Improved Window Switching Interfaces

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CHI 2010, April 10 – 15, 2010, Atlanta, Georgia, USA.
ACM 978-1-60558-930-5/10/04.

Abstract
In this research, we explore ways of improving window switching interfaces. Empirical studies reveal how people currently organise and switch between windows. These characteristics inform our new design: Spatially Consistent Thumbnails Zones (SCOTZ).

Keywords
Window switching, window use, longitudinal studies, novel interaction techniques.

ACM Classification Keywords
H5.2 [User Interfaces]: Interaction styles.

General Terms
Design, Experimentation, Human Factors.

Introduction
Switching between windows on a computer is a very frequent task. Previous work has found that people have more than eight windows open for almost 80% of the time and that the average time between window switches is 20.9 seconds [2]. Our own research confirms this; we found a median window activation time of only 4.3 seconds. Simultaneously, the number of windows people have open can be expected to increase as the popularity of large monitors and multi-monitor setups increases.

Current window switching interfaces do not always cope well with larger numbers of windows. For example, window titles on the Windows taskbar can become too truncated to be easily recognised and identical window icons can make it impossible to differentiate between different windows when using (Windows XP) Alt+Tab. Also, the positioning of windows, or the window representations, can be different from switch to switch, such is the case with Windows Alt+Tab, thereby hindering the development of spatial memory.

The aim of our research is two-fold: (1) to further explore and characterise how people switch between and organise windows and (2) to develop a new window switching interface called SCOTZ that specifically tries to exploit the characteristics of window use.

This work is relevant to the field of HCI in the following ways:

Originality. The design of SCOTZ is novel and innovative. It draws on an empirically derived characterisation of window switching as well as exploits human spatial memory.

Importance. As window switching is such a common task, any small improvement of the speed of the interaction can lead to large cumulative gains.

Results and validity. We performed longitudinal study of window use and paired this with the development of a visualisation tool to further characterise the data. Our treemap experiments and simulations have led to interesting insights about the effects of size morphing and stability. By distributing SCOTZ to "real world" users we aim for the most naturalistic setting possible.

Contribution. The results from our longitudinal study have not only informed the design of SCOTZ, but the data is potentially useful for many other researchers. Our treemap experiments have led to interesting insights about the effects of size morphing and (in)stability of visual layouts. These findings are interesting for many other types of research on (novel) interaction techniques.

Empirical studies of window use

Having a good understanding of how people use windows is useful for the development of new window switching and management techniques. However, there have been surprisingly few studies that attempt to empirically characterise patterns of behaviour in window use. We conducted an empirical study of window use. In particular, we studied revisitation patterns to windows and applications, the methods people use to switch between windows, and how people organise windows on their screen, including moving and resizing actions. As far as we know, no empirical study that combines all these aspects of window use has been employed before.

In an initial empirical study we found that application switching follows a Pareto-like distribution, with 80% of all switches being to approximately 16% of applications and window switching following a similarly skewed, albeit less pronounced, distribution with 80% of all switches being to 35% of windows [5]. Furthermore, we found that multiple monitor users are more likely to use a direct click on the target window and less likely to use the Windows taskbar for window switching than single monitor users. We also found that single monitor users are more likely to use Alt+Tab than multiple monitor users. Because the number of participants of this initial study was rather limited (nine participants), we conducted a three week follow-up study where the window use behaviour of 26 participants was unobtrusively logged. The results of this study are currently being analysed. The results will also be used to explore how well current window switching interfaces support common window use behaviours.

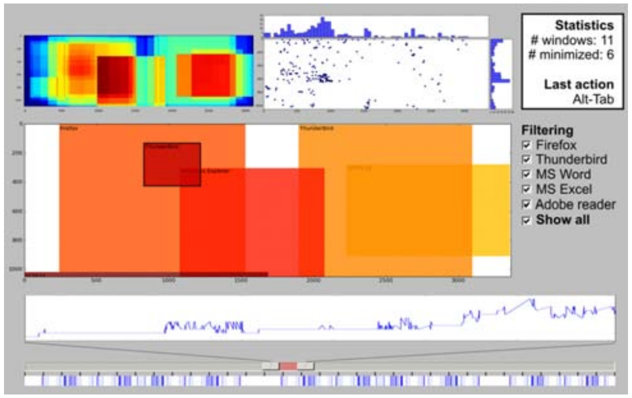

figure 1. A mock-up of our visualisation tool Window Watcher*.*

We paired the empirical study with the development of a visualisation tool called Window Watcher (see figure 1). This visualisation tool supports the extraction of meaningful characterisations from the data [4].

Development of SCOTZ

We are developing a new (full-screen) window switcher called SCOTZ (Spatially Consistent Thumbnail Zones, see figure 2). The design principles that guided the development of SCOTZ were 1) the need for spatial constancy and 2) the wish to capitalise upon the repetitive nature of application and window switches (result from empirical study), by increasing the screen estate allocated to the most used applications and thereby reducing Fitts' Law targeting time. Each application zone contains thumbnails for the windows belonging to that application. Size morphing is applied to reflect the relative use of each application; the more an application is switched to, the larger the size of the application zone.

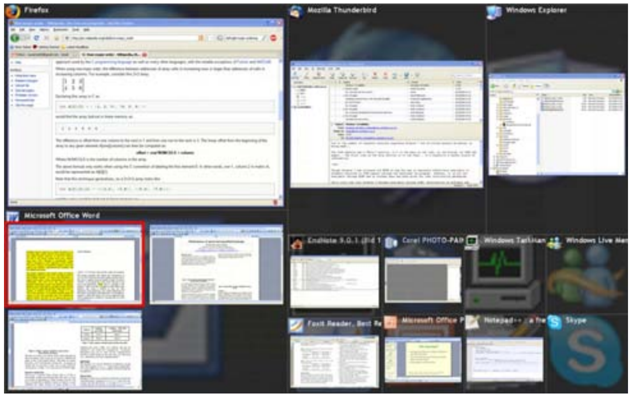

figure 2. Our new window switcher SCOTZ.

Treemaps

SCOTZ implements two different treemap algorithms for the layout of the application zones. A treemap is a space-filling structure for the visualisation of data [3]. In a 2D display, the screen is recursively divided into rectangles of various sizes, with the size of the rectangles representing some underlying quantitative data attribute. Various algorithms for generating treemaps exist, but because of their individual favourable performance in terms of stability and aspect ratio the spiral [6] and squarified [1] treemaps are good candidates to be used in SCOTZ. We confirmed these individual benefits by running several simulations. An experimental comparison between these treemaps and a completely stable layout that did not use size morphing revealed that the inherent (slight) instability of treemaps did not negatively affect performance. As this seems counterintuitive, a follow-up study compared several treemap layouts in more detail. Overall we found that all layouts supported expertise development, even a random treemap, where items were constantly placed in different locations. Though the relatively good performance of the random treemap might seem surprising, it can be explained by theories of *guided search* [7].

Our current results are inconclusive in terms of which treemap layout is preferential for SCOTZ. However, the results of the treemap studies are applicable to *any* context where changing visual layouts are used.

Conclusion and future work

Our empirical study reveals several interesting window use patterns, which we use to analyse the adequacy of current window switching interfaces as well inform the design of SCOTZ. Our new window switcher SCOTZ is currently in development and initial feedback has been very positive. Additional experiments support and validate the underlying principles of SCOTZ.

A prototype of SCOTZ is currently available online.[1] This version includes logging, so we can keep track of how and how much people are using SCOTZ. SCOTZ will be compared to current window switching interfaces, such as the Windows taskbar and Alt+Tab by means of modelling as well as an experimental study. This experimental study will also be used to validate our model.

1 http://www.cosc.canterbury.ac.nz/scotz

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