

Managerial Use and Emerging Norms: Effects of Activity Patterns on Software Design and Deployment

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“Like most phenomena—atoms, ants, and stars—characteristics of organizations appear to fall into natural clusters, or configurations.” — Henry Mintzberg

Abstract

Software use in many organizations has spread vertically. I present evidence that applications that are widely used in organizations have at least three distinct patterns of use: one for individual contributors, one for managers, and one for executives. Use within each of these groups is shaped by its particular activity and incentive structures. Interaction among group members promotes shared social conventions and feature use. When designing, acquiring, or supporting such an application, the best approach could be to treat it as three distinct applications. The applications discussed include shared calendars, email, application-sharing, shared workspaces, browsers and desktop videoconferencing.

1. A shift in technology use in organizations

Software has been used in organizations for forty years. For most of that time, few managers and executives used software directly. They were central to acquiring technology and read computer-generated reports, but the refrain was, “Managers don’t type.”

No longer. Between 1989 and 2002, CEO use reportedly rose from 21% to 76% [10]. A Bureau of Labor Statistics survey in September 2001 reported that over 80% of executives and managers use computers, primarily for email and “Internet” [5]. In the late 1980s, a high-tech manager might have email printed and filed, to be read just prior to the next scheduled meeting with the sender [19]. Today, managers get more email than individual contributors [22] [2].

What changed? Almost everything. Technology, to start with. Email attachments appeared in the 1990s, along with the Web, intranets, PowerPoint, and the commercial use of the Internet. A medium previously used for informal communication and often a source of

managerial suspicion became useful for sharing formal documents. The environment changed. Fax, courier mail, inexpensive long-distance rates: the pace of business increased. Personal secretarial or administrative support decreased, forcing managers to do more for themselves. Managers changed, too—an older generation retired, replaced by men and women who had become familiar with technology when they were students or individual contributors.

Keyboards lost the negative association with secretarial work as professionals adopted PCs. GUIs, experienced staff, and home use made learning less intimidating. Business publications, mass media, and entertainment media promoted computer use. (In 1993, computer use by children and professionals played a key role in each of the blockbusters *Jurassic Park*, *Sleepless in Seattle*, *The Fugitive*, and *The Firm*.)

Through the 1990s managers became late adopters of software first used by individual contributors. Today managers may be early adopters of some software. These changes have significant and largely unexplored implications for technology design and deployment.

Organizational behavior suggests why software use might differ across vertical slices of an organization. Next, after a brief review of one theory, several technologies are considered that show marked differences in individual contributor, managerial, and executive use. Even relatively simple applications such as calendars and browsers are used quite differently. Many design and deployment opportunities have been lost through not recognizing these changes.

Interactive use of software creates benefits for shared conventions governing its use. Within each user group we find pressure, subtle or overt, to use software the same way. My concluding recommendations for requirements analysis, task analysis, design, deployment, and support, if partly familiar, have not been heeded with this new set of stakeholders.

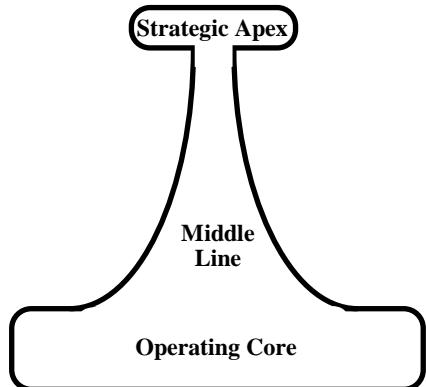


Figure 1. Central parts of an organization.
(After Mintzberg [14].)

2. A typology of organizational forms

Often, organizations are segmented vertically: Engineering, Sales, Finance, and so on. Mintzberg's [14] typology of organizations focuses on organizational behavior that crosses divisions.

Mintzberg notes that organizational characteristics fall into five "natural clusters or configurations." Three are part of the "main line," directly involved in production (Figure 1). The operating core comprises the individuals who produce the organization's products or services. The strategic apex is top management. The middle line includes the managers in between. Admins or aides who work closely with managers and executives are grouped with them. The two peripheral parts (not shown in Figure 1) are the technostructure, who define the work processes of the organization, and the support staff, such as IT, mailroom, cafeteria, public relations, and legal staff.

These parts often vie for influence. In different types of organizations, different parts dominate, different ways to coordinate work are favored (direct supervision, mutual adjustment, standardization of work processes, outputs, or skills). For example, in a divisionalized company, the dominant middle line may favor standardization of output, allowing each division the freedom to formulate its internal work processes.

Mintzberg provides much more detail, but the key point is that his framework leads naturally to the idea that the same application will be used differently by individual contributors, managers, and executives, due to differences in the way they work. Each group is important in large and mid-sized organizations, so careful consideration of the differences is warranted.

3. Case study of calendar use

This study focuses on six months of on-site informal observation and 20 one to two-hour interviews of

Boeing employees in 1997-1998. It also draws from approximately 100 interviews and a survey filled out by 2500 employees of Sun Microsystems and Microsoft, partly reported in [17] and [18].

Boeing managers and their office administrators ('admins') had used and shared online calendars for years. Individual contributor use grew slowly until the company embraced a vision of a digital future that required universal access, just prior to the study. Boeing had 7 non-interoperable software calendars with 1000 or more registered users. IBM Profs was used most widely. Others included All-in-1, Lotus Organizer, Schedule+, and Calendar Manager. Boeing planned to standardize on Exchange and Schedule+ and had begun a rollout.

Engineers, admins, managers, a director, an executive secretary, and staff involved with technical and training aspects of the rollout were interviewed. They worked at different sites in the Puget Sound and used different calendars. Not all were involved in the rollout. Many had used more than on-line calendar and could compare features.

The study was not undertaken expecting to find differences in calendar use—calendars seemed a simple application. But differences soon became apparent.

3.1. Feature use by individual contributors

'Individual contributors' or 'individuals' refers to most employees to whom no one reports. Managers sometimes do individual work, but their overall activity and incentive patterns are set by managerial duties. Admin and staff work that directly supports a manager is included here under managerial activity.

Many individual contributors spend much time working alone and have few meetings. They do not delegate. Much of their work is visible, many account for time closely. When they do interact, *communication* with team members and others is central.

Meeting reminders. Reminders that beep or pop up appeared in online calendars in the 1990s. Many individual contributors identify them as their favorite feature or the feature that attracted them to online calendars [17] [18]. Paper calendars were portable and versatile, but it was easy to lose track of time and miss a meeting. Reminders solved this problem.

Meeting invitations. Integration with email draws individuals to online calendars. Emailed invitations that are easily inserted into an online calendar remind someone using paper calendars that life could be easier.

Printing. Individuals rarely print their calendars. Often they have only a few meetings, most of which are regularly scheduled.

Calendar visibility. Calendar users can control how much information they share, globally, meeting-by-meeting, or person-by-person. Some individuals who had not used online calendars felt that they would be comfortable showing ‘free-busy’ time but were concerned about ‘micro-management’ should they reveal all of their calendar content to others—with whom they are meeting, where, the topic, and so forth.

3.2. Feature use by managers and admins

“Study after study has shown that managers work at an unrelenting pace, that their activities are characterized by brevity, variety, and discontinuity... Managers strongly favor the oral medium—namely, telephone calls and meetings” [15]. A principle concern of managers is *information sharing*, relaying information down, up, and across an organization. Much of their activity and network of associations is relatively visible, a function of their job.

As noted above, Boeing managers had used online calendars for years, personally or with the help of a secretary or admin. Understanding this activity requires considering the admin and manager together. First-level managers had admin support at Boeing; in other organizations this appears at the next level. Most admins are individual contributors, but when handling a manager’s calendar, an admin is a surrogate, responding to the pressures on the manager.

Meeting reminders. One admin had recently begun using Schedule+. She asked if I could relay a request to its developers. I asked “What message would you like to get to them?” She said a useless, frustrating feature should be removed: meeting reminders. She and her managers knew their calendars inside out and were always aware of the clock. The Schedule+ rollout default issued reminders for regularly scheduled meetings, and she did not know how to turn them off.

This prompts two observations: 1) People with different roles value features differently; 2) Teams designing or deploying an application may be unaware of this. Mostly individual contributors, they set defaults based on their perspective. In survey data reported in [20], 93% of individual contributors rated meeting reminders as important, whereas only 60% of admins and 70% of managers did.

Meeting invitations. Admins who spend a lot of time maintaining calendars find it easier to click on or drag-and-drop an invitation than to type meeting information from an email or phone message. One admin expressed great annoyance that not everyone used them.

Printing. Many managers print their calendars one to three times daily. Schedule+ had several print format

options. Understanding them was important to admins. Asked about training she received during the rollout, one said that she learned some things, but hadn’t felt the training was really designed for her. It wasn’t. It covered meeting reminders, of no interest to her, and did not fully cover printing.

Calendar visibility. Coming from a university environment where no one shared calendar information, I was surprised to find open sharing embraced by managers and individual contributors at Boeing, a pattern also seen at Sun. Managers found it very useful to share calendar details with one another. They and their admins used the information in myriad ways: to learn where someone would be after a meeting, when they might be interrupted, where a meeting was being held, who was involved, and to learn about other parts of the organization.

Open sharing was so useful that there was little risk of micromanagement or other misuse of calendar information. To do so would discourage accurate calendar maintenance and open sharing, and eliminate the benefits. About 90% of Boeing employees had fully open calendars, marking as confidential an occasional private meeting. It is an example of greater efficiency resulting from trust or social capital.

3.3. Feature use by execs and their secretaries

At higher levels of management, the pace picks up. There is more delegation—to admins, staff specialists, and subordinates. The focus is on *coordinating* work across the organization. Decisions have large impacts on lives and careers, so political and corporate sensitivity of actions is more pronounced.

Executive schedules are booked months in advance, with staff playing a major role in calendar maintenance. The rollout team felt initially that conversion software would be too expensive (for example, to convert a PROFS calendar to a Schedule+ calendar). People would have to retype calendar content. But executive secretaries protested: what would take an individual a few minutes could take them days. The team had to reconsider the decision not to get conversion software.

Meeting reminders. Executives have even less use for them than managers.

Meeting invitations. One executive secretary worked with a lower-level admin who loved meeting invitations. The executive secretary confided that she was working to stamp out the use of a dangerous feature: meeting invitations! Why? Formerly, when the executive asked her to schedule a meeting that was proposed in email, she could point out risks in agreeing to take a particular meeting. Now the executive

sometimes accepts an email invitation with a button-click, reducing her involvement in the decision and possibly requiring her to cancel it, which is trickier than declining in the first place. This executive secretary was at loggerheads with an admin she worked with, but neither seemed to fully understand why.

Printing. Executives relied heavily on printed calendars. They organized and viewed information in particular ways and had grown attached to specific print formats. Schedule+ supported seven formats. One day a rollout team member said that the single most unforeseen problem was the fussiness of upper management about print formats. (He himself never printed his calendar.) This major problem was eventually solved by paying Microsoft to develop dozens of customized print formats for Boeing use.

Calendar visibility. The only people I interviewed at Boeing who managed calendars that were not open to public viewing were the executive secretary and a director. Executive calendars were all closed. At their level, who meets with whom and about what is sensitive. Executives don't even share free-busy information. The same pattern was found at Sun.

- 1. Individual contributors**
 - Live at desks, reminders are popular
 - Meeting invitations are an incentive to use
 - Printing is unimportant
 - Initial privacy concerns often yield to open sharing
- 2. Managers and 'office administrators'**
 - "Live from calendars," reminders are unnecessary
 - Meeting invitations are very useful
 - Printing is important
 - Benefits of open sharing can be immense
- 3. Executives**
 - Live on the road, scheduled far in advance
 - Meeting invitations can be dangerous
 - Printing is very important
 - Meeting sensitivity is high, visibility is blocked

Figure 2. Feature use by different employees

3.4. Constellations of features

Figure 2 summarizes the patterns derived from these studies. These roles bring different activity structures, demands on time, sensitivities, incentives. Different features appeal to each. Consider an account by an executive who became an individual contributor:

"My calendar was jammed full, and I had an executive secretary. Therefore my entire life revolved around my calendar. I didn't need reminders – I looked at the calendar – oh, several times an hour. Moreover, my secretary was always changing it, so I had to look to see what was happening. And I could rely on her to make sure I didn't miss important events. She could tell if I was

getting ready in time. Reminders, therefore were a pain. An extra dialog box that distracted and had to be dismissed..."

"I am no longer an executive. I no longer am so bound to my calendar. I no longer have a secretary. The past week, I have missed two meetings. In one, I knew about the meeting. It was on my calendar. I was seated at my phone, at my computer. Lost track of time and missed the meeting. Here is where I should have used reminders."

'One size fits all' is often the rule for installation defaults, training, documentation, and FAQs. In this case, design and practice did not reflect the fact that feature use varies systematically and that people rarely customize what they are given.

For example, in Boeing's requirements analysis, a range of employees might be consulted and their preferences merged. A feature that appeal to everyone is in, but features essential to one group but not useful to others may not make the cut. "It may turn out that the resulting set of features isn't usable by anyone," one employee observed. Then one approach to defaults, documentation and training is created.

The Boeing/Sun calendar pattern is not universal. For example, at Microsoft, open sharing of calendar information not the practice. Most employees reveal only free-busy time. Why the difference? One factor is undoubtedly the influence of product defaults. Boeing calendar use had been heavily PROFS, which defaulted to open sharing. At Microsoft, individual contributors dominated the design of Schedule+, which defaults to show free/busy only. At Sun, an admin was a key Calendar Manager design team member; the Calendar Manager open sharing default is the one that benefits admins and managers. Once people establish work practices around defaults, only a strong incentive will overcome them. (That executives everywhere block calendar access reveals the sensitivity of their actions.)

3.5. Another case of overlooking this pattern

In the late 1990s, a team of highly experienced interface designers created a set of office applications to run on a 'network computer': streamlined, core-functionality email, calendaring, and other productivity tools. The initial intent was to support 'transaction processors.' When no one fitting this description was found internally, desiring to establish the product's utility, a deployment was undertaken, first to individual contributors, then managers and executives. I discussed the process with team members at the time.

Managerial use revealed a major problem. The reduced-functionality calendar had no printing capability. As at Boeing, individuals rarely printed calendars, but managers did. A new release was

necessary. Another problem surfaced. As at Boeing, open sharing of calendar details was the norm, with private meetings blocked off one at a time. The calendar allowed this, but not blocking access to the entire calendar in one step. This was unacceptable to executives, forcing another redesign.

Considering the operating core, middle line, and strategic apex independently in gathering requirements, designing a system, planning a rollout, or setting up support could reduce confusion, backtracking, resistance, miscommunication, and lost opportunities. Whether in Marketing, Engineering, Finance, and so forth, these groups share many perspectives, biases, ways of working, priorities, and incentives.

4. Other widely used applications

4.1. Email

An ethnographic report on email use in organizations of the 1980s described differences between individual contributors and managers. [19]

The asynchronous, informal medium appealed to individuals but not to heavily-scheduled, interrupt-driven managers. Informality enabled individuals to bypass hierarchy; because recipients could choose if and when to read or respond, an email exchange resembled a casual elevator or hallway conversation more than a formally scheduled meeting. Email forced managers to handle rapid rumor-propagation and reduced their ability to place a motivational spin on a directive from above, since an original forwarded verbatim by other managers would reveal alterations.

Managers feared that email would distract employees. In the early 1990s some analysts still predicted that organizations would remove email once negative effects on productivity were proven [20]. Managerial acceptance grew slowly, quickening as features useful to managers were added, such as document attachments and calendar integration.

Today, managers average more email than individuals. Models indicate that optimal email filing and retrieval strategies depend on volume [1], which suggests that different features would benefit each group. Email received as a “bcc:” may be spam for individuals but important for managers, a difference that led to a design change in an email organizer [3].

Email threading is useful to individuals and managers, but an executive in my organization instructs people **not** to include him in threads: He wants a report after a thread concludes. Again, the demands on time and the disposition to delegate at that level suggests special features that might serve executives.

4.2. Real-time communication and app sharing

NetMeeting supports application-sharing, chat, shared whiteboard, open floor control (any participant can drive the application) and point-to-point audio and video. Many of these features were ideal for the use envisioned: by two or three individual contributors. The design did not include features that are useful to managers holding larger meetings: tools for managing agendas, action items, brainstorming, and so on.

I observed deployment in an organization that used NetMeeting 2.0 heavily for large distributed meetings. They used speakerphone conference calls, never point-to-point audio. The first time one team used it, people intentionally or accidentally used the open floor control to wrest control from the manager and one another. Afterward the furious manager said that that open floor control was designed only because a developer liked the technical challenge. Large meetings were often disrupted when someone accidentally shared material or blocked the view of an object being discussed.

NetMeeting 3.0 provided multiple floor control models, but not other tools managers would have liked. One group kludged a brainstorming tool: Everyone typed their ideas into the chat window, which one person copied into a notepad and from there into Word, where he deleted the names one line at a time to get the desired list of ideas. (A NetMeeting developer noted that by using a spreadsheet instead of Word, all names could be deleted at once. Faster, but still not elegant.)

By coincidence, a team of NetMeeting developers visited the site. They had not previously seen the product used by more than three people at once. When told of documentation written by the company to help users, a NetMeeting team member later wrote, “I’d like to see your training materials... Most of the materials we developed for NetMeeting 3.X were for the clients calling just one other person.”

Should the team have designed for managed meetings as well as pairs of collaborators? An opportunity existed. But the key point is that very different feature sets would support each scenario.

Recently, the same organization rolled out a similar product, WebEx, to thousands of employees. Middle managers were a major problem for the support team. Executives had staff who trained on the application and set up sessions for them. Individual contributors who wanted to use the product also underwent training. Middle managers wanted to use the product, but did not want to take the time for the formal training. Addressing their requests for personalized training was a significant challenge.

4.3. Shared workspaces

Orlikowski [16] described the early use of Lotus Notes in Alpha Corp, a consulting company. The Partners saw potential benefit in sharing experiences: less duplication and more profit. However, consultants had little time or incentive to learn and use the system. In a competitive “up or out” environment, consultants’ value is in their experience and knowledge; sharing it with colleague-competitors was not a priority.

Had this difference in perspective been anticipated, incentives to use the system could have been introduced, an approach later stressed by a competitor.

Alpha Corp’s IT team members were *not* in a competitive “up-or-out” battle to become partners. Installing thousands of copies of Notes world-wide, they used Notes to share best practices in the fashion envisioned for the consultants.

Different parts of the organization with different incentive structures yielded different patterns of use.

Recent products such as Groove and Sharepoint allow the creation of team workspaces. They serve as document repositories, enable change notifications, and may include group calendars or other features. In one case, a decision to adopt such a product was overruled by the manager. If he was not entered as a group member, documents would be inaccessible to him. If he was, he would receive more information than he wanted—information useful to individual contributors. An interface for managers was an overlooked—and in this case essential—design opportunity.

4.4. Web browsing

A study of Web use by individual contributors and high-level managers found that both groups used the Web heavily, but in different ways [11]. Individuals sometimes spent 30 minutes on the web; managers did not. Managers more often search the group’s internal web sites for information, and task subordinates or admins to keep the content current. They often send URLs “FYI” to peers, subordinates, or superiors. They may forward a URL received by email to a subordinate and ask for summarization of the content on the site.

The authors do not mention it, but these patterns suggest that different tools could help each group.

4.5. Desktop videoconferencing: an example

The concept of video often appeals to executives. Polycom and Tandberg systems were recently put on the desktops of Boeing executives who thought it would be useful to see each other when speaking on the

phone. The systems were not used because of how calls are set up. One executive doesn’t phone another. The task of finding a mutually free moment is delegated to executive secretaries who use the phone to do so dynamically, bringing in the execs when an opportunity arises. There is not time to establish a second connection through the computer system.

5. How general are these findings?

You have probably thought “there must be more than three patterns” and “does this apply to more complex software?”

In application use as in other behavior, we will find differences based on individual preference, cognitive style, and so forth. Email use varies from massive Inbox to meticulous file system, even among individual contributors. Among those openly sharing calendar information, some people leave family events in view, others do not. And so on. Nevertheless, several factors suggest that three or four major patterns should account for much of the design space for the relatively simple, widely-used software I have described:

- 1) Broad activity and incentive patterns are shared, and widely-used technologies support them. Most individual contributors have few meetings, need to communicate with team members, and are engaged in production. Most managers have many meetings and need to share structured information. Most executives coordinate efforts, delegate tasks, and are more political. These factors guide effective technology use.
- 2) These technologies support interaction; interaction is more efficient when we use a technology the same way. “Conventions are essential for governing cooperation,” wrote Mark (2002). She ascribed a major technology setback to a group’s inability to form conventions. Successful use is accompanied by the emergence of norms. Pressure to use a technology the same way strengthens particular patterns in a group and diminishes the appeal of alternatives. Mainly in groups that interact minimally, or find a strong case for working differently, will conventions be resisted.
- 3) Only influential user groups in an organization receive special attention in design, requirements analysis, deployment, training, and support. Other organizational groups might benefit from different technology configurations, but may not influence decisions. Mintzberg’s techno-structure and support staff may not be critical

enough to design for. An exception is IT support, discussed below. The three central groups are critical in most sizable organizations.

There is a cost to supporting multiple interaction patterns in an organization. Different interfaces, training packages, and sets of usage conventions are expensive and confusing. Pressures to conform, for the sake of mutual intelligibility, reduces the number of major variations. Each pattern of use occurs in a group whose members mostly interact among themselves.

If different patterns appear at each level, one would expect to see clashes among people who work across levels. After reviewing evidence for such clashes, I take up the case of IT, then address other types of software.

5.1. Conflicts on the boundaries between levels

The executive secretary who disliked meeting invitations supervised an admin who loved them; the two were at loggerheads. An admin who was hostile to meeting reminders worked for first-level managers and interacted with engineers who relied on reminders, which were set by appointment creators, not recipients. A Director was torn over whether to share his calendar details. He had done so and recognized the efficiencies (the manager pattern), but he was embarrassed by exposure in one incident and had reluctantly decided to block access (the executive pattern).

This leads to an interesting question. Will boundaries between levels be perpetuated or strengthened if each group adopts its own conventions, speaks its own technical “language”? Perhaps, but not necessarily. It is plausible that behavioral conventions have always differentiated these groups, but been less visible, less explicit. Technology use may help employees become “multi-cultural” over time and move more gracefully between levels.

5.2. IT support staff: A special case

In the Lotus Notes example, support staff resembled individual contributors in some ways, but had a different incentive system. This affected their use of the software and through them how others came to see it.

Most support staff may be peripheral organizational members, but technical support shapes the experience of others. They contribute to acquisition decisions. They often establish defaults and oversee training.

IT professionals are thus a fourth group for vendors to consider carefully—as most already do. For hardware and software companies, *external* IT professionals are important customers whose views are considered in design..

Other special cases may arise. For example, an individual in Sales could have as many meetings as managers, but different incentives. How will this translate into software use?

5.3. Other types of software

What about software with diverse, distinct stakeholders, such as nurses, doctors, and lab technicians? Or CAD, ERP, CRM systems?

In the former case, these groups will benefit from different interfaces, as they always have. But: if nurses, their managers, and hospital administrators all use the system, each is likely to have different needs. Complex systems will of course need to examine vertical distinctions, but within each vertical slice there may also be a new need to examine horizontal levels, as managers in these areas become hands-on users.

For example, a large IT group reporting to a chief information or technology officer may have executive, managerial, and individual users of its own tools.

To illustrate this and address the second question, at the end of a recent interview of two people rolling out a major customer relations management (CRM) application in a mid-sized company, I learned that the sales manager and CFO were hands-on users of a system designed for the sales force. I asked whether any changes to the interface might benefit the managers and executive, and the reply was “I could spend a day telling you about it!”

6. Discussion

Summarizing the key points:

- 1) Management increasingly uses software
- 2) Due to their contexts, managers and executives use even simple applications differently
- 3) Within an organizational level, use is becoming more uniform
- 4) These changes have implications that have not been addressed

The first is not controversial. The examples were set out in support of the second. Next I suggest that the third point is consistent with past experience with other technology. Then I discuss these insights in the context of other approaches to identifying individual and group differences, arguing that a key distinction is a focus on how people juggle, not on what they are juggling. This leads to the concluding sections on implications for design, deployment, and communication among users and developers.

6.1. Interaction and convention

Personal preferences often conflict with social conventions. The more we interact, the more likely we are to adopt prevailing cultural norms. Life is easier and exchanges more efficient when behavior is predictable. As we interact more through software, individual differences in using software give way to widespread conventions.

Consider an automobile driver in 1903, before there were traffic laws. Personal preferences had free rein in design and use. One could drive at any speed, signal turns in any manner, with or without lights and brakes. But as traffic increased, drivers had to interact. Considerations of safety and efficiency led to conventions that constrain behavior, codified in steadily expanding motor vehicle statutes.

Some conventions are arbitrary—it does not matter which side of the road we drive on as long as everyone drives on the same side. Others are directly tied to safety and efficiency, such as speed limits and turn signals. Over time, lights, wipers, brakes, and horn became more standardized, as have road signs. Personal preferences operate in a narrower range: I can buy a stick shift (but perhaps not rent one). I can paint my vehicle any color.

Traffic has picked up on intranet and Internet ‘highways.’ Browsing, communication and collaboration features are found in most applications. Digitally mediated interaction promotes behavioral conventions, but not necessarily a single set of conventions. Just as different rules and regulations govern driving in the US and the UK, or apply to automobiles, trucks, and motorcycles, studies of technology use indicate that multiple sets of conventions govern the use of software applications.

The same forces operated, slowly, on individual productivity tools. Early word processors were used as improved typewriters, to produce documents that were then printed and distributed. An author could use any software, font, style, and feature. But when we adopted networks and email attachments, we no longer computed in private. Pressures to conform grew—document sharing or co-authoring promote use of the same word processor, templates, styles, fonts, and so forth. Best practices are communicated in the course of interacting and collaborating.

Conventions emerge more rapidly in the use of collaboration technology because interaction is constant. This includes the growing number of applications that solely support communication, information sharing, and coordination. It also encompasses individual tools as they add collaboration

features, such as when meeting invitations were added to calendars in the 1990s.

Interactive use leads to greater conformity in different ways. Many group support technologies must be used by all group members to be effective. This leads to significant (if sometimes subtle) peer pressure to adopt. Once people are working together, some differences can't coexist gracefully: Do we emphasize with italics, underling, or bold? People learn about useful features by seeing others use them in a shared object or session. Finally, people establish social conventions to enhance predictability and efficiency.

Features that fit well with an activity pattern are likely to propagate, overriding individual differences based on experience, working style, or aesthetic preference. A strong individual or a cultural preference may prevail, but over time, conformity within a bounded community of users is likely to emerge.

6.2. Identifying and addressing differences

Efforts to identify and address individual and group differences in technology use has a long and mixed history. Differences exist at all levels: motor skill, perception, cognition, social interaction, and culture; experience, knowledge, and aesthetic preferences. Within organizations, people have different tasks, roles, and ways of working.

Differences that cannot be worked around, such as color blindness, or the specific capabilities of the very young and very old, must be confronted directly, although identifying them is easier than addressing them effectively. Historically, most attention has been given to level of experience: novice vs. expert, user vs. IT professional. And again, designing for both categories has proven challenging.

Approaches to identifying differences. Task analysis identifies the steps in a work process, whether it is a cognitive task such as copying text or an organizational task such as processing a form. It has been extended to include analysis of the work domain [e.g., 21], in which a given individual carries out many tasks. Stakeholder analysis [12] is even more fine-grained, often used to design a system for one organization rather than a widely-used product.

Contextual Design [4] stresses the more general concept of ‘role’: “(a collection) of responsibilities that accomplish a coherent part of the work.” One person often fills several roles in (and outside) a workplace. Contextual Design focuses on identifying and supporting people in their various roles in the organizational context. Approaches based on personas [7] and scenarios [6] also consider roles and tasks.

These efforts focus on the specific tasks and roles. This is necessary, but we also need to step back and consider the bigger picture, which encompasses *entirely unrelated* tasks and roles in which a person engages: the coarse structure of their days, the forces acting on them and the resources available to them. How many meetings do they have, how often do they work for long stretches on one task, how much do they delegate, how sensitive are their activities.

Many of us are “trying to keep a lot of balls in the air,” with each ball representing one task, project, or role. Most analysis methods focus on understanding each ball, which is essential in supporting those activities. But to understand juggling, we pay less attention to each object in the air and a lot of attention to their number and other constraints on performance.

An organization has many job titles, many roles, many work scenarios, but few basic activity patterns. A handful of patterns may cover most workers. If the patterns determine how software is used, it can help us narrow our focus while avoiding crucial omissions.

The examples suggest that this is true and often overlooked. For example, a set of detailed scenarios may portray only individual contributors or a set of enterprise personas may omit an executive. Significant opportunities are lost.

Approaches to software support for different users. Moving from observations of differences to designing for different groups is a big step. Experience has shown that adding features and providing alternative views come with a cost.

Including any feature conceivably useful to anyone increases complexity. Options, preferences, customize, settings, controls – such menus are challenging to design and mostly ignored in use. By the time we have enough experience to figure out how to benefit from customizing, inertia and satisficing prevail. Automating such support has progressed very slowly from early adaptive interface AI efforts [see 8] to recent work that emphasizes less ambitious but more promising mixed-initiative interfaces [9].

Recognizing that there may be three or four distinct patterns of primary interest could make detection and interface presentation less overwhelming. Although software today can accommodate differences better, emerging norms may reduce the need to do so.

“Office automation” efforts of the 1980s and workflow management systems today attempt to comprehensively and formally represent tasks and roles to guide work processes. From these have come important lessons: creating and maintaining representations of tasks and roles is difficult; people frequently shift roles; and experience, level of trust,

and idiosyncratic preferences are important factors that are generally not represented in the systems. These are among the few applications with distinct interfaces for managers and individual contributors, but they have not fared well. This is further support for a less detailed focus in most applications.

We benefit from looking at the forest rather than the trees, by reducing the consideration to a few less fine-grained behavior sets.

7. Implications for design and use

This analysis does not of course address use in homes, small organizations, or groups with atypical activity patterns.

The paper touched on cases where requirements gathering, design, usability testing, deployment, and support would have benefited from focusing on individuals, managers and executives as distinct customers in sizable organizations. Stakeholder analysis and other requirement engineering is challenging for widely deployed software. When everyone is a stakeholder, a principled approach to sampling or analysis is required.

In practice, requirements from all stakeholders are often pooled and prioritized at a feature level. This can result in eliminating features that are crucial to one group. It could be more effective to consider the effort to be one of gathering requirements for three products: individual, managerial, and executive applications.

It must come together in design. Designing the right set of features and enabling people to find them are not new challenges. If scenarios and personas cover the key groups, we may get by with fewer. Guiding users is easier when we recognize sets of feature that are often used or avoided together.

Doing it right may be easier! Consider gathering information from a dozen people who speak three different languages. Bring all into one room and confusion reigns. Interviewing each language group separately makes more sense.

In product usability testing, data from individuals and any managerial users who are recruited are pooled. Analyzing data by group could reduce the noise, yielding a few clear patterns in place of one fuzzy picture. Tests with the same number of participants could yield cleaner results. Listening to users is easier when they speak with a few distinct voices.

Deployment and support are similar cases. On the one hand, setting up three sets of training materials, and possibly three FAQ sites, is a larger effort. On the other hand, if each is customized to the likely priorities of

one group, it can be shorter and more effective, and reduce subsequent support calls.

8. Looking ahead

Because most managers and executives are now hands-on users of software, there is no reason to expect them to be late adopters of technology useful to them. IM is used in wired workplaces for multitasking at large meetings. Managers were avid adopters of WebEx in an example mentioned earlier.

Early managerial adoption of a technology has implications for vendors and IT departments. Decisions to research a technology, build a product, and acquire software is made by managers. Most feedback from user organizations to consulting or vendor companies comes through managers. The inadequacies of this mediation were pointed out by usability researchers and practitioners, but when individual contributors were the ultimate users, there was a relatively fast market correction when software was not useful for them.

When managers form a distinct "community of use," their mediator role is weakened. A technology they use may receive support even when the larger base of individual users has problems with it. This leads to new challenges in determining the needs of individual users, and opportunities for those who do so.

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