Email Overload at Work: An Analysis of Factors Associated with Email Strain

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ABSTRACT
Almost every office worker can relate to feelings of email overload and stress, but in reality the concept of email strain is not well understood. In this paper, we describe a large-scale nationwide organizational survey examining the relationship between email use and feelings of email overload and task coordination. We found that higher email volume was associated with increased feelings of email overload, but this relationship was moderated by certain email management strategies. The contribution to the field of CSCW is a better understanding of the concept of email related stress, and initial scale development for the assessment of email-related overload and perceptions of the work-importance of email.

Categories and Subject Descriptors
H.5.3 [**Information Interfaces and Presentation**]: Group and Organization Interfaces – *computer supported cooperative work, synchronous interaction*

General Terms
Design, Human Factors, Management, Measurement

Keywords
Computer-mediated communication, Coordination, E-mail, Electronic mail, Email, Overload, Stress, Strain

1. INTRODUCTION
The nature of workplace communication has changed over the past 50 years, in large part due to the introduction of networks and electronic communication systems. People and information are easier to access than ever before, and organizations are now thought of as networks of individuals rather than strict hierarchies or location based entities [25].

However, much of the classic research on the nature of communication at work was done prior to the introduction of electronic communication technology [21]. In the late 1980's and early 1990's, as organizations began to adopt information technology and electronic communication systems, many scholars predicted that these technologies would alter the face of the workplace potentially leading to problems of information overload [26]. With the rapid adoption of email as a central method of communication and information exchange in the work place, organizational and technological research has not yet caught up in understanding the ways that the nature of work has changed in the networked organization.

Email is, to date, the most successful and widely used form of computer-mediated communication. Even though classic research on workplace behavior emphasized a preference for face-to-face communication and distain for the written word as means for exchanging up-to-date information and handling the complex and equivocal affairs of project management [5, 21] electronic mail seems to be gaining on phone and face-to-face interaction by leaps and bounds as the central method of information exchange at work [16].

The dramatic increase in the use of email as a method for workplace communication over the past 10 years along with daily experiences with email failures has contributed to the notion in the popular press of increases in "email overload" or email related stress. Unlike Whittaker and Sidner [31] who use the term "email overload" ironically to refer to the expansion of electronic mail beyond its basic communication functions, we use the term literally to mean email users' perceptions that their own use of email has gotten out of control because they receive and send more email than they can handle, find, or process effectively.

It is unclear whether email overload is simply media hyperbole and a backhanded expression of nostalgia for communication methods of the past, or whether it is a real phenomenon that has consequence at the individual and organizational levels. The study reported here aims to answer the following research questions:

- Is email overload a distinct and measurable concept or is it simply a reflection of more general, communication intensity, work life, or role overload at work?
- Is email overload simply a function of email volume or do other job-related and communication-related factors have an influence? In particular, are there certain email management strategies that help people deal with a large volume of email?

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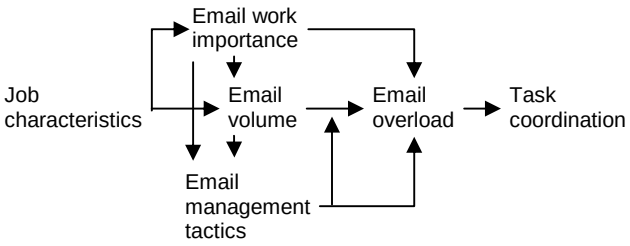
- Does email overload have discernable consequences for the individuals and organizations that experience it?

To address these questions we conducted a national survey of white-collar workers in the United States. The survey asked respondents about the nature of their job, the importance of electronic mail in doing their jobs, and the strategies they used to handle their mail. We used regression techniques to develop a path model of the relationship between job characteristics, email communication, email management strategies and feelings of email overload. We then looked to understand how these feelings of email stress related to the more general work outcome of task coordination. Figure 1 shows a schematic view of the research framework that we describe and test in more detail below.

Figure 1 – Research framework



2. RELATED WORK

2.1 Communication in the Workplace

White-collar work is communication-intensive. According to both shadowing and diary studies, mangers spend 50-80% of their day in interpersonal communication, and professionals spend 35-60% of their day in communication with co-workers [21, 22]. According to organizational theorists, these descriptive results occur, because the complex, dynamic and interdependent nature of the work that many professionals and managers perform requires communication to be successful [20, 27]. Because plans are rarely detailed enough and are frequently made obsolete under the pressure of dynamically changing circumstances, managers and professionals cannot coordinate using planning and routines the way that people with more independent or routine jobs can [6, 20, 21, 27].

The same literature that emphasizes the communicative nature of managerial and professional work also stresses a preference for in-person communication and an under use and even aversion to text-based communication [21]. According to this perspective, text-based communication is too slow and rigid to be compatible with the rapid changes and ambiguities associated with highly interdependent and dynamic work [5, 6, 21].

Although they differ in the direction of their predictions, both of these positions predict that the nature of individuals' jobs and the tasks they perform should affect how important email is for their work and the volume of email they exchange. To the extent that email is only another tool to help white-collar workers deal with communication-intensive jobs, then we expect that people who have more relationally complex jobs, with more supervisors, subordinates, and projects to manage will see email as more important and exchange more of it.

Levels of interdependence, autonomy, and task variety influence the nature and amount of communication people engage in with relation to their work [20], and we wanted to include these features of work in our model of email overload. Interdependence is typically defined as how much an individual's work depends on and influences the work of others [11]. Jobs with higher levels of interdependence should be associated with greater need for coordination of work tasks and higher levels of communication [6]. In turn, we expect email to serve an important role in the work of highly interdependent people.

The amount of freedom or autonomy allowed in a job is strongly related to feelings of general job stress [15]. Autonomy is defined as the extent to which individuals are able to decide when and how they carry out their work [11]. The more freedom a job allows, the greater control individuals feel over their work tasks, and in turn the more satisfied and less stressed they are with work [15].

Finally, the level of task variety can have an influence on communication utility. Task variety here refers to how much variation there is in an individual's day to day work tasks [11]. Workers who are required to engage in many different types of tasks may find communication more central to their work because of the need to tap others in the organization with widely varying skills and experiences relevant to their current task. In addition they can feel higher levels of role strain and role conflict because they are being asked to do many different types of work [12].

2.2 Email Management Tactics

2.2.1 Handling the flow of incoming messages

Although researchers [3, 7, 19, 26, 31] have identified many functions that email serves in accomplishing work, email is fundamentally an interpersonal and organizational communication tool. Its extended functions derive from its role as a communication medium. People use it for task and information management because so many of their tasks and so much of their information is exchanged via electronic mail.

With respect to feelings of email overload and behavior associated with handling the incoming flow of messages, our hypotheses were that frequently checking for new email messages would increase feelings of email overload because of the subsequent interruption and disruption to ongoing tasks [13], while restricting yourself to checking email at specific times would result in decreased feelings of email overload.

2.2.2 Archiving messages for later use

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]. These functions of email are naturally associated with different types of message handling behaviors which may increase or decrease feelings of email overload.

Whittaker and Sidner [31] classified email users into three group in terms of their filing and archiving behavior.: *frequent filers* who constantly cleaned their inbox, *spring cleaners* who cleaned their inbox once every few months, or *no filers* who did not clean up their inbox and used search tools to manage it. People file messages into mail folders to make them easier to find. Whittaker and Sidner's qualitative evidence was that frequent filers report feeling control over their email. However, these researchers note

multiple problems with frequent filing, including the cognitive effort of creating the folders, "failed folders" that are created but not used, and the loss of important reminders buried in folders. Based on key-stroke-level modeling, Bälter [1] concluded that higher numbers of folders in the archiving hierarchy actually decreased the efficiency of message storage and retrieval, because of the additional time required in searching for the appropriate folder when filing, and again when retrieving a particular message.

Because the function of email as an information archive is so important for work, we expected filing behaviors to have an influence on feelings of email overload. Based on the previous work on email filing, our hypotheses were that people who frequently filed messages into folders and kept a substantial hierarchy of folders would feel less overloaded with email because of their more organized and structured use of the medium.

2.2.3 Inbox message visibility

Ducheneaut and Bellotti [3, 7] performed a study of email use across three organizations and found most notably that people used emails as reminders for things they had to do and for task management more generally. Because the email inbox was frequently viewed in checking for new incoming communication, it was a particularly useful place for leaving messages needing action. However, higher volumes of incoming email meant that this email handling strategy backfired in that messages were quick to fall off the email horizon. We were interested in examining the use of the inbox as a to-do list, and behaviors that should influence the visibility of individual email messages in the inbox, such as leaving messages in the inbox, and deleting messages after reading them. These email management tactics may moderate the relationship between email volume and feelings of email overload.

2.3 Email communication and coordination

Communication in the workplace is used for coordination—managing interdependencies with others [27]. Unstructured interpersonal communication is an example of an organic coordination process through mutual adjustment [20]. When coordinating in this way, individuals exchange information about their current states and adjust their behavior to others' goals and actions in a dynamic manner [27].

To the extent that electronic mail is a tool for coordination, we expect that people who use it more and for whom it is a more important aspect of their work life would report that they have more successfully coordinated their work with others. However, to the extent that email overload undercuts the potential benefits associated with the use of electronic mail, we expect that people experiencing email overload will report less successful coordination with others.

3. METHOD

Our goal in this work was to examine associations between the perceived importance of email to work, email volume, and feelings of email overload proposed in figure 1. In order to collect data from a set of individuals with widely varying job characteristics, and begin to quantify the notion of email strain, we utilized a survey approach. Using a survey meant that the data we gathered were entirely self-reported respondent perceptions.

3.1 Sample

Survey participants were recruited from across the United States using a survey sampling service. Invitations to participate were sent via electronic mail to 3900 individuals randomly selected from the sampling service database, stratified by organizational size and job type (managerial, professional, and sales); participants were given 5 dollars as compensation for completing the survey, and entered into a weekly raffle to win 200 dollars. Seven hundred people attempted to complete the survey, for a response rate of 18%. Of these, we screened out 150 respondents as ineligible because they did not have a job or did not use email for their work. A total of 484 individuals completed the survey in its entirety (12% of the initial mail out).

Participants ranged in age from 20 to 81, with the average age being 43.5. Respondents were more likely to be female (65%) and more likely to have a higher income than the sample as a whole. Forty-five percent of the respondents indicated they were in a professional occupation, 26% were in managerial occupation, and 18% were in sales. Participants' tenure in their current position ranged form less than one year, to 46 years with the average number of years in the current position being 8.4 (Std. Dev.=8.4 years). Respondents in our sample worked an average of four days per week (Std. Dev=1 day), an average of 10 hours per day (Std. Dev=3 hours), and used a computer for an average of 6 hours per day to do their work (Std. Dev. =3.6 hours).

Respondents were fairly well distributed across organizational sizes, with 47% of the sample coming from organizations smaller than 500 employees, 20% of the sample coming from organizations with 500-2499 employees, and 29% of the sample from larger organizations.

3.2 Measures

To test our central hypotheses regarding email usage, participants were asked about their perceptions of email work importance, their general email management tactics, their feelings of email overload, and their task coordination. Participants were also asked about the nature of their work to control for general job characteristics that might affect feelings of overload.

3.2.1 Job Characteristics

3.2.1.1 Relational complexity

To assess an individual's general job complexity, respondents indicated the number of people reporting to them (span of control or number of subordinates), the number of managers they report to, and the number of projects they were involved with.

3.2.1.2 Interdependence, Autonomy, & Task Variety

To assess other features of work likely to be associated with email importance, value and overload, we used the Interdependence, Autonomy, and Task Variety scales from Hackman and Oldham's Job Diagnostic survey [11]. We used a sub-set of 3-5 items from each scale, and in a discriminate factor analysis these items factored on each subscale as expected. By measuring these central features of work, we were able to take into account aspects of the participant's work not directly apparent from job titles or simple counts of projects or subordinates.

3.2.1.3 General Communication Demands

In addition to measuring basic aspects of participants work, we were also interested in understanding the amount of structured

communication their job demanded. We asked participants to indicate the number of weekly meetings they attended to provide an indicator of the amount of structured face-to-face and phone conference communication they engaged in at work.

We also wanted to examine the relationship between the number of weekly scheduled meetings and the amount of email messages exchanged by participants, in order to control for general communicational demands of the job in our analyses.

3.2.2 Email Work Importance

We developed a four item scale of email work importance, shown in Table 1, to assess participant's perceived importance of the medium in getting their work done. Participants were asked to rate their agreement with each statement on a five point likert scale (1=strongly disagree, 2=disagree, 3=neither agree nor disagree, 4=agree, and 5=strongly agree). The Email work importance scale was highly reliable in our sample, with a Chronbach's alpha of 0.83. In a confirmatory factor analysis, all items in the scale loaded on the same factor.

3.2.3 Email Volume

Respondents estimated the number of email messages they received, read, and sent each day (see Table 1). Because there was a high correlation between these estimates, we collapsed the items into an Email Volume scale (Chronbach's alpha = 0.84).

3.2.4 Email Management Tactics

We based our measurement of email management tactics on the previous literature characterizing general email usage patterns and functions of email for work. We examined the following categories of email management behaviors: handling the flow of incoming email messages, inbox management and archiving messages for later use. We developed a set of eight items related to each of these general categories of email management behaviors. Participants were asked to rate their frequency of each email management behavior on a five point likert scale (1=never, 2=seldom, 3=sometimes, 4=often, 5=always). The scale items are shown in Table 1. We expected these items would group into components about checking mail, managing the inbox and filing, but a confirmatory factor analysis did not reveal this structure. Therefore, in subsequent analysis we use each email management tactic item individually rather than as part of a scale.

3.2.5 Email Overload

The central measure in this study was an assessment of individual feelings of email overload—that their ability to handle email was out of control. We developed a 7-item scale, shown in Table 1, with a set of statements about efficacy of email use. Participants were asked to rate their agreement with each statement on a five point likert scale (1=strongly disagree, 2=disagree, 3=neither agree nor disagree, 4=agree, and 5=strongly agree). This scale was highly reliable, with a Chronbach's alpha of 0.82, and items loaded on one factor in a confirmatory factor analysis.

3.2.6 Task Coordination

We used the coordination portion of a reliable and validated scale of group transactive memory assessment to measure task coordination [18]. The coordination portion of the scale is focused on perceptions of coordination efficacy. Respondents were asked to rate their agreement on a five point likert scale (1=strongly disagree, 2=disagree, 3=neither agree nor disagree, 4=agree, and 5=strongly agree) to a set of four statements about the people they work with most closely. Scale items include: "We work together in a coordinated fashion", "We accomplish tasks smoothly and efficiently". The task coordination scale was highly reliable in our sample (Chronbach's alpha = 0.85).

Table 1 – Email scales and items

Scale	Items
Email Work Importance (α=0.83)	1. Email is critical for getting my work done. 2. I spend a lot of time waiting for replies from others to my email. 3. I use email a lot for my work. 4. It would be harder to do my work without email.
Email Volume (α=0.84)	1. How many new email messages have you received in the past 24 hours? 2. How many new email messages have you read in the past 24 hours? 3. How many email messages have you sent in the past 24 hours?
Email Management Tactics	1. I check my email as soon as I see or hear that a new message has arrived. 2. I restrict myself to checking my email at specific times of the day. 3. I try to keep my inbox size small. 4. I keep messages in my inbox as a reminder of things I need to do. 5. I leave messages in the inbox after I have read them. 6. I delete work-related email messages after I read them. 7. I manually file my messages as soon as they come in. 8. I file my messages into separate folders.
Email Overload (α=0.82)	1. I can handle my email efficiently. (R) 2. I have trouble finding information in my email. 3. I can easily deal with the amount of email I receive. (R) 4. I sometimes miss information or important messages. 5. I reply quickly to the message I need to. (R) 6. Dealing with my email disrupts my ongoing work. 7. I find dealing with my email overwhelming.

This task coordination metric allowed us to examine how behaviors with email and feelings of email overload influence or are influenced by higher level work outcome factors and perceptions of efficacy at work, in this case, task coordination. Because we were examining feelings of overload with relation to a communication medium, and communication is a critical method of coordinating work, coordination effectiveness was the most relevant outcome measure to include.

3.3 Data Analysis Method

The goal in this study was to test the associations implied by the causal relationships depicted in Figure 1. To do so, we constructed a series of nested models using standard least squares regression analysis, predicting each outcome in Figure 1 from the variables causally prior to it. We first regressed the job characteristics on perceived email work importance. Then email importance was added to the model to predict email volume. Next

the job characteristics, email work importance and email volume were used to predict email overload. Finally we regressed all email management tactics on perceptions of email overload, to see the direct influence of these tactics on feelings of overload. Finally, we used email overload and the variables leading up to it to predict task coordination.

Each subsequent model included all variables from the prior models, so that all direct and mediation effects could be evaluated [2]. Results for the models tested are reported using standardized beta weights. Although this analysis does not prove causality between the factors in our framework, it is necessary to demonstrate that a causal relationship exists.

4. RESULTS

4.1 Job Characteristics

As indicated above, the individuals in our sample were from a variety of job types. In order to get a more detailed sense of the nature of their work, we asked about features of the job likely to lead to increased amounts of communication, including number of subordinates, managers, and projects. In addition we measured the level of interdependence, autonomy and task variety in participants' work. We used these measures of job characteristics in our regression analysis, rather than reported job role because they provided better characterization of participants' actual work demands. Finally we asked participants to report the number of meetings attended on a weekly basis to provide an estimate of general communication demands of their work. Means and standard deviations for these job factors are reported in Table 2.

4.2 Email Management

Respondents in our sample received an average of 41 email messages per day, read 32 messages per day on average, and sent an average of 21 messages per day. The mean number of messages in the inbox was 311 with only 10% of the sample having an inbox larger than 600 messages. These numbers are consistent with previous work on email use and volume [4].

Although participants came from many different organizations across the nation, the overwhelming majority of our respondents (76%) reported using Microsoft Outlook as their primary work-related email client (client distribution: Lotus Notes (7%), Novell GroupWise (6%), Mozilla Thunderbird (2%), and other clients accounting for an additional 10% of participants).

4.3 Modeling Email Work Importance

Previous work on communication in the workplace conducted prior to the introduction of email has noted that communication is more instrumental for work that is interdependent and dynamic where activities frequently need to be coordinated with others in a

Table 2 – Regression Models for Email Work Importance, Email Volume, Email Overload and Task Coordination

Measures	Mean (SD)	Model 1 Email Work Importance	Model 2 Email Volume	Model 3 Email Overload	Model 4 Email Overload	Model 5 Task Coordin-ation
		Beta (β)	Beta (β)	Beta (β)	Beta (β)	Beta (β)
Intercept		+2.48***	+0.30	2.40***	3.58***	2.47***
# of Subordinates	2.31 (2.71)	-0.01	+0.08	+0.09*	+0.07	+0.06
# of Managers	3.37 (2.30)	-0.02	+0.07	-0.01	-0.01	-0.03
# of Projects	2.53 (2.18)	+0.26***	+0.09	-0.04	-0.02	-0.13**
Interdependence	3.32 (1.04)	+0.21***	+0.02	-0.05	-0.05	-0.01
Task Variety	3.93 (3.94)	+0.13**	+0.03	-0.05	-0.05	+0.06
Autonomy	4.03 (0.98)	-0.01	-0.05	-0.20***	-0.16***	+0.29***
# of meetings/ week	1.59 (1.23)		+0.18***	+0.12*	+0.06	+0.07
Email work importance	3.87 (0.86)		+0.24***	+0.12*	+0.15**	+0.00
Email Volume	2.47 (1.21)			+0.16**	+0.13*	+0.05
Percent Spam	24% (29%)			+0.14**	+0.11*	+0.09
# of email folders	17 (28)				+0.11*	-0.03
Check if new message	3.78 (0.92)				-0.19***	+0.02
Restrict checking	2.06 (1.08)				+0.17**	+0.13**
Manually file into folders	2.98 (1.09)				+0.04	+0.05
File emails into folders	3.38 (1.17)				-0.07	+0.05
Keep inbox small	3.79 (1.06)				-0.14**	+0.02
Use inbox as to-do list	3.86 (0.93)				+0.07	+0.08
Leave messages in inbox	3.15 (0.95)				+0.06	+0.01
Delete after reading	3.00 (0.95)				-0.09	-0.02
Email Overload	2.21 (0.71)					-0.26***
R-Squared		**0.17**	**0.19**	**0.14**	**0.26**	**0.22**

*p<0.05; **p<0.01; ***p<0.001

Table 3 – Differences in email habits across low and high email work importance and low and high email volume

		Email Work Importance (A)			Email Volume (B)		
		Low (N=194)	High (N=289)	Stats	Low (N=233)	High (N=236)	Stats
	Email Variables	Mean (S.D.)	Mean (S.D.)	p>|t|	Mean (S.D.)	Mean (S.D.)	p>|t|
Email Statistics	Email Volume- messages received	33 (28)	51 (34)	***	18 (9)	64 (30)	N/A
	Number of messages in the inbox	187 (156)	415 (1337)	**	184 (854)	438 (1315)	*
	Number of email folders	9 (12)	23 (34)	***	10 (12)	25 (36)	***
	Times checking inbox per day	12 (11)	21 (13)	***	12 (10)	20 (14)	***
	Percent spam / last 20 messages	26% (32%)	23% (28%)		19% (25%)	29% (32%)	**
Email Management Tactics	Check when message appears	3.6 (1.0)	3.9 (0.9)	***	3.7 (1.0)	3.8 (0.9)	
	Restrict checking to specific times	2.3 (1.1)	1.9 (1.0)	***	2.0 (1.0)	2.1 (1.1)	
	Manually file new messages	2.9 (1.1)	3.0 (1.1)		2.9 (1.1)	3.1 (1.0)	**
	File messages into folders	3.1 (1.2)	3.5 (1.2)	**	3.2 (1.2)	3.6 (1.1)	***
	Keep inbox small	3.9 (1.0)	3.8 (1.1)		3.9 (1.0)	3.7 (1.1)	
	Use inbox as a to-do list	3.6 (0.9)	4.0 (0.9)	***	3.9 (0.9)	3.9 (1.0)	
	Leave messages in the inbox	3.0 (1.0)	3.3 (0.9)	**	3.2 (0.9)	3.1 (1.0)	
	Delete messages after reading	3.1 (0.9)	2.9 (1.0)	**	3.0 (0.9)	3.0 (1.0)	

*p<0.05; **p<0.01; ***p<0.001

spontaneous and unscheduled manner [20, 27]. To determine if this pattern is also true of email communication, we used standard least squares regression, to regress the "Email work importance" scale on job characteristics. Model 1 in Table 2 shows the results. R-squared for this model was 0.17, meaning that 17% of the variance in email work importance was accounted for by the measured job characteristics.

Consistent with previous literature, higher interdependence and higher task variety significantly increased the importance of email to an individual's work (β=0.21, p<0.001; β=0.13; p=0.006). In addition, number of projects also increased email work importance (β=0.26; p<0.001). This may be because participation in more projects can result in greater interdependence with others and more types of tasks to manage.

In our analyses we wanted to account for the impact of job characteristics on the overall amount of communication required for work, using the number of weekly meetings as a proxy indicator. A regression of job characteristics on weekly meetings showed that number of subordinates, number of managers reported to, and number of projects all significantly increased the amount of communication required for work, in this case weekly meetings an individual engaged in (β=0.16, p<0.001; β=0.09; p=0.03; β=0.30, p<0.001). By including weekly meetings as an indicator of general work communication demands at work in the rest of the models tested we were able to control for the influence of the overall volume of communication on email management tactics and feelings of overload, and focus on the role of email volume specifically.

We next looked at how the importance of email for work and the amount of general communication required (weekly meetings) influenced the amount of email volume an individual sent and received in Model 2 of Table 2. The more important email was for getting work done, the more email an individual received (β=0.24, p<0.001). In addition, the importance of email for work completely mediated the influence of task interdependence and variety on email volume. An increase in weekly meetings was also associated with an increase in email volume (β=0.18, p<0.001) and weekly meetings completely mediated the influence of relational complexity (number of subordinates and managers) and number of projects on email volume.

4.4 Email Management Tactics

Participants were asked to indicate how frequently they used each of the email management tactics listed in Table 1. We used multiple regression analyses, controlling for job characteristics and meeting frequency, to determine whether the importance of email for work and email volume influenced frequency of use of these email management tactics. However, due to space constraints, in Table 2 we present only the mean frequency that each email management tactic was used.

To assess the association of email importance with the use of these tactics, we computed independent-sample t-tests, comparing people who value email a little or a lot, as defined by a median split. To assess the association of email volume with the use of these tactics, we computed independent-sample t-tests, comparing those people who have low and high volumes of email, as defined by a median split on the email volume scale. Results of these comparisons are reported in Table 3.

Both email work importance and volume were associated with checking email more times per day, filing messages more often, and using more email folders. Perceived work importance of email specifically was associated with a higher likelihood of checking whenever new messages arrived, and reduced likelihood of restricting checking times. In addition, people with higher perceived work importance of email were more likely to keep messages in their inbox and less likely to delete messages after reading them. At the same time, they kept more messages in the inbox on average and were less likely to attempt to keep their inboxes small. Finally, they were more likely to use the email inbox as a place for storing to-do's.

4.5 Modeling Email Overload

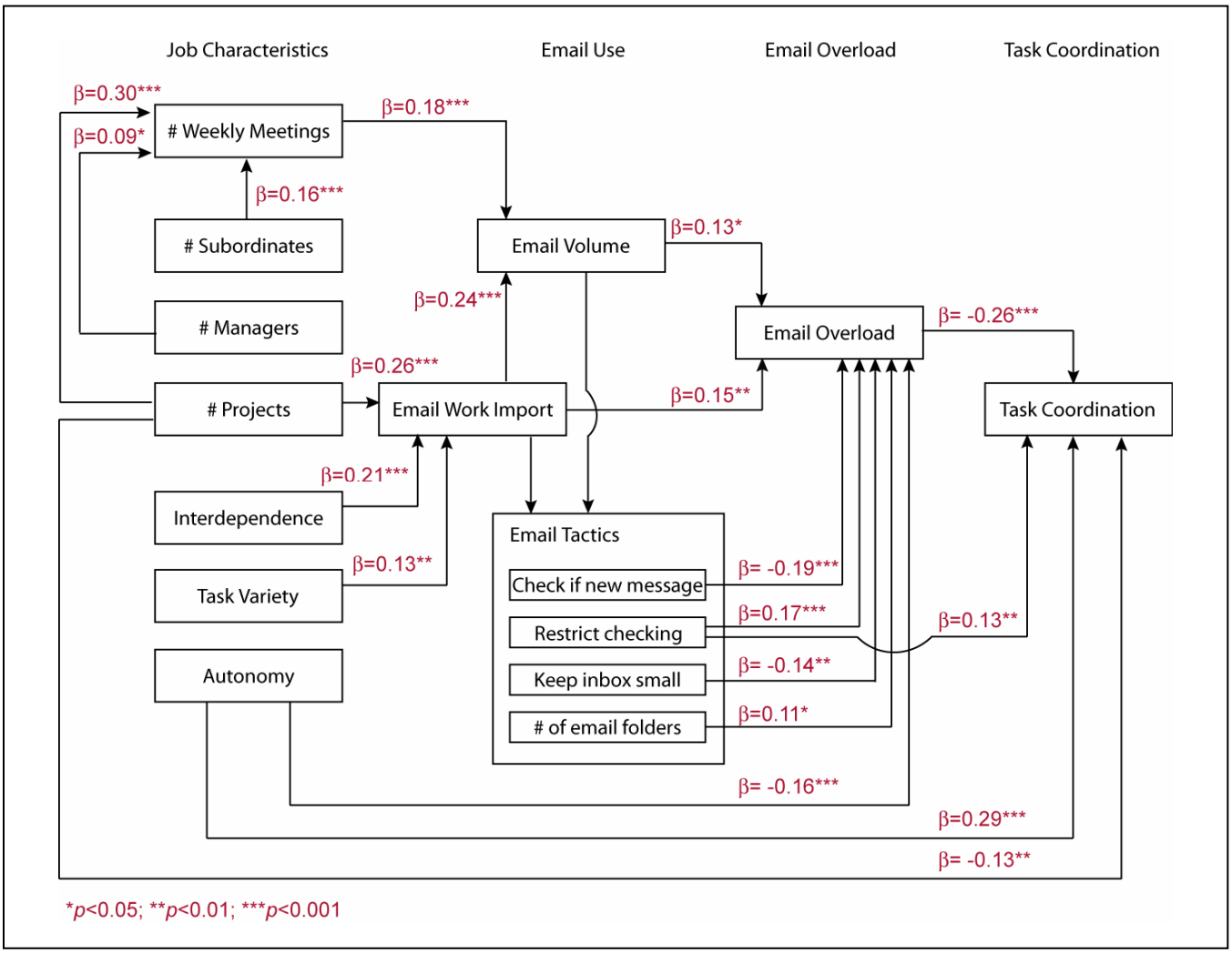
We measured individuals' feelings of email overload using the "Email Overload" scale shown in Table 1. We used standard least squares regression to predict email overload from job characteristics, email importance and volume of email communication. Model 3 of Table 2 shows the results. As expected, we found that autonomy significantly decreased feelings of email overload. Because job autonomy has been shown in other research [15] to significantly decrease feelings of general job stress, including autonomy in the model allowed us to control and account for its influence on stress more generally. The perceived importance of email for work, number of meetings per week, number of subordinates, overall email volume, and percent of messages that are spam all significantly increased feelings of email overload in Model 3 (Table 2).

To examine the direct influence of email management tactics on feelings of email overload, and to see if the use of particular email management tactics mediated the relationship between email volume and overload, we added tactic items in Model 4 of Table 2. With email management tactics in the model, number of meetings per week and number of subordinates no longer influenced feelings of email overload.

Interestingly an increase in the number of email folders was associated with a significant increase in feelings of email overload (β=0.11; p=0.02). Restricting email checking to specific times was also associated with increased feelings of email overload (β=0.17; p<0.001), while checking email each time a new message appeared was associated with lower feelings of email overload (β=-0.19; p<0.001). Finally, keeping the inbox small was associated with significantly lower feelings of overload with email (β=-0.14; p=0.003).

Did the use of these different email management tactics reduce the impact of email volume on feelings of overload? To look at this relationship, we added interaction terms crossing email volume with the email management tactics in Model 4. The addition of the interaction terms significantly increased the variance in email overload accounted for from 26% for Model 4 without the interaction to 30% for the model with the interactions. The interaction terms did not alter the direct effects of the email management tactics on feelings of email overload. However, there

Figure 2 – Regression Analysis Results



was a significant volume by email tactic interaction for "Checking when new message appears" (β=-0.52; p=0.01). Individuals with higher email volume benefited more from frequently checking for new messages; using this tactic reduced their email overload more than it did for individuals with lower email volume.

4.6 Modeling Task Coordination

As shown in Figure 1, we had predicted that individuals with less email overload would be more successful at coordinating their tasks. We performed a standard least squares regression with task coordination as the outcome variable, and job characteristics, email volume, and email management tactics as predictor variables. Model 5 in Table 2 shows the results. Of the job characteristic variables, having more projects predicted lower feelings of task coordination (β=-0.13; p=0.008). In addition, greater autonomy was associated with significant and substantial increase in feelings of task coordination (β=0.29; p<0.001).

As predicted, greater feelings of email overload were associated with a significant and substantial decrease in task coordination (β=-0.26; p<0.001). Surprisingly, however, the email management tactic of restricting checking to specific times was also associated with increases in feelings of task coordination (β=0.13; p=0.008). The results for all regression analyses performed are summarized in Figure 2, showing significant relationships, standardized beta coefficients, and their significance levels.

5. DISCUSSION

White-collar workers in this sample processed a moderate amount of email. Email was perceived as more important to their work as their management responsibilities were greater, if their work depended upon the activities of others, if they worked on many projects, or if their work involved many different types of activities. Once perceptions of email importance were controlled for, these features of the job did not predict the volume of email that people sent or received. However, the number of face-to-face meetings they participated in did predict email volume. These results suggest that for certain job types that are communications intensive, email is used to augment other types of organizational communication, in particular regularly scheduled meetings. More generally, these results suggest that communication in one media may generate communication in the other.

People for whom email was important to their work had different ways of handling email than did people for whom email was less important. Mintzberg and other organizational scholars have argued that spontaneous communication in the workplace provides fresh information that managers and other white-collar workers need to manage dynamic task. People for whom email was important seem to use email in a similar way. They adopted tactics that allowed them to get up-to-the minute communication, while at the same time having ready access to their archive of messages for later task and information management. The volume of mail received also affected the kinds of email management tactics employed. Respondents with a higher email volume checked their email more frequently, and were more active filers reporting more frequent filing behavior and having more email folders.

These influences on email management strategy suggest that the design of an email client could be tailored to the role of email in ongoing work and the volume of email received. To date, work on interface improvements for email clients have assumed a homogenous user base with respect to volume of email received and work demands. One could imagine an intelligent email client that adjusts the capabilities it offers to the volume of mail a user receives.

5.1 Email Management Tactics and Overload

The results from our analyses suggest that some ways of using email were more effective than others. The data are at odds with conventional wisdom that urges managers to check their email only at the end of the day [24]. They are also inconsistent with our initial hypotheses that more frequent checking of email would lead to increased feelings of email overload due to the disruption and fragmentation of work. Instead, the data here suggest that checking whenever new messages arrive rather than checking at restricted times is one method for reducing email overload. This could be because checking at restricted intervals means that email messages pile up such that there are more messages to deal with on average when email is checked than if messages were dealt with continuously. Although, handling large numbers of messages is associated with more email overload, this association of volume with overload is reduced among people who read their mail whenever new messages arrive.

Maintaining larger numbers of email folders was also associated with higher levels of email overload in our data. This was counter to observations made by Whittaker and Sidner that the use of folders and frequent filing would be associated with a decrease in feelings of email overload [31]. It may be that individuals who use many folders but do not file frequently feel they are "failing" at keeping up with their email, as did the *spring cleaners* in the study by Whittaker & Sidner [31]. Or perhaps, corresponding with the results of Bälter [1], the use of a large hierarchy of folders puts a large burden on the user because of multiple searches for the appropriate both when filing and retrieving messages, and increased difficulty in finding the right folder the more folders in the hierarchy. This burden then is not simply loss of efficiency as documented by Bälter [1] but can result in negative psychological outcomes as well. New search mechanisms, and the use of virtual folders, such as those in Google's desktop and Gmail products, may begin to alleviate this problem as users transition to new email organization techniques [30].

It is interesting to compare the results from the research presented here with those reported by Bellotti et al's [3]. Although the studies use very different methodologies, they have interesting parallels. In their main study (study 2) Bellotti et al conduct an in-depth analysis of how the functions for which seven white-collar workers use email interact with their email management tactics to influence email overload. 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. Their analysis highlights the importance of using email for handling complex coordination among interdependent individuals and interdependent task sequences. As in the current study, their research highlights the tension between attempting to keep inboxes small and use folders to make important information easy to find, versus the use of large inboxes to keep the new and relevant information easily at hand.

Bellotti et al attribute email overload between incompatibilities between the interdependent, complex nature of white-collar work and the email programs that fail to sufficiently accommodate the task-based nature of electronic communication [3]. In contrast, our research measures task interdependence with a standardized and reliable survey instrument. In our data greater task interdependence is not associated with greater feelings of email overload. In contrast, the importance of email communication and volume of email communication increase feelings of email overload, independent of task interdependence.

5.2 Task Coordination

Once pre-existing characteristics of an individual's job were included in our analyses, neither email importance nor volume was associated with respondents' perceptions that their work with others was more coordinated. 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. This result indicates that email overload is not simply a negative psychological phenomenon, but also has negative organizational consequences. An important area for future research is examining how breakdowns in the use of email associated with overload affect coordination, as in the work of Bellotti et al [3].

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 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.

5.3 Limitations

This research suffers from methodological limitations common to most cross-sectional, survey research about communication: potential selection bias, the accuracy of self-reports measures of communication, common-method biases that inflates the association between independent and dependent variables, and causal ambiguity. Although computer monitoring of the email value and the use of email management tactics could increase the accuracy of these measures (allowing validation of the email scales developed) and reduce common-method biases, computer monitoring raises privacy concerns and is feasible only when all participants are part of the same organization. This research trades off these limitations for the generalizability that comes from using a large, national sample of white-collar workers.

In addition, one cannot draw causal inferences from cross-sectional surveys, which measure variables at only one point in time. Although we have shown associations that are consistent with the causal model sketched in Figure 1, we would need longitudinal data collection or experimental, intervention research designs to more convincingly demonstrate causal relationships between the factors in our framework.

Over time people change their work habits and email management tactics to manage overload. In fact some email management tactics are exactly responses to overload. Spam filters are a good example- they exist because of a reaction to prior levels of overload. The feedback relationship between overload and email management tactics was not something we were able to examine with this data. However longitudinal data collection would also be useful for examining this issue.

There were several aspects of work and communication that we did not measure in our survey that may influence the relationships between email volume and feelings of email overload. In this survey we could not take into account the nature of the messages received, and the structure of the communication which may have a significant effect on task coordination. We also do not have information about other contextual factors related to the work of our respondents, such as proximity of any deadlines or distributed versus co-located respondents and co-workers. In future work, we plan to examine the influence of these contextual and dynamic features of work and communication on feelings of email overload.

5.4 Conclusions

Despite the limitations associated with the data collection method chosen, this work provides a valuable quantitative examination of the concept of email overload. Drawing form the rich history of previous qualitative and observational work on email usage, this study begins to draw the link between particular ways of interacting with a communication medium, email, and broader aspects of work and productivity. We have proposed and shown evidence for a framework connecting features of work, their impact on email volume and email management tactics, and in turn the impact on feelings of email overload and the ability to coordinate work.

Based on the results of this study, what seems to be generally true for email management tactics is that staying aware of important incoming information is better. And the more communication a person receives the more they need to keep up with it at a moment by moment basis, as shown in the direct and moderated influence of frequent email checking on reduced feelings of email overload in our study. With respect to the information management function of email, individuals want information to be more available at the surface level. In our sample having a smaller number of folders, and keeping your inbox small, behaviors that increase the surface level visibility of individual email messages, reduced feelings of email overload.

Finally, our findings suggest that if workers could control email overload– either by adopting software that is designed for making email easier to use or by adopting effective tactics for using email as a communication modality -- their coordination at work would improve.

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