

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

Jonathan Grudin
Microsoft Research
Redmond, WA 98027 USA
jgrudin@microsoft.com

Abstract. Software use in many organizations has spread vertically as well as horizontally. This paper presents 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. Failure to do so results in problems and lost opportunities. The applications discussed include shared calendars, email, application-sharing, shared workspaces, browsers, and desktop videoconferencing.

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

A shift in technology use in organizations

Software has been used in organizations for forty years. For the first twenty or thirty years, few managers and executives used software directly themselves.

Managers were central to acquiring hardware and software, they read computer-generated reports, but the saying was, “Managers don’t type.”

That changed. Between 1989 and 2002, CEO use reportedly rose from 21% to 76% [Jackson, 2002]. A Bureau of Labor Statistics survey in September 2001 reported that over 80% of executives and managers use computers, slightly more than the percentage of professionals, with email/Internet being their heaviest focus (BLS, 2002). In the late 1980s, it was not unusual for a manager in a high-tech company to have email printed and filed, to be read just prior to the next scheduled meeting with the sender (Perin, 1991). Today, managers get more email than individual contributors (Whittaker & Sidner, 1996; Bälter, 2002).

What changed? Almost everything. Technology, for one thing. 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 thus often a source of managerial suspicion became useful for sharing formal documents, a key management task. And 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 students or individual contributors.

Keyboards and displays lost the negative association with secretarial or clerical work as more professionals used them. GUIs, experienced staff, and home use made learning to use software less intimidating to managers. Business publications, mass media, and even entertainment media promoted computer use. (In 1993, computer use by children and professionals played a key role in the blockbusters *Jurassic Park*, *Sleepless in Seattle*, *The Fugitive*, and *The Firm*.)

Through the 1990s large numbers of managers became late adopters of software that had first been 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.

This paper reviews a theory of organizational behavior that suggests why we might find differences in software use in different vertical slices of an organization. Several technologies are considered – one in detail, others briefly – each of which shows marked differences in individual contributor, managerial, and executive use. Even relatively simple applications such as calendars and browsers are used differently.

Increased interactive use of software creates benefits for shared conventions around use. As a result, within each group we find pressure to use software the same way. Because the significance of these changes through the 1990s were not recognized, many design and deployment opportunities were lost. The paper concludes with concrete recommendations for requirements analysis, task analysis, design, deployment, and support.

A typology of organizational forms

Often, organizations are segmented vertically according to mission: Engineering, Sales, Finance, and so on. This is more useful in considering specialized software applications – CAD, CRM, and so forth – than widely-used applications such as online calendars or email. Mintzberg's (1984) typology of organizations focuses more on the behavior of people in organizations than on specific missions. It focuses on how people juggle, not on what they are juggling.

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 and 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. Peripheral to these central parts are the technostructure, the people who define the work processes of the organization, and the support staff, which includes IT personnel as well as mailroom, cafeteria, library, public relations, and legal staff.

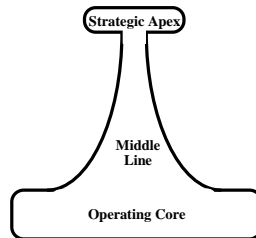


Figure 1. Central parts of an organization. (After Mintzberg, 1984.)

These parts often vie for influence. In a given organization, one part often has a stronger influence based on the nature of the business and its environment. Mintzberg identifies different types of organization, each manifesting the ascendancy of one part. In a start-up, the founders or executives – the strategic apex – have most influence. In a university, the professors and lecturers – the operating core – have unusual influence, and so on.

There are different ways to coordinate work, each corresponding to one type of organization: direct supervision, standardization of work processes (e.g., an assembly line), standardization of outputs (as in piecework), standardization of skills (through diplomas or accreditation), and mutual adjustment. The preferred means of coordinating work depends on the type of organization. For example, the

middle line tends to favor standardization of output, which allows each division or department 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 these differences is warranted.

Case study of calendar use

This study combines data from quantitative and qualitative studies of calendar use at Sun Microsystems and Microsoft that involved approximately 100 interviews and a survey filled out by 2500 employees, along with six months of observation and 20 interviews at Boeing in 1997-1998. Boeing will serve as the principal case, with supporting data from the other sites.

Boeing managers and their office administrators ('admins') had used and shared online calendars for years. Just prior to the study the company embraced a vision of a digital future that required universal access, at which point most individual contributors follow suit. 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 was standardizing on Exchange and Schedule+, had begun a trial rollout, and sought to understand current practices to smooth the transition.

Those interviewed worked at different sites and included engineers, admins, managers, a director, an executive secretary, and staff involved with technical and training aspects of the rollout. Many had used different on-line calendars over the years and could compare features. Several had recently shifted to Schedule+.

The study was not undertaken to find differences in calendar use based on vertical level. Calendars seemed a straightforward application for handling appointments. The differences emerged from the interviews and observations.

Feature use by individual contributors

'Individual contributors' refers to employees to whom no one reports. Although managers sometimes work as individuals, their overall activity and incentive patterns are set by managerial duties. Admin and staff work that directly supports a manager is considered part of managerial activity.

Many individual contributors who keep online calendars spend blocks of time working alone and have relatively few meetings (nevertheless often complaining of the number). They do not delegate. Much of their work is visible: Many must account for time closely. Along with individual production, *communication* with team members and others is important.

Meeting reminders. Reminders that beep or pop up appeared in online calendars in the 1990s. Many individual contributors identify them as a favorite feature and the feature that first attracted them to online calendars (Palen, 1998; Palen & Grudin, 2002). Paper calendars were more portable and versatile, but it was easy to lose track of time and miss a meeting. Reminders solved a problem for individual contributors.

Meeting invitations. Integration with email also draws individuals to online calendars. Emailed invitations that can be 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 few meetings, most of which are regularly scheduled.

Calendar visibility. Online calendar users can control how much information they share, globally, meeting-by-meeting, or person-by-person. Some individual contributors express concern about 'micro-management' should they reveal all of their calendar content to others. Most are comfortable showing 'free-busy' time – when they are and are not available – but have mixed feelings about revealing the details: with whom they are meeting, where, the topic, and so forth.

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” (Mintzberg, 1989). 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 pattern requires considering the admin and manager together. At Boeing first-level managers had admin support; in some organizations this activity pattern appears at the next level. Most admins are individual contributors, but when handling a manager's calendar, an admin responds to the pressures on the manager, acting as a surrogate for the manager.

Meeting reminders. One admin who had recently begun using Schedule+ asked if I could relay a request to its developers. I asked “What message would you like to get to them?” She said that there was a useless, frustrating feature that should be removed: meeting reminders. She and the two managers she worked with knew their calendars inside out, were clock-conscious, and had no need to be reminded. But the Schedule+ rollout default was to issue a reminder for regularly scheduled meetings, and she did not know how to turn them off.

This prompts two observations: 1) People with different roles in an organization value features differently; 2) Teams deploying an application may be unaware of this. The deployment team – mostly individual contributors – set

defaults based on their view of the application. In the 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 much easier to click on or drag-and-drop an invitation than to type meeting information from an email or phone message. Some admins expressed annoyance that not everyone used them.

Printing. Many managers print their calendars one to three times daily (in contrast to individuals, who rarely print calendars). 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 initially surprised to find open sharing embraced by both managers and individual contributors at Boeing, a pattern also see at Sun. Managers found it extremely 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 ended, when they might be interrupted, where a meeting was being held, who needed to be involved, to coordinate efficiently, and to learn about the organization.

Open sharing of calendar information was so useful that there was little risk of micromanagement or other abuse of calendar information, which would discourage accurate calendar maintenance and open sharing, eliminating the benefits. About 90% of Boeing employees had fully open calendars, marking as confidential an occasional private meeting. This is an example of efficiency gains that go hand in hand with trust or social capital.

Feature use by executives and executive secretaries

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

Executive schedules are heavily booked for months and years in advance. Staff plays a major role in calendar maintenance. The rollout team decided initially that conversion software (for example, to move information from a PROFS calendar to a Schedule+ calendar) would be too expensive. People would have to retype calendar content. They had not anticipated that although this would only take them a few minutes, it might take an executive secretary days. The rollout team was forced to reconsider the decision not to get conversion software.

Meeting reminders. Executives have even less use for them than managers, with staff to aid them.

Meeting invitations. An 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? In the past, the executive asked her to schedule meetings that were proposed in email. She could point out risks in agreeing to meet with that person at that time and place. Now the executive, receiving an invitation in email, sometimes accepts it 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. Thus, this executive secretary was at loggerheads with admins she worked with, but no one understood why.

Printing. Executives relied very heavily on printed calendars. They organized and viewed information on them in particular ways and had grown very attached to specific print formats. Schedule+ supported seven formats. At one point the leader of the rollout team reported that the single most unforeseen problem was the fussiness of upper management about print formats. (He himself never printed his calendar.) It was a major problem, eventually solved by paying Microsoft to develop dozens of custom-designed print formats for use within Boeing.

Calendar visibility. The only people interviewed at Boeing who managed calendars that were not open to public viewing were the executive secretary and a director. Executive's calendars were all closed. At their level, who is meeting with whom and about what is sensitive. Executives don't even share free-busy information. This reticence was also found at Sun, where most employees other than executives also openly share calendar information.

Constellations of features

Figure 2 summarizes the patterns derived from interviews and observations at Boeing and Sun. People in these roles have different activity structures, demands on time, sensitivities, incentives. Different features appeal to each. Consider this account by a former 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."

These patterns are not recognized in software design, acquisition, roll out, or training. 'One size fits all' is often the rule for installation defaults, training, documentation, and FAQ lists. The software does not reflect the fact that certain

sets of features naturally go together, and people rarely take advantage of customization to adjust what they are given.

- | |
|---|
| <ol style="list-style-type: none"> 1. Individual contributors <ul style="list-style-type: none"> – 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' <ul style="list-style-type: none"> – "Live from calendars," reminders are unnecessary – Meeting invitations are very useful – Printing is important – Benefits of open sharing can be immense 3. Executives <ul style="list-style-type: none"> – 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. Calendar feature use by different employees.

For example, in Boeing's requirements analysis, a range of employees might be consulted and their preferences merged. Features that appeal to all survive (e.g., flexible ways to specify recurring meetings). A feature 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. A single documentation set and training program is created.

The Boeing/Sun calendar patterns are not universal. At Microsoft, open sharing of calendar information by managers was not the practice. Some employees share calendar information and find it useful, but most reveal only free-busy time. Why the difference? A strong factor is undoubtedly the influence of early experience, usually governed by the product defaults. Calendar use at Boeing began with PROFS, which defaulted to open sharing. At Microsoft, individual contributors dominated design and the design of Schedule+, which defaults to show free/busy only. At Sun, a key Calendar Manager design team member happened to be an admin, and the Calendar Manager open sharing default is the one that benefits admins and managers. Once people establish work practices around the defaults, it takes a strong incentive to overcome them. The fact that executives everywhere block calendar access is thus a strong indicator of sensitivity.

Further consequences of overlooking the patterns

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 hypothetical 'transaction processors.' When no one fitting this description was found and with management wishing to establish the product's utility, a broad deployment in their own organization was begun, first to individual contributors, then to managers and executives. I discussed the outcome with team members.

When managers began using the reduced-functionality calendar, a major problem emerged. It had no printing capability. As at Boeing, individuals rarely print calendars but managers do. A new release was necessary. Another problem surfaced when executives began using it. Again as at Boeing, open sharing of calendar details was the norm, with private meetings blocked off one at a time. And again executives are an exception. The calendar allowed one to make individual appointments private but not block access to the entire calendar in one step. This was unacceptable to executives, forcing another redesign.

It may be advisable to consider the operating core, middle line, and strategic apex independently when gathering requirements, designing a system, planning a rollout, or setting up support. This could help avoid confusion, backtracking, resistance, miscommunication, and lost opportunities. Cutting across the more commonly considered divisions into Marketing, Engineering, Human Resources, Finance, and so forth, these groups share outlooks, biases, ways of working, priorities, and incentives.

Other widely used applications

Email

In an ethnographic report on use of email in organizations in the 1980s, Perin (1991) described differences between individual contributors and managers. The asynchronous, informal medium appealed to individual contributors but not to heavily-scheduled, interrupt-driven managers.

The informality enables individuals to bypass hierarchy. Recipients can choose if and when to read or respond, rendering an email exchange more like a casual elevator or hallway conversation than a formally scheduled meeting.

Email forces managers to handle rapid rumor-propagation and reduces their ability to place a motivational spin on a directive from above, since the original could be forwarded verbatim by other managers, revealing alterations.

Managers feared that email would distract employees. Even in the early 1990s some management analysts predicted that organizations would remove email once they recognized its negative effects on productivity (Pickering & King, 1992).

Email use spread slowly. Managerial acceptance grew as features useful to them were added, such as document attachments and calendar integration.

Today, managers average more email than individual contributors. Models indicate that different email filing and retrieval strategies are optimal for different volumes (Bälter, 2000), suggesting different features for the two groups. Email received as a "bcc:" is usually spam for individuals but is often important email for managers, a difference that led to a design change in an email organizer (Bälter & Sidner, 2002).

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. This is consistent with the demands on time and the disposition to delegate at that level, and suggests that targeted design innovations could serve executives.

Real-time communication and application sharing

NetMeeting supports application-sharing, chat, shared whiteboard, and point-to-point audio and video. It was envisioned as being used by two to four individual contributors. It included open floor control (any participant can use mouse or keyboard to drive the application), point-to-point audio, and other features that were useful when two people interacted. 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 with very heavy NetMeeting 2.0 use. It was used primarily for distributed meetings conducted by managers. Point-to-point audio was never used. Most involved speakerphone conference calls linking several sites. In the first trial by one group, people intentionally or accidentally used the open floor control to wrest control from the manager and one another. Afterward the furious manager said that the floor control model was used only because a developer liked the technical challenge. In large meetings, disruptions frequently occurred when someone accidentally shared out material or blocked the view of the object being discussed.

NetMeeting 3.0 provided multiple floor control models, but not the 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."

The key point is not that the team should have designed for managed meetings rather than for pairs of collaborators, though an opportunity existed. The point is that very different feature sets support each scenario.

Today, the same organization is rolling out a similar product, WebEx, to thousands of employees. Middle managers are a major problem for the support team. Executives have staff who train on the application and set up sessions for them. Individual contributors who want to use the product also go through the training. Middle managers want to use the product, but do not want to take the time for the formal training. Their requests for personalized training are a major problem, a significant challenge in rolling out the product.

Shared workspaces

Orlikowski (1992) describes the early use of Lotus Notes in Alpha Corp, a consulting company. The “strategic apex,” the Partners, saw potential benefits in sharing experiences: less duplication and more profit. However, individual consultants had no 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.

Addressing this unanticipated difference in perspective was expensive. Had it been anticipated, incentives to use the system to share knowledge could have been introduced, an approach subsequently stressed by an Alpha Corp rival.

Alpha Corp deployed thousands of copies of Notes around the world. A support team handled installation and training. Support team members were *not* in the competitive “up-or-out” battle to become partners. 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 technology use.

Several recent products (e.g., BSCW, Groove, Sharepoint) allow the creation of team or project workspaces. These 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 because there was not a separate interface for the manager. If the manager was not entered as a group member, documents would be inaccessible to him. If he was included, he would receive more information than he wanted – information useful mainly to individual contributors. A management interface was an overlooked – and in this case essential – design opportunity.

Web browsing

A study of Web use by Jones et al. (2001) covered individual contributors and high-level managers. Both groups used the Web heavily, but in different ways. Individuals sometimes spent 30 minutes on the web; managers did not. Managers

were more likely to search their group’s internal web sites for information and task admins or subordinates to keep them current. They often send URLs “FYI” to peers, subordinates, or superiors. If summaries do not accompany URLs received in email, they forward the links to subordinates for summarization.

Although the authors do not suggest it, these patterns suggest that different tools could help each group.

Desktop videoconferencing at Boeing

The idea of video often appeals to executives. Polycom ViaVideo and Tandberg 1000 systems were recently put on the desktops of executives at Boeing who thought it would be useful to see each other when speaking on the phone.

The system was not used because of how calls are set up. One executive doesn’t simply phone another. Rather, 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 no time to establish a parallel connection through the computer system.

How many patterns?

A common response to drafts of this manuscript has been “there must be more than three patterns.” If you look closely at application use, of course you 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 are more comfortable placing family events in view than others. And so on.

Nevertheless, several factors suggest that three or four major patterns could account for much of the design space:

- 1) Broad activity and incentive patterns are in fact 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 a lot of meetings and need to share information more formally. Most executives have to coordinate efforts, can delegate tasks, and are more political than the others. These factors can lead to clear choices for effective technology use.
- 2) Only influential user groups in an organization will merit special attention in design, requirements analysis, deployment, training, support, and so on. Mintzberg identified other groups in an organization. These groups might benefit from different technology configurations, but in many organizations they do not influence decisions. The technostructure—employees responsible for work practices—can be very important in manufacturing or insurance companies, but are usually less influential. Similarly, support staff may not

be critical enough to design for, with the exception of technical support, discussed in the next section. The three central groups are clearly critical in most organizations, though not all – a start-up may have no managerial level; assembly line workers may not use a particular technology.

- 3) Many widely-used technologies support interaction: communication and information sharing. Interaction is much 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 described here is accompanied by the emergence of norms. Growing pressure to use a technology the same way leads to the strengthening of particular patterns within a group and the disappearance of alternatives. Only in groups that interact minimally, or where there is a very strong case for working differently, will existing sets of conventions be resisted.

There is a cost to supporting multiple interaction patterns in an organization. Different interfaces and training, different sets of usage conventions can lead to confusion. Pressures to conform, for the sake of mutual intelligibility, will keep the number of major variations low. Each pattern of use will occur in a group whose members predominantly interact among themselves.

Conflicts on the boundaries between levels

If pressures promote convergence of behavior, one would expect that people on the borders between groups would come under conflicting pressure. That was observed. The executive secretary who disliked meeting invitations supervised an admin who loved them, and the two were at loggerheads. An admin who was very hostile to meeting reminders worked for first-level managers and thus interacted with engineers who relied on reminders. (Reminders are set by appointment creators, not recipients.) A Director was interviewed who was torn over whether to share his calendar details. He had shared them and recognized the efficiencies in doing so (the manager pattern), but he had been embarrassed by exposure in one incident and had reluctantly decided to block access (the executive pattern).

This leads to an interesting and unresolved 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 enable employees to become “multi-cultural” over time and move even more gracefully between levels.

IT support staff: A special case

Support is a fourth of Mintzberg’s organizational parts. Most support staff are somewhat peripheral, but technical support shapes how others see a technology.

They contribute to acquisition decisions. They often establish defaults and oversee training. In the Lotus Notes example, support staff resembled individual contributors in some ways but had a different incentive or reward system, which affected their use of the software, and through them how others came to see it. They are a fourth group for vendors to consider carefully, as most already do.

In an organization with a large IT group, including possibly a chief information or technology officer, IT can have executive, managerial, and individual users of its own tools. And a hardware or software company, in addition to its own internal IT staff, has external IT professionals as important customers whose views should be considered in design. Any application used vertically through a segment of an organization is likely to see the pattern outlined in this paper. Because of its inherent technical sophistication, IT is likely to be among the first.

Other exceptions will undoubtedly arise. For example, an individual in a Sales division could have as many meetings as managers, but different incentives. How will this translate into software use?

Discussion

Summarizing the key points:

- 1) Management increasingly uses software
- 2) Due to their contexts, managers and executives use it 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, which in retrospect is surprising mainly because the applications in question seem so simple at first glance. Next I will suggest why the third point is consistent with experience with other technology. Then I will discuss these insights in the context of past approaches to identifying individual and group differences, and why a somewhat different view emerged. Finally, there are concrete implications for design and deployment, to which a reader already aware of the first three points might prefer to skip.

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 that are 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.

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 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., Vicente, 1999), in which a given individual carries out many tasks. Stakeholder analysis (Kling, 1992) is even more fine-grained, typically used to design a system for one organization rather than to develop a widely-used product.

Contextual Design (Beyer & Holtzblatt, 1998) 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 [5] and scenarios (Carroll, 2000) 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 Fischer et al., 1984) to recent work that emphasizes less ambitious but more promising mixed-initiative interfaces (Horvitz, 1999).

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.

Implications for design and use

Let’s preface these remarks by noting that this analysis does not address use in homes, small organizations, or groups with atypical activity patterns. It is just a beginning.

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 the elimination of 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 challenges. But not new challenges. If our scenarios and personas cover the key groups, we may get by with fewer. Guiding users could be easier when we recognize sets of feature that are often used or avoided together.

Doing it right may be easier

Testing illustrates how testing three sets of users could be easier than testing one. Imagine 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 contrast, in product usability testing, data from managerial users, if any are included, is pooled with that of individuals. Analyzing data by group could reduce the noise, yielding a few clear patterns in place of one fuzzy picture. Usability tests could require the same number of participants, with representatives from each group analyzed independently. ‘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.

Looking ahead

At the end of a recent interview of two employees involved in rolling out a customer relations management (CRM) application in a mid-sized company, the following exchange occurred:

“Do the manager and CFO (Chief Financial Officer) use the software directly or do they get reports based on CRM data?”

“Both.”

“Would they like anything changed in the interface to help them use it?”

“I could spend a day telling you about it!”

Specialized applications used by everyone in a vertical slice of an organization will undoubtedly have level-specific aspects of use. A corollary is that software that accommodates the needs of managers and executives will be used by them.

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 the example mentioned earlier.

Early adoption of a technology by managers 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, despite inadequacies of this mediation pointed out by HCI and CSCW researchers and practitioners. However, 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 role as mediator is weakened. A technology used by managers and others may receive positive feedback even when the larger base of individual users has problems with it. This provides new challenges in determining the needs of individual users. It provides great opportunities to those who make the effort to do it.

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