A novel mobile device user interface with integrated social networking services

Yanqing Cui*, Mikko Honkala[1]

Nokia Research Center, Otaniementie 19, Espoo 02150, Finland

Abstract

Modern mobile devices support accessing Web-based social networking services from the user interface (UI) of Web browsers, applications, and mobile widgets. While effectively accessing these services, people may find it tedious to switch between multiple user interfaces in order to be aware of the latest content. Aiming for an improved user experience, we experimented with integration of these services into mobile devices' main user interface. The integrated content is presented beyond application silos and automatically filtered to highlight the relevant elements. A mobile system called LinkedUI was developed and deployed in one lab test and one field study. Three findings emerge from these studies. Firstly, it is feasible to construct an alternative device UI that supports integration of Web content across applications and services via hyperlinking. Time, publisher (e.g., contacts), content types, and geographical locations are key dimensions for association of content. Secondly, the alternative device UI enables better usability of accessing social networking services than accessing them from individual Web sites on mobile devices. It helps people to be aware of the latest content during microbreaks. Thirdly, automatic filtering, on the basis of one user's data, is one promising approach to identifying relevant content. Given filtered content, most people using the automatic filtering approved the functionality and experienced a better sense of control that is arguably due to the reduced information volume.
© 2013 Elsevier Ltd. All rights reserved.

Keywords: Mobile Web; Social networking services; Hypertext navigation; Automatic filtering; User experience

1. Introduction

People have begun forming habits of regularly checking pushed live content on their mobile devices. When having a minute or two, they often glance at their devices to maintain *awareness* of what is going on in their social networks or in the public world (Church and Oliver, 2011; Oulasvirta et al., 2012; Taylor et al., 2008). This common use case, however, is not well supported by the current mobile user interfaces (UIs): mobile Web browsers, mobile applications and mobile widgets (Cui et al., 2011; Kaikkonen, 2009). These conventional UIs confine the content to separate silos. Navigation among these structures is time-consuming and error-prone (Cui et al., 2011; Marsden and Jones, 2001; Robbins et al., 2008). The proliferation of mobile functions inevitably leads to a broad and deep hierarchy, which makes it hard for people to locate target functions from multiple sources (Marsden and Jones, 2001; Ziefle et al., 2007).

With mobile devices, people may also find it difficult to access personally *relevant content* amid a multiplicity of feeds. This user problem becomes apparent when a system combines content from multiple services – for example, in Unified Inbox (Sohn et al., 2010), Motorola' Motoblur (Bentley et al., 2010), Windows Phone's Hubs, and HTC's Friend Stream. These systems started to emerge recently. Automatic filtering prioritizes and highlights relevant content without much user involvement. It is potentially preferable over customization wherein people manually hide or highlight content on the basis of their own criteria. It is not easy to create customization options that suit all people; neither is it easy to engage people in customizing these tools (Paek et al., 2010).

To address the aforementioned user problems, we experimented with an alternative device UI that integrates Web-based social networking services with mobile devices. The research questions in this work are: *How can social networking*

---

*Corresponding author. Tel.: +358 44 5213648; fax: +358718036857.
E-mail addresses: yanqing.cui@gmail.com,
yanqing.cui@nokia.com (Y. Cui), mikko.honkala@nokia.com (M. Honkala).
[1]Tel.: +358 50 5704102; fax: +358 718036857.

feeds be integrated and automatically filtered for presentation on mobile devices? How do people perceive and use these mobile systems with integrated Web services? We answer these questions by building a novel mobile system: the Linked Internet UI Concept, or LinkedUI, and evaluating the system in user studies.

LinkedUI is an alternative device UI covering all functions in a mobile device. The device UI incorporates two key functionalities. Firstly, LinkedUI fetches and associates social networking feeds, and it uses *hypertext navigation* to structure the *entire* device UI. Social networking feeds are accessible in many device views, including home and search. Secondly, to alleviate information overload, LinkedUI supports *automatic filtering*. It learns a user's interests, predicts what content the user might click, and filters content accordingly. From a technical perspective, it is an *on-device* filtering solution wherein only a single user's click data are used for analysis. It predicts *user clicks* instead of user ratings because user clicks are the most common user actions in real-world systems (Chen et al., 2011; Paek et al., 2010; Wang et al., 2010).

The novelty of this paper is twofold: (1) LinkedUI is not yet another mobile application but an alternative device UI. It effectively incorporates hypertext navigation and automatic filtering for structuring and presenting all content and functions in a mobile device. Explorations of alternative UIs are important for the evolution of mobile UIs. However, a limited number of the previous studies address this topic. The related studies typically envisioned alternative device UIs but seldom fully implemented them due to the development efforts required (Björk et al., 2000; Marsden and Jones, 2001; Sohn et al., 2010). (2) We conduct systematic user evaluations with the new device UI. For example, automatic filtering may compromise a user's sense of control, comprehensibility and privacy when applied to personal social networking feeds (Jameson, 2008; Ozenc and Farnham, 2011). These user problems are important but are often overlooked in early evaluation studies (Van velsen et al., 2008).

The bulk of this paper addresses design details of LinkedUI systems (Section 3), system implementation (Section 4), and user evaluation results. The system was tested in one lab test (Section 5) and one field study (Section 6). The main purpose of these studies is to evaluate LinkedUI functionalities with real usage data and user opinions.

2. Related work

LinkedUI experiments with an alternative device UI with integrated social networking services. Its key elements include structuring the mobile UI with hypertext navigation, fetching and aggregating content from multiple services, and automatically filtering the integrated content. In this section, we review the work in these key fields.

2.1. Alternative mobile device UIs based on hypertext navigation

The conventional device UIs typically organize functions using hierarchies such as applications and Web sites. These UIs confine the functions into separate information "silos". To complete a task, people must follow distinctive hierarchy structures of multiple services (Cui et al., 2011; Marsden and Jones, 2001; Robbins et al., 2008). This process can be slow and error prone on mobile devices considering the limited input and output capabilities and dynamic mobile contexts (Church and Oliver, 2011; Cui and Roto; 2008; Taylor et al., 2008).

LinkedUI experiments with an alternative UI navigation in place of hierarchy structures. It organizes Web content together with other native content via hypertext. The relevant literature is traced back to early hypertext systems. Hypertext is the structure of using nodes and links as a medium of thinking and communication for users (Conklin, 1987). In a meta-analysis of earlier empirical studies, Chen and Rada concluded that hypertext users tend to be more effective than non-hypertext users, particularly when the users do not aim at specific goals (Chen and Rada, 1996). This conclusion holds true for mobile users (Ziefle et al., 2007). As one main limitation, hypertext navigation was used in Web applications (Buchanan et al., 2001; Chan et al., 2002; Kaikkonen and Roto, 2003; Ziefle et al., 2007), but not in native applications on mobile devices. A menu hierarchy is, instead, used in the native UI. This dichotomy is confusing for mobile users (Freyne et al., 2010; Kiljander, 2004).

In line with LinkedUI design principle, some earlier studies have explored the feasibility of using hypertext to structure the mobile device UI. Marsden and Jones envisioned organizing the entire mobile UI (both WAP and local application functions) in hypertext style; but they did not fully implement the new system (Marsden and Jones, 2001). PowerView introduced *linkage* for navigation of information on mobile devices. It constructed links between data of different types and used these to generate the presentation of all information related to the current view. Unlike hyperlinks, the linkage was not used to provide navigational shortcuts but instead employed to offer a context for the current view (Björk et al., 2000). Diehl created an associative PDA to store personal information through a network of associations on ubiquitous devices (Diehl, 2009). Diehl's work focused on the underlying principles, and it did not address the UI presentation of associated content. Falke continued to sketch how associations can be created and used in UI presentation, using note-taking applications as an example (Falke, 2008). This concept work, however, has not been pursued further in the literature. Overall, these studies envisioned the seminal mobile UIs but seldom fully implemented these UIs due to the development efforts required.

2.2. Service aggregation on mobile devices

Previous studies experimented with services aggregation, ranging from early studies about augmented device views to the recent studies about social networking aggregators. These service aggregation studies typically took place as workaround in conventional hierarchy based UIs. Although not aiming for genuine solutions to replace hierarchy-based UIs, these studies