

# News Tracker Application

## **ABSTRACT**

As news is increasingly accessed on smartphones and tablets, the need for personalising news app interactions is apparent. We report a series of three studies addressing key issues in the development of adaptive news app interfaces. We first surveyed users' news reading preferences and behaviours; analysis revealed three primary types of reader. We then implemented and deployed an Android news app that logs users' interactions with the app. We used the logs to train a classifier and showed that it is able to reliably recognise a user according to their reader type. Finally we evaluated alternative, adaptive user interfaces for each reader type. The evaluation demonstrates the differential benefit of the adaptation for different users of the news app and the feasibility of adaptive interfaces for news apps.

## **IDENTIFICATION OF NEWS READER TYPES**

We deployed an online questionnaire<sup>1</sup> using CrowdFlower with the aim of identifying stereotypical patterns of behaviour and individual experiences on mobile news reading. Although other studies [2,3] reported interesting insights on news access and consumption, this survey was designed to reveal reading and navigational behavior especially on smartphones.

The questionnaire consisted of 24 questions probing demographic information and news reading behaviour on mobile devices including the estimated time spent on news reading each day, the frequency of reading, browsing strategies, reading styles and so on. The sample comprised 140 respondents (54 females, 72% aged between 19-35, 60% hold a higher education qualification). The only requirement for participants was that they read news on smartphones. Respondents received a token payment for participating. Analysis revealed interesting tendencies in users' preferences. Respondents mainly reported that they read the news once a day for between 10 and 30 minutes, preferably during the mornings and at home. Regarding their navigation and reading of news, no strategy dominates. When they browse, users do it either through all sections or they jump to a particular section whereas when they read they might skim or read the whole article. In addition to the descriptive analysis we performed a hierarchical clustering analysis on the responses to all questions from all participants. The analysis revealed three homogeneity clusters and was conducted in three steps:

Reader Types /Clustering Factors	"Trackers"	"Reviewers"	"Dippers"
Frequency	Many times a day	Once a day	Less than once a day
Total daily reading	<b>5-10</b> min	<b>10+</b> min	<b>0-5</b> min
Browsing Strategy	Both	Through all sections	Particular section
Reading style	Skimming	Detailed reading	Scanning
Location	Public transport	Home	Home

#### **Tracker:**

A person who likes to be informed about the latest stories and any updates to stories he or she is following, usually reading the news for up to 10 minutes at a time and several times a day at intervals, for example, when travelling. Due to her limited time she prefers to extract the important bits of a story (i.e. reading by skimming).

#### **Reviewer:**

A person who likes to catch up on the day's news, preferably at home. He likes an in-depth analysis of the stories he reads and will read at length to fully understand the story (i.e. a detailed reading). He usually reads the news once a day, spending more than 10 minutes to get through all the stories of interest and likes being informed on a variety of topics.

## **Dipper:**

A person with a casual interest in the news but likes to read news on specific topics such as sport. She always knows what she is looking for so does not spend more than 5 minutes accessing the news. She likes to browse particular sections to find stories and looks for specific facts or pieces of information without reading everything (i.e. reading by scanning)

## **INTERACTION LOGGING AND CLASSIFICATION**

Having characterised mobile news readers as one of three types, the question that follows is whether a news app could detect a user as being a particular reader type from their interactions alone. We now report a study to examine this question involving the development of a mobile news app capable of collecting and classifying users' interaction data.

**User Modeling: Predicting News Reader Types** The logged interaction data was used to identify each participant's news reader type using a naïve Bayes classifier. The classifier was developed in three steps:

(1) The five clustering factors were extracted from the raw interaction data by abstraction. For example, reading style was estimated using the formula<sup>2</sup> in which the proportion of the article exposed to the user by using scroll positions, divided by the total size of the document and multiplied by the number of words to approximate the number of words viewed. The number of words read per (wpm)<sup>3</sup> was estimated by dividing the approximate number of words seen by the reading duration. Finally, the reading speed was interpreted as one of the three reading styles: reading for comprehension (i.e. detailed reading) up to 230 wpm; scanning, reading faster than 700 wpm, and; skimming, a reading speed between normal reading and scanning.

(2) Creating the training set: each user was classified by taking the transformed values of their interaction log for each of the five factors identified by the clustering of survey results (e.g. frequency, total daily reading, etc). We classified each user as a particular news reader type corresponding with the five factors and making the simplifying assumption that the factors are equally weighted. So, each item in the training set was of the following form: user id, F1, F2, F3, F4, F5, Class (where Fn: Factor, Class: news reader type). The training set therefore consisted of 23 users, each consisting of a profile of five factors derived from their interaction logs and each

identified as one of the three types of reader. A word of caution is appropriate here. As a separate check of the classification of reader types, each user had been asked to complete the survey. Only a 55% correspondence was found between participants' answers to the survey (e.g., for how long they read the news each day in total) and the collected interaction data. It was of course such self-assessments in the survey that produced the original clustering factors. Hence a separate study is needed to establish whether the same news reader types would emerge from the cluster analysis if logged interaction data were added to the survey data.

(3) Implementing the classifier: We used a canonical profile for each of the three types to validate the classifier. The canonical profiles represent the interaction log values for the five factors for a prototypical user of that reader type. For example, for the Tracker reader, the canonical profile says they read news many times a day, with a total reading time of less than five minutes, using both browsing strategies, a skimming reading style, and primarily a public transport location. The classifier was able to correctly classify the canonical profiles with up to 88% accuracy for Trackers, 91% for Reviewers and 92% for Dippers. Future work will validate the classifier over a new corpus of interaction logs to be collected from users of the news

## **ADAPTIVE UI AND EVALUATION STUDY :**

Having shown that we can recognise a user's news reader type from a data log of their interactions, the next question that arises is whether the different types would benefit from different adaptive forms of the news app.

To examine this question we devised adaptive user interfaces for each news reader type through a series of semi-structured interviews and contextual inquiries with 10 participants. The interviews probed participants' about their news reading and their opinions on a range of customizable features of current mobile news apps and design suggestions of our own. Participants were also asked to experience reading the news with our news app and provide comments on its design. For example, Trackers receive the latest stories or updates in the top static area for quick access and we replace the horizontal organisation of stories to a full-width layout because they like to get a quick snapshot of the news. For Reviewers we did not make significant changes because it seemed that the baseline interface almost meet their needs. For Dippers, we provide the search functionality to enable quick browsing of specific facts and the jump-to category feature to allow faster navigation. For Trackers and Dippers we also have the extra feature of summaries to support their reading behaviour. The way summary is presented in each of the types differs depending on their characteristics.

For example, Trackers receive summaries as a paragraph because they are skimmers..

## **EVALUATION STUDY OF THE ADAPTIVE UI VARIANTS :**

We conducted a laboratory study to compare the baseline and adaptive variant of the news app interface for each news reader type. The comparison was of time to find (browsing) and read (reading) the news in benchmark tasks. The following hypotheses were.

- H1: The adaptive UI for Trackers improves their performance over the baseline UI.
- H2: The adaptive UI for Reviewers improves their performance over the baseline UI.
- H3: The adaptive UI for Dippers improves their performance over the baseline UI.:

At the beginning of each session participants completed a questionnaire that would allow their news reader type to be determined. Demographic information was also collected. Once their type was identified, participants were instructed to complete a set of predefined tasks on both interfaces. It should be noted that the tasks necessarily varied between news reader types, appropriate to their characteristic patterns of news reading. For example, Reviewers were asked to find and read specific articles and then briefly described what the article was about. After completing the tasks with both interfaces, participants completed the comparison questionnaire. A short debriefing at the end of the experiment sought participants' views on how easily they were able to find and read articles with each interface and the features of the adaptive variant.

### **Design:**

The experiment was a one way within-subject design on UI type (baseline, adaptive variant), conducted independently on each group of news reader type (Trackers, Reviewers, Dippers). Dependent variables were the time taken to find articles and the time taken to read them. Participants were not aware which interface was the baseline and which was the adaptive design.

## **CONCLUSION AND FUTURE:**

We explored the feasibility of recognising patterns of news reading interactions and evaluated three adaptive interface designs for different news reader types. We show that from their interaction log, a specific user can be recognised as one of three kinds. The reader types emerging from the online survey are well defined and distinct. The evaluation of the three variant interfaces suggests that different news reader types need different user interfaces. We have demonstrated a method for monitoring users' news reading behaviour and inferring news reader type from it. In the future we will further explore the design of adaptive interfaces, in order to be in a position to demonstrate a complete adaptive mobile news framework providing automatic personalisation of news.