BEHAVIOR
Consistency between micro-level and macro-level cognitive mechanisms
Cost: attention units to get the work done. (Presumably the activity also has monetary costs, such as purchase of software, but this is external to the model.)
Investment: attention units expended toward a potential reward, where the reward can either be external to the model (such as payment for services) or an attention investment pay-off.
Management of complexity as a cognitive task involves linguistic and representational strategies that can in themselves be viewed as notational, and subject either to direct manipulation of the notation or more abstract interaction.
Pay-off: reduced future cost, also measured in attention units, that will result from the way the user has chosen to spend attention.
Risk: Probability that no pay-off will result, or even that additional future costs will be incurred from the way the user has chosen to spend attention.
Numerous studies have shown that early adopters are heavy users of commercial, professional and interpersonal information sources
Users who are encouraged to act, rather than read about acting, are more successful in their learning. Users who are encouraged to perform tasks that are directly related to their goals in using the software are more able to formulate realistic plans, the set of steps they envision will take them through a series of actions to their goals
People average about three minutes on a task and somewhat more than two minutes using any electronic tool or paper document before switching tasks.
People worked in an average of ten different working spheres. Working spheres are also fragmented; people spend about 12 minutes in a working sphere before they switch to another.
Email users are heavily invested in their existing tool. They are thus unlikely to adopt an entirely new tool that requires them to move their legacy email archives and learn new software without some top-down organizational imperative (such as organizational edicts or moving to a new company with different supported software).
“I don't think that if we implemented that we would get much benefit out of it and there would be a significant cost.”
In this paper we present empirical results that suggest that people organize their work in terms of much larger and thematically connected units of work.
INFORMATION ORGANIZATION
Folder overlap was particularly evident between the document and email hierarchies
Users receiving many messages were more likely to create folders, possibly because this serves to rationalize their inbox, allowing them to better see their ‘todos’
Archivers focus on ensuring that personal information management is stored for later info-ret. As a result of building complex hierarchies of folders, these individuals spend a considerable amount of time filing and sorting email.
Managers distribute emails to employees
Prioritizers organize their email in order of personal priority. They develop organizational schemes in which they neglect or delete email to ensure that certain emails remain within the email inbox window
In multiproject settings where the projects are of a rather similar nature, it is easier more directly to use the knowledge generated by one project in another.
In the highly projectified companies of the kind investigated in the study, time issues emerged as even more relevant, since the schedules of different projects are partly dependent on each other.
In many organisations project overload syndrome can occur, caused by having too many large change projects running at any one time. This results in resource conflicts (particularly if the resource pool for change projects is already limited), delays in the completion of the project and a general weariness of change across the organisation.
For the 28 users who had created file and email folders, the average file/email overlap was 7.0 folders (sd.5.6).
“Because if I had to do it all myself it would be equivalent to if it was wrong 100% of the time. So the fact that it’s right 75% of the time or something is –saves me three quarters of the time it would take. And since I get so much mail and I have to manage it somehow I would have to be foldering or tagging anyway.”
“I would guess that maybe there’s one new tag a week on average”
“So there’s a lot of new tags being created either for new conferences, new employees, new grants and then maybe the other thing probably in there is new research projects. That’s much rarer.”
TASK MANAGEMENT
After accessing the email client, every participant engaged in email triage. Email triage is the process where a user filters, sorts, and generally organizes their email queue.
Participants noted that they made a clear distinction between short responses, messages that required a short message or action, and long responses, messages that demanded a well composed message or for the participant to organize materials for a response.

process started with looking for emails that they had mentally noted, were flagged, or left unopened during morning triage. If the participant did not have time or information necessary to compose a response during the day, the response rolled to the next day where it would again be reviewed and reprioritized.
Some messages are flagged or tagged with higher importance and the inbox is occasionally flag-sorted such that flagged messages bubble to the top. Many users resend messages to themselves
TIME MANAGEMENT
Delays and deviations from schedules may be a consequence of project overload,but project overload may as well be a consequence of problems with meeting pre-set schedules and deadlines.
Project overload was significantly and negatively correlated with the proportion of projects that adhered to their time schedule.
Time focus, schedules and time limits are important in almost all kinds of projects, and time pressure is an important driving force for work progress.
“this was my time on the island”
Calendar is time management. Email is todo management. Sometimes I put time to do things on the calendar, so I have reserved time to review a paper for a student or something like that. Sometimes I will send myself emails as reminders to do things.
EMAIL
Management of complexity as a cognitive task involves linguistic and representational strategies that can in themselves be viewed as notational, and subject either to direct manipulation of the notation or more abstract interaction.
A recent survey found that email overload is viewed to contribute to a loss of productivity and a significant decrease in task coordination.
We identified seven specific problems that participants in our study experience with task management in email: 1. Keeping track of lots of concurrent actions: One’s own to-dos and to-dos one expects from others. 2. Marking things as important or outstanding amongst the less important items. 3. Managing activity extending over time or keeping track of threads of activity and discussions. 4. Managing deadlines and reminders, which may be associated with particular messages or other content. 5. Collating related items (e.g., an extended thread or responses to a survey) and associated files and links. 6. Application switching and window management. 7. Most important, getting a task oriented overview, at a glance, rather than scrolling around inspecting folders.
Email has become an overloaded tool supporting far more than just messaging. It requires sophisticated integration with other resources such as document management and event management.
Email users are heavily invested in their existing tool. They are thus unlikely to adopt an entirely new tool that requires them to move their legacy email archives and learn new software without some top-down organizational imperative (such as organizational edicts or moving to a new company with different supported software).
“I don’t know that I have a strict rule between what goes into my to-do list and what stays in the inbox.”
“it’s right enough of the time that I kind of assume it’s right”
“Stuff in my inbox is either has not been read yet or it has been read and I’ve moved it to my done folder. So I have a big folder that I keep all of the messages that I’m done with. And I either am really done with it or I have added an entry in my to-do list that tells me what I need to do. And then the other stuff that’s in my inbox that I have read is something else that I need to do that is maybe less work.”
“the main reason I put a tag on something is for retrieval of relevant emails”
Email is my primary communication mechanism with my students and my collaborators etc. That and Google Calendar are my lifeline. Most of what I do is through email.
The thing for me for intelligence or filtering would be if I could train an assistant to differentiate between these are the things you need to look at eventually or look at right now. “Are you in your office” vs. “Here’s a proposal from the curriculum committee…”
Almost all of my communication occurs in email
Giant inbox. Search to access what I want. I mark messages as unread that need to be dealt with in a timely manner until they are dealt with. If a message hasn't been dealt with, it stays unread. It may stay unread for a month. Obviously it's been read, but I remark it as unread. I organize it on my desktop with unread at the top. On Android, I can't do this.
INFORMATION RETRIEVAL
Other work has examined how people refind personal files on their personal computers, showing that people are more reliant on folder access than search.
Participants were usually able to remember whether a particular message was in their mailbox. Also, memory for specific information about each message was generally good; people remembered content, purpose, or task related information best, correctly recalling over 80% of this type of information, even when items were months old. However, frequent filers tended to remember less about their email messages.

Components of autobiographical events that have a logical mapping onto email message attributes are people, time and activity. In most cases, these can be mapped to 'sender,' 'time' and 'subject' of a message
People first work on information tasks that have a higher level of interest for them and a greater degree of domain knowledge
A qualitative study of 125 knowledge workers found that information format, accessibility, and quality contributed to productivity constraints.
Knowledge workers' productivity is inhibited due to software bloat, information overload, and communication overload.
The theory of task-technology fit posits that increased utilization of a system can actually result in poorer individual performance if the technology does not readily support the subset of tasks an individual need to perform (Goodhue et al.1995).The fundamental argument is that a particular technology must fit the task in order to confer benefits to the user.
important when fixing misclassified mail. The prevalenof these types of barriers suggests the need for intelliguser interfaces to be able to direct end users to the museful places to give feedback, such as which words willhave the strongest effect on message reclassification.
The fact that Selection and Coordination barriers accounfor most observed barriers is confirmed by tquestionnaires, where 16 of 22 respondents (72%)mentioned difficulty in determining which words were important when fixing misclassified mail. The prevalenof these types of barriers suggests the need for intelliguser interfaces to be able to direct end users to the museful places to give feedback, such as which words willhave the strongest effect on message reclassification.
The second factor leading to obstacle closure was the *visibility of expected benefit* . In Attention Investment terms, she expended attention when she perceived the benefits of overcoming the obstacles to be greater than the cost.
Organizing strategy is influenced by the likelihood and style of retrieval. Our qualitative data suggests that users are more likely to re-use files than emails or bookmarks,particularly over the long-term. Users perceive that file organization is more worthwhile since the cost of filing is offset by predicted benefits at retrieval time. Also, users tend to retrieve email by sorting on metadata, such as "sender" and "date received". Therefore there is less need to organize to facilitate folder-based browsing.
Participants stressed how the nature of acquisition varied between the tools - from manual in files and bookmarks, to uncontrolled in email: (P11: "everything just gets stuffed into the inbox"). All participants actively collected both files and email. File collections were highly prized, and many participants expressed the pride they felt towards the contents, much of which they had kept over a number of years: (P29: "Some of them I'll need again, some of the things I'm quite proud of ... why should I throw it away? It doesn't cost me anything"). Email collections were valued less more than files, but most participants noted the sentimental orprofessional value of a subset of their messages: (P24: "I keep them to make sure I've got one thing from them to reply to. Also it's nice that the person has written"). Bookmarks were of low importance for most participants (supporting findings in [9]), however all but one collected them to some extent.
Therefore we developed our own classification based on participants' strategy descriptions (Table 3). Our sample included 2 no-filers (folderless spring-cleaners), and 8 frequent filers - but no spring-cleaners (users who only clean their inbox periodically). The remaining 21 participants had large inboxes (>75 items, average 1137), like the nofilers and spring-cleaners in [13], however their reported strategies did not match these classifications. They filed some new emails immediately (typically those of perceived long-term value such as e-commerce receipts), and deleted low-value spam. Other messages were left in the inbox, which was occasionally spring-cleaned. In other words they employed multiple strategies – a combination of frequent filer, spring cleaner, and no-filer.
ML BEHAVIOR
These learned programs do not come into existence when the learning environment has left the hands of the machine learning specialist; instead, they are learned on the user's computer. Thus, if these programs make a mistake, the only one present to fix them is the end user.
Explanations of system behavior are extremely beneficial. Explanations that answer why certain outcomes happened, based on user actions, can contribute positively to system use.
The user's willingness to invest time providing information to an intelligent system can be viewed in terms of a cost-benefit risk judgment by users, drawing on Attention Investment theory (Blackwell 2002). According to this theory, in weighing up whether to provide feedback, users' perceptions of costs, benefits, and risks each play key roles. One of the charges of a good user interface is to provide the user with the information needed to make assessments f costs, benefits, and risks that are reasonably close to actual costs, benefits, and risks.
Debugging, however, can be difficult for even trained software developers—helping end users do so, when they lack knowledge of either software engineering or machine learning, is no trivial task.
End users' experience with intelligent agents does not necessarily suffer when they are exposed to more knowledge of how the agent works.
Making an agents' reasoning more transparent is one way to influence mental models.

Participants who were presented with structural knowledge showed no evidence of feeling overwhelmed by this additional information and viewed interacting with the intelligent agent in a positive light, while participants holding only functional mental models more frequently described their debugging experience in negative terms, such as “confusing” and “complex”.
When an intelligent agent’s reasoning causes it to perform incorrectly or unexpectedly, only the end user is in a position to better personalize—or more accurately, to debug—the agent’s flawed reasoning
Learning barriers overcome with invalid assumptions often led to insurmountable barriers
MULTITASKING
Sharing time between several projects, at an individual level, may result in perception of work as disrupted and fragmented, in elevated levels of time pressure, and in fewer opportunities for recuperation between periods of intense and strenuous work.Other negative consequences of sharing time between many projects are decreased competence development, and less improvement in work routines. Switching from one project to another can result in considerable amount of set-up time. On the other hand, there are also indications that multi-project settings can provide for increased learning and a rich work content.
The factors that seem to relate most to a sense of overload are the number of threads one is tracking per day, and the length of the intervals between messages in those threads.
Email is multitasking. I pick something on one of my todo lists. Unless I get distracted by something that just came in email that I can polish off quickly. I have levels of todo lists. Daily priority list… what really really has to be done today. Done on paper. Some of it done on paper. Longer term one by deadline in email. I don’t get it longer and longer. I write down stuff that I really hope I get done today. Email. CHI paper for an hour. CS352 for an hour. I don’t know what is… but I did that. Hiring. Got my boarding pass. Worked on CMU talk. CS519 grading. Then I went to CS352 class. Email was the vehicle for hiring and boarding pass. Class was web. CHI was word processing and a little email.
~~I’m not as good as young people are. Now nobody my age can do that (homework on the bus). Compared to other people in my job… about the same.~~ We all have to multitask. Compared to the general population… more coping mechanisms… as deadlines are more important.
Oh, I hate context recovery. Context switch is a huge cost for me. Did you do your homework as a kid? It was so easy then… Interruptions now… much harder. Interruptions are awful. Turn off email when I have a terrible deadline. That and the todo list helps me recover context. What am I doing next?
~~Code has a higher recovery cost than writing.~~ Sometimes a paper I haven't seen in a long time also take longer to recovery. Mostly I still have a good memory.
Certain level of interruption can actually improve performance by increasing an individual’s focus on the primary task and allowing the individual to multitask, however, they have also shown that excessive interruptions affect human behavior by negatively impacting recall, accuracy, efficiency, stress level, and ultimate performance.
Found an inverted-U-shaped relationship between multitasking and productivity – more multitasking enabled by more technologies is found to relate to declining project performance when technologies are used beyond the optimum.
Knowledge workers’ productivity is inhibited due to software bloat, information overload, and communication overload.
Studies have shown that knowledge workers are interrupted on average every three minutes since the proliferation of communication technologies such as e-mail, instant messaging, and other distractions while it takes workers nearly eight uninterrupted minutes to regroup for productive thinking
PARADOX OF THE ACTIVE USER
Users apply prior knowledge even when it does not apply. Attack: Repress potential connections to prior knowledge. Example: Explicit system models. Performance feedback.
Users apply prior knowledge even when it does not apply. Mitigate: Make or describe system as truly similar to something familiar. Example: Direct manipulation. Natural Language.
Users focus on end products at the expense of prerequisite learning. Attack: Make learning the system intrinsically rewarding. Example: Performance feedback. Systems as games.
Users focus on end products at the expense of prerequisite learning. Mitigate: Make learning the system easy. Example: Training wheels. Undo.
PROJECT MANAGEMENT
Breaking large projects down into sub-projects or work packages is regarded as one of the most important tasks in new or development projects.
Keeping the plans simple, with the right level of detail, can encourage a project to be reviewed regularly and easily. This makes them useful communication tools and effective monitoring devices for the project.
Email systems also support the application of a series of workflow-related programs in a distributed R&D projects.
In dispersed R&D teams IT can support four basic tasks. (1) Coordination of decentralized project activities. (2) Exchange of technical information. (3) Promotion of creativity and quality. (4) Formation of a personal network and development of trust.

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MENTAL MODEL
“I mean, if I also had the ability to highlight a word and say, “This is an important word. Make sure you’ve got a weight on this.” That might be nice. But I really don’t want to do that. I just want to tell it the right tags because I’m tagging it to get work done and I don’t really want to spend time teaching it stuff.”
“I took off the old tag, so EISI 2014 just got a bunch of negative training data and 2015 doesn't have any yet positive training data.”
“if you ask me about any tag, I can probably give you my mental policy, and if I can't, it's probably because I need to improve it”
“It didn’t seem to do anything good. Because the problem was when I retrained it they were just fat again so they –I think. That’s my hypothesis. That if I just reset them and don’t retrain them maybe that would be a good. But yeah, I’m not convinced it’s actually doing anything. That’s just my impression that it wasn’t solving the problem.”
MS: Did you end up with both tags on those messages? TD:No, I deleted the service one, then. MS:So you leave the most specific tag. TD:Generally. I’m probably not consistent on that. I have the same thing happening on conferences. There’s where I am thinking like a machine learning guy and saying, “Well, if I leave the conference tag on there then the conference tag will be happy with these which it should be because they are about conferences.” And so that won’t confuse it as much. So I am thinking like that. But I don’t think end users should ever be thinking like that