E.g. Conversation for action (CfA).

Illlocutionary point

- An illocutionary point is the basic purpose of a speaker in making an utterance.
 - To assert something
 - To commit to doing something
 - To attempt to get someone to do something
 - To bring about a state of affairs by the utterance
 - To express an attitude or emotion

Conversation analysis

- Higher level analysis of conversations possible.
- Kane & Luz, 2006, 2007 present research on medical multi-disciplinary team meetings.
- Identify 4 parts of MDT:
 - presentation of patient details and findings
 - agree on staging and diagnosis
 - review patient management options
 - articulate patient management decision.

Text based communication

- Most common media for asynchronous groupware.
- Familiar medium, similar to paper letters. Electronic text may act as speech substitute
- Types of electronic text:
 - Discrete directed messages, no structure
 - Linear messages added (in temporal order)
 - Non-linear hypertext linkages
 - Spatial two dimensional arrangement.
- Linkages may exist to other artefacts
- Weak back channels. Difficult convey affective state (happy, sad)
- Illocutionary force - urgent, important.

Grounding constraints

- Establishing common ground depends on *grounding constraints*.
Contemporality - utterance is heard as soon as it is made.
Simultaneity - communicating at the same time
Sequence - the utterances are ordered
- Often weaker in text based communication - loss of sequence.
Network delays or coarse granularity leads to overlap.

Grounding constraints

- Other media constraints may be better for text:
 - **Reviewability** - can return later.
 - **Revisability** - can review and revise before sending.
- Some media may affect the amount of information that is available
 - **Visibility**
 - **Audibility**
- **Co-presence** - if you cannot see and hear the same things as your communication partner, slows down process.

Simultaneity

1. *Beth: how many should be in the group?*
 2. *Rowena: maybe this could be one of the 4 reasons?*
 3. *Rowena: please clarify what you mean?*
 4. *Beth: I agree*
 5. *Rowena: hang on*
 6. *Rowena: what did you mean?*
- 1&2, 3&4 composed simultaneously, lack of common experience.

2-1-3-4-5-6 vs. 1-2-4-3-5-6

Breakdown of turn-taking result of poor back-channels.

Maintaining context

- Remember that context is essential for disambiguation
- Text loses external context, hence deixis linking to shared objects can help.
 1. **Alistair:** Brian's got some lovely roses.
 2. **Brian:** I'm afraid they're covered in greenfly.
 3. **Clarise:** I've seen them they're beautiful.2&3 correspond to 1, but *transcript* suggests greenfly are beautiful - implications for capture systems.

Pace and granularity

- Pace of conversation - rate of turn-taking.
 - Face to face - every few seconds.
 - Telephone - half a minute.
 - Email - hours or days.
- Face to face communication is highly interactive.
 - Initial utterance is vague
 - Feedback gives cues for comprehension.
- Lower pace
 - ⇒ less feedback
 - ⇒ less interactive.
- Strategies to increase granularity
 - Eagerness** - looking ahead in conversation. “Cup of tea? One sugar?”
 - Multiplexing** - several topics in utterance. “No thanks. Cold isn’t it?”

Co-ordination mechanisms

- People often need to co-ordinate their work with others.
- Achieved through the use of a range of co-ordination mechanisms.
- Co-ordination mechanism is the combination of an artefact (e.g. grid on whiteboard, shared form, list of jobs on computer system etc.), and a protocol surrounding it's use.
- Mechanisms embedded in software may explicitly represent the protocol for use.

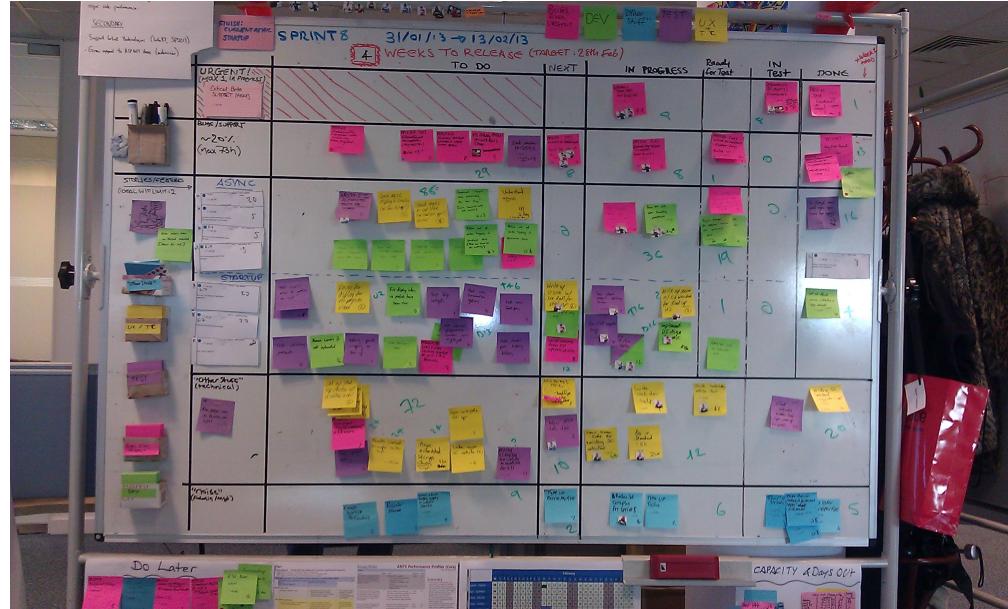


Image: Agile pirate blog

- Job oriented. MTurk. Snag lists/Traq
- Time oriented - Calendars, Doodle
- Dependencies, progress - Agile/Scrum.
- Customer oriented - Queue tickets & counter number, Tear off strips etc.
- Resource oriented. OR schedule.

Group dynamics

- Work groups constantly change in structure and size.
- Several groupware systems have explicit roles.
- But roles depend on context and time, and may not reflect duties.
- Social structure may change, democratic, autocratic and group may fragment into sub-groups
- Groupware systems rarely achieve this flexibility
- Groups also change in composition
 - new members must be able to “catch up”.

Experimental studies on groups

- More difficult than single-user experiments
- Subject groups
 - Larger number of subjects - more expensive
 - Longer time to “settle down”
 - Even more variation
 - Difficult to timetable
 - Hence often only three or four groups.
- The task
 - Must encourage cooperation
 - Perhaps involve multiple channels
 - Creative task
 - Decision games - rely on group coordination.
 - Real-time simulated process control tasks.

Experimental studies on groups (2)

- Data gathering
 - Several video cameras + direct logging of application
 - Problems
 - Synchronisation
 - Sheer volume of data
 - Record from each perspective
- Analysis
 - Vast variation between groups
 - Within groups experiments
 - Micro-analysis - eg. gaps between utterances
 - Anecdotal and qualitative analysis - include group differences in analysis.
 - Look at interaction between group and media
 - Controlled experiments may be problematic.

Field studies

- Experiments dominated by group formation
- Field studies more realistic
 - Distributed cognition -> work studied in context
 - Real action is situated action
 - Physical and social environment both crucial
- Contrast:
 - Psychology - controlled experiment
 - Sociology and anthropology - open study and rich data.

Field studies - ethnography

- Ethnography very influential:
 - A form of anthropological study
 - Special focus on social relationships
 - Does not enter actively into situation
 - Seeks to understand social culture
 - Unbiased and open ended
 - Contrast with participatory design
 - Workers enter into design context
 - In ethnography designer enters into work context
 - Both make workers feel valued in design hence encourage workers to “own” the products.

Organisational issues

- Organisational factors can make or break groupware
- Studying the work group is not sufficient, all systems are used within a wider context and the crucial people may not be direct users
- Before installing a new system the designer must understand:
 - Who benefits
 - Who puts in effort
 - The balance of power in the organisation
 - And how it will be affected
- Even when groupware is successful it may be difficult to measure that success.

Who benefits?

- Disproportionate effort
 - Who puts in the effort ≠ who gets the benefit.
 - Example shared diary:
 - Effort: secretaries and subordinates enter data
 - Benefit: manager easy to arrange meetings
 - Result: falls into disuse.
 - Solutions: Coerce use(!) Design in symmetry.
- Free rider problem
 - No bias but still problem
 - Possible to get benefit without doing work
 - If everyone does it, system falls into disuse.
 - Solutions:
 - Strict protocols
 - Increase visibility and rely on social pressure.

Critical mass

- Early telephone system
 - Few subscribers - no-one to ring
 - Lots of subscribers - never stops ringing.
- Electronic communications similar:
 - Benefit proportional to number of subscribers
 - Early users have negative cost/benefit
 - Need critical mass to give net benefits
- How to get started?
 - Look for cliques to form core user base
 - Design to benefit an initial small user base.

Conflict and power

- People and groups have conflicting goals.
- Identify stakeholders, not just the users.
- Groupware affects organisational structures.
- Communication structures reflect line management.
 - E.g. Cross-organisational communication can disenfranchise lower management.
- Technology can be used to change management style and power structures.

Social processes: example (Grudin)

“With one work management system, any employee who reported a ‘priority problem’ received system-generated requests to forward progress reports to the Chief Executive Officer—an extreme example of a design that ignores the sensitivity of certain communications. Employees stopped reporting problems. The vigilant system noted this and alerted the administrator. The employees dealt with the resulting complaint by writing a program that periodically opened files and changed dates, which satisfied the watchful, automatic monitor. Thus sabotaged, the system was of little use and was eventually removed.”

Evaluating benefits of groupware

- How do we measure our success?
 - Job satisfaction and information flow hard to measure
 - Economic benefit diffuse throughout organisation
- Costs of hardware and software very obvious.

Exception handling

- Groupware has to adapt to/enable ad hoc problem solving and improvisation; post hoc rule-based systems are too rigid and brittle.
- In Reality, decoupling of rules and actual work patterns is pervasive - allows for flexibility and localized judgment
 - Learn how work is really done.

Chocolate factory [from Grudin, 94]

Computerized stock control and sales order processing systems were introduced at a chocolate factory. Severe problems arose when the Computer Services division of the food company installed the systems in the chocolate factory:

"[People in] Computer Services refer to a 'production mentality' where [chocolate factory] staff respond to problems as and when they arise and are loathe to indulge in long-term planning and adopt specific procedures. Most important, they expect others to adjust to them, and resist the discipline the computer imposes. Moreover, not only did management fail to impose set procedures, but further ad hoc arrangements were positively encouraged by the sales department, as in the case of one customer who was assured that they could amend their Friday order up to 1:00 pm on a Monday... No doubt it believed it was working in the best interests of the company, but its actions created considerable problems for those trying to operate the computer."

In some areas the manual system continued to be used out of necessity. At one point, the general manager decided someone was sabotaging the system.

Continued...

By recognizing the large amount of *ad hoc* problem solving in human activity and realizing that descriptions of "standard process" are often *post hoc* rationalizations, we can see the behavior that upset the computer services division as characteristic of efficient performance.

After all, catering to the needs of specific customers is often considered a virtue, not a vice. In the case study, the general manager recommended that the system be withdrawn, but "he was overruled by group head office who were not prepared to lose face over the installation." By hiring new personnel and taking other expensive measures, the computer system was made to work. Upper management wanted this large, expensive system to succeed.

A typical groupware application or feature, such as meeting scheduling, voice annotation or even meeting support, will rarely have the same degree of cost, visibility, and backing, and thus would fail under similar circumstances.

Infrequently used features

- “To a hammer, everything looks like a nail”: group communication may be infrequent.
 - Integrate group features with individual activity
 - Design should be unobtrusive yet accessible
 - Add groupware features to already existing applications (e.g., MS Office)

Difficulty of evaluation

- Group context introduces social, motivational, economic, political dynamics that are hard to measure. Lab situations and prototypes are ineffective. Because of a lack of definitive studies, the same mistakes are repeated over and over again.

Breakdown of intuitive decision making

- Developers cannot rely on their own individual informed intuition when group processes are concerned. Too many applications target managers, neglecting to accommodate other users - resistance results.
- Involve real users early on in the design process.