Towards Enhanced Visualisation Techniques to Support Ubiquitous Access to Personal Information

Simone Beets and Janet Wesson
Department of Computing Sciences
Nelson Mandela Metropolitan University, P. O. Box 77000, Port Elizabeth 6031
Tel: +27 41 5042323, Fax: +27 41 5042831
email: {Simone.Beets2, Janet.Wesson}@nmmu.ac.za

Abstract-The volume of personal information (PI) increases constantly, and due to the current mobile technology trend, information is being stored on a number of different devices. This has led to a high level of dispersion of PI, referred to as the information fragmentation problem, and thus, an increased difficulty in managing and using this information. The inflexible nature of existing hierarchical systems makes it difficult for users to maintain the organisation of PI. Current personal information management (PIM) research provides possible solutions, but these solutions are mainly limited to viewing PI on a single device or to focussing on a subset of PI. This research will identify the problems with existing PI organisation methods and visualisation techniques and investigate whether enhanced organisation methods and visualisation techniques can be designed to support ubiquitous access to PI.

Index Terms—Personal Information Management, Organisation Methods, Visualisation Techniques

I. INTRODUCTION

Tasks that a user performs such as storing, organising, retrieving, viewing and processing of PI are referred to as personal information management (PIM) [1]. The volume of personal information (PI) increases constantly, and due to the current mobile technology trend, information is being stored on a number of different devices [2]. This has led to a high level of dispersion of PI, referred to as the information fragmentation problem, and thus, an increased difficulty in managing and using this information.

Effective PIM tools should unobtrusively support and assist with a person's daily tasks, referred to as ubiquitous computing (UbiComp) [3]. PI should be suitably organised to enable efficient information retrieval [4]. The current method used to organise PI is hierarchical [5]. The inflexible nature of existing hierarchical systems makes it difficult for users to maintain PI organisation across different devices [6].

A PIM visualisation tool should provide an overview of a user's personal space of information (PSI) regardless on which device the PI is stored or the PI type [7]. Several shortcomings were identified with the current PI hierarchical organisation method and thus, the PI visualisation techniques currently used do not sufficiently support PIM. Current PIM research provides possible solutions, but these solutions are mainly limited to viewing PIM on a single device or to focussing on a subset of PI, for example documents, images or emails.

Section II discusses related work regarding PIM and the current PI organisation methods and visualisation techniques employed. Design recommendations for PI organisation and visualisation are identified in Section III. Conclusions will be made in Section IV and Section V outlines future work.

II. RELATED WORK

A. Personal Information Management (PIM)

A key problem relating to PIM is described as the information fragmentation problem [2]. When users work on a project, their information is collected from various sources [1]. A variety of PIM tools, such as email clients and file systems, are used to store and manage this information.

UbiComp refers to the concept of computers and software unobtrusively supporting users with their daily tasks [3]. Seamless and ubiquitous access to PI is required to fully support PIM [1]. As a user's PI increases in volume and over multiple devices, this PI is becoming increasingly dispersed over these devices.

B. Organisation

The current method used to organise PI is in hierarchies of files and/or folders [5]. A PI hierarchical organisation method makes use of a tree structure to organise information items and personal information collections (PICs) [1].

The inflexible nature of existing hierarchical systems makes it difficult for users to maintain sufficient PI organisation [6]. Hierarchies do not provide explicit links between various information relating to the same project or task. Furthermore, additional cognitive load is required to classify PI items [8] and separate structures exist to organise different PICs of various PI types in separate applications, such as email and file systems [9].

C. Visualisation

The indented list is most commonly-used for file browsing [5]. Figure 1 illustrates the document and media hierarchy visualisation of Windows Explorer (WE) using the indented list.

An evaluation of the use of WE was conducted in [5], which determined that participants of the study did not make use of the system as they found it confusing, time-consuming and redundant. The participants noted that WE does not provide an overview or make use of effective screen-space. Navigation, information retrieval, colour-coding and interaction were also typical information management problems experienced with WE.
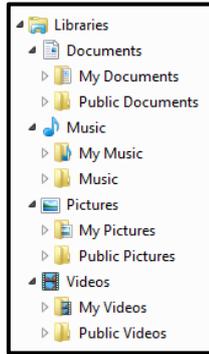
Figure 1 The Indented List Visualisation of WE

III. DESIGN RECOMMENDATIONS

A. Organisation

Certain design recommendations were identified to assist in improving PI organisation and are described as follows:

- *Logical / Task-based Organisation:* Task management is an important aspect of PIM [1]. A PIM tool should provide a logical organisation to support task management.
- *Context Awareness:* Context can assist in task awareness [4]. A PIM tool's organisation needs to make use of contextual information to effectively support a user's tasks.
- *Single versus Multiple Structures:* It is important to have a suitable structure for effective information retrieval [9]. More than one type of organisation structure may be suitable [4].
- *Associations of PI Items:* Inter-relationship and inter-linking between PI types are important for PIM [4]. Tagging could possibly be used for this association process [6]. The application of semantic web technology for PIM allows the creation of semantically-rich PIM tools, which can make use of the structure and semantics of a user's PSI as metadata [1].
- *File Sharing:* An extension of PIM research deals with the social activities element, referred to as group information management (GIM) [1]. File sharing and GIM will need to be considered when designing a PI organisation method, as other users may need to access a user's PI.

B. Visualisation

Certain design recommendations were identified from the shortcomings of PI visualisation and are described as follows:

- *Organisation-dependent Visualisation:* The information visualisation (IV) technique(s) used for PI visualisation will depend on how the PI is organised. A taxonomy of IV techniques according to data type was identified by Shneiderman [10]. Thus, the IV technique(s) used for PI visualisation will depend on the PI structure.
- *Multiple IV Techniques:* In addition to the visualisation reliance on PI organisation, the IV technique(s) used will also depend on the PI type. Each PI type may require a different IV technique [7].
- *The Visual Information Seeking Mantra:* A well-known and commonly-used mantra for IV was identified by Shneiderman namely, "Overview first, zoom and filter, then details-on-demand..." [10]. This mantra should be followed when designing PI visualisation techniques.

IV. CONCLUSION

This paper has identified problems with current PI organisation methods and visualisation techniques, and highlighted a need for enhanced methods and techniques to support ubiquitous access to PI. This research will propose a framework for enhanced organisation methods and visualisation techniques to support ubiquitous access to PI from multiple devices.

V. FUTURE WORK

Future work will involve further investigation into current organisation methods and visualisation techniques used for PIM. It will need to be determined whether suitable PI organisation methods and visualisation techniques exist, whether these methods and techniques need to be enhanced or whether organisation methods and visualisation techniques need to be designed to support ubiquitous access to PI.

VI. REFERENCES

[1] J. Indratmo and J. Vassileva, "A Review of Organizational Structures of Personal Information Management," *Journal of Digital Information*, vol. 9, no. 1, pp. 1–19, 2008.

[2] J. Aires and D. Gonçalves, "Personal Information Dashboard - Me, At a Glance," in *PIM 2012 Workshop*, pp. 1-8, 2012.

[3] R. J. Weiss and J. P. Craiger, "Ubiquitous Computing," *The Industrial-Organizational Psychologist*, vol. 39, no. 4, pp. 44-52, 2002.

[4] K. Latif and A. Min Tjoa, "Combining Context Ontology and Landmarks for Personal Information Management," in *2006 International Conference on Computing & Informatics (ICOCI 2006)*, pp. 1-6, 2006.

[5] M. Golemati, A. Katifori, E. G. Giannopoulou, I. Daradimos, and C. Vassilakis, "Evaluating the Significance of the Windows Explorer Visualization in Personal Information Management Browsing Tasks," in *Proceedings of the 11th International Conference Information Visualization (IV'07)*, pp. 93-100, 2007.

[6] F. Evequoz and D. Lalanne, "Indexing and Visualizing Digital Memories through Personal Email Archive," in *Proceedings of Supporting Human Memory with Interactive Systems, Workshop (HCI 2007)*, pp. 21-24, 2007.

[7] H. C. Jetter, J. Gerken, W. A. König, and H. Reiterer, "ZOIL - A Cross-Platform User Interface Paradigm for Personal Information Management," in *PIM'08: Proceedings of the Workshop on Personal Information Management (CHI 2008)*, pp. 1-9, 2008.

[8] M. R. Rajamanickam, "Visualization Systems as Navigational Aids Around the Web of Personal Information: A Survey," in *Information Visualization - Course Paper*, pp. 1-40, 2009.

[9] L. Sauermann, L. van Elst, and A. Dengel, "PIMO - a Framework for Representing Personal Information Models," in *Proceedings of I-Semantics' 07 of the International Conference on New Media Technology and Semantic (JUCS)*, pp. 270-277, 2007.

[10] B. Shneiderman, "The Eyes Have It: A Task by Data Type Taxonomy for Information Visualizations," in *Proceedings of the IEEE Symposium on Visual Languages*, pp. 336-343, 1996.

Simone Beets received her Master of Science degree (Cum Laude) in 2011 from the Nelson Mandela Metropolitan University. She is presently studying towards her PhD degree at the same institution.