

Understanding the Management and Need For Awareness of Temporal Information in Email

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Abstract

This paper introduces research into the presence of temporal information in email that relates to time obligations, such as deadlines, events and tasks. A user study was undertaken which involved a survey, observations and interviews to understand current user strategies for temporal information management and awareness generation in email. The study also focused on current difficulties faced in temporal information organisation. The results are divided across trends identified in use of the inbox, calendar, tasks list and projects as well as general temporal information organisation difficulties. Current problematic conventions and opportunities for future integration are discussed and strong support for careful visual representation of temporal information is established.

Keywords: Time, Temporal information, email, User Interface, Information management, Awareness.

1 Introduction

User Interfaces with which users regularly interact provide ideal conditions under which to monitor critical information subject to change. Despite the gradual nature of this change, software alerts and notifications are often abrupt and inconveniently timed. One common type of critical information requiring regular monitoring is time-obligations (such as deadlines, appointments and tasks). A software environment, which presents these opportunities and yet has struggled to evolve to offer more intuitive means of representation and interaction is email. As such, in this paper we investigate prospects of time management and awareness in email.

The success and ubiquity email enjoys as a channel of communication is well recognised: From the 2.8 million emails currently sent every second [21], through to the 3.8 billion accounts anticipated by 2014 [22]. The rapid proliferation of the Internet has seen email emerge as one of the most successful information systems created. Its use, and indeed preference, as a productivity tool has also been well documented [3,4,5,18,24]. This use includes purposes that it has not specifically evolved to meet, such

as Task and Time Management. Flags, appointment reminders and even the inbox itself have served as stopgap solutions to this end. Whittaker, Bellotti and Gwizdka [27] described Task Management in email as “THE critical unresolved problem for users”. Ducheneaut and Bellotti [12] described email as being “overloaded, providing inadequate support for tasks it is routinely used to accomplish”. The email interface provides an interesting set of opportunities and challenges for such integration.

Due to the time-related information email is privy to, especially in the workplace, enterprise-focused email clients (such as Microsoft Outlook and Lotus Notes) often append calendar/scheduling and task-list sub-applications to the email environment. A trend which is increasingly reflected in social webmail solutions (such as Hotmail and Gmail). This partnership is intended to allow users to benefit from the incoming information they receive in their inbox that impacts their allocation of, and ability to manage, time.

We describe information relating to time in the context of email as “Temporal Information” (hereafter TI). TI represents a time-related subset of Personal Information Management (PIM) and is closely related to, but not restricted to, Task Management (TM) and Project Management (PM). It refers to instances where explicit dates, times or spans-of-time occur in email communication. In practice, this often translates to the presence of deadlines, task times, project lifespans, availability and meeting details. This important, but easily overlooked, information becomes buried within the bodies of long messages or amidst a high-traffic inbox.

Beyond these explicit instances of TI, there are often more difficult to define implicit associations, such as the useful lifespan of an email, the optimal response time, the need to prioritise tasks by immediacy, the timely delivery of notifications or reminders. Due to the use of email as a productivity tool in enterprise environments it often contains, or implies, such time-sensitive information.

This distinction of explicit and implicit TI differs slightly to existing work [1], in that it categorises any embedded TI as explicit. It also broadens the definition of implicit TI to include connections between projects and contacts that exist only as associations in the user’s mind, and normal conversation that triggers temporal associations. This type of implicit TI includes for example, remembering that a deadline occurs on an unknown day in the second week of October, knowing that a task cannot be assigned to a colleague who has a large workload, or knowing that a meeting cannot occur in July because the project manager will be on away.

Despite not having a specific date and time associated, this knowledge is useful, but difficult to accommodate in current email applications.

In spite of this strong interdependence of communication and time, modern email interfaces still lack any substantial representation of time, other than as text in amongst text messages. Right now the time-of-delivery is the only “active” TI element in inbox interfaces: allowing sorting. Some email environments, such as Gmail, offer date-recognition [13], but use of this feature is contingent on users also maintaining a separate calendar. While generally email clients and calendar applications are separately robust programs, they are typically not well integrated. Despite their complimentary nature, users are forced to use two fairly idiosyncratic interfaces to manage the same type of information, forcing duplication and segregation of information and interrupting the flow of execution. As we elaborate in the next section, prior research has broadly acknowledged these incompatibilities between the inbox and associated sub-applications (calendar, task list, projects) and prompted further investigation into their effects. We therefore conducted a study to investigate how email users currently manage TI, whether the current integration of the inbox and accompanying sub-applications inhibits their ability to effectively manage TI, and to what extent existing email features allow users to remain informed of TI. The goal of developing this understanding is to identify ways to improve the management and awareness of TI in email. We pose that providing a representation of TI in email will empower email users by exposing them to previously inaccessible information management strategies and enhance their abilities to time-manage in an increasingly overwhelming work environment.

2 Related Works

2.1 Understanding Email Use

This research borrows from earlier work in understanding and characterising email users. Whittaker and Sidner [28] made the distinction between Non-filers, Frequent-filers and Spring-cleaners that made it easier to understand user strategies in coping with email overload, equally as applicable to TI as PIM in general. Barreau and Nardi [2] identified three types of information in email: Archived, Ephemeral and Working, to which Gwizdka [14] made the further distinction of Archived information being either Prospective or Retrospective in nature. Prospective information in this context includes email warranting future action, an activity that Gwizdka suggests is inadequately supported [14]. The naming of these information types alone suggests a temporal order or logic to the timeliness or status of information within email. Identifying user characteristics helps identify how their behaviour will map into UI requirements, such as the presence of folders and labels for Frequent-filers. Past research demonstrates both a preference for the use of email over specialised Task Management tools [3,5,24] and success in the prototyping of email-integrated TM features [4,18]. The presence of a visual representation of

TI may render yet another important user-modelling characteristic.

2.2 Email Content-Analysis: Recognising TI in Email

Due to the rich dataset email inboxes create, content analysis is an area of email research that will prove valuable in identifying and prioritising TI relating to tasks, events and project deadlines. In the past, it has been used to consolidate organisational knowledge [11], facilitate life-logging [16], automate filtering of email [9,19,20] and of particular relevance, date-extraction [23]. While the focus of this research is not data-mining or inbox analysis, this research will need to make use of intelligent content analysis techniques to isolate both the explicit TI (existing in message content) and the implicit TI (existing as connections of knowledge in the user’s mind and conversation history). Understanding where content-activation is feasible will inform the interaction possibilities involving TI, underpinning critical UI design decisions.

2.3 Visualisation in a Congested User Interface

A final domain of relevant email research, and one that warrants careful delineation, is email visualisation. Cognitive theory provides support for easing understanding of a complicated conceptual schema (like time) with a more commonly experienced schema (like space) [8]. However, prior research attempts have demonstrated a critical difference between traditional visualisations (which results in a context where the final representation of information is the primary visual element in the solution, often becoming the entire user interface) and supplementary visualisations (which we identify as elements that integrate into, and support, the overall user interface). That is, supplementary visualisations are secondary elements, which compliment, rather than commandeer, the interface. Gwizdka [15], Viegas et al. [25] and Yiu et al. [30] were successful in highlighting specific attributes of email in their prototypes using traditional visualisations, but (sometimes intentionally) at the cost of familiarity to the traditional inbox list environment. Conversely, Remail’s “Thread-arcs” [17] represents threaded conversation in a navigable reply-chain diagram alongside the message body. This “supplementary” style solution is the type aspired to in this study, as user’s current familiarity with the inbox-metaphor has proven a powerful and effective association worth retaining as the primary user interface [26]. In 2001, Ducheneaut and Bellotti [12] even posed the concept of email as a “habitat” which referenced worker’s familiarity with, and prolonged exposure to, the tool.

2.4 A Gulf of Communication Between Sub-Applications

The “gulf” we refer to (the persistence of which we confirm in the results) is not a new or emerging problem. It is a staid and widespread phenomenon across many modern email applications, referring to the disconnect between the inbox and calendar and has been briefly identified among other areas for investigation in prior email research. More than ten years ago, Bellotti and

Smith [6] recognised a “*compartmentalising of information ... within non-integrated applications*” as an inhibitor to email-calendar PIM. Then again in 2005, Bellotti et al. [5] stated “*Current mail tools compartmentalize resources along application lines rather than activity lines, with attachment folders, contacts and calendar features as separate components*”.

In 2006 and then 2007, collaborations between Whittaker, Bellotti and Gwizdka [26,27], every one an established email researcher in their own right, distilled their combined experience with this problem in these words;

“We may schedule meetings and appointments using email, but email itself does not provide dedicated support for calendaring functions.” [26]

“These problems are exacerbated by the fact that most email systems have no inbuilt support for PIM besides Folders.” [27]

Despite these broad early observations, the impact of the “gulf” on TI management has not received significant focus in prior user studies. Further to this, we suggest that the isolation of the inbox from all other sub-applications in email (including the task-list, projects and contacts) poses a critical “trickle-down” concern. This is because the inbox serves as the point of arrival for almost all communication in email, thereby determining the extent to which the sub-applications can assist in TI management and awareness altogether. As such, this research places importance on understanding the “flow” of information through the email environment. The detailed investigation presented in this paper contextualises the severity of these problems of disconnection against real user needs and concerns.

3 Methodology

In order to understand the TI needs of email users, a survey, observations and interviews were conducted. During the observations, users were given hypothetical tasks, and the observations and interviews took place as combined sessions. This combination of quantitative and qualitative research methods was employed to obtain balanced results about levels of user knowledge, feature use, shortcomings and ad-hoc solutions.

3.1 Survey

110 anonymous participants took part in an online survey to gauge initial trends about the use and knowledge of PIM features in email and treatment of TI. Participants included students, creative industry professionals and information workers ranging in age from 18 through 52 (mean=27). 18 short questions focused on user habits, both electronically and on paper, in a number of different situations requiring information to be remembered. For example, participants were asked the following questions;

- What type of information is the most crucial for you to be kept aware of (in email)?
- Do you use post it notes (or other handwritten notes) to remember things?

- How often do you create appointments in your email application?
- If you had to find an important date in your inbox quickly, how would you go about finding that?

More general questions about email client choice and life-logging tools (blogs, journals, calendars etc) were used to characterise participant PIM strategies. Three questions were open, though several closed questions asked for elaboration. Links to the online survey were distributed via email lists and IP addresses were recorded to prevent duplicate responses. No remuneration was offered for survey completion.

3.2 Observations

A dozen student and workplace participants (five male, seven female), ranging in age from 21 through 60, took part in approximately half-hour observations conducted using their preferred email client. Locations for the observations varied depending on the types of users (typically in offices), but quiet and private places were selected so participants would feel comfortable answering honestly and to maintain their privacy. When not using their workplace computers, participants were provided a laptop to access their preferred Webmail applications. The first four questions required users to think-aloud as they dealt with mock-emails arriving from friends, managers or colleagues emulating real work and social tasks spanning different lengths and requiring varying degrees of effort to action. This approach was selected because it was not feasible to conduct observations targeting the unpredictable arrival of email containing very specific types of TI without violating participants’ right to privacy and in a fixed window of availability.

The remaining 15 questions were a mix of mock-email situations and hypothetical situations or questions about their current inbox and strategies for remembering messages, during which participants could be probed further about actions they had performed. The situations presented were diverse but commonplace, such as small tasks like reminding oneself to send photos to a friend, through to preparing for the start of a large new project. Situations posed during the observation session included;

- You’ve just received a new email (email arrives), you have to remember to check this email in two days time. How would you do that?
- How would you find out what deliverables you have due this week?
- A long term project has commenced this week which may last several months and involve many people, what steps do you usually take to organise yourself? If any

Emphasis was placed on what actions were taken when the emails were received (such as immediate-reply, leave-in-inbox etc) and also the action taken on the emails themselves. The observations also presented the opportunity to observe how participants structured their workspace (when possible) and the presence of post-it notes, notebooks, schedules and bulletin boards. Data from the observations was collected in the form of notes, automatic logging, and voice recordings.

3.3 Interviews

The same dozen participants who partook in the observations also answered the 19 open-ended questions from the structured interviews. The interviews were conducted immediately after the observations, in the same location but away from the computers. While the observations focused on demonstration of feature knowledge and strategies, the interviews focused more qualitatively on how participants related to email as a tool. The interviews took approximately 45 minutes each. They asked participants to reflect on their habits in dealing with TI, their impressions of different email applications and features as well as which TI needs could be better supported in email. For example, the following questions were asked of interview participants;

- Do you keep a calendar (paper or digital)? If so, where? If not, why?
- Does your email application have a calendar feature? How often would you say you access/use this feature?
- Have you created appointments before? How would you describe the process of creating appointments in email?

The interviews also prompted for further explanation of self-reminding email strategies. The focus on how participants related to email and what they struggled with differentiated the scope of the interviews from the observations, which focused on demonstration of knowledge and strategies.

4 Results

The following points were identified from trends in the surveys, which were explored further in the observations and interviews. Results are presented together to provide quantitative and qualitative support for the findings.

The results in this section cover a broad range of TI issues, consideration of which provide some indication as to the way different facets of email will be affected by TI integration attempts. To demonstrate how these recommendations would impact modern email applications, the findings are divided into the four Ti-focused sub-applications: inbox, calendar, tasks and projects. The contacts/address book is omitted as, despite having TI relevance, it did not feature prominently in participant responses. Additional results pertaining more to general TI integration than to any existing sub-applications are also included.

4.1 The Inbox

4.1.1 Style of Inbox: Breadth or Depth of Feature Visibility

The surveys revealed a preference for Gmail for social accounts, with 72% of participants actively using the web application and participants demonstrating excellent knowledge of its features during observation. Although opinion was strongly divided for (P10,P11,P12) and against (P2,P3,P8) its interface during interviews. For work, even amongst Gmail users and advocates, Outlook was most commonly identified by interview participants

as the best email application they had used (by seven out of twelve interview participants, with 43% of survey participants using the client). One implication derived from this distinction was in regards to feature visibility. Feature-knowledge participants displayed during observations of Gmail use originated from the fact that Gmail's smaller, but more focused, feature-set was highly visible (e.g. search, tagging, chat and priority inbox, all accessible from the inbox). By comparison Outlook's more robust feature set, including sophisticated scheduling, filtering and Task Management had to be found through menus, tabs, dialogue boxes and screens that remove users from the context of the inbox. When asked how they recall project emails during observations, Gmail users were usually one click away from performing a sort or search. Interestingly, one of Gmail's few discreet features, the date-recognition pane that appears circumstantially in the message view, was not well sighted by observation participants (with three out of eleven Gmail users noticing the feature and only one having used it).

4.1.2 Finding Time in the Inbox

Survey participants were asked how they organise email that contains an important date so that they will remember it later. While responses between flagging, filing, filtering, leave-in-inbox, memorising and other were quite evenly split, the easily distinguished preferred action was search (40% of responses). This is to say that these participants take no preparatory actions in remembering dates, relying instead on opportunistic search [28]. Both the observations and interviews confirmed this preference for search when looking for dates in their email;

"I don't have a failsafe ... I'm fairly confident I'll be able to find it (using Gmail search)" -P7.

A more general question later in the survey asked which methods participants employ to retrieve an email message which contains a specific date, again search (with 79%) proved the dominant technique. During the observations, given the same scenario, every one of the twelve participants chose to search.

On the surface, this would seem to suggest that the only course worth exploring is how to enhance search for all information retrieval in email. But we have seen that users who do take preparatory actions (like folder creation) use these prepared means of relocation before opportunistic search [28]. Further to this, as Whittaker et al. point out [26], search does not address the TM aspect of email, or facilitate reminding. Scalability also presents concerns, reliance on search necessitates indexing and trawling over categorical sorting and organization.

It is worth investigating whether easier methods of organising TI would reduce reliance on search or simply prove more effective for TI retrieval and awareness-generation specifically. It then becomes a question of establishing the threshold at which any preparatory action is deemed acceptable, given the potential recollection benefits gained.

4.2 The Task List

4.2.1 Creating a Task: a Task Itself

When asked what type of email information participants forgot, 38% of survey participants made mention of TI issues, most regularly citing events and deadlines as the type of TI they forgot. This was followed by resources (such as links and files) at 30%. When compared to paper post-it-note users, which comprised 68% of all participants, 68% of this subgroup attributed TM information as the content of post-it-notes while only 7% attributed resources. This indicates that while both tasks and resources are frequently forgotten, participants required task information to be made more visible. During interviews, participants explained that post-it-notes were for “*jotting something down quickly*” (P3) and for “*urgent and immediate*” things (P12). Previous studies have also identified visibility as a critical factor [6,27]. Given this impression of immediacy, it is common that website URLs and file paths are both difficult and inconvenient to manually transcribe. By comparison, times, dates, names and room numbers are easy and quick. While this clearly has implications for PIM entry techniques, we note that in these specific circumstances, duplication and externalisation occurs despite the information system itself being the source of the TI. That is, users willingly rewrite this information where it will be seen, if it is convenient to do so. This can be seen as a failing of email, as information must be externalised to remain useful and clearly is not accommodated sufficiently within the inbox to facilitate recall. In order for TI implementation in email to succeed then, the interaction must be perceived to be quicker and easier than post-it-note use to provide real incentive to switch. Bellotti and Smith drew similar conclusions on paper note usage [6], especially for the purpose of reminding. Flags serve as rudimentary task-identifiers, but suffer from limitations relating to date-association, project-association, overabundance and being non-differentiable.

“I flag everything red, but then you become immune to red” –P1.

“In Outlook you can click to flag, but then (it takes) another 3 to 4 steps before you can set a date” –P3.

4.3 The Calendar

4.3.1 All-or-Nothing Calendar Use

In current email environments appointments are the only link between inbox and calendar. Our survey results hint at a dichotomous state where users either frequently, or never, create appointments. Almost half (46%) of all participants had either never (31%) created an appointment or did so rarely (15%).

Self-reported statistics from the survey (representing the total number of calendar entries for the current month) mirror this “all or nothing” distribution, with a high standard deviation of 26 resulting from responses as low as 0 (the mode), as high as 150, a median of 3 and mean value of 14. Only four participants reported having 100 or more events in their calendar.

4.3.2 Having to Check the Calendar

This divide is further apparent from results in our survey that indicate 30% of participants enter important dates from email into the calendar, while 52% found alternate means of remembering the date (like transferring-to-a-diary, transferring-to-phone, marking-as-unread, flagging, transferring-to-paper-note). The remaining 18% of participants took no action to remember the date. One interview participant commented (on calendar use):

“It makes sense to, but I just don’t. I never got around to using it” –P11.

Modern address books in email remember contacts users have been in correspondence with, without requiring manual data-entry. In this context the address book now learns intelligently from the inbox. Calendars have a similar wealth of, so far untapped, information (Ti) embedded in email messages and interaction history. Participant’s perception of disconnection between the inbox and calendar makes them separate tools. This disconnection was not just a hurdle for current users of calendars, but an inhibitor to calendar use adoption altogether. Visibility plays an important role in influencing this perception;

“I don’t see the calendar when I sign in, it would help if I saw it on sign in or if it was more visible” –P8.

4.3.3 Calendars: a continued practice of rigidity

During observations, participants who took no action in creating calendar entries were asked to elaborate why. Their responses suggest the “information scraps” dilemma identified by Bernstein et al. [7] plays a role. Some pieces of information are perceived to be too small to warrant significant action (such as the creation of a calendar event).

“I do nothing... or create a calendar entry if it is important. Deadlines warrant a calendar entry” –P4.

Alternative actions varied greatly from paper-notes, mobile-phone reminders, relying on memory, asking friends for reminders or doing it immediately. By comparison, small tasks involving resources provided more consistent responses (such as the use of bookmarking to remember websites). Browsers go to lengths to minimise data-entry effort by using information that is already available (page title and URL) while calendars generally make little attempt to leverage the existing context.

Information that cannot be accommodated by the system sometimes becomes a burden for human memory instead. During the surveys participants were asked what proportion of information (which needs to be recalled) they commit to memory, rather than record. Almost half (46%) memorised “few” things, while more than a third (36%) claimed to memorise “half” or the “majority” of items they had to remember.

Calendars, in email, have also traditionally been a destination for appointments and events. Despite being suitable for the aggregation of other types of TI, allocations of time that are both smaller (tasks, tracking) and larger (projects) are not typically present. Because of this, Calendars are not an accurate reflection of workload, only availability.

The observations made it apparent that in spite of features like flags, tasks and events, participants did not have a place in email where an aggregated view of their obligations could be made clear. Participants were asked where they went to get an impression of how busy they were that week. Five participants went to the calendar appended to their email client, but found only meetings there. Participants had to check a number of places to get a feel for where their deliverables were recorded;

"I go to the calendar to see how busy I'm going to be for meetings and the paper to-do list. Also, I keep an excel spreadsheet where I check off tasks. The Excel is online. It's not really helping" –P1.

Flags (despite being in common use) once created, could only be recalled as a separate list of "red" emails, of which there were usually many. Again, they provided little indication of immediacy, priority or project associations. Without this context, the list of flagged emails proved quite overwhelming. Participants were usually quick to leave this view rather than interact with it further.

4.3.4 The Gulf Between Inbox and Calendar

Discussion with the workplace interview participants revealed that calendars were used because they provided the only way to organise meetings. Their use was expected in workplaces. Some professional participants had not even considered a calendar for personal use outside of work.

Most notably, projects, which stand to benefit from placement within a calendar environment due to their long lifespan, critical deadlines and need for visualisation were absent. Also omitted were tasks and other TI uses (like completion rates, deliverables, delays and postponements), despite their presence in the adjoining inbox.

The current need to laboriously transfer TI from email messages to the calendar is an overhead that has users questioning whether each instance of TI is worth the effort involved in transfer;

"Make it easier. Dates, people. It doesn't feel streamlined" –P12.

Once transferred, the separation of the inbox and calendar creates a further concern that the TI becomes invisible. Awareness is only maintained by switching between these programs, posing a task-switching concern. For a user who has few instances of TI and no professional obligation to refer to the calendar, this constant "switching" is a burden of little benefit.

"I opened Google calendar and was impressed with how good it was, but I just keep forgetting to check it" – P11.

"Things (calendar events) go past without me noticing" –P8.

As outlined in the related works section, the "compartmentalising" [5,6] of the inbox and calendar was identified more than a decade ago and the same disconnect was reconfirmed five years ago [26]. Our current findings suggest the gulf remains problematic even today, in modern email applications for even experienced email users (for whom email access has been commonplace throughout their entire schooling or work history).

One interesting way participants coped with the "gulf" was to copy all email message content into a calendar event description field. This duplication was necessary because, in time, the connection between the event and the email that initiated it would be lost. This is further demonstration of the isolated way these complimentary features work;

"There are events with emails associated, but no way to link them. Maybe a keyword search" –P6.

"There is no relation to the original email. Linking would be handy" –P4.

4.4 Projects

4.4.1 Big Association For a Little-known Feature

It is interesting to note, from the survey results, the poor performance of the "projects" feature (3%) of Entourage in retrieving temporal information. The projects feature is a substantial effort to co-locate information and resources in email that can be categorised into projects. Yet it is seldom used or known despite a prominent location alongside the calendar and contacts shortcuts, ever present at the top-left of the Entourage interface. A similar feature called "Journals" is available in Outlook, but is much less visible. Only one of the twelve interview participants had heard of either feature. Observation participants who were asked to locate all communications and deadlines relevant to a specific current project again confirmed the division between preparatory and opportunistic retrieval strategies. Filers chose to view their project folders while non-filers chose to search. Interview participants were surprised to learn of the projects feature altogether;

"(I knew about) the task manager, yes, but not the project manager. Didn't know it existed" – P3.

When explained what the projects feature allows, during interviews, participants expressed interest in investigating the feature. Not surprising given the strong role projects play in categorising and retrieving emails. In our survey, participants were asked what they associate emails with. "People" proved the primary association (74% of participants) with "Projects" also proving a strong association (for 50% of participants). Projects usually have critical TI associations, usually in the form of deadlines or milestones that are not yet well accommodated in email.

During observations, when participants were asked what actions they take upon the start of a new project, creation of a folder was the only suitable action within email. The calendar played no role. A later question asked participants how they could find all the important dates pertaining to one of their current projects. For participants who did not have a "roadmap" document or timeline available, the email-related solutions were grim;

"email the project manager" –P1.

"I could do a series of searches based on assumed dates" –P2.

"Manual process of looking through the emails" –P3.

"Look through the folder, pretty time consuming" – P12.

Given the strong connection between projects and TI, projects will be an important aspect of TI awareness-generation and management. Designers will need to be mindful to not re-create the “disconnection” that calendars currently face.

4.5 Temporal Information in Email

4.5.1 Satisficing in the Absence of Temporally Displaced Actions

During the observations, participants were asked to demonstrate how they handle a number of tasks that were temporally displaced, biased towards future action. In the first instance, participants were given a resource (link) via email that they needed to remember to come back to in 2 days time. Flagging and Leave-in-inbox were the most common solutions (9 participants), but checking it immediately was also a popular choice (7 participants). Participants counted on remembering to check it again at the right time, often coupled with the above techniques.

The second instance provided a similar scenario, where participants were given an email address for a contact who could not be contacted for another three days. Seven out of twelve participants chose to email immediately anyway, only one participant chose to use the “draft” feature to write an email in preparation of the correct day.

The third instance asked how participants organise to send an important email on a day they knew they would not be near a computer. Five participants opted to use a smart-phone on the correct day. Two participants organised for colleagues to send on their behalf. Other responses included flagging, sending immediately, using public computers and transferring to a paper calendar.

The final instance provided the participants with an email that would no longer be useful in two days time. The most common response (eight participants) was to leave-in-inbox.

In the above scenarios the participants were given enough information to know what the useful lifespan of the email was. Many of the decisions above suggest that despite knowing what the optimal response time/method was, participants made sub-optimal compromises due to the lack of features that could facilitate the correct course of action.

4.5.2 Reluctance of Change to a Sensitive Environment

An important insight was gained from the interviews which was not apparent in the survey or observations: while participants could identify shortcomings between their TI needs and actual feature availability and scope, they expressed reluctance in changes to the email interface. This is despite ten out of twelve participants agreeing that the integration of TI features would benefit their productivity;

“It would be nice to have a quicker way to link dates with emails” –P3.

“It definitely would be an improvement, any ability to turn an email into a task would be very good” –P4.

Further discussion led some participants to confide that they doubted integration could be done without serious changes to the current User Interface. Several participants mentioned that they had just discovered a comfortable balance with email. In recognition of this we supplement Ducheneaut and Bellotti’s “habitat” analogy [12], based on observed user hesitation, by suggesting that email is a “sensitive habitat”, almost an ecology. Suggesting that proposed changes to the interface need be mindful of the balance users have created for themselves in which they are comfortable, in an environment that they frequent for much of the working day.

So when moving forward, this “balance” is of critical importance. It determines what will be tolerated in this sensitive combination of interface elements. Solutions that present drastic change fail to capitalise on users’ current familiarity with the effective list-view inbox. While very subtle improvements, like Gmail’s date-detection feature and Entourage projects risk going unnoticed altogether.

4.5.3 But Careful Integration is Necessary

Meanwhile, participants of our interviews call attention to the missed opportunities of TI integration. When asked, “how good is your email application at letting you know of upcoming dates and times” responses included;

“It doesn’t do that, really” –P11.

“Gmail doesn’t let me know. Outlook doesn’t unless you set a reminder. I have to do it myself” –P12.

But when asked whether participants would welcome a “more integrated” calendar in the inbox, ten out of twelve participants said yes. Ten participants also agreed that having the calendar separate and out-of-view resulted in events and deadlines creeping up unexpectedly. Visibility is a critical factor in TI awareness generation.

“I think visually if it was all there, it would be easier to see what’s coming up. You have everything in front of you” –P5.

While having everything in front of you is a recipe for clutter and confusion, having the right things in front you are grounds for making more informed decisions and remembering critical information. Given the responses we have attained and prior research prioritising email content [10], we have confidence that (due to the criticality of deadlines, meetings and tasks) TI is the “right” information. The “right” representation of this information though, remains a challenge for researchers and email User Interface designers.

5 Discussion

Some Personal Information Management habits examined here have endured more than a decade. The inbox is still the to-do list for many email users, social or professional. The calendar has been available during that time yet has not emerged as the TI management tool of choice, only of obligation. Marrying this new (and evolving) communication technology with these traditional (and static) time management tools is proving inadequate for modern needs.

Despite working well separately, they are limited in their ability to work together in their existing forms. Nor should they need to, their existing forms could not have anticipated modern functionality. This conservative logic needs to give way to new thinking that recognises email as the high-traffic productive tool it is and re-imagines the accompanying calendar and other sub-applications in a way that compliments email's strengths, but acknowledges its capacity to overwhelm. The paper metaphors that sustained these sub-applications as individual tools (a grid calendar with boxes that can be written in, a lined task list with checkboxes that can be ticked, project "folders" which accumulate resources) are proving restrictive in a digital context. They do not reflect the highly interactive nature of email or the rich interconnections of email messages and the deliverables they engender. These tools need to be revisited in order to better support, rather than hinder, TI management and awareness generation. Rather than forcing users to regularly visit four separate applications to manage their time obligations in isolation, which becomes a time obligation itself, users request solutions that minimise organisation effort and streamline real-world processes.

The integration of TI features needs to consider both temporal information and interactions. TI needs to be made available and visible at the right time, and can be complimented by temporal actions which allow users to act on emails at a time of their choosing. Being able to delay or advance the sending, deleting, sorting and sharing of email can assist in information management, while appropriate and contextual representation can assist recall. For example, if a message will no longer be required in the inbox beyond a specific date, users should not have to wait until that date to remember to delete that message. Here, preemptive action has the potential to save time and effort in inbox maintenance later (when it is less imperative). A simple option to mark-for-deletion on that date would suffice. If that date is present within the message body, it should be identifiable.

Any solution though, will need to be carefully considered and have minimal impact on the familiarity and even affection users display for their preferred email application. A critical balance between useful addition and intolerable distraction awaits designers who would attempt to change this complicated ecosystem.

6 Conclusion

Our fieldwork, coupled with the findings from research in this field, leads us to conclude that there are opportunities to improve handling of TI in email which may better facilitate the flow of TI through the inbox and into the other sub-applications, and importantly, back again. Current interactions possibilities are not modelled after modern workflows or observed user behaviour, but instead are driven by paper methodologies that pre-date and ignore email use strategies and do not scale well with the sheer volume of incoming information which creates unique challenges for the email environment. In particular, the supporting sub-applications that come bundled with email are resulting in an out-of-sight out-of-mind condition rather than providing truly integrated task, event and project management support. Successful

integration is contingent on designing easier information management techniques and facilitating recall by leveraging existing data, presented in context, and in time to be useful.

One critical area for improvement, identified by participants as a problem in the inbox, calendar and task list, is the lack of visibility of TI. Without visibility of obligations, awareness is difficult to generate. A further risk to awareness generation comes in the form of over-reliance on opportunistic search. Without preparatory effort made by the user in information organisation, the system will grow inefficient in identifying connections and making suggestions in anticipation of obligations. The visual representation of these obligations also suffers similarly. The onus shifts back to the user in having to remember the right search queries and doing so in time to meet a deadline. This is not meant as a recommendation to dissuade development of opportunistic retrieval methods, but as encouragement for the design of more persuasive preparatory methods. At the heart of this persuasion lies a difficult integration attempt which must convince users that the email environment is a single cohesive information management tool, the organisational benefits of which outweigh the perceived effort involved.

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