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Improving transport timetables usability for mobile devices: a case study

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1 Introduction

Transport timetables are typically generated to fit a standard template. The stops are generally listed consecutively in the left hand side of the table while each column represents a vehicle journey. Therefore each cell of the table contains the time at which the vehicle arrives and/or departs from a specific stop. This representation has worked reasonably well for decades and it is universally accepted. A recent trend however is for people to move towards checking such information on mobile devices like smartphones and tablets. In fact, more than 70% of traffic in the Nottingham City Transport website is already coming from mobile devices. These devices have much smaller screens than computers and therefore presenting large timetables is not the best option since finding the right information can be frustrating for users, as confirmed by our usability study.

Evaluating the usability of websites in mobile devices has become very relevant in the last few years. In the public transport field, Kjeldskov et al. [3] carried out a usability study for a mobile guide for Melbourne's tram system. They surveyed users in different scenarios and found 22 different issues including readability and navigation flow.

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Another way of finding usability issues is performing an eye-tracking study like the one by Fukuda et al. [1], where the authors evaluated the usability of timetable systems on a desktop computer. Identified issues included small font size, design of navigational buttons and unclear navigation flow. Unfortunately, eye-tracking systems are still not robust enough to be used in smaller screens.

In this paper we present the challenges we found on generating bus timetables, a usability study for improving bus timetables in mobile devices and the user interface changes implemented a result. This work has been completed in partnership with Nottingham City Transport Ltd.

2 Challenges in timetables generation

In the United Kingdom, bus operators are required to provide bus route and timetable information in a TransXChange[1] file. This standard format is quite complex since is able to model all kind of relations. For that reason, processing this file is challenging. Once this information is stored in our system, we prepare the timetables by querying the database.

Timetables are on-demand generated for an individual bus line depending on the date and bus direction. Sometimes, several bus lines are joined in the same timetable which makes the generation more complicated. For instance, bus stops (i.e. rows) need to be ordered in a meaningful way taking into account that bus lines share some of them but also follow different paths. Similarly, columns should follow an ascending temporal order. Due to these restraints it is common to find large groups of gaps in the timetables that do not look visually appealing.

3 Usability study

We have followed a continuous usability testing approach as suggested in [4]. That is, tests are performed with a reduced number of users and then user interface changes are made based on their feedback. This process is repeated several times until finding a satisfactory result.

A total of 12 users were asked to follow three prescribed scenarios and answer a number of questions in each of them (e.g. 'In what direction do you have to take the bus' or 'At what time do you expect to arrive'). We split the users in two equally sized groups in which one of them used the original website while the other used the new modified version. In the three scenarios, users were asked to realise a hypothetical trip from one place to another. The difficulty varied according to the characteristics of the presented timetable (e.g. number of stops, number of lines and bus frequencies).

After completing the questionnaire, three additional questions covering customer satisfaction as suggested by ACSI[2] indicators, have been asked:

[1] TransXChange is the UK standard for exchanging bus schedules https://www.gov.uk/government/collections/transxchange

[2] American Customer Satisfaction Index http://www.theacsi.org

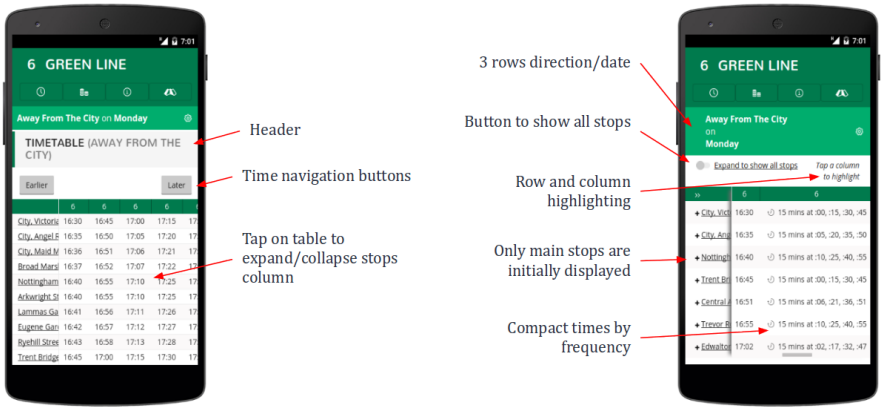

Fig. 1 Original (left) and modified (right) versions

– Overall satisfaction. How did you feel overall with finding the information in the timetable? From 1 (very dissatisfied) to 10 (very satisfied).
– Level of difficulty. How difficult was it to find the information that you needed? From 1 (extremely difficult) to 10 (extremely easy).
– Expectancy. Do you think that this timetable is the most appropriate tool for finding the bus information? From 1 (falls short of your expectations) to 10 (exceeds your expectations).

At the end of the tests users were asked to provide any additional feedback or further suggestions.

4 Timetable UX changes

We have split the user interface changes in two categories: a) responsive design, and b) interactive controls. These changes have been refined during the usability study thanks to users feedback. Figure 1 shows the original and the modified versions.

Responsive design Mobile devices have smaller screens and therefore less space to present information. Our approach was to dynamically compress the timetables on-demand in both dimensions, to best fit the user's screen size. Firstly, columns representing journeys which share the same frequency are merged. Then, the number of rows is reduced to only show the main stops. Such main stops can be either defined a priori, e.g. in a TransXChange file, or defined by the user (e.g. favourite stops). If this is not the case, there are several approaches which can be followed to automatically select the main stops (e.g. stops in most popular searches, stops served by multiple lines).

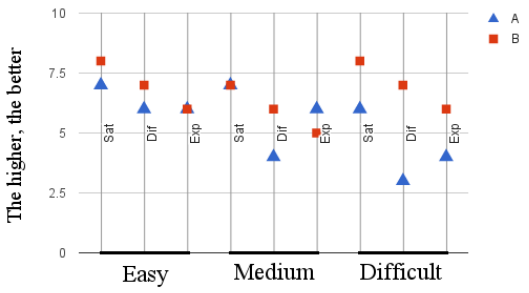

Fig. 2 Mean of key performance indicators per scenario

Interactive controls In order to enhance user experience we have added several controls to the timetable. In the first place, to avoid the loss of information due to timetable compression, we included the possibility of showing/hiding all the secondary stops and also showing/hiding intermediate times of the compressed columns. In addition, to facilitate timetable browsing it is now possible to highlight individual rows and/or columns.

5 Results and future work

The average results of key performance indicators are presented in Figure 2. The modified version (B) has outperformed the original version (A) in the majority of the indicators for all scenarios. Most notable improvement has been observed within the difficult scenario. We believe that such improvement comes from the fact that the compacted version of a very large and cluttered timetable makes its exploration easier.

Our initial findings are promising, but require further validation on a larger scale. Hence, we plan to perform a large scale A/B testing experiment in the live website in order to get more confident results. We will also include user context similar to [2], where the UI was simplified by taking into account user location and date/time.

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