Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
Trinity Saint David

Investigating the Usability of Data Visualisation in Mobile Web Applications

Jasper Dorado
BSc Web Development

1 Introduction

Mobile phones are everywhere all around us, and the popularity of social media has allowed us as a society to grow accustomed to constant access to large amounts of information from anywhere, such as the news, books, videos and so on from the convenience of small devices.

It is apparent that the majority of us use our mobile phones to access and share information every day in one way or another, which indicates the importance of finding effective ways to display large amounts of information on mobile devices. This project explores, through research, the limitations of mobile devices as well as the tools and methods which designers and developers can use in order to circumvent these limitations and create an efficient and effective product.



2 Aim and Objectives

The aim of this project is to investigate the usability of data visualisation in mobile web applications.

The objectives are to:

• Research and establish an understanding of usability testing, data visualisation software and responsive mobile web application development.

• Apply responsive mobile web techniques to develop a website to display data, applying usability principles

• Evaluate the usability of data visualisation in web applications through usability testing, and analyse the results to determine which methods are most effective.

3 Implementation

This experiment focuses on two types of visualisations, the pie chart and the stacked bar chart to display data.

With the use of two proposed interactive mechanisms, usability evaluation will later be carried out in order to determine the more effective option. These are:

• Drill-Down Approach (DD): Initially displays a broad summary of a large dataset, which users will be able to "drill down" onto to view a more focused display on smaller parts of the dataset.

• Changing Chat Type Approach (CCT): Automatically remaps the data from a less detailed overview into a stacked bar chart that provides more detail when screen size is that of a landscape orientation.

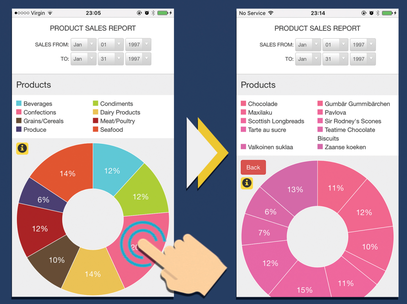


Figure 1: Drill-Down Approach



Figure 2: Changing Chart Type

4 Evaluation

The focus of the experiment is to determine which data visualisation techniques are the most effective from the implemented design. Therefore, the most appropriate method of evaluation was through usability testing which is performed by users and evaluated by usability experts.

There are a total of seven participants for this experiment who were recorded with audio and video while performing their designated tasks.

Following the Think Aloud usability testing method, the participants have been asked to complete two tasks on mobile devices.

Examples:

"Find the most sold item in the category of Beverages for the month of June in 1997."

"Find the employee with the most amount of sales in the category of Dairy Products for the month of October in 1996."

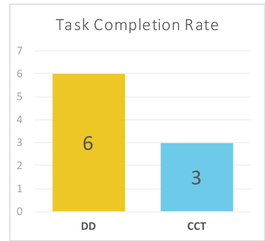
5 Hypothesis

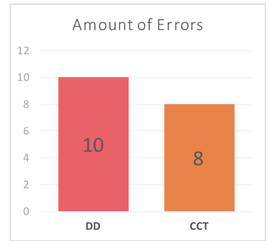
The literature review on this project has found that the drill-down approach is already an established and well known interactive mechanism in many platforms including desktop PCs, and also that users usually expect the same browsing experience on mobile devices and desktops despite their differences.

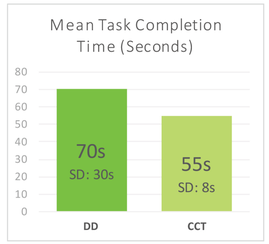
The researcher hypothesises that the combination of the drill-down mechanism's familiarity as well as expectations of users regarding mobile web browsing and interaction will result in the majority of users being more effective in using the more natural and familiar interactions that the drill-down approach utilises, enabling them to be more productive.

6 Analysis

An analysis was conducted on the outcomes of each task such as measuring the effectiveness of the application through the rate of completion and amount of errors, and measuring efficiency based on each participants' task completion times.







7 Conclusion

This experiment has been able to measure the effectiveness and efficiency of the data visualisations by using the Think Aloud usability testing method.

Results indicate that users are more likely able to complete tasks where tapping or clicking elements on the screen is the required interaction, which is compliant to the hypothesis that users have a higher likelihood to succeed in tasks that share similar features to desktop PC interactions. This suggests that future developments in mobile visualisation and interaction should consider incorporating features that mostly rely on common and transferrable skills from desktop experiences.