

TABBED BROWSING BEHAVIOUR IN DIGITAL SPACE

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Abstract. Browsing the Web in a parallel way – in multiple browser windows and especially in multiple tabs – has become a common way to travel in digital space. Users perform tabbed browsing in various scenarios: from keeping tabs opened in order to make them into a bookmark or a “to-do” note, to managing multiple tasks concurrently in different tabs. This type of behaviour can add to user modelling, allowing us to better understand intentions and motivations of digital space travellers. In this paper, we present two approaches to observing and modelling the tabbing – a single-system user tracking through page-included scripts and the open Web browsing tracking through our browser extension distributed through Brumo platform.

1. Motivation

Current web browsers support visiting multiple web pages at once, either by using multiple windows and, more commonly used, through multiple tabs. This behaviour is called parallel browsing, tabbed browsing, or simply tabbing. For the purpose of modelling the user behaviour through the means of web usage mining, browsing in multiple windows is often not distinguished from browsing in multiple tabs and the focus lies on the act of having multiple web pages opened at once, regardless of the user interface differences [5].

The tabbing is nowadays accepted as the more accurate description of browsing activities than the previous linear models, in which users are considered to be visiting each resource in the Web space, a webpage, only once per loading it, and to be loading them sequentially. In reality and in tabbing-aware models, users can return to previously accessed page by keeping it opened, switching to another page and then switching back to the former page, without performing the action of *page load* again. This has implications not only in revisitation rates [6] and other web usage mining metrics, but also when mapping the path of a traveller in the digital space.

Common scenarios include [4]: *reminders* (keeping opened tabs with tasks to do later), *opening links in background* (opening multiple links in multiple background tabs), *multitasking* (switching to a tab to perform a new task), *going "back and forth"* (switching between two or more pages), *frequently used pages* (keeping pages opened for later use), *short-term book-marks*.

2. Observing and modelling the tabbing

Our approach is summarized in Figure 1. The travelling through digital space can be observed from the point of a single site (or a ring of sites) that would include user tracking scripts and observe all its users, but only within the given subspace of the Web (case II). Another possibility is to observe the entire information space accessed by the user by using a browser extension, which tracks all users' steps on any visited page except in privacy mode (case I). However, as a disadvantage, only users who voluntarily chose to install the tracking extension are mapped in this way, as opposed to the former approach, where all users of a given site are modelled.

While the browser extension can track the user actions of switching the pages directly, when using tracking scripts, each page only sees user actions within that given page. We proposed an algorithm for aggregation of actions observed across different pages from the same site to produce a tabbing actions model also in the Case II scenario [1].

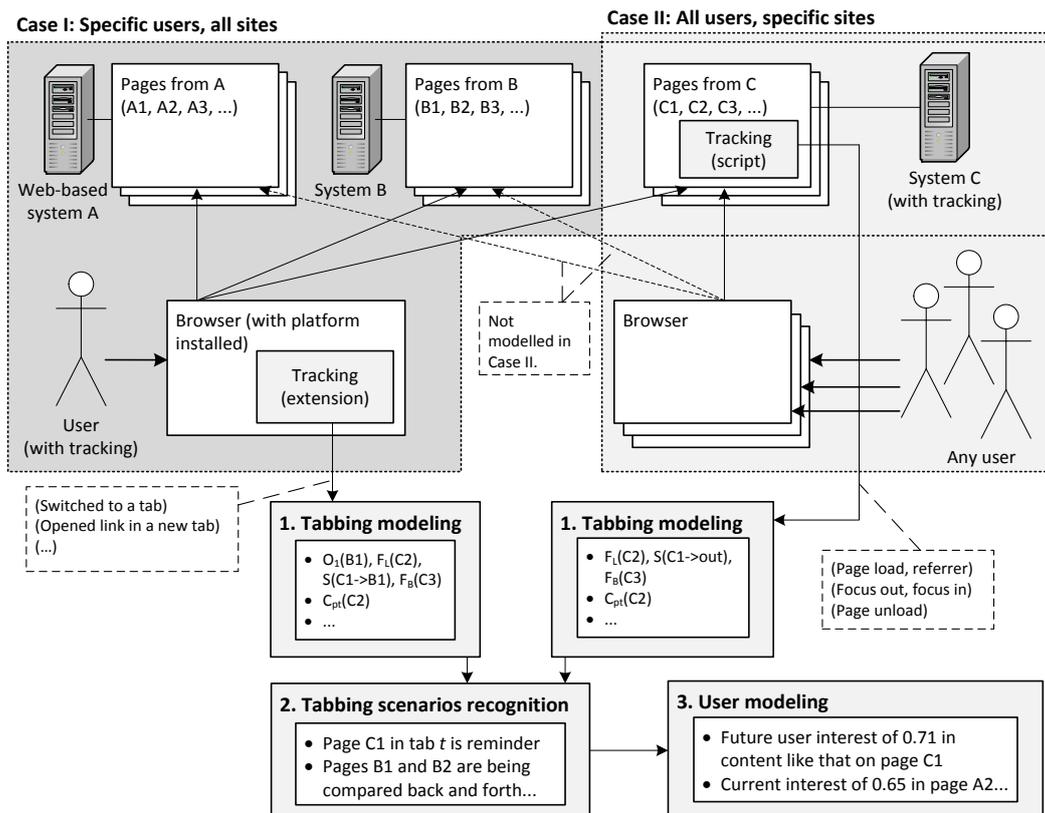


Figure 1. Overview of our Web browsing behaviour-based user modelling approach which includes tabbed browsing [3].

3. Applications of tabbing-aware browsing behaviour models

The observed behaviour has multitude of uses. A direct application is in user modelling, where scenarios of tab usages can help reveal user's current and future interests in topics represented by web pages opened in different tabs. Keeping a tab opened for future use, closing no longer needed tabs, switching between groups of them, all of these are indicators of current and future user interests. Such model allows better personalization in adaptive digital space.

Another possibility is an inference about the content visited by the user. If users commonly switch from a page to other pages and back, there is an implied relation between those pages. For example, a learning object in a web-based educational system can be automatically augmented with content from other commonly switched-to pages.

We have evaluated the proposed approaches in item recommendation and learning object augmentation in the ALEF¹ adaptive learning system.

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¹<https://alef.fiit.stuba.sk>