Too Many Hierarchies?
The Daily Struggle for Control of the Workspace

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Abstract

This paper reports research aimed at improving cross-tool support for personal information management (PIM). We present results from a study in which we investigated how users manage three collections of personal information: documents, email and web bookmarks. These findings have motivated the design of a software prototype that allows users to mirror folder structures between various PIM tools. We discuss the results of an initial evaluation that suggest that this approach may offers benefits to many users including improved control and consistency.

1 Introduction

Personal Information Management (PIM) describes the everyday process carried out by an individual as he or she gathers, handles and organizes information (Lansdale, 1988). In both the physical and digital domains, PIM is a pervasive ongoing activity. In the physical world, the accumulation of information resources, typically in the form of various types of paper-based documents, is a familiar feature of our personal environments, both at work and at home. In addition, the explosive growth in personal computing over the past two decades means that individuals are now able to maintain collections of *digital* information. Today's computers allow users to collect and manage a diverse range of information resource, such as document files, email messages, to-do items, contacts, and web bookmarks. However, there is much evidence that PIM is poorly supported by current technology, and that many users struggle to manage the information that they accumulate over time. Studies of PIM have highlighted the problems users encounter and the limitations of the organizational support offered by tools, typically based on the traditional hierarchy (Lansdale, 1988). Whittaker *et al*. (2000) highlight the general lack of progress within HCI towards improving tool support for PIM and other fundamental computer-based activities.

2 Our Cross-tool Perspective on Personal Information Management

Our research focuses on the problems that result from the *distribution* of digital PIM across a range of distinct tools, such as the file system and email. As a result of this distribution, those users who choose to manage multiple types of information must do so in parallel. We argue that many of the most pressing PIM-related problems encountered by users are not due to the design of

particular tools, but instead can be attributed to this fragmentation of PIM across a range of poorly integrated and inconsistently-designed tools.

Several areas of related research have influenced our *cross-tool* perspective. Our work draws on the conceptualization of a computer as an *activity space*, populated by the tools and resources that facilitate user action, and the constraints that limit it (Kirsh, 2000). From this theoretical perspective both a user's production activities[1], as well as supporting activities such as PIM, are not confined to specific tools, but are distributed across a range tools throughout digital activity space. In order to provide effective support for such cross-tool activities, integration between tools is crucial. However there is evidence that this issue is not being given enough attention by designers. Bellotti and Smith (2000) note the *compartmentalization* of PIM activities due to poor integration between tools. For example, document collections are often divided between those stored in the file system and those stored as email attachments. In terms of the theoretical framework offered by Kirsh, compartmentalization may be considered as one set of constraints imposed on a user's activity space by poorly designed tools. Whilst we acknowledge the need to improve user interfaces to specific tools, such work often ignores user needs in the wider context. We suggest that some of the most pressing PIM-related issues faced by computer users can only be addressed through a cross-tool approach. Our work is based on this cross-tool perspective, and aims to provide more coherent, integrated support for PIM. We first discuss the findings from a cross-tool study of users' PIM practices.

3 Exploratory Study – Method and Results

We carried out a series of semi-structured interviews to investigate user practices in managing three collections of personal information: (1) documents, (2) email, and (3) web bookmarks. All twenty-five participants worked in an academic context and had at least five years of computing experience. Interviewees included users of Windows, Linux and MacOS. Interviews were carried out in each participant's workplace, and were centered on guided tours of the three collections on their primary desktop computer. We also enquired about the strategies they employed, and the problems they encountered in the three tools. Interview data consisted of our notes, and screenshots of the user's folder hierarchies. We carried out content analysis on the data to identify common user strategies and problems. Folder names were classified by type and compared between tools for each user.

As would be expected with such an individual activity, a wide range of behavior was observed, varying both between users, and between tools for individual users. In general documents and email tended to be collected much more extensively than bookmarks. Most users preferred to rely on other mechanisms such as search engines instead of devoting effort to managing bookmarks. In terms of structure, documents tended to be organized into folders most thoroughly, whilst there was a tendency for users to rely on message metadata for organizing email via sorting mechanisms. Any active bookmarks tended to be located in unstructured lists. The study highlighted the fact that individual users employ a variety of PIM strategies in different parts of the workspace to manage different types of information with varying degrees of success. Most users could not be described as being globally “messy” or “tidy”.

[1] We find it helpful to differentiate between a user's production and supporting tasks. Production tasks are those that drive a user's computer usage (for a school teacher production tasks might include lesson preparation and administration). Supporting tasks such as PIM are carried out to enable their production activities, but are arguably not the prime motivator for using the computer.

We were often surprised at the vehemence expressed regarding PIM-related problems, and have coined the term *bugbear* for recurring problems that frequently or seriously affect users. Since PIM is an ongoing and often repetitive everyday activity, we found that even relatively minor bugbears can build up and have a negative impact on productivity and/or user experience. We were startled to find that a perceived failure to manage personal information can seriously dent users' self-image, e.g. they "feel bad" for "being untidy". All users emphasized the overheads of managing email, due to the higher (and uncontrolled) creation rate of messages compared to manually created files and bookmarks. However, subjects tended to be dissatisfied with the organizational state of *all* three collections, expressing feelings of guilt, stress, and lack of control.

A particular source of exasperation was the existence of old unfiled items, such as emails in the inbox, and icons on the desktop. Most users said that they did not have enough time to organize the collections, resulting in a lack of satisfaction regarding their tidiness. Twenty of the twenty-five users managed folders in two or more of the three tools (typically the file system and email tool). For many of these users, we noted a significant level of *folder overlap* – folder names that appeared in multiple PIM tools. Folder overlap was particularly evident between the document and email hierarchies (an average of 21% for the first seventeen users[2]). Overlapping folder names were generally based on participants' primary production activities, and were most commonly expressed in terms of role, project and interest. Folder overlap indicates that the study participants were devoting effort towards organizing resources relating to the same production activity in multiple tools. In other words, there are redundant aspects to user's information management activity when viewed from a cross-tool perspective.

We also observed a range of *cross-tool* problems that bridged multiple collections:

- Users complained that the management of certain types of information was compartmentalized between distinct tools (e.g. documents managed separately as files, desktop icons, and email attachments).
- Users complained about the need to coordinate production activities across multiple tools. Common scenarios included starting a new production activity (setting up folders in distinct tools), and finishing a production activity (archiving items in distinct tools).
- Annoyance was also caused by inconsistencies between different tools in terms of how they provided equivalent functionality such as "create new folder" or "mark this item as important". Users found this particularly irritating between tools from the same vendor!

4 Design of WorkspaceMirror

These findings, particularly those of folder overlap, lead us to question what benefits might be offered by sharing folder hierarchies between tools. In other words, do users really need the flexibility to develop distinct classification schemes for different types of personal information? In order to explore this idea we have designed a software prototype, WorkspaceMirror, which allows users to replicate changes to folder structures between their PIM tools. WorkspaceMirror has been implemented under MS Windows and synchronizes changes made to the folder hierarchies in three tools: (1) email folders in MS Outlook, (2) the user's document area in the file system, and (3) bookmark folders stored under Favorites. The tool works in one of two modes: automatic or prompted. In prompted mode the creation, deletion or renaming of any folder causes a dialog box to be displayed asking the user if they want to replicate the operation in the other two tools.

[2] Note that the quantitative results relating to folder overlap (folder names in common between tools) was carried out for seventeen users and is reported in more detail in Boardman (2001).

Our design can be considered as a step towards the full unification of personal information management that has been proposed in systems such as Lifestreams (Freeman & Gelernter, 1995). However such *revolutionary* technologies have been criticised for a lack of evaluation (Boardman, 2001). In contrast, a prime aim in our work was to facilitate evaluation by pursuing an *incremental* design based on relatively modest changes to standard software. This has the advantage of enabling evaluation in real user workspaces with minimal disruption to the users concerned.

5 Initial Evaluation

We have carried out an initial evaluation of WorkspaceMirror with a small number of users to determine whether our design is workable. A major challenge was the lack of any accepted evaluation methodology regarding PIM tools (Whittaker *et al*. 2000). The limitations of traditional performance-based measures of usability for complex, ongoing, interleaved activities such as PIM (Dillon 2001), lead us to steer away from a task-based experiment. Instead we based our evaluation on a longer-term field study. Four of our colleagues have been using WorkspaceMirror in their primary desktop workspaces over four months, and are providing feedback via diaries and weekly interviews. We have also correlated this qualitative data with fortnightly logs of their evolving folder hierarchies to track their usage of any mirrored folders. We triangulated the data to build up a rich picture of the user's attitude to WorkspaceMirror, and investigate whether it influenced their PIM practices. Note that all four users had previously developed folders in the three tools. WorkspaceMirror was deployed in prompted mode, so as to give users more control over mirroring and allow them to retain the flexibility to organize each collection differently.

Three of the test users have provided highly positive feedback regarding the tool. They found the idea of sharing categories between tools both intuitive and compelling. In particular they welcomed the increase in consistency between the three folder hierarchies that resulted from mirroring. Although there was not always a direct one-to-one mapping between their folder requirements in each tool, they welcomed the chance to reflect on the relevance of the organizational decisions made in one tool, to other contexts. Occasionally mirrored folders were not always used for the storage of items in all tools, but the testers indicated that the improved consistency outweighed the side effect of increased clutter. The users also reported lower management overheads and easier retrieval of filed items, however we have not yet attempted to confirm these results objectively. Two users mirrored mostly between the document and email collections, whilst the third mirrored between all three tools. In general mirroring was seen to be most useful for high-level folders, which tended to be based on cross-tool projects and roles. Feedback has also included a number of design requests that we are considering adding to future versions. These include support for cross-tool navigation (e.g. enabling traversal between mirrored folders via a context-menu option), better handling for email attachments (e.g. automatic saving of document/bookmark attachments in mirrored folders), and project management-like facilities (e.g. cross-tool high-level functionality such as "start project" and "archive project").

The fourth user provided a useful counter-example. He did not see any point in mirroring folders between the three tools, preferring the flexibility to each organize collection differently. He also found the prompting intrusive. However he has left the software running to test its robustness, and has indicated that he would find the tool more useful when setting up new project workspaces, or for users setting up a computer for the first time. Our initial evaluation indicates the potential benefits of our design, although the trade-off between consistency and reduced flexibility warrants further investigation.

6 Discussion and Future Work

One criticism that can be levelled at most PIM-related research to date, including our own, is that it has tended to focus on the needs of professional users – the so-called knowledge workers who manage information in a work context. We call for our field to devote increased attention to the needs of "social" users - people who use their computers for personal rather than work activities. Towards this end, we are currently extending both study and evaluation to users with less technical know-how. We envisage that these "social" users will find the simplification of workspace offered by cross-tool designs like WorkspaceMirror especially helpful.

We are also working towards extending our design in various ways. Firstly we are working towards including the feedback from our test users. In particular we aim to improve its configurability, so that those users who only want to mirror between certain tools can do so. We are also interested in how the scope of WorkspaceMirror can be widened beyond the desktop to encompass online tools such as web-based email and document management. A final intriguing, albeit longer-term, research direction is suggested by Chaffee and Gauch (2000) who have researched how user-defined sets of categories can be used to structure sets of search results. In the future, we hope to investigate whether mirrored folder categories could be used to in this way, and thus take a step towards the unification of information management and information retrieval

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