Groupware as a Design Center

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C onduct a search in a business index using the term "groupware," and you'll find lots of information on Lotus Notes and similar software, but you'll find very little about groupware as a design center. In contrast, futurist and think tank literature, as well as on-line business and academic resources, reflects a move toward "software sociology." If software—or any communications product for that matter—is being designed, developed, built, and used by *groups* of people, then, according to some forward thinkers, we need to apply some of our knowledge of interpersonal dynamics to the design of these products.[1] Participatory design approaches to computer supported collaborative work (CSCW) processes are an extension of this idea.

Groupware Redefined

While LotusNotes has become synonymous with groupware (the result of clever marketing), the key to successfully implementing groupware is to consider it as "a group of technologies, techniques, and services designed to help people collaborate more effectively, productively, and creatively."[2] Groupware, then, consists of hardware, software, services, and support. Services and support will become increasingly impor-

tant as all-in-one packages give way to component architectures, and information migrates from retrievable text-based databases to interactive multimedia servers.

Developments in the networking of interactive multimedia spurred by the convergence of telecommunications and computing technologies will cause dramatic changes in the way we work, learn, and live. The effects of global change are beginning to surface in the business environment. A 1994 Gartner Group report makes note of these global changes. "The move to groupware reflects a shift in management models from the Industrial Age to the Information Age. Information technology will play a critical role by better 'informating' employees with 'just in time— extremely current—information.' "[3]

This same report emphasizes that, "Groupware is not a product. It's a design center, a way of building applications and solutions. Groupware products are platforms on which groupware solutions can be implemented…. An effective groupware strategy depends on the presence of a coherent backbone services strategy, which, in turn, depends on a coherent core network infrastructure strategy."[4]

Key problems with groupware deployment include:

- An inadequate enterprise backbone services plan.
- Overplanning and overdesign.
- Lack of experience.
- Weak design and development methods.
- Ignoring architecture and data.
- Insufficient bandwidth and connectivity.
- Information flows and forms do not always follow function.

While these problems are difficult to manage in corporate LAN/WAN environments, they become more complicated as companies expand from *intra*-office networking to *inter*-office networking with

clients and global partners. In the public and small business sphere, lags in the diffusion of connectivity, hardware, and software caused by economic constraints and user inexperience continues to be problematic.

Groupware and Globalization

Large corporations will lead the way, as they have greater resources and a greater incentive to change. Globalization is requiring corporations to coordinate 24-hour operations worldwide and to manage knowledge across the whole enterprise. At the same time, decentralization is giving rise to smaller headquarters while shifting responsibility to autonomous business units, and an increasingly competitive business environment is fostering the practice of reengineering. All are factors that lead to the development of teams.

A recent story in *Fortune* asserts that global competition is forcing companies to make the investment in groupware because the only thing sure to be harder than operating with teams is operating without them.[5] But, they also point to a recent survey conducted by The Center for Effective Organizations at the University of Southern California which showed that, while 68% of Fortune 1,000 companies use self-managed or high-performance teams, only 10% of the workers participated in teams. It seems that companies are utilizing groupware considerably more for "work groups" than for teams.

Teams and Technology

"Teams and technology go hand in hand. They interact with one another and jointly affect the shape of business process.... Groups of workers are not teams. Teams operate on a different level of energy. Teams share vision, have mutual trust, and make joint decisions—not necessarily the case with work groups."[6] While teams commonly operate within a larger "work group," there are many areas, such as accounting, where individuals form part of a work group, sharing information resources (that are increasingly stored on servers) without exercising a collaborative team function.

Grantham and Nichols relate teams and technology to a business process that can be described in terms of temporal and spatial flow, pace, and information flow. They define three characteristics of information flow:

- How does information move around?
- How fast does it move?
- Where does it go?

In this model, technology is characterized by how fast it changes, how it provides feedback, and how visible it is. Technology and teamwork interact. Each seems to simultaneously cause and effect. The key issues are:

- How often do team members talk and to whom?
- What do they talk about?
- Who is connected to whom in the group?
- How are they connected?

Teams are also central to The Institute for the Future's description of groupware as: "the most common term used in the marketplace to describe the information technology to support flatter, team-based, network-style organization and its collaborative work groups." Groupware is related to:
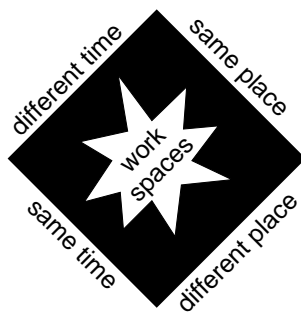
> [A] strong trend in the U.S. toward what we think of as a "marginal" workforce, working at the margins of full-time work.... By the year 2000 these non-traditional work arrangements will approach one-half of the total U.S. workforce.... It is clear that the organization of the future in the U.S. will have less hierarchy (although hierarchy will not go away completely), it will be network-style in its structure, and it will be team driven. By teams we mean small, ad hoc, cross-organizational, time-driven, task-focused work groups.[7]

Groupware Design

Businesses, then, need to incorporate the concept of teams and information flows into groupware design if they are going to stay competitive in the coming economic environment. They need to see groupware as a center for developing new procedures, tools, and infrastructure for collaborative work environments. "Quality collaboration—the efforts that have driven breakthroughs in science, the arts, and technology—occurs with neither the frequency nor the intensity it should, in part because there are few tools explicitly designed to encourage or support it."[8]

Groupware design should seek the flexibility of different time-different place, "virtual" interactions, with the personal familiarity of a face-to-face meeting. As place and time give way to virtual spaces, communications can be organized along asynchronous and synchronous modes of communications, delineated into four basic types of groupware options: same time/same place, same time/different place, same place/different time, and different place/different time.

Figure 1

Source: Institute for the Future

Table 1 outlines where some of the most important communications tools fall in this paradigm. It should be noted, however, that these are non-exclusive categorizations, and some technologies are useful in several categories. We should also note the importance of the simplest of tools, such as the fax and phone. Conference calling (simple group audio teleconferencing), for example, constituted a $1 billion dollar market in 1993.

Groupware for teams appears to succeed most often when it is simple and relies on simple applications built quickly and evolves in small, gradual steps based on user feedback. In addition, teams must be implemented in combination with other organizational changes. When they're introduced in isolation, with little or no training or support, they tend to fail. Knowledge workers or creative types whose primary tasks are done alone aren't necessarily better off in a team; making them sit in a team meeting waiting to reach a consensus can even stifle creativity. The most common problem: inadequate planning leads to the wrong teams being formed for the wrong kind of job.

The formation of teams is a factor that should be incorporated into the groupware design process. Organizations should build on their specific structures and goals. Key questions to ask are:

Table 1

Same Time/Same Place Technologies (Face-to-Face Meeting)	Different Time/Different Place Technologies

• Interactive Whiteboard
• Digital Overhead
• Multimedia Presentation Software
• Videotape or Disk Player
• Speaker/Sound Systems
• Recording Devices
  - Video/Audio Recorder
  - Stenography / Minutes Taking Recorders
	• E-mail
	• News Groups
	• Voice Mail
	• Fax
	• Lotusnotes
	• Client/Server Technologies (Internet Gateways)
	• Dictation/Personal Recorders

Same Time/Different Place Technologies (Simulating Face-to-Face Meeting)	**Same Place/Different Time Technologies**
• Video Teleconferencing • Desktop Video • Conference Calling	• Collective Work Spaces • General Workstations • Task Oriented, Dedicated Stations

Source: Institute for the Future

- How have teams been formed in the past?
- What will their goals and timelines be?
- How will teams function within a larger workgroup?
- How will they relate to other teams?

The following two tables provide useful information for designing teams and groupware. Table 2, abstracted from literature dealing with teams, outlines key considerations for the development of teams. Table 3 defines five of the most common "species" of business teams. Depending on their structures and needs, however, organizations may have other types of teams.

Groupware Design Centers

Business systems and information technology related to groupware may be segmented into two different (but complementary) design centers:

- *Process-Centric systems* in which process rules drive user and system behavior.

Table 2
Key Considerations for Developing Teams

Use the right team for the right job.
- *Most teams popular today are of two broad types: work teams, which include high-performance or self-managed teams, and special-purpose problem-solving teams.*
- *If a work team has the authority to make decisions about how the daily work gets done, it's properly described as a self-managed or high performance team.*

Create a hierarchy of teams.
- *Create a structure that encourages teams to work together and seize initiative. Team members should be able to make decisions on the spot. They can't run back to their functions for permission.*

Develop integration teams: A fourth layer of management to move information horizontally.
- *These teams act like the corpus callosum, the part of the brain that transfers information back and forth between the left and right hemispheres.*

Teams require trust.
- *Team members shouldn't fear that they'll lose their autonomy or that their workload will increase — or worse that the process will lead to reengineering.*
- *Companies that use teams best generally still pay members individually, but with a significant difference: they make teamwork — a sharing attitude, the ability to deal well with others — a key issue in an individual's annual performance review.*

People issues should be tackled head-on.
- *Managers and workers must be trained to deal openly and frankly with other team members. While this is elementary, most organizations don't do an adequate job.*
- *Different functions need to develop relationships in order to interact effectively — ask questions or favors. Otherwise team work will stall.*

Source: Fortune (September 5, 1994)

- *User-Centric systems* in which users drive and shape process and system behavior—the system adapting to the user versus the user adapting to the system.

As envisioned by the Gartner Group, a Design Center defines primary constraints that come into play in the design and tradeoff processes. Ideal groupware solutions are optimized around three factors: User-Centric, Externally Aware, and Individually Rewarding (see Table 4).

User-Centric models focus on design by class of user, identifying specific benefits to deliver to each class of user and biasing the system toward optimizing around user (and job specific) needs rather than system resources. Leverage the human asset, not the system. These models support flexible, ad hoc, user-driven processes. User-Centric systems recognize the

Table 3
The Five Most Common "Species" of Teams

Management Teams
Consisting mainly of managers from various functions like sales and production, this species coordinates work among teams. This most popular of types comprises knowledge workers who gather to solve a specific problem and then disband.

Work Teams
An increasingly popular species, work teams do just that—the daily work. When empowered, they are self-managed teams.

Virtual Teams
A characteristic of this new type of work team: members talk by computer, flying in and out as needed, and take turns as leader.

Quality Circles
In danger of extinction, this type, typically made of workers and supervisors, meets intermittently to air workplace problems.

Problem-Solving Teams
This most popular type comprises knowledge workers who gather to solve a specific problem and then disband.

Source: Fortune (September 5, 1994)

Table 4

User-Centric	Externally Aware	Individually Rewarding
• Class of User Focus • Human Capital Asset • Flexible-User Driven • Roles and Personalities • Fit with Formal Process • Normal Non-connected State • Local Operations & Information	• Virtual Promiscuity (any partner) • Transparency • Any Information Source • One User Interface	• Adds Value to Daily Accomplishments • Minimum Personal Cost • Cultural Change Not Required

Source: The Gartner Group

different roles and responsibilities of the user and the system:

- Certain procedures must be process driven, such as legal or regulatory constraints.
- User constraints should be imposed where there is no other choice.

Externally Aware factors revolve around issues of portability and connectivity. A stateless design—one

that considers all possible user platforms—should be implemented that supports the broadest range of user styles and connectivity options. Since various system and external factors may cause interruptions in data flow, design should also assume that the communications state is only sometimes connected. Workstations should be able to perform even when connectivity problems occur.

Individually Rewarding factors rely mostly on hardware and software design, but are also related to User-Centric factors. Users should feel as close to the data and operations as possible. Groupware should be easy to use and connect to. It should facilitate work—not complicate it, and users should feel that it adds value to their work. Interface design should be sensitive to the particular culture of the user. Executives, for example, may not like entering long strings of texts, or even using keyboards. Instead of users conforming to the process, the process should adapt to the user.

User-Centric systems, like most groupware mail and scheduling packages, tend to be document smart and data stupid, despite the emergence of semi-structured documents. Process-centric systems, like most client/server applications, tend to be data smart and document stupid. This dichotomy is a major barrier to both business and educational communications, as business increasingly adopts networked communications, and universities increasingly seek to adopt the best in scheduling, calendaring, e-mail, workflow, and distributed data systems.

New Groupware Models

Software—particularly groupware, object-oriented software, and new classes of system software that intrinsically adapt to the communications environment—will change, and be changed by, the business landscape. New business models will emerge. Technology, in the form of software objects, is likely to be packaged with content. "Content providers and communication carriers will assume significant roles and help define new industries."[9]

New models are also emerging from university environments and impacting product development. An excellent example is the Mosaic client/server architecture developed by the University of Illinois which has been a driving force in the emergence of Internet access via service providers such as MCI and America Online. While the diffusion of home information networks will be fueled by the demand for

entertainment, the most successful service providers will likely be those who also offer services that address changing needs and demographics, such as distance learning and telecommuting. In addition to the development of new applications, the move toward groupware to support collaborative work in universities will prepare the workforce of tomorrow to be more team-oriented, more technologically capable and innovative, and better prepared to deal with the global environment.

For the business environment, the first (micro) wave of change is likely to be characterized by four factors:

(1) The entry of new major players such as Microsoft, IBM-Taligent, Novell-Wordperfect, Oracle, and a number of other document management vendors.
(2) The modularization and opening up of LotusNotes and its technologies.
(3) The development of substantially more *procedural* standardization.
(4) The proliferation of object-oriented software automation methods in office suites.

The market will be driven primarily by the way management strategies for teamwork are evolving. Groupware adoption is currently less than 5%, but the industry is entering a rapid adoption phase which should continue for the next five years.[10]

A Paradigm Shift

We are currently in transition from a centralized view of systems to a distributed "federation" which will facilitate the growth of groupware systems. Sharp declines in the cost of storing and processing information will lead to devices becoming more personal, portable, capable, and smart, replete with innate communications capabilities. But despite the ubiquitousness of communications, they are likely to be neither continuous nor inexpensive. Declines in unit communications costs will not be able to keep pace with the storage and memory requirements of object-oriented software office suites and the amount of data flowing through networked communications.

Groupware will stabilize over the next 10 years as it becomes an integral part of the system software. A new form of groupware, described as the "Little Sister" paradigm (as opposed to "Big Brother"), will emerge. Intelligent personal professional assistants will evolve into personal groupware.

"Personal groupware is defined as technology that records interpersonal interactions, extracts patterns, and interrogates their owner about the interactions, building a heuristic model. It advises the users and does their bidding semiautomatically."[11] Intelligent agent technology is developing rapidly and will play an important role in "informating" society. At last year's Groupware '94 conference, vendors demonstrated sophisticated agents that can scan data sources for context and meaning, rather than just words.

New Opportunities

Rating the best of today's groupware products no higher than a "C," The Gartner Group has identified "abstraction" as an opportunity in the groupware development marketplace. Stating that "Groupware is void of abstraction principles.... Groupware requires an understanding of—and the action to address—the implications of a lack of abstraction: it's impossible to automatically: (1) organize and relate one document to another; (2) summarize content (the way descriptive statistics summarize data); or (3) flag key items that deserve management attention."[12] All are possible with *investment in personnel at the user level.*

Abstraction is key to both ROI and cost/benefit analysis. Additionally, it adds value to the growing quantity of multimedia data being compiled, stored, and accessed via client/server technology and large interdependent networks. Key factors affecting the growth of networks are issues over the ownership of information and ongoing developments in applications relating to the security of the networks. These factors are increasingly important as defense industry repurposing, and national information infrastructure projects are launching gigabit testbeds for linking research and educational institutions, government, and industry. All will require the skills of information workers.

Robert Johansen says an important reason for instituting groupware is to achieve continuity. He is optimistic about the future of groupware and collaborative work because the human and organizational needs are so great. He believes that "groupware is gradually overcoming barriers that are part technological, part social, and part cultural."[13] This notion of continuity is related to the changing nature of the workforce—employers want to retain more of the knowledge of veteran staff who retire or move on. Continuity will also be important as public and private

institutions begin to establish networks that will carry them into the 21st century.

Groupware Applications

Groupware applications are based on the convergence of computer networking and multimedia technologies. Computer networks—local or wide area—provide the basic benefits of groupware to collaborative work group members: resource sharing, information sharing, application sharing, accessing remote information, and communications.

Developments in groupware and networking technologies occur symbiotically. Advances in one spur developments in the other. For example, many of the simplest applications for automated information retrieval that make navigating massive networks possible are tested and improved in public/private networking projects. Some simple search tools, or "knowbots," are already proliferating on the world wide web. These represent the "larvae stage" of intelligent agents and are referred to generically as "spiders" and "robots," or by proprietary names such as "Lycos," "WebCrawler," or the "WWW Worm.".

Table 5
Functions That Groupware Supports

• Face-to-Face Meeting Facilitation	• Computer Conferencing
• Group Decision Support	• Text-Filtering
• Computer-Based Telephony Extensions	• Computer-Supported Audio/ Video Teleconferencing
• Presentation Support	• Conversational Structuring
• Project Management	• Group Memory Management
• Calendar Management	• Spontaneous Interaction
• Group-Authoring	• Comprehensive Work-Group Support
• Computer-Supported Face-to-Face Meetings	• Nonhuman Meeting Participants (Using
• Screen-Sharing	Intelligent Agents)

Source: McLellan and Knupfer, *Multimedia Review* (1993)

Examples of intelligent machine development at advanced research laboratories include:[14]

- Bell Lab's "Rapport System" where participants may communicate through voice and data only, or add full-motion video.
- Olivetti Research Laboratory's "Pandora," an experimental groupware system where researchers use an

electronic clip badge that links them to Pandora, the lab's experimental video and audio communications system.

- Media Space at Xerox PARC, an experimental project developed specifically for collaboration of design work, which eliminates shared computer applications. In this latter example, design is seen less as a technical activity than a social activity. The communications interface is a touch-sensitive video screen that can be used with a peripheral system to allow designers to both see each other and sketch together. This application is based on the idea that "drawing directly on a monitor reproduces the familiar experience of putting pen to paper."

The development and diffusion of these types of technologies will radically change our conceptions of work, learning, and leisure activities and will depend greatly on advances (and increasing affordability) of the silicon chip. In his book, *Microcosm*, George Gilder states:

> The Central event of the 20th century is the overthrow of matter. In technologies, economics, and the politics of nations, wealth in the form of physical resources is steadily declining in value and significance.... The powers of mind are everywhere ascendent over the brute force of things.... Today, ascendent nations and corporations are masters not of land and material resources but of ideas and technology.[15]

If, as Gilder claims, we are shedding our "materialism," then groupware systems must be "designed" to address all aspects of communication. Groupware design needs to recognize the value and facilitate the creation of the *im*material: those virtual and intellectual products that are increasingly shaping our future.

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Illustrations of concepts from this article have been published on the World Wide Web in connection with a teleconferencing seminar between the University of Texas at Austin and the University of Texas, El Paso on the effects of NAFTA and other border issues. They may be accessed through the table of contents at http:// naftalab.bus.utexas.edu/.—Ed.

[1] C. E. Grantham, with L. D. Nichols, *The Digital Workplace* (New York: Van Nostrand Rheinhold, 1993).

[2] H. McLellan and N. N. Knupfer, "Virtual Collaboration via Groupware," *Multimedia Review,* Vol. 4, No. 1 (Spring 1993).

[3] D. Whitten, *Groupware: Real Market or Myth?* (Stamford, CT: The Gartner Group Conference Support, 1994).

[4] D. Whitten, *Groupware: Real Market or Myth?*

[5] B. Dumaine, "Trouble with Teams," *Fortune*, Vol. 130 (September 5, 1994).

[6] Grantham and Nichols, *The Digital Workplace.*

[7] R. Johansen, *Groupware in North America* (Menlo Park, CA: Institute of the Future, 1993).

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