

## Human-Computer Interaction 2005 Special Issue

Topic/Idea	Quote	Citation	Thoughts
Miscellaneous	The whole paper	(Ducheneaut & Watts, 2005)	<p>So the general idea of the paper is identifying 3 main streams of research that have been undertaken in regards to email:</p> <ol style="list-style-type: none"> <li>1. Email as a Filing Cabinet</li> <li>2. Email as a Production Line</li> <li>3. Email as a Communication Genre</li> </ol> <p>That is, being summarized:</p> <ol style="list-style-type: none"> <li>1. “Cognitive aspects of information organization and retrieval”</li> <li>2. “Efficiency and effectiveness of organizational communication”</li> <li>3. Focus on media richness, how email is maleable in different situations, features and uses in different settings</li> </ol> <p>The three streams are rather disparate it seems, but each makes important progress in the three areas. They then propose a model that could potentially unify the areas (or at least establish an ontology for the categories) and suggests where research should go in order to make further progress.</p>
Filtering	“Landsdale (1988) also emphasized the cognitive difficulty of categorizing items. This task is doubly difficult, first in determining which categories to use and second in remembering these categories later, at the time of retrieval. Consequently, people are reluctant to file information away either because they cannot decide how to categorize it or because they are not confident in their ability to retrieve it later.”	(Ducheneaut & Watts, 2005)	In other words, people don't like making and maintaining folders. It is hard for them to remember.
Filtering	“Information which is logically related to the required memory will not succeed in eliciting recall unless it is also related to the way in which that information was interpreted: we need a richer set of metadata.”	(Ducheneaut & Watts, 2005)	Why is it hard? Because there really is no connection between naming that one folder and putting an email in it, and remembering that you did so later on.
Filtering	“Landsdale (1988) concluded that every attempt to retrieve information is based on two different psychological processes: (a) recall-directed search followed by (b) recognition-based scanning. ... Storing or categorizing information leads to a dilemma: the more time a user has to	(Ducheneaut & Watts, 2005)	So you have to first think about what it is that you are trying to find, and then go and find things that are similar to it in order to aide recall. However, that leads to a problem. First, people are unlikely to take the time to set up good folders/categorization.

	<p>spend to categorize an item, the less likely it is that the categorization will be done at all. Moreover, the more we automate this process, the less the user will be able to recall due to fewer associative links in memory. Associations between items of information are constructed by active involvement on the part of the person for whom the e-mail has significance. This suggests that automatic filing and message folders, two ubiquitous features in contemporary e-mail software intended to help rationalize the information overload problem, do not match human cognitive processes very well.”</p>		<p>However, having computers set up categorization for you won't work either, because you won't have the links to the possible categorizations in memory so they won't know where to look.</p>
Filtering	<p>“Kidd found the knowledge workers’ desks to be cluttered and to seemingly function as a spatial holding pattern for current input and ideas. These workers, however, are changed by the information they process: once informed by some written material, they have no particular need to retain a copy of the informing source (e.g., they take a lot of notes but then discard them: the act of writing is more important than an external memory store). However, if a piece of written material has not yet informed them, then they cannot sensibly file it away because its subsequent use or role in their world is still undetermined, which is why they use piles and a spatial information organization scheme. Kidd concluded that computer support for knowledge work might be better targeted at the act of informing rather than on passively filing large quantities of information in a disembodied form.”</p>	(Ducheneaut & Watts, 2005)	<p>Tell the user about the data, let them file it in their head (become aware of the information), and then go on to file it away. <i>Inform</i> and clear off the desk.</p>
Organization	<p>“Fertig, Freeman, and Gelernter (1996) believed that Barreau and Nardi’s users preferred a location-based search because it is the lesser of evils: If other search methods had been available, they would have been used. They thought that a location-based search is only possible when users don't archive or give up using archived information. They argued that it is a “cart and horse” problem: If archiving were better supported, users would archive.”</p>	(Ducheneaut & Watts, 2005)	<p>Remember, this is 1995, years before Google changes the search scene. This makes a lot of sense in retrospect.</p>
Organization	<p>“Lifestreams is an approach to organizing a user’s personal files. It uses a simple metaphor, a time-ordered stream of documents, to replace conventional files and directories. Every document a user creates is stored in his or her lifestream, as are all the documents other people send him or her.”</p>	(Ducheneaut & Watts, 2005)	<p>Very interesting... like similar to OS X's Time Machine?</p>

Organization	<p>“It is worth noting, however, that users show little confidence in learned rules for text classification (Pazzani, 2000), which directly questions the validity of a completely automated approach to e-mail filing. ... Using an adaptive classifier, the system predicts and proposes the three existing folders that are most likely to be appropriate for a given message.”</p>	(Ducheneaut & Watts, 2005)	Probably not going to work to start auto-filing things away for a user. The suggestion thing could work. (But in the end, is it really important to have categorization at all?)
Organization	<p>“Rather than automatically file a message, the Tapestry system uses “appraisers” to assign it a priority ranging from 1 to 100. An appraiser is a predicate or query that is applied to each new message received (e.g., if it contains “St Marcellin,” give it 100; if it contains “Monterey Jack,” give it 5). Collaborative filtering is also implemented: A user can rate each message as “Like It” or “Hate It;” he or she can then write an appraiser saying, for instance, “send me all the messages that X liked.” The user can then sort his or her messages in decreasing priority, processing only the most important ones. More recently, researchers have been applying techniques from the field of AI to tackle the same problem. The Priorities system from Microsoft Research (Horvitz, Jacobs, &amp; Hovel, 1999), for instance, infers the criticality of e-mail messages using Bayesian networks.”</p>	(Ducheneaut & Watts, 2005)	<p>Cool stuff, being able to figure out the <i>value</i> of an email!</p> <p>Look into the criticality measure indicated here.</p>
Definition	<p>“They reiterated one of Mackay’s (1988) conclusions: Although e-mail was originally designed as a communication application, it is now being used for additional functions that it was not designed to support, such as task management and scheduling as well as personal archiving.”</p>	(Ducheneaut & Watts, 2005)	Email is not just a conversation.
Categorizing	<p>“Whittaker and Sidner emphasized the importance of a visual reminding function:Users who tried to create dedicated “action” folders abandoned the strategy, because they had to explicitly remember to go to it and view its content, rather than being reminded by working with the whole set of messages. In this regard, Landsdale’s (1988) and Malone’s (1983) claims are confirmed: It is clear that successful filing is highly dependent on being able to imagine future retrieval requirements, and that it requires considerable effort.”</p>	(Ducheneaut & Watts, 2005)	It is difficult to say what your needs will be in the future, which is what makes coming up with a good filing system difficult.
Categorizing	<p>“Although in principle there may be an optimal strategy, in practice, management of messages and tasks varies considerably with experience and numbers of folders (Ducheneaut &amp; Bellotti, 2001).”</p>	(Ducheneaut & Watts, 2005)	In other words, you won't find a "one size fits all" strategy for this. This kind of focuses me in the direction, "if one technique won't work for all, then what larger idea will? Behaviors? Adaptability?"

Behaviors	<p>“Takkinen and Shahmehri (1998a, 1998b, 1999) argued that users’ construal of e-mail is primarily as a task management tool rather than as a messaging system. They reached this conclusion on the basis of two studies of high-mail-traffic professionals who need to manage e-mail in different organizational roles. The authors reported that the advanced formatting features in e-mail systems (e.g., using extrabold type, HTML, etc.) are rarely used because it takes time and because the messages are mostly short, and also because the receiving side cannot be presupposed to see the same layout; instead, documents are created in a word processor and attached to the message.”</p>	(Ducheneaut & Watts, 2005)	<p>Users use email to receive, delegate, manage, and track tasks. It is much less about writing letters than it is about giving and receiving to-dos.</p> <p>Because of this, the formatting of a message is much less important than the contents, so you do what you can to get your message across quickly and succinctly. It’s not a magazine, it’s a checklist.</p>
Behaviors	<p>“Forwarding, in contrast, is very common as is the use of aliases and the address book. Messages can gather momentum in terms of those who are subject to their circulation.”</p>	(Ducheneaut & Watts, 2005)	<p>So getting the right message to the right people is a critical function and behavior of email.</p>
Categorizing	<p>“Filtering, transfer to folders, and two or three-paned displays are not adequate to support classification, organization, and getting an overview of a set of messages, because the strategies for sorting and searching are not all covered. Takkinen and Shahmehri (1998a, 1999) have extended their Categorization Assistant For E-mail system (CAFE) by defining three modes of usage: the busy mode for intermittent use at times of high stress, the cool mode for continuous use at the computer, and the curious mode for sporadic use when exploring and (re)organizing messages when more time is at hand.”</p>	(Ducheneaut & Watts, 2005)	<p>There is probably not one golden UI that will meet all the demands. So that brings up an interesting question: is a UI appropriate at all? When we are having a face-to-face conversation, there is no UI. Or if there is a UI, how lightweight can it be to stay out of the user’s way?</p>
Behaviors	<p>“More recent research within the storage and retrieval tradition has shifted the argument toward messaging that subserves task management. The cognitive demands of such work thus revolve around group-defined task-level operations and not individual-created message-level operations.”</p>	(Ducheneaut & Watts, 2005)	<p>This is probably why products like Basecamp and Asana are used a lot. There is still a disconnect there however, because there are still just plaintext messages being sent around that don’t tie in super well to the original system.</p>
Processing	<p>“Winograd and Flores (Flores et al., 1988; Winograd &amp; Flores, 1987) proposed that the design of a tool for communication and management in an organization should embody an orientation toward the management of action. They suggested that this ought to be done by understanding the role of background and language in setting the dimensions of the space in which people interpret and generate their possibilities for action.”</p>	(Ducheneaut & Watts, 2005)	<p>If a tool can figure out what context a message is being sent in, and what the actual message entails, then it can do a better job of helping to get the right actions completed.</p>

Processing	“The earliest suggestion for technical improvement is probably computational mail (Anderson & Gillogly, 1976), in which programs are embedded in each message. When the message is opened, the program is executed.”	(Ducheneaut & Watts, 2005)	Similar to the "will you approve the order?" screen in the MS video.
Processing	“Collaborative decision making through e-mail places great strain on the participants’ ability to maintain the thread of their arguments. ... Active Mail was devised to address the collaborative nature of e-mail by supporting consistency between versions of messages and maintaining dialogue continuity (Goldberg, Safran, & Shapiro, 1992). It treated messages as a shared space that participants in a discussion can edit from within their own e-mail client.”	(Ducheneaut & Watts, 2005)	Sounds like Google Wave.
Collaboration	“Second, once a message is sent, there is traditionally little or no control over its content, in the event, for example, that the sender wishes to change it.”	(Ducheneaut & Watts, 2005)	So if you need to collaborate on something, why not have an online doc that everyone can work on and then receive messages when something has changed (like you edit and then it prompts you to write about your changes, and everyone gets that update)? In a real world use case with something like Google Docs, how much could be done with shared docs instead of email? Or is that just a use case for remote collaboration?
Collaboration	“The functionality for sending and receiving electronic messages, available in many groupware products, has been shown to be by far the most heavily used and is universally acknowledged as the most critical facility (Bullen & Bennett, 1990; Farshchian & Divitini, 1999). ... But widely deployed systems attempting to structure e-mail exchanges to improve workflow have so far proved unsuccessful; other prototypes have not been deployed widely enough to get meaningful results.”	(Ducheneaut & Watts, 2005)	So people like sending/receiving email, and they find it a convenient way to communicate. But attempts to add more structure to these conversations have not worked. I wonder what type of structuring they are thinking about.
Collaboration	“The e-mail as a production line theme examines messaging technology as a facility for work production within groups, across individuals in terms of their role as members of the group. This approach seems to be particularly useful in contexts where activities are fairly repetitive and well-defined but it breaks down easily when more flexibility is required.”	(Ducheneaut & Watts, 2005)	Straightforward tasks can be accomplished with something other than generic email. Creative conversations cannot.
Definition	“Barnard, for instance, proposed that “an organization is born when there are individuals who are able to communicate, and who are determined to engage in actions oriented toward a common goal” (1938, emphasis added).”	(Ducheneaut & Watts, 2005)	Communication is absolutely key to an organization. Without it, the organization cannot function.

Media Richness, Behaviors (bad)	“Social networks, social influence, interpersonal relationships, and organizational power structures all affect how groups and individuals use e-mail (Garton & Wellman,1995).For instance,El-ShinnawyandMarkus(1998)foundthat users generally preferred electronic mail over voice mail for most communication purposes.These results do not support a hypothesis derived from IRT that technologies such as voice mail would be preferred to e-mail for ambiguous and socially significant situations because they are intrinsically “richer.” As a result, social influence theories have gained considerable ground in the past years, at the expense of rational theories such as IRT.”	(Ducheneaut & Watts, 2005)	People make “incorrect” choices about the media to communicate on as it should be according to IRT. Maybe this is behavior that can be corrected?
Behaviors (bad)	“In particular, effective senior managers were found to use e-mail heavily and for precisely the kind of judgment-intensive, equivocal communications tasks that e-mail was supposed to be poor at supporting.”	(Ducheneaut & Watts, 2005)	Oops, this should probably be a no-no requiring retraining.
Media Richness, Behaviors	“Through collective behaviors like answering messages as they arrived, e-mail senders invested this medium with the speed and richness usually associated with the phone.”	(Ducheneaut & Watts, 2005)	This is why IRT is telling us stuff contrary to what the actual behaviors are. People have changed how they actually use email, and now the medium represents something different than its original intent, and is this okay?
Media Richness	“People, as actors in a social or organizational context, themselves “process” data into information and hence richness dimensions of e-mail arise in association with the organizational processing units that are instituted over time, not just in the raw-data bandwidth terms of IRT.”	(Ducheneaut & Watts, 2005)	Again, this is another reason that IRT/media richness is failing to direct the proper use of email—it was not taking into account the added richness that people were giving the medium.
Behaviors (good)	“E-mail’s lack of cues can make it easier for group members to contribute to group discussions. ... Many studies have also found that, as a corollary of the equalization effect, people can be less inhibited, nonconformist, and combative when using e-mail (Adrianson&Hjelmquist, 1991; Hiltz, Johnson,&Turoff, 1986; Kiesler & Sproull, 1992; Kiesler, Zubrow,Moses, &Geller, 1985; Siegal, Dubrovsky, Kiesler, & McGuire, 1986).”	(Ducheneaut & Watts, 2005)	This is probably a good thing, as it removes inhibitions.
Behaviors (bad)	“E-mail groups tend to be more polarized and are slower to develop leaders and reach consensus (see, for instance, Kiesler&Sproull, 1992), which is somewhat balanced by the fact that their greater range of ideas may also produce more innovative and better decisions (Valacich, Paranka, George, & Nunamaker, 1993).”	(Ducheneaut & Watts, 2005)	In order to counteract this, you should probably establish the group and the boundaries and expectations outside of initial emails, and then transition to email once you are in the collaboration mode.

Behaviors (good)	“Even if members never meet beyond the medium, their responsibilities to one another exist within a socioeconomic world that requires them to understand the consequences of their dealings through e-mail.”	(Ducheneaut & Watts, 2005)	Going along with the previous thought, meeting in real life should reinforce this responsibility towards one another, and hopefully lead to better email conversations.
Collaboration	“Most of the work has concentrated on how individual users interface with their computers, how two persons interact online, or how small groups function online (Garton & Wellman, 1995); much less attention has been devoted to the effects at a larger organizational or social level. In”	(Ducheneaut & Watts, 2005)	Research opportunity: how do organizations at the social level interact with email?
Processing	“As a concluding remark for this section, note that all of the components we proposed automate very few e-mail activities. Instead, they point users at potentially interesting information patterns that they can interpret as they see fit.”	(Ducheneaut & Watts, 2005)	In the end, email probably won’t be about automation. It will be about presenting the right information to the user at the right time in the right context. Giving the user help doesn’t mean doing stuff for them, it means making tasks easier to accomplish in less amount of time.
Processing	“Perhaps because it is so hard to pin down, academic research has had surprisingly little effect on the design of new e-mail interfaces. We think it is time to put some of this knowledge to use and reinvent e-mail so that its interface reflects the diverse range of practices it is used to support.”	(Ducheneaut & Watts, 2005)	It’s hard to apply research to the real world because of the vast nature of the topic. But let’s try!
Business Issue	“Indeed, the main computer tool used to support project management and informal workflow seems to be e-mail for many knowledge workers (Ducheneaut & Bellotti, 2003; Venolia, Dabbish, Cadiz, & Gupta, 2001).”	(Bellotti, Ducheneaut, & Howard, 2005)	Perhaps this is previous to Basecamp and whatnot, but it tells us the email is what is used to manage tasks primarily in business.
Causes	“Not surprisingly, the biggest challenge identified from this type of research is e-mail volume: as more and more messages pile up in the inbox, the time it takes to file or retrieve messages quickly increases (Bälter, 2000) until the user feels overwhelmed.”	(Bellotti et al., 2005)	This is one form of IO. However, the research says that this is a smaller part of the problem (see next quote).
Causes	“We can summarize these challenges as being related to the quality rather than the quantity of e-mail and it is this quality that we examine in detail in this article.”	(Bellotti et al., 2005)	The quality of information (or how much interdependency there is in a thread) is a real driver of IO.
Business Issue	“knowledge workers seem to use e-mail as their main resource to support task management on an ad hoc basis. Supporting this claim, in a recent study (Bellotti et al., 2004), we counted 882 “to-dos” across 16 individuals with diverse job descriptions. ... Of these, the largest proportion of “to-dos,” 35% were represented in e-mail, which was as many as in “to-do” lists and the calendar combined (the next most popular resources).”	(Bellotti et al., 2005)	Again, email becomes task management.

Facts	<table border="1"> <thead> <tr> <th data-bbox="407 142 596 164">Activities Coded As</th> <th data-bbox="701 142 869 164">Examples and Notes</th> <th data-bbox="974 142 1068 164">Percentage</th> </tr> </thead> <tbody> <tr> <td data-bbox="407 175 554 196">Announcements</td> <td data-bbox="617 175 869 196">For example, agenda, out-of-office</td> <td data-bbox="995 175 1026 196">35</td> </tr> <tr> <td data-bbox="407 201 596 238">Dialogue, discussion, negotiation</td> <td data-bbox="617 201 764 222">Includes questions</td> <td data-bbox="995 201 1026 222">28</td> </tr> <tr> <td data-bbox="407 243 596 280">Organizing, arranging, coordinating, scheduling</td> <td data-bbox="617 243 890 264">Includes assignment of responsibility</td> <td data-bbox="995 243 1026 264">27</td> </tr> <tr> <td data-bbox="407 285 512 306">Not an activity</td> <td data-bbox="617 285 932 345">For example, spam, out-of-office auto-reply, bounced messages; this low proportion is a result of the use of spam filters</td> <td data-bbox="995 285 1026 306">8</td> </tr> <tr> <td data-bbox="407 350 596 388">Coauthoring, document review</td> <td data-bbox="617 350 932 371">Includes paper-writing and graphics design</td> <td data-bbox="995 350 1026 371">2</td> </tr> <tr> <td data-bbox="407 393 554 430">Formal information gathering</td> <td data-bbox="617 393 806 414">For example, form filling</td> <td data-bbox="995 393 1026 414">1</td> </tr> </tbody> </table>	Activities Coded As	Examples and Notes	Percentage	Announcements	For example, agenda, out-of-office	35	Dialogue, discussion, negotiation	Includes questions	28	Organizing, arranging, coordinating, scheduling	Includes assignment of responsibility	27	Not an activity	For example, spam, out-of-office auto-reply, bounced messages; this low proportion is a result of the use of spam filters	8	Coauthoring, document review	Includes paper-writing and graphics design	2	Formal information gathering	For example, form filling	1	(Bellotti et al., 2005)	Cool breakdown of the types of messages in a typical inbox. <ul style="list-style-type: none"> <li>35% are announcements? Make your client reformat these as one-time view items and get rid of them with one click!</li> <li>The 28% probably greatly influences the level of IO based on the quality of the messages.</li> <li>Wouldn't be surprised if the 2%/1% items cause 80% of the work.</li> </ul>
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Facts	<ul style="list-style-type: none"> <li>30% of activities involving only two people</li> <li>10% of activities involving three people.</li> <li>5% of activities involving four people.</li> <li>4% of activities involving five people.</li> <li>45% of activities involving more than 20 people.</li> </ul>	(Bellotti et al., 2005)	Cool breakdown of how many people are involved in a typical email conversation. Are those 45% of those activities involving 20+ people announcements?																					
Miscellaneous	“Bälter and Sidner, 2000, argued that the fewer recipients there are of a message, the more important it is).”	(Bellotti et al., 2005)	This is a good way to figure out a priority of an email.																					
Facts	“we found eight employees in our organization keeping track of 74.4 active “to-dos” (median 65) using, on average, 11.25 different kinds of resources (median 11.5), including calendars, lists in notebooks, and jottings on slips of paper, with e-mail being by far the single most important of these.”	(Bellotti et al., 2005)	People tracking todos.																					
Causes	“This “overload” reflects the increasing speed at which tasks can be handled with computing resources, and the increased networked connections between people, increasing the possibility and ease of making requests and demands of others (Sproull & Kiesler, 1991). And, as Mackay (1988) put it, “it should not be surprising that the effect of lowering the cost of delegating tasks by e-mail increases the volume of e-mail” (p. 351).”	(Bellotti et al., 2005)	More and more email and requests are being sent because it's easy and “cheap” to do so. What determines the cost of delegation? Ease of action? Would feedback (“You've assigned Bob to 20 things recently”) add weight?																					
Facts	“This phenomenon has been observed by other researchers to be a common practice, particularly for senior managers. For example, Mintzberg (1973) talked about chief executives' work as being characterized by “brevity, variety and fragmentation” (p. 31), with each deskwork activity lasting, on average, 15 min and each phone call 6 min. Sproull (1984) estimated that managers work on 58 activities per day lasting, on average, 9 min (including, on average, three 1-hr meetings, suggesting many activities take less time than 9 min), and Reder and Schwab (1990)	(Bellotti et al., 2005)	So managers deal with tons of different threads, it's just how they operate.																					



	also observed senior managers engaging in 30 distinct tasks per day.”		
Behaviors (good)	“The work is nonproblematic from a task management point of view, in the sense that it is easy to execute and then forget about, using the resources at her fingertips.”	(Bellotti et al., 2005)	What characterizes a task that you can do and forget about, versus a task that you must remember and keep coming back to? What pattern of behavior is this, where you read, do, and forget until an action is required? Is it helpful/beneficial? What are the downsides? How can all tasks (if this is good behavior) be modified to fit this pattern?
Causes	“However, neither rapid-response nor extended-response tasks are, we believe, the source of the biggest headache in managing “e-mail overload” (as defined in Whittaker and Sidner, 1996). We believe that a significant source of overloading is an overlooked factor that we call interdependent task management.”	(Bellotti et al., 2005)	Again, it is not tons of easy messages that cause information overload, it is a few hard, interdependent messages. What about auto-suggesting resources, like the MS video of underlined words?
Definition	“These are obligations that depend on the action of others to be fulfilled. We predict that if the quantity of e-mail were held constant, those with more interdependent tasks would feel more overloaded because, in addition to needing to manage rapid and extended responses, they have to remember to come back to tasks after being able to forget about them when a request for action is issued to someone else. Further, they have to manage other people’s activity to complete such tasks.”	(Bellotti et al., 2005)	Interdependent tasks
Facts	<ul style="list-style-type: none"> <li>• 23.1% reading e-mail.</li> <li>• 6.2% scanning inbox.</li> <li>• 2.4% deleting messages.</li> <li>• 2% looking for messages.</li> <li>• 1.1% spent adding attachments.</li> <li>• 9.5% filing messages.</li> <li>• 0.8% opening attachments.</li> <li>• Most of the rest spent writing e-mail and editing documents.</li> </ul>	(Bellotti et al., 2005)	The amount of time people spent doing different activities in email. 55% of time is therefore spent “writing e-mail and editing documents.”
Definition	“Rapid-response, extended-response, and interdependent tasks are what e-mail task management consists of.”	(Bellotti et al., 2005)	These are the three types of emails that can be present in email task management, according to this paper. – Awesome definition
Techniques	“Hollan and Stornetta (1992) suggested that ephemeralDLs would be a potentially interesting feature to add to e-mail clients. Their intuition is certainly corroborated by our study.”	(Bellotti et al., 2005)	Gmail does this now (you can make groups and send stuff to a group).

Behaviors	“In addition, managers are involved in more threads on a daily basis, although their threads do not apparently involve more steps than those of others.”	(Bellotti et al., 2005)	Lots of different threads (see the quote about managers dealing with 58 activities per day.)
Causes	“The difficulty arises because older messages in the thread drift out of the inbox or get filed and thus disappear from view and cease to act as reminders about the task in the inbox. ... Verbal reports and video data from our participants suggest that people are forgetting or doing extra work to avoid forgetting threads with these large intervals.”	(Bellotti et al., 2005)	This is one of the reasons that the fire-and-forget method doesn’t always work for interdependent tasks—they must be revisited by the person in order to be truly effective, and people forget to do that.
Causes	“Note that delays are not a problem, as long as they are not interfering with the completion of a task; one can simply forget about the thread until a response arrives. However, tasks can have deadlines or at least an issue of timeliness (in Bellotti et al., 2004, we found that after 2 weeks, incomplete “to-dos” are unlikely to ever get done, with 68% being done within a week). Thus, it is necessary to keep in mind ongoing interdependent tasks to make sure that they do not extend beyond a reasonable completion time.”	(Bellotti et al., 2005)	Again, this is the issue of fire-and-forget not working, and why. What if you could assign a deadline to an email, and if not responded to yet, would bring the message back from time to time for the recipient (and the sender?). Sounds anal but...
Techniques	“The thrask model was made considerably more powerful by elevating documents and links to be first-class citizens and displaying them in the preview pane when selected in the item list view.”	(Bellotti et al., 2005)	Just make it easy to see the data referred to in the email. I’m also thinking of the MS video where it would highlight a word and present you more information about it. That makes a lot of sense now.
Causes	“Overload is closely related to—in fact, enabled by—the phenomenon of “reinvention,” (Sproull & Kiesler, 1991) in which users take features intended for one purpose and use them for another. An example of how users reinvent to support overloaded functions is how people often mark an important message as “unread” so it will be visually distinctive and continue to catch their attention—completely changing the meaning of the “unread message” marker.”	(Wattenberg, Rohall, Gruen, & Kerr, 2005)	This makes me think that users will always be re-inventing and repurposing features in order to fit their specific scenarios and usage. There will never be one tool to rule them all. So is adding features kind of a futile effort in efficiency? Should we be attacking this from some other perspective other than adding features (ie, targeting behavior or something?)
Definitions	“Further evidence of e-mail overload comes from analysis of messages themselves. In Chu, Eagan, Stern, and Moody (2003), 15 e-mail users were asked detailed questions about the purposes of specific e-mail messages. Hand-clustering of the survey results revealed three rough categories of messages: those with a workflow character that required a response, those that provided information with no response expected, and those that are part of a traditional conversation. Within these, 12 fine-grained categories were	(Wattenberg et al., 2005)	Three types of email messages: <ol style="list-style-type: none"> <li>1. Workflow messages that require a response</li> <li>2. Information, no response required</li> <li>3. Conversations</li> </ol>

	found, ranging in character from negotiation of meeting times to automatically generated records such as pay stubs.”		
Behaviors	“The assistants helped their managers in many ways, but two particular types of action stood out. Assistants frequently directed attention, by prioritizing lists of messages, actively interrupting their managers, or highlighting important sections of a message, such as the mention of a particular colleague. They also frequently spent time in “context creation,” gathering additional pieces of information relevant to a particular message. Both behaviors address problems that could potentially be solved through software solutions as well; indeed, our work on threads, described later, can be viewed as a method of context creation.”	(Wattenberg et al., 2005)	Things assistants do: <ul style="list-style-type: none"> <li>• Direct attention</li> <li>• Prioritize messages</li> <li>• Highlight important information in body</li> <li>• Do context creation</li> </ul>
Definitions	“In addition, these studies revealed a bimodal distribution of threads: thread trees tend to be either “bushy” (many messages are a response to a single document) or deep (each message has a single reply, as in a chain of conversation). As suggested by Venolia and Neustaedter (2003), this dichotomy may reflect different common uses of e-mail; for example, informing a group of users and requesting feedback from each versus having an extended back-and-forth conversation with a small number of users.”	(Wattenberg et al., 2005)	Email threads tend to either be “bushy” or “deep,” so either lots of replies around one original message, or many sequential messages.
Techniques	“First, in many settings—such as a large corporation—significant “extra” data is available beyond what is found in standard e-mail headers. To give one example, corporate directories can be used to extract a variety of data on senders and recipients. Thus in the future, it may be desirable to automatically highlight messages that come from a user’s supervisor or otherwise use data from an organizational chart for display and message retrieval.”	(Wattenberg et al., 2005)	I had this idea too, and I've seen it elsewhere going back several years. So why hasn't this ever seemingly be integrated somewhere yet? Why do people suggest it but then don't test it?
Behaviors (bad)	“One reminding strategy involves setting up dedicated “to-do” folders containing reminders about outstanding tasks (Whittaker et al., 2002a; Whittaker & Sidner, 1996). However, we found that the majority of users (95%) abandoned this strategy, on the grounds that it required an additional cognitive step.”	(Whittaker, 2005)	Reminder folders or to-do folders generally don’t work (which is probably why I’ve also abandoned 3 or 4 really beautiful to-do apps too).
Behaviors (bad)	“A common strategy when being delegated collaborative tasks is to respond or forward the original message to relevant others, leaving the original message in the inbox as a reminder about that task. This serves to manipulate	(Whittaker, 2005)	This is an interesting mark to note that users know how to manipulate their own attention, or what tools/features of an email client can cause them further attention in the future. Worth remembering

	attention. Users know that they will return to the inbox to access new messages. In the course of doing so, they hope that they will see the reminder and recall the outstanding task.”		for future research, “What facets of your email use actually manipulate your attention? Which ones do you self-manipulate?”
Behaviors (bad)	“In a separate study, Venolia et al. (2001) found that leaving a message in the inbox was by far the most frequent reminding strategy. It was much more common than other techniques such as using flags or classifying messages as “to-do” items.”	(Whittaker, 2005)	Probably the least efficient method of dealing with information overload, but the most common.
Effects	“Visual reminding is compromised when there are too many inbox messages. As the number of inbox items increases, older outstanding items are overlooked when processing new incoming messages.”	(Whittaker, 2005)	This explains why even my Gmail approach to having my inbox be my todo would fail after 25 messages--I wouldn't see the old ones. Very likely in a corporate environment. So just archiving to clear an inbox isn't the only solution. What about setting a time to revisit the message, like Boomerang?
Miscellaneous	“Advocates of message removal argue that users’ main problem is that they receive too many messages with insufficient time to process these. According to this view, lack of time means that messages are left in the inbox, which then becomes unwieldy as unprocessed messages accumulate. A large volume of incoming messages also means that users don’t have enough time to remove processed messages from the inbox by filing them. Message removal has the simple aim of reducing the overall number of inbox items, rather than providing direct support for collaborative task management.”	(Whittaker, 2005)	Sounds like Inbox Zero and, to a large extent, Gmail's philosophy of email.
Techniques	“Personal filing has not been successful, however. It is not commonly used (Bälter, 1998; Bellotti et al., 2003; Whittaker & Sidner, 1996), despite being introduced over 15 years ago (Mackay et al., 1989; Malone et al., 1986) and being available for several years in commercial products such as Outlook, Eudora, Netscape, and NotesMail.”	(Whittaker, 2005)	Again, filing isn’t going to get us anywhere, so let’s forget about it at this point.
Techniques	“Filing is a major problem for e-mail users: Categorization is a cognitively difficult task (Lansdale, 1988; Malone, 1983; Whittaker & Sidner, 1996), made yet more difficult because folder categories change as the user’s work focus shifts (Kidd, 1994; Whittaker & Hirschberg, 2001; Whittaker & Sidner, 1996).”	(Whittaker, 2005)	Another reason why filing is difficult is that needs change, but folders don’t. (Sidenote: seems like effective searching overcomes all this EXCEPT for seeing long lists of disparate messages relating to something common that would have been otherwise represented by a folder.)
Techniques	“Several agent-based systems have been designed to provide assisted filing (Boone, 1998; Cohen, 1996; Mock, 2001; Segal & Kephart, 1999; Takkinen & Shahmehri,	(Whittaker, 2005)	Unfortunately then, even if it works with 85% accuracy, it isn’t going to do us any good to work with AI/ML to categorize.

	1998). These systems use machine learning techniques to automatically elicit the defining characteristics of existing folders, based on message header properties and content. ... More seriously, assisted filing does not get to the heart of the problem. As- sisted filing classifies inbox messages into existing folder categories, whereas a major user filing problem is with defining new folders (Whittaker & Sidner, 1996).”		
Behaviors (bad)	“Independent work by Venolia et al. (2001) confirmed this: Marking outstanding messages as unread was judged to be much more effective for reminding than using dedicated “to-do” flags or other types of visual coding.”	(Whittaker, 2005)	Again, probably the least effective way of preventing IO, but the most common and evidently most effective for users that manipulate their attention to get stuff done. Mind trick.
Causes	“One important limitation of more formal techniques is that they require transposition of information from one medium to another, for example, accessing a task from voicemail, and logging it in one’s day planner. Because of this, there is a tendency for people not to combine information into a centralized master list and people tend to leave information in the original delivery medium— whether this is e-mail, voicemail, or paper (Blandford&Green, 2001).”	(Whittaker, 2005)	Again, this is why to-do’s (folders and apps) don’t seem to work very well, because of the manual transfer of information.
Techniques	“One highly salient feature of paper-based task management is the use of spatial cues, in particular, “document piling” and “pile placement.” Piles consist of sets of associated documents, which are often related to tasks, with documents relating to a particular task being stored together. Spatial placement of the entire pile can also be a critical reminding cue. ... Furthermore, workspace piles usually relate to outstanding tasks. As with e-mail, once tasks are completed, then the contents of the relevant pile are filed away for archival purposes.”	(Whittaker, 2005)	Similar to my idea of a new GUI that represents different projects with piles. See their implementation and discussion of TeleNotes (p63 on) for what they found. Old old implementation (mid-90s) so we could probably do much more now.
Techniques	“All users exploited the spatial aspects of piles inTeleNotes to engage in task management. They placed different tasks at different desktop locations to manage different ongoing communications, with a median of four different task piles at any one time. ... Another reason was concerns about screen real estate (again mentioned by three users). Piles are deliberately designed to remain constantly visible on the user’s desktop, as reminders about outstanding communication tasks. A difficulty, however, is that piles also consume space: Constructing multiple piles reduces the space for viewing other desktop applications with	(Whittaker, 2005)	This would work <i>really</i> well in a touch-based environment, specifically a Surface or an infinite-plane iPad interface.

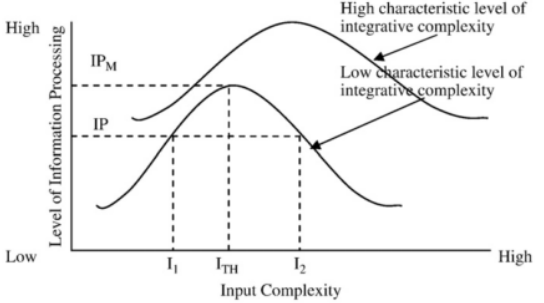
	which the user is actively working.”		
Techniques	“However, it seemed that people used TeleNotes to highlight important tasks. According to one user, ‘it’s good for pulling out tasks I want to be sure to remember, but I don’t want to use it for everything.’”	(Whittaker, 2005)	I wonder what would make it so that the person wouldn't want to use it for everything. Probably all the little tiny messages that are one-liners or one-timers. Maybe put them in a normal list view?
Techniques	“Although we provided users with the ability to specify their own task labels to differentiate different threads, users sometimes inadvertently gave tasks similar labels—a problem we had observed with e-mail folders. Two other users observed that when tasks became complex, they wished to generate subtasks, which are not represented in the current design.”	(Whittaker, 2005)	So maybe this type of system would work best not as an organization method, but as a gateway to then seeing a list of messages. "Click Door A to see all of the emails related to Project A" type deal.
Miscellaneous	“Both TeleNotes and ContactMap are radically different from most current e-mail systems, although we have strong evidence that they supported key Collaborative Task Management activities. Nevertheless, our users did not completely abandon their regular e-mailer. One reason for this was that neither of our prototypes was fully featured, so that users had to revert to their regular e-mailer when they needed features that were missing from our systems (Ducheneaut & Bellotti, 2001).”	(Whittaker, 2005)	Lesson learned (from this and several other papers): if you are going to introduce a radically different approach to email, your prototype had better not lack core features, or it will be viewed as a failure by users even if it was a success as far as the research goes. Either go 100% all the way and do a full client, or work within the bounds of an existing client. This halfway stuff just won't work in the real world.

## General Information Overload Articles

Topic/Idea	Quote	Citation	Thoughts
Behaviors (good)	“Companies also need to establish organizational norms for electronic communication, either explicit or implicit. If a standard is implicit, senior executives should set an example.”	(Hemp, 2009)	Example from text: train lower employees not to send weekly reports to all division heads just to maintain visibility.
Behaviors (good)	“A firm might create a weekly “e-mail–free morning”: a ban on in-house, though not external, e-mail (and possibly phone calls, instant messages, and drop-in chats). The aim would be to carve out an extended stretch of relatively uninterrupted time.”	(Hemp, 2009)	
Behaviors (good)	“...a manager might identify for her direct reports situations in which an in-person exchange or a phone call should replace an e-mail – not so much to foster face-to-face interactions as to speed decision making. When three or four e-mails have bounced around a group, someone may simply need to pick up the phone and settle the issue at hand.”	(Hemp, 2009)	
Behaviors (good)	“For example, e-mail could be reduced significantly if group newsletters and announcements were posted on a company intranet or wiki, which pulls in people seeking the information instead of pushing it at them. A rule of thumb: If the information in an e-mail you’re about to send, even if potentially important in the future, is not urgent, post rather than push.”	(Hemp, 2009)	This is mentioned elsewhere in an academic paper... <b>should find it.</b>
Business Issue	“Although nearly everyone acknowledges that individuals, to varying degrees, pay a personal price in their struggles to manage e-mail and other types of information, few businesses have viewed the challenge as a corporate issue.”	(Hemp, 2009)	This is really saying that companies need to tackle this on a corporate level. Unfortunately, a few well-intentioned individuals probably won’t be able to dig themselves out of the IO hole if everyone around them is still contributing to it.
Filtering	“Michalski can afford to let go a bit, because he has at his disposal a set of powerful and personalized filters: social networks that gather, select, and value information for him.”	(Hemp, 2009)	What other valuable filters exist that could be applied to help?
Costs (\$)	“Nathan Zeldes and two other researchers put Intel’s annual cost of reduced efficiency, in the form of time lost to handling unnecessary e-mail and recovering from information interruptions, at nearly \$1 billion.”	(Hemp, 2009)	‘nuff said. <b>(Find the original study)</b>

Costs (-)	“A study by Microsoft researchers tracking the e-mail habits of coworkers found that once their work had been interrupted by an e-mail notification, people took, on average, 24 minutes to return to the suspended task.”	(Hemp, 2009)	It goes on to say that perhaps up to half of the regearing is due to getting distracted by personal time wasting (Facebook, texts, surfing, etc.) (Find the original)
Costs (-)	“Another eerily familiar, if rarely articulated, consequence of information overload is receiving attention from researchers: the delay in decision making when you don’t know whether or when someone will answer an e-mail message.”	(Hemp, 2009)	Did I tick them off? Are they gone? Should I escalate? Are they just busy?
Facts	“Still, a survey of 2,300 Intel employees revealed that people judge nearly one- third of the messages they receive to be unnecessary. Given that those same employees spend about two hours a day processing e-mail (employees surveyed received an average of 350 messages a week, executives up to 300 a day), a serious amount of time is clearly being wasted.”	(Hemp, 2009)	That means savings of 40 minutes a day on average.
Facts	“Of course, not everyone feels overwhelmed by the torrent of information. Some are stimulated by it. But that raises the specter of...[cue scary music]...information addiction. According to a 2008 AOL survey of 4,000 e-mail users in the United States, 46% were “hooked” on e-mail. Nearly 60% of everyone surveyed checked e-mail in the bathroom, 15% checked it in church, and 11% had hidden the fact that they were checking it from a spouse or other family member.”	(Hemp, 2009)	This is another interesting facet of the problem—creating a dependency on the matter, instead of just facing it as a problem.
Effects	“Author Linda Stone, who coined the term “continuous partial attention” to describe the mental state of today’s knowledge workers, says she’s now noticing – get this – “e-mail apnea”: the unconscious suspension of regular and steady breathing when people tackle their e-mail.”	(Hemp, 2009)	
Effects	“Researchers say that the stress of not being able to process information as fast as it arrives – combined with the personal and social expectation that, say, you will answer every e-mail message – can deplete and demoralize you.”	(Hemp, 2009)	Probably will have a lot more specific stuff in some of the academic papers about this.
Miscellaneous	“Can everyone just stop whining about information overload? I mean, in the knowledge economy, information is our most valuable commodity.”	(Hemp, 2009)	Very valuable thought. Information is <i>the</i> currency of today. The companies that learn to manage this currency better than others will win the game.
Causes	“The productivity of individuals and groups depends strongly on their information-processing characteristics.” “Factors that contribute to information overload include non-routine tasks, task interdependencies [68], task interruptions [59], and time pressure.”	(Paul & Nazareth, 2010)	Explained more later, but the basic idea is that the more complex the information is and the less time you have to deal with it, the more IO you will experience.



Causes	<p>“Schroder et al. [55] proposed a nonlinear (inverted U-shaped) relationship between the complexity of input information and the level of information processing (Fig. 1), drawing from work by Miller on cognitive processing limitations [46]. The level of information processing is the maximum when the input complexity is moderate, i.e., neither too high nor too low. This is referred to as the “optimal point” of input complexity by Schroder et al. [55]. When input complexity increases, individuals increase their information processing up to the “optimal point” beyond which they fail to process all input information and experience information overload [26].”</p>	(Paul & Nazareth, 2010)	
Behaviors	<p>“Driver and Struefert [13] also imply that an individual's information seeking behavior is consistent with his or her information processing capability.”</p>	(Paul & Nazareth, 2010)	<p>In the end then, how a technology helps you process information should be based off of how you seek it.</p>
Causes	<p>“When the time required to process information exceeds the available time, information overload occurs [54].”</p>	(Paul & Nazareth, 2010)	
Causes	<p>“Likewise, increases in irrelevant information and loss of cognitive attention are posited to contribute to increased information overload [51].”</p>	(Paul & Nazareth, 2010)	
Causes	<p>“Prior research has shown that GSS-based groups can experience information overload as an unintended consequence of the use of technology. Some of this overload may be caused by the application of the technology itself, e.g. excessive discussion in computer mediated learning, free-wheeling in electronic brainstorming, and the like. However, in many decision making situations, a group may have to deal with potentially large amounts of available information, none of which is generated by the group itself. In these cases, the effects of overload may be experienced. Information overload situations can be avoided by operating in decision environments in which information load matches with the processing capacity of information [4]. Individuals assess overload conditions based on their ability to process input information load and their preference for the rate of processing information [50].”</p>	(Paul & Nazareth, 2010)	<p>Technology can be the cause, not just the cure! If you are not using technology correctly (too much/too little) or are using it to gather too much information (or too much is given to you by the system, ie, no built-in filtering) then you may experience IO. In order to mitigate this, match the technology to your information processing abilities/capacity.</p> <p><b>Q: How do you measure your processing capacity?</b></p>
Filtering	<p>“Hiltz and Turoff [23] also suggest that the use of filtering and scanning features in CMCS can help users to avoid information overload. The use of filtering mechanisms has also been advocated by Schultze and Vandenbosch [56]</p>	(Paul & Nazareth, 2010)	

	who studied users of LotusNotes in a firm.”		
Facts	“A survey of 840 organizations reports that 47% of their workers spend 1–2 h, and 34% spend more than 2 h on any given workday processing email (American Management Association 2004).”	(Gupta, Sharda, & Greve, 2010)	Whew, that’s a lot of email time.
Effects	“This is causing several problems. First, it leads to a perception of a shortage of time thereby resulting in information overload (Dennings 1982; Markus 1994; Berghal 1997; Jackson et al. 2003).”	(Gupta et al., 2010)	So, is the time really short? Or is it more the perception of a time shortage that leads to the IO?
Effects	“Knowledge workers often use audible and visual notifications such as messengers and have the tendency to respond to messages as soon as emails arrive (Jackson et al. 2003). This often results in the interruption of ongoing tasks. Jackson’s study suggests that although the time lost due to each email interruption may be small, the cumulative effect can become sufficiently large given that an organization is comprised of several knowledge workers, each receiving dozens of emails in need of processing each day.”	(Gupta et al., 2010)	Should probably <a href="#">look up this Jackson paper</a> , as it’s referenced a lot in this article.
Definition	“Another definition from the theory of distraction describes an interruption as “an externally generated, randomly occurring, discrete event that breaks the continuity of cognitive focus on a primary task” (Corragio 1990).”	(Gupta et al., 2010)	Good definition of “interruption.”
Definition	“When an email arrives randomly, additional time is needed to switch from a current work medium to the email medium. This time is referred to as switching time (Cutrell et al. 2000; Czerwinski et al. 2000) or more commonly as interruption lag (Trafton et al. 2003).”	(Gupta et al., 2010)	Definition of “switching time” or “interruption lag.”
Facts	“Jackson and colleagues (2001 and 2003) found that a knowledge worker takes an average of 1 min and 44 s to react to a new email by activating the email application.”	(Gupta et al., 2010)	Multiply that by 300 messages a day and you get 7.2 hours of email. Ouch.
Definition	“This recovery time is also referred to as resumption lag (Trafton et al. 2003) and has been reported to be around 64 s per email interruption (Jackson et al. 2003).”	(Gupta et al., 2010)	Definition of “resumption lag.”
Definition	“Based on the survey conducted by American Management Association (2004), we categorize knowledge workers, on the basis of their dependency on email communication, into four different types: very high users of email, high users, low users, and very low users. “Very high” users	(Gupta et al., 2010)	Definition of types of email loads/users.

	<p>spend an average of 4 h per workday processing email, “high” users 3 h, “low” users 2 h and “very low” users 1 h. “Very high” and “high” users of email typically represent workers with a higher need for communicating at work, e.g. executives, CEOs, distribution and marketing managers, sales personnel, marketing managers, workers at geographically dispersed organizations, etc. “Low” and “very low” users of email are knowledge workers with less communication requirements, e.g. office assistants, analysts, programmers, etc.”</p>																				
Effect	<p>“Zijlstra et al. (1999) also found that interruptions could cause people to perform a primary task more quickly, but postulated that the relationship between interruptions and task performance would be an inverted U-shape, indicating that the cumulative effect of interruptions at some point does have a negative effect on primary tasks.”</p>	(Gupta et al., 2010)	You do well under pressure <i>up to a point</i> , and then you start to perform more poorly.																		
Effects	<p><b>Additional time spent (in min)/ day</b></p> <table border="1"> <caption>Data for Fig. 5: Effect of policy x email dependency on primary task completion time</caption> <thead> <tr> <th>POLICY</th> <th>Exponential (Expo) (min/day)</th> <th>Non Stationary Expo (min/day)</th> </tr> </thead> <tbody> <tr> <td>C1</td> <td>~18</td> <td>~15</td> </tr> <tr> <td>C2</td> <td>~17</td> <td>~14</td> </tr> <tr> <td>C4</td> <td>~20</td> <td>~18</td> </tr> <tr> <td>C8</td> <td>~38</td> <td>~35</td> </tr> <tr> <td>C</td> <td>~60</td> <td>~50</td> </tr> </tbody> </table> <p><b>Fig. 5</b> Effect of policy x email dependency on primary task completion time</p>	POLICY	Exponential (Expo) (min/day)	Non Stationary Expo (min/day)	C1	~18	~15	C2	~17	~14	C4	~20	~18	C8	~38	~35	C	~60	~50	(Gupta et al., 2010)	Continuous is obviously bad. Half as bad is checking 8x/day (every 45 mins). Checking 4x/day seems to be the max for marginal returns, and be quite good (takes 1/3 <sup>rd</sup> the time to accomplish tasks).
POLICY	Exponential (Expo) (min/day)	Non Stationary Expo (min/day)																			
C1	~18	~15																			
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C4	~20	~18																			
C8	~38	~35																			
C	~60	~50																			
Definition	<p>“The term technostress was coined in 1984 by clinical psychologist Craig Brod, who described it as a modern disease caused by one’s inability to cope or deal with ICTs in a healthy manner.”</p>	(Ayyagari, Grover, & Purvis, 2011)	Real live disease. Good motivation to try and fix things.																		
Effects	<p>“Stress in the workplace is recognized as contributing to a litany of health and quality-of-life issues that could have far reaching consequences (Cooper et al. 1996; Sutherland and Cooper 1990; Tennant 2001).”</p>	(Ayyagari et al., 2011)	Again, a real, physical issue.																		
Effects	<p>“The use of ICTs has produced a perpetual urgency and creates expectations that people need, or are obligated, to work faster (Hind 1998). Straub and Karahanna (1998) argue that technostress likely comes from the</p>	(Ayyagari et al., 2011)	Very interesting idea, because when you switch between email and other primary tasks, you are certainly fragmenting your work. A little reminder adds to that sense of urgency. Therefore, finding																		

	fragmentation of work.”		ways to keep tasks contiguous and to remove urgent expectations (or replace urgent needs with proper channels of communication) could go a long way.
Effects	“Stressed IT professionals are linked to issues of organizational commitment, turnover intentions, and work exhaustion (Ahuja et al. 2007; Moore 2000).”	(Ayyagari et al., 2011)	Want to reduce turnover and other costly problems? Reduce technostress.
Effects	“Two recent studies have emphasized the importance of technostress by studying the impacts of technostress (Ragunathan et al. 2008; Tarafdar et al. 2007). These studies have found that individuals experiencing technostress have lower productivity and job satisfaction, and decreased commitment to the organization.”	(Ayyagari et al., 2011)	Again, issues of commitment and job satisfaction can be very costly to an organization. Dealing with the technostress created in a job could have a real monetary effect by reducing these costs.
Definitions	“Stress arises when an individual appraises the demands placed by the environment as exceeding the individual’s resources, thereby threatening the individual’s well-being (Cooper et al. 2001; Lazarus 1991).”	(Ayyagari et al., 2011)	You get stressed out when there is more to do than you can do.
Causes	“The acts of certain highly motivated individuals create unspoken norms (Davis 2002) for the whole group or organization (for example, in terms of responding to e-mails quickly), commonly referred to as “tragedy of commons.””	(Ayyagari et al., 2011)	This is a real issue, and one that must be dealt with somehow on a group level by establishing expectations?
Effects	“The results of the present study suggest that technostress is real, and deserves attention in the present technology-oriented environment. The results indicate that approximately 35 percent of the variance in strain is explained by proposed stressors (i.e., work overload, role ambiguity, work-home conflict, job insecurity and invasion of privacy offered in H10). The strongest contributors to strain in this sample were role ambiguity and work overload, which exhibited similar path coefficients. The next strongest predictor was work-home conflict, followed by job insecurity. Contrary to expectations, invasion of privacy did not significantly relate to strain.”	(Ayyagari et al., 2011)	Stress from technology can be traced to stress caused by: <ol style="list-style-type: none"> <li>1. Role ambiguity</li> <li>2. Work overload</li> <li>3. Work-home conflict</li> <li>4. Job insecurity</li> </ol> Interestingly, invasion of privacy doesn’t stress people out (just think of Facebook).
Miscellaneous	“The results provide indirect empirical support for the argument that in an information economy, attention is a scarce resource (Davenport and Beck 2001).”	(Ayyagari et al., 2011)	That’s a great tagline: “your attention is a scarce resource.”
Miscellaneous	“For instance, Weber (2004) called for more research to better understand e-mail in organizational context, including understanding the stressful effects of e-mail. The conceptualization presented in this inquiry could be applied to e-mail, not only to address whether use of e-mail	(Ayyagari et al., 2011)	Could we use their same instruments, replacing “ICTs” with “email” to generate data like that?

	systems is stressful, but also to shed light on what aspects of e-mail systems are stressful.”		
Behaviors (bad)	“Multicasting – Anyone can send e-mails to any individual and many individuals at one time, contributing further toward receivers’ overload. This problem is compounded when individuals send multiple reminders and queries (simply because they can) that are often unnecessary. The result is redundant information and multiple interruptions, ultimately causing receivers’ overload.”	(Gupta, Sharda, Ducheneaut, Zhao, & Weber, 2006)	How can we avoid multicasting?
Miscellaneous	“The availability of data is a major challenge to pursue research in this area (due to various privacy issues).”	(Gupta et al., 2006)	Building an email anonymizing tool could be valuable for research (masks sender/receiver names/addresses, project names, dollar figures, dates/times, etc.)
Future Research	<p>“Current e-mail clients need to be redesigned to manage complex, interdependent tasks. There are four main requirements:</p> <ol style="list-style-type: none"> <li>1. Break the messaging-system metaphor - The principle for achieving this outcome is ‘task-centric collections.’ Interest should be on the task and not on the individual messages when arranging them. Individual messages can represent tasks, but interdependent tasks comprise threads of message files, links, and drafts. The incoming messages (replies in a thread, with any attendant files or links) should be grouped automatically by analyzing the message data. Attachments become “first-class citizens” - they are often more important than the message itself. Attachments and links must take precedence over the message.</li> <li>2. Application Neutrality – E-mail is like a habitat, and thus, application switching while working on e-mails should be minimized.</li> <li>3. Task-centric meta-information for items within e-mail - Information such as deadlines, reminders, and actions within e-mails should be assigned meta-information so that concurrent activities can be tracked.</li> <li>4. Aggregation of information for an overview - This will allow the state of all tasks to be assessed at-a-glance instead of scrolling through folders.”</li> </ol>	(Gupta et al., 2006)	Great summary of “what to do now.”
Facts	“Interruptions, in general, consume about 28 percent of a knowledge worker's day, which leads to 28 billion lost hours per year in the United States (Spira and Feintuch, 2005). At an average cost of \$21 per hour (U.S.	(Gupta et al., 2006)	Ouch, more than half a trillion dollars is lost due to interruptions here.

	Department of Labor Bureau of Labor Statistics, June 2005), this translates into an annual cost of \$588 billion to U.S. companies (Spira, 2005).”		
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## IORG Specific Papers

Topic/Idea	Quote	Citation	Thoughts
Behaviors	“Previous work has demonstrated that people have rhythmic temporal patterns of activity in the workplace, and that these rhythms can help coordinate interaction (Begole et al., 2002).”	(Tyler & Tang, 2003)	
	“Those with larger inbox sizes relied more on search rather than filing messages into folders.”	(Tyler & Tang, 2003)	Who has a small inbox these days? No one. ☺ So maybe that’s why search should be more prevalent.
Behaviors	“Our interviews showed that people had a clear sense of when to expect email responses from people based on how quickly they had responded in the past, and that they could form this expectation after just a few interactions.”	(Tyler & Tang, 2003)	If people can learn it that quickly, then a machine ought to be able to do so as well. This would be valuable information to show when composing a message to someone.
Behaviors	“We initially expected individuals to exhibit different types of basal email rhythms (e.g. Alice is a “fast emailer” whereas Bob is “slow”). While those differences exist, we generally found more significant timing themes on a per-organization, per-relationship, and per-conversation basis. For example, our subjects typically responded more quickly to: <ul style="list-style-type: none"> <li>• messages from people within their workgroup (per-organization)</li> <li>• messages from people with whom they have a history of quick communication (per-relationship)</li> <li>• messages in a continuing conversation thread (per-conversation)”</li> </ul>	(Tyler & Tang, 2003)	There are exceptions to general response times, as mentioned here.
Behaviors	“In the course of our interviews, we found a family of behaviors that reflect a user’s desire to project a specific image of the time between receiving and reading or replying to email. We call this projection the user’s responsiveness image. ... In our interviews, we observed that people actively craft their image through the way they respond to email. People go to special lengths to project a certain type of responsiveness, in certain situations.”	(Tyler & Tang, 2003)	We actively try to manage the perception that others have of how responsive we will be to emails, very interesting. Could software give us a dial that allows us to communicate this to others (built in to the “expect a response from this person in X hours” prompt when composing?)
Behaviors	“Besides tracking people’s historical response rates, other contextual cues for response rate were conveyed through email itself. An important resource is the use of “auto-reply” or “vacation” messages. This feature creates an automatic response to any email received with a message	(Tyler & Tang, 2003)	Another clue for determining responsiveness: auto-away messages.

	that usually explains that the user is absent and sets an expectation of when they will be able to respond to the message.”		
Behavior	“One interesting use of the auto-reply feature was described by Ellen, a supply buyer. She typically takes a day to catch up on email after returning from an extended trip. During this time, she may be less responsive to new incoming mail. Her solution is to leave the ‘Out-of-Office’ auto-reply feature activated during this day after she returns (even though she is in her office), conveying to others that they should not expect her typical responsiveness.”	(Tyler & Tang, 2003)	This is another example of users using a feature of an email client to purposefully manipulate attention or awareness. Way to go users.
Behaviors	“Others also mentioned that they could sometimes tell when an email correspondent was busy or in a rush through the writing style of the message. If the message had typographical errors, no capitalization or punctuation, incomplete sentences, or other indications of being hurried, that could convey that the email sender was busy, especially if that was not their usual writing style.”	(Tyler & Tang, 2003)	Another cue that a machine learning algorithm ought to be able to pick up on to determine further responsiveness. (Albeit this would most likely need to be implemented server side to track against previous styles of all messages and do the comparison.)
Behaviors	“Shared online calendars have been shown to be a valuable resource for coordinating group work (Palen, 1999), and several users mentioned them as a way of explaining email delays.”	(Tyler & Tang, 2003)	And yet one more tool for determining responsiveness.
Behaviors	“A common tactic we observed when a message was important or urgent was to send a voicemail in conjunction with an email. Typically, the email contained detailed data or attached documents, and the voicemail signaled the urgency of the message.”	(Tyler & Tang, 2003)	Sounds like a pain for the recipient, but it makes sense.
Behaviors	“Also, personal email has a different asynchronous style associated with it. People often do not expect responses to personal email within a day. They do not seem to expect such a high priority in responding to personal email, and think of it more like traditional letter writing where a response could be more leisurely.”	(Tyler & Tang, 2003)	This presents the other side of emailing (personal communication) that appears to be able to vary widely from business email.
Behaviors	“We also noticed several instances of the same two people carrying on two or more overlapping conversations, each with distinct timing patterns. These observations suggest that reciprocity can be a per-conversation as well as a per-relationship phenomenon.”	(Tyler & Tang, 2003)	This obviously presents a challenge to any ML algorithm, because in my experience it is very true that different conversations can have different reply rates. Very interesting facet however.
Definition	“Whittaker and Sidner’s 1996 paper on email overload [8] explored how people manage their email and noted that email was not only for communication, but for both task management and maintaining personal archives—that is,	(Fisher, Brush, Gleave, & Smith, 2006)	Ah, so that is the other meaning of overloaded, as in an overloaded method. Meaning using it for more than just communication. That makes more sense now.



	email was ‘overloaded.’”		
Facts	“Today, the total messages in our 600 users’ email archives are distributed in a power-law curve <sup>1</sup> , with the mean at 28,660 email items (median = 15,797). As shown in Table 1, this is more than 10 times the average size of the 1996 archive of 2,482.”	(Fisher et al., 2006)	In other words, inboxes are a lot bigger than they used to be. Elsewhere in the article it also talks about the average number of received messages doubling in 10 years to 87/day (median was lower). The group we care about, executives, are probably the cause of that, and so the problem is growing.
Techniques	“However, the stark contrast to 1996 does highlight the importance of search and organization tools, particularly if we believe people’s email archives will continue to grow.”	(Fisher et al., 2006)	Search is becoming ever more important in email. Indeed, it is a vast repository of knowledge, much like a mini-Internet.
Techniques	“Perhaps more interesting is that the percentage of very large folders a user has is somewhat negatively correlated to number of folders ( $\rho = -0.456$ , $p < 0.001$ ). This suggests that people with many big folders also have fewer folders overall. This may happen as people come to rely on technologies like desktop search and begin to pile messages into fewer folders.”	(Fisher et al., 2006)	Again, search is becoming extremely important.
Definitions	“We believe that the strategies that Whittaker and Sidner describe still function as ideal types. Interviews with participants might allow us to explicitly categorize participants based on how they felt about their folder usage and the size of their inbox. However, our quantitative data does not reflect the clear groupings we might expect if participants were consistently applying one email handling strategy.”	(Fisher et al., 2006)	So the original definitions (no filers, frequent filers, or spring filers) still apply, with perhaps the addition of “few folder filers.” However, a straight up categorization is not possible based just on numbers, you have to do interviews to figure that out. Maybe some future research opportunity here.
Definitions	“The first use of the term “email overload” came from Whittaker and Sidner [8], and referred to the many different functions that email served: as calendar, to-do list, data archive, and contact list. The term “overload” has been broadly reinterpreted since as the feeling of being overwhelmed by email [7]. While some sources disagree [3], others argue that incoming email carries so many new tasks that users cannot keep up to date [2]. The popularity of email disciplines and methodologies [1,6] suggest that there is a general concern about overload.”	(Hogan & Fisher, 2006)	Again, a redefinition of what overload is/was, and what it has morphed into today.
Definition	“Bellotti et al. [2], examining email as a center for tasks, found that users’ perceptions of overload corresponds to the number of unresolved tasks in the users’ inbox (and not the volume of messages incoming).”	(Hogan & Fisher, 2006)	Ah, now this is good to know. Email Overload /= # of messages, but = # of tasks. <b>Find this paper.</b>

Instrument	“Our scale can be used not only to judge degree of overload within a population, but can be used to examine correlates of overload in email and organizational behavior.”	(Hogan & Fisher, 2006)	Nice, easy to use Likert scale in here on measuring overload (that’s the purpose of this paper).
Facts	“The preferred model (shown in Table 2) indicates that overload is connected to both to behavioral factors (how the user responds to those messages, variables 1-6) and to structural factors (what sort of email comes to the user, 7-9). Users are more likely to suffer from overload if they are distracted by notifications (1) or if they try to pick-and-choose important messages (3) using a multi-pass strategy; users are less likely if they feel that they can keep on top of their email (2, 6). We find that overload is actually negatively related to incoming messages that are addressed to the user (9). This is fortunate, because it suggests that overload may be aided by a ‘restructuring’ of the email checking process, rather than simply ‘getting less mail.’”	(Hogan & Fisher, 2006)	Get help interpreting these results.
Facts	“White-collar work is communication-intensive. According to both shadowing and diary studies, managers spend 50-80% of their day in interpersonal communication, and professionals spend 35-60% of their day in communication with co-workers [21, 22].”	(Dabbish & Kraut, 2006)	That’s a lot of communication.
Behaviors	“Researchers have noted that email is used for many other functions beyond simply communicating, most importantly information archiving, and task management [3, 4, 6, 19, 25, 30, 31].”	(Dabbish & Kraut, 2006)	Again, our email inboxes are becoming a mini-Internet.
Miscellaneous	“Like the current study, they conclude that the nature of the tasks the workers perform shape the tactics they use to manage their email and that some tactics help them cope better than others.”	(Dabbish & Kraut, 2006)	Tasks => coping tactics. How you deal with stuff varies then with the task at hand.
Miscellaneous	“Increased email overload, however, was associated with reduced coordination effectiveness. This demonstrates a very real connection between efficacy with a communication medium (email) and the ability to coordinate work not noted in previous work on task coordination.”	(Dabbish & Kraut, 2006)	
Behaviors	“The surprising and counter-intuitive finding that restricting email checking actually results in increased task coordination is difficult to understand. This relationship may occur because individuals who restrict checking their email are less fragmented in their attention and more effective at completing work tasks. Or this relationship may	(Dabbish & Kraut, 2006)	They bring up a good point here about how checking only at certain intervals increases expected response times, and this may cause some people stress. However, it may also be because we are looking at to different outcomes: 1) does checking at intervals decrease overall email overload and 2)

	occur because restricted checking periods increase certainty around an individual's expected reply time to email and in turn facilitate coordination with other team members. It may be useful to examine the role of email response expectations and distraction on task coordination."		does checking at intervals increase overall productivity? The two are not necessarily correlated I don't think.
Causes	"Iqbal and Bailey have shown that interruptions during periods of higher mental workload cause users to take longer to resume their suspended tasks and have larger negative affect [19]."	(Iqbal & Horvitz, 2007)	The higher your mental workload, the worse interruptions are going to affect you.
Facts	"Mark et al. have sought to understand the influence of interruptions on task switching and found that users frequently switch between tasks and 57% of their activities are interrupted [22]."	(Iqbal & Horvitz, 2007)	Over half of all of our tasks are interrupted.
Facts	"For email, the average time to return to any suspended application (time spent on the diversion) was 9 minutes and 33 seconds (S.D.=13m, 15s). For IM, the return time was 8 minutes (S.D.=11m, 32s) on average."	(Iqbal & Horvitz, 2007)	When you switch to another task, in this case email or IM, you will normally spend between 8 and 9.5 minutes there.
Facts	"Overall, for email alerts, suspended application windows that were less than 25% visible because of obscuration by other windows took significantly longer to return to as compared to application windows that were more than 75% visible ( $t(20)=3.131, p<0.005$ ). ... Whether or not participants indeed had the ability to maintain awareness of suspended tasks, our study suggested that visibility of the suspended application windows may have often served as a reminder to return to tasks."	(Iqbal & Horvitz, 2007)	It is helpful to actually still be able to see your old task in order to switch back to it. Out of sight, out of mind.
Facts	"An immediate response to an email alert was associated with users taking, on average, 16 minutes and 33 seconds (S.D.=27m, 20s) in the resumption phase before returning to the state of the application in advance of the suspension. For delayed responses, the resumption phase spanned 15 minutes and 50 seconds (S.D.=25m, 5s) on average, not significantly different from the resumption time for immediate responses."	(Iqbal & Horvitz, 2007)	Phew! So it takes you on average 16.5 minutes to get back up to speed on your primary task, after it already took you 9.5 minutes to read/respond to an email. So now 26 minutes have passed and you're finally back to where you were. This obviously needs to be compressed. I find it interesting that IMs don't require significantly less time to work through than emails. I would have thought task switching with an IM window would be much higher, like when I switch between Gchat and other stuff. This kind of indicates that, even if your email client were to ask you for a simple up/down yes/no, it may still be highly detrimental.

Behavior	“In the interviews, users who responded to IM more quickly than to email cited two reasons for such quicker responses: one, they could quickly respond and switch back to what they were doing and two, they felt the social obligation of responding quickly as someone was waiting on the other end.”	(Iqbal & Horvitz, 2007)	Social contracts, darn.
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## Bibliography

- Ayyagari, R., Grover, V., & Purvis, R. (2011). TECHNOSTRESS: TECHNOLOGICAL ANTECEDENTS AND IMPLICATIONS. *MIS Quarterly*, 35(4), 831-858. Retrieved from <http://www.misq.org/skin/frontend/default/misq/pdf/appendices/2011/AyyagariGroverPurvisAppendices.pdf>
- Bellotti, V., Ducheneaut, N., & Howard, M. (2005). Quality versus quantity: E-mail-centric task management and its relation with overload. *Human-Computer Interaction*, 20, 89-138. Retrieved from <http://portal.acm.org/citation.cfm?id=1466574>
- Dabbish, L. A., & Kraut, R. E. (2006). Email overload at work: An analysis of factors associated with email strain. *CSCW '06 Computer Supported Cooperative Work* (pp. 431-440). Banff, Alberta, Canada. Retrieved from <http://dl.acm.org/citation.cfm?id=1180941>
- Ducheneaut, N., & Watts, L. A. (2005). In search of coherence: a review of e-mail research. *Human-Computer Interaction*, 20, 11-48. Retrieved from <http://portal.acm.org/citation.cfm?id=1466572>
- Fisher, D., Brush, A., Gleave, E., & Smith, M. A. (2006). Revisiting Whittaker & Sidner's "Email Overload" ten years later. *CSCW '06 Computer Supported Cooperative Work* (pp. 309-312). Banff, Alberta, Canada. Retrieved from <http://dl.acm.org/citation.cfm?id=1180922>
- Gupta, A., Sharda, R., & Greve, R. a. (2010). You've got email! Does it really matter to process emails now or later? *Information Systems Frontiers*, 13(5), 637-653. doi:10.1007/s10796-010-9242-4
- Gupta, A., Sharda, R., Ducheneaut, N., Zhao, J. L., & Weber, R. (2006). E-mail Management: A Techno-Managerial Research Perspective. *Communications of the Association for Information Systems*, 17, 941-961.
- Hemp, P. (2009). Death by information overload. *Harvard Business Review*, 87(9), 83-89. Harvard Business School Publication Corp. Retrieved from [http://ocvets4pets.com/archive21/Death\\_by\\_Information\\_Overload\\_-\\_HBR.org.pdf](http://ocvets4pets.com/archive21/Death_by_Information_Overload_-_HBR.org.pdf)
- Hogan, B., & Fisher, D. (2006). A scale for measuring email overload. *Microsoft Research*, 7-9. Retrieved from <http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:A+Scale+for+Measuring+Email+Overload#0>
- Iqbal, S. T., & Horvitz, E. (2007). Disruption and recovery of computing tasks: field study, analysis, and directions. *Proceedings of the SIGCHI conference on Human factors in computing systems* (pp. 677-686). ACM. Retrieved from <http://dl.acm.org/citation.cfm?id=1240624.1240730>

- Paul, S., & Nazareth, D. L. (2010). Input information complexity, perceived time pressure, and information processing in GSS-based work groups: An experimental investigation using a decision schema to alleviate information overload conditions. *Decision Support Systems*, 49(1), 31-40. Elsevier B.V. doi:10.1016/j.dss.2009.12.007
- Tyler, J. R., & Tang, J. C. (2003). When can I expect an email response? A study of rhythms in email usage. *Proceedings of the eighth conference on European Conference on Computer Supported Cooperative Work* (pp. 239–258). Kluwer Academic Publishers. Retrieved from <http://dl.acm.org/citation.cfm?id=1241902>
- Wattenberg, M., Rohall, S. L., Gruen, D., & Kerr, B. (2005). E-mail research: targeting the enterprise. *Human-Computer Interaction*, 20(1), 139–162. L. Erlbaum Associates Inc. Retrieved from <http://portal.acm.org/citation.cfm?id=1466575>
- Whittaker, S. (2005). Supporting collaborative task management in e-mail. *Human-Computer Interaction*, 20(1), 49–88. L. Erlbaum Associates Inc. Retrieved from <http://portal.acm.org/citation.cfm?id=1466573>