User Interface Personalization in News Apps

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ABSTRACT

News is increasingly being accessed on smartphones and tablets, establishing mobile news reading as one of the most popular activities on mobile devices. News reading is also a very individual activity with marked differences in the way people read and access the news, however, news apps have limited personalization. In this paper, we approach news personalization as a two-dimensional problem. We discuss news personalization in terms of 'what' content is delivered to the user and 'how' that content is consumed. We present our approach towards user interface personalization in news apps and we conclude that news content recommendation and user interface personalization should co-exist in news apps.

CCS Concepts

•**Human-centered computing → HCI design and evaluation methods; User models;** •**Human-centered computing →** User interface design;

Keywords

Mobile News Reading; Personalization; User Interfaces

1. INTRODUCTION

News reading is being changed rapidly due to advances in digital methods of consumption. App markets are now bursting with prominent apps for accessing news spanning the globe, delivering completely tailored news recommendations either based on users' interests or location and aggregating news from multiple sources. The use of mobile devices to consume news media is rapidly growing and is seen as the future for the news industry as recent numbers show [2].

Reading the news is now amongst the most popular activities people perform on a daily basis with their handheld personal devices [3]. Additionally, it is a very individual activity in which people follow idiosyncratic patterns for accessing and reading the news. For example, people are likely to have distinctive ways in browsing news headlines or choosing how much of an article to read and how they do it [18]. This implied diversity in users' news reading behaviour is reflected by the wide choice of available news apps, by the personalization features of some apps, and by the development of recommendation engines to filter news. The proliferation of smartphones and tablets along with the indispensable nature that play in peoples' everyday life indicate their significant role as platforms for cross-media news

consumption. News services are now able to help people find news that is relevant to them, to recommend the right news to the right users when they want it, and to help users abreast of news by aggregation over multiple sources. Billsus and Pazzani [8] have early identified several ways of providing such personalized news service. The most widely used is through news content recommendation by pushing filtered articles predicted to match user's interests. Alternatives include adaptive news browsing by changing the order of articles' categories, contextual news access by offering users access to additional information related to the news they are reading and news aggregation by automatically aggregating news stories from multiple sources. A significant amount of work has been conducted in the area of news recommendation. News recommenders have been widely deployed both in the desktop and mobile environment and techniques from the broader area of recommendation systems such as content-based or collaborative-filtering have been used [6, 20].

However, progress in personalizing the choice of news content has not been matched by progress in personalizing the way that content is accessed and read. Mobile news apps are a particular case in point of the need for adaptive personalization in user interfaces. News apps frequently adapt to users' individual news interests through recommendation services and many allow user customization of news feeds [8]. But, their user interfaces do not adapt to how individual users characteristically select and read the news, as opposed to what news they are interested in reading.

In this paper we present news personalization as a two-dimensional problem, defined by the 'what' and the 'how' aspects. The 'what' is characterized by the content itself, i.e. the content that is delivered to match user's interests and preferences through news recommendation engines. The 'how' is defined by the user interface in terms of the presentation of news stories and the interaction that is used to access and interact with news stories. Finding articles to match user interests is different to how users selecting and reading them. We highlight in this paper the need of user interface personalization and we conclude that new content recommendation and user interface personalization should exist side-by-side in a news personalized service.

2. RELATED RESEARCH

2.1 Adaptivity in News Apps

Much of the news personalization literature is encapsulated in the areas of adaptable and adaptive systems [25, 27]. Adaptable systems allow users to manually tailor the interface or the system to fit their particular needs and demands to complete specific tasks. Although these systems may require additional effort and time by the end user to learn how to customize and use them [22], they are widely deployed. The majority of news apps allow users to manually create a personalized experience mainly through configurations and customizations, for example, by explicitly selecting topics of interest or specifying system's parameters on how they want the visual presentation of a story.

We reviewed news apps from Apple's and Google's marketplaces that provide personalization mostly in an adaptable manner; first, to get a better understanding of how they achieve personalization, and, second, to identify possible gaps that would inform the design of more personal user interfaces. Our review is based on online tech blogs including the DigitalTrends, the Wired, the BusinessInsider and the SimplyZesty.

Leading news organizations such as BBC and CNN have already realized the need of personalization in their own news apps. For example, BBC news app provides a more personal news reading experience through customizations of the interface and other system's parameters related to the content. Example features of the revamped app include the most read stories, an option to add a list of news stories user follows, presentation settings of displaying and categorising the stories such as a compact layout or carousels and many others.

A new breed of news apps, the news aggregators, has drawn the attention lately. This type of service mainly focuses on the aggregation and the classification of news content from multiple sources. With more news sources emerging and a tremendous amount of stories spanning all over the world, news aggregators help users to identify news topics of interest easily and access specific topics from different news providers. Flipboard, for example, uses the metaphor of a 'personal magazine' by making the entire reading process stylish. It gives the sense of flipping a magazine page while navigating through news. Users curate and share their own mini-magazines with the app, drawing in stories on their preferred topics. Zite is an intelligent magazine-like news app that recommends stories based on user's interests and reading habits. The app learns user's preferences through a thumbs-up or thumbs down button on each story. Inside.com – Breaking News allows users to select news topics to follow and then provides 300-character summaries of relevant stories along with links to the original sources. Newsbeat is another aggregator but one that creates 'personalised radio news bulletins'. Users select their preferred text news sources from which stories are pulled each day, summaries created, then news podcasts created using text-to-voice technology. Feedly aggregates news items, longer articles, blog posts, and quick videos into a single spot in an elegant way. Further, instead of providing a massive list of articles it breaks the content feed up into manageable chunks. News360 differentiates from other aggregators by incorporating two swipeable screens, in which the top part shows the most popular stories while the bottom displays the current article you are reading.

Social networking platforms such as Facebook and Twitter are becoming distribution channels for news stories. Recently, it appears to be a huge interest in such services with more people getting their news stories and updates from social networks as numbers indicate [4]. Therefore, this kind of service could used to develop apps that pull or leverage knowledge from users' social networks activities. For example, Pulse, developed by LinkedIn, delivers personalized news from a user's professional network. Further, Phelan et al. [24] proposed a system, which recommends and ranks news articles by analysing real-time Twitter data.

Apart from news apps, web portals such as Google News and Reddit aggregate news sources and/or recommend news articles to assist desktop end-users to find and read news more efficiently. These systems gather information about their users either explicitly, i.e. users give rates to articles, in the case of Reddit, or implicitly by observing user behaviour, i.e. track user's activity, reading preferences, etc., in the case of Google News [20].

Although, the larger portion of news apps adopt the adaptable way of providing personalization, the alternative is the use of adaptive principles. Adaptive systems attempt to overcome some of the limitations of adaptable systems by dismissing the user from manually personalizing the system or the interface. Adaptive systems mainly leverage prior knowledge about the user or exploit user's content to infer their goals and needs to automatically alter the system's behaviour. However, despite these potential benefits of adaptive systems, news apps tend to adopt the adaptable principles by letting users manually customize the content or the interface themselves. Today, however, users are more sophisticated interacting with user interfaces than a decade ago. Adaptive principles could possibly work better for today's smartphone user interfaces. Smartphones have much more advanced capabilities such as 3G connectivity, high-resolution screens, sophisticated interactions with the user interface (swipe, flick, scroll) and others. The priority in pre-smartphones era was to deliver content but we believe users now expect more than that.

2.2 News Reading Behaviour
An investigation of news reading behaviour is the necessary starting point to creating personalized news services. The news domain is characterized by a number of particular challenges such as finding the right stories for the right people at the right time or presenting news stories in a way that match the particular needs of the reader. Many studies and reports focused in analysing human behaviour to identify patterns of news consumption, users' preferences, and others. We believe news personalization needs a clear understanding of how people consume news, especially on mobile devices. Addressing questions such as how news readers select stories to read, what reading patterns follow while reading, is an essential prerequisite to effectively create personalized systems.

Liu [21] identified a new reading behaviour (named as screen-based reading), mainly emerged with the advent of digital news services, which is characterised by more time spent on browsing and scanning, keyword spotting, one-time reading, non-linear reading, and less time on in-depth reading. Recently mobile news readers, particularly younger audiences, are exposed in a more snackable format of consuming digital news. A recent study from BBC R&D [1] identified the need of delivering news stories in a quick, snappy format while also providing readers the opportunity for in-depth reading when needed. Other data from Reuters [5] and Pew Research Centre [3] revealed interesting insights about news consumption on mobile devices. One to every five mobile news readers tend to read in-depth news articles a study from Pew Research Centre identified. Likewise, a Reuters Institute report showed that more than a third of online news users across all countries use two or more digital devices to access the news and a fifth uses a mobile phone as their primary access point.

Summarizing these findings, it is evident that news reading, especially on mobile devices, is a very individual activity. There are characteristic differences amongst people in the way they consume news, especially in younger audiences. We believe there is potential and this diversity in news reading behaviour should be taken into account when we design and deploy news personalized services.

Although these studies have presented interesting insights about mobile news reading behaviour, to the best of our knowledge, no study has attempted to categorise news readers based on particular news reading characteristics. Categorizing users as the basis of adaptation has been demonstrated in other domains such as the AVANTI project for people with disabilities [26], the work

conducted by Carberry et al. [10] for natural dialogues, the visiting styles/categories in a museum scenario [29], and others. This idea dates well back when Elaine Rich (1979) introduced the idea of using stereotypes to model users and concluded that the use of stereotypes in conjunction with the ability to record explicit user statements about himself may provide a powerful mechanism for creating computer systems that can react differently to different users.

In our previous research [12] we surveyed people who read the news on their mobile phones with the aim of identifying stereotypical patterns of news consumption. We identified three distinct kinds of news reader (we label Trackers, Reviewers and Dippers) distinguished by five 'reader factors'. The five characteristic factors included how often they read the news, how much time they spend on reading, how they browse to find stories, what strategy they use to read and where they read the news. For example, Trackers are news readers who read the news many times a day and in short bursts, they tend to skim read articles rather read them word for word, and they read the news in different locations. We believe this news reader categorization could be useful for any news personalization service either focused on recommending articles or personalizing the user interface.

2.3 Learning the User

Given that we believe there are three kinds of news readers, how would we identify an individual reader as belonging to one of three kinds is the next step in creating personalized user interfaces for news apps.

Undoubtedly, any kind of personalization relies on the system having an effective user model wherein "unobservable information about a user is inferred from observable information from that user" [14]. Such unobservable information may include the user's interests, knowledge, background and skills, goals and tasks [9]. Observable information is collected either explicitly through direct user intervention and/or implicitly through monitoring user activity [17]; the latter is often preferred by users. User models vary in the methods used for inferring unobservable information from the observable. Rudimentary methods used for re-ordering menus include recency and frequency scores of command usage [16]; more sophisticated methods of user modelling involve supervised learning techniques for inferring preferences from interaction data [8, 19]. Some user models infer group level user stereotypes and categories, as previously mentioned, particularly in relation to natural dialogues [10] and accessible systems for users with disabilities [26]. User modelling has also been demonstrated with mobile devices that log interaction data, including interactions with search engines [7] and with web pages [11], and using function usage histories to refine menu displays [15, 23]. Further, Billsus and Pazzani [8] have demonstrated the use of supervised learning methods to develop a news recommendation system. They proposed NewsDude, which uses a combination of algorithms to model short-term and long-term user's interests.

Therefore, having a successful user modeling component that classifies users as one of three kinds is at the core of our approach to provide user interface personalization.

2.4 A News App's Personalized User Interface

Our approach focuses on the idea of user interface personalization in news apps compared to the widely applied news content recommendation. Having an effective way of identifying user's news reading type, we envision a news app, which alters its interface and interaction in response to user's stereotypical behaviour, i.e. offering the user to choose a variant interface that would suit better their idiosyncratic news reading behaviour. We propose user interface personalization through variant interfaces for each news reader category as opposed to feature-level adaptation.

Much of the work in the literature has been focused on feature-level adaptation [13, 23], i.e. modification of specific user interface features in response to interactions with specific functions. An alternative approach would be to determine a category for a user and provide a matching user interface variant. In our previous work [12], we developed an early prototype of the variant interfaces matching the three news reader categories. The interface consists of two levels: the navigation and the reading. The former consists of features related to how users interact with the news app interface, i.e. how they browse to find stories, what strategies they use to select stories and how frequent they access the news. The latter includes features related to how users perform the reading task, specifically, how stories are presented to better match user's reading style.

3. DISCUSSION

News personalization is a very specific domain that has unaddressed challenges in providing personalized service. Much of the work in this domain has been focused on recommending news content, whereas personalizing the user interface has received less attention.

We believe that personalization of news access needs to broaden its scope to also include not only what content users access but also how they access and interact with that content. Mobile news access makes the need for personalized interaction with news apps much more apparent. This is not simply because the displays and input are still relatively limiting, but because of the different ways in which different users read the news with mobiles and the different settings in which those individual users read the news. Adaptive news navigation through reordering menus of headlines is clearly one area of personalization of how a user accesses the news. However, we propose that adaptation could be far more extensive and multi-dimensional. For example, users are likely to have idiosyncratic patterns for browsing news headlines to which a headline display could respond dynamically and adaptively. Interaction with mobile news is likely to vary significantly between users in the way they browse news headlines and the way they read news articles, for example, how much a person chooses to read of a news article [28]. Those variations are also likely to conform with particular profiles in the sense of stereotypical patterns for accessing and reading news. Therefore, the idea of recommending variant user interfaces for particular news reader types would be suitable for this kind of personalization. Although, one can argue about the effectiveness of this approach due to the limitation of categorizing news readers as one of three kinds. Human behaviour is more complex and people can fall in between categories or behave as a different kind per day. We acknowledge the limitations, but nevertheless, this approach is a preliminary step to user interface personalization. Future directions may include a more sophisticated way of identifying news readers types or a combination of them. This also reflects the variant interfaces design at the point of selecting features to create an individual variant interface.

To sum up, user interface personalization is less explored in news services compared to news content recommendation. Despite the adaptive features of news apps through customizations, we believe mobile news apps are in the need of more sophisticated

ways of user interface adaptive personalization. We believe this is the time that both news content recommendation and user interface personalization should coincide to constitute the ideal news personalized app.

4. CONCLUSION

In this paper we present news personalization as a two-dimensional problem, characterized by what contents users access and how users access and interact with news content. We realize the importance of user interface personalization in news apps and we discuss our approach towards this direction. Our previous work supports the feasibility of user interface personalization and we conclude that news content recommendation and user interface personalization should co-exist in news apps.

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