Collaborative Newspaper Demo: Exploring an adaptive Scrolling Algorithm in a Multi-user Reading Scenario

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ABSTRACT

We present the *Collaborative Newspaper*, a prototype that manages scrolling of the same content on a public display for several users simultaneously. Usually it is not possible for passers-by to conveniently interact with public displays, as content is not interactive or responsive. Especially news screens are normally showing one news article after another, reducing the amount of information fitting the screen dimensions. Our prototype relies on an adaptive scrolling algorithm analyzing people's gaze to enable them to read the same text with individual scrolling speed. We are using head-mounted eye trackers for on-screen gaze estimation and a big-sized display presenting news articles to the users.

Author Keywords

Collaborative; Multi-user reading; Adaptive scrolling; Gaze-based interaction; Shared content.

ACM Classification Keywords

H.5.m. Information Interfaces and Presentation (e.g. HCI): Miscellaneous

INTRODUCTION

Over the last decade, the digital augmentation of urban space steadily increased. Especially, we can find more and more large scale displays (e.g., video walls and media facades) at public places. Gaze usually indicates what is attracting us and what might be interesting [5]. Gaze-based interaction is applied to various types of applications. It offers a convenient way to interact hands-free at a distance with the increasing number of public displays in our everyday environment. The development of head-mounted eye trackers will drive the use of gaze-based interaction in in pervasive settings [2].

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Figure 1. This figure illustrates the collaborative newspaper application with its three text columns, teaser image and article headlines. Left: day layout; Right: night layout.

When providing information like news, the main problem with large public displays is the lack of interactivity. Usually only headlines with small abstracts are presented to people, as the screen size limits the available space for information. Hence interested people have no possibility to receive further infromation about the displayed content right in place.

With our developed prototype, we present a system that uses an adaptive scroll algorithm (see Figure 1). It provides the opportunity to display many news texts at once on a single screen. The news texts are shown in different columns and will be completely readable, even if they are not fitting the screen height. Head-mounted eye trackers are used to track persons' gaze on the screen and detect the location in the text to recognize their reading behavior. This knowledge is used to adapt the scrolling speed to the individual reading speed. Furthermore our system enables people to simultaneously read the same text in the the same colum. In our prototype we allow up to three persons per text.

RELATED WORK

The collaborative newspaper system comprises techniques and approaches from different domains. For reasons of brevity, we only discuss directly related work. We also submitted a full paper where we discuss the complete related work.

Jacob [3] takes a closer look at eye characteristics and distinguishes between fixations and saccades. Fixations are hard to

detect and to use for special actions. According to the Midas Touch problem, they can lead to interaction problems. In addition saccades and jittery motions can be ignored as the user is not aware of these. Hence we mainly rely on gaze movements, ensuring that all allowed actions in our scenario are undoable.We used the concept of automatic error-prevention mechanisms, proposed by Vrzakova et al. [6], for gaze-based interaction in our scenario.

Kumar et al. [4] proposes different approaches to control scrolling via gaze data in a single user setting. We use their findings and adapt one of their approaches to our needs.

Text 2.0 by Biedert et al. [1] uses a stationary eye tracker to support a person in a single user scenario reading a text on a normal desktop monitor. The system is able to detect the reading position and supports the user while reading with additional features (e.g., music adapted to the text, translation). However, as it uses a remote eye tracking system it is not suitable for a multi-user scenario.

COLLABORATIVE NEWSPAPER

The idea of our collaborative newspaper is to enable several persons to read text displayed on a public screen at the same time. As space is limited, numerous texts might not fit the screen dimensions. Hence scrolling is essential to finish reading a displayed text. For this purpose we developed an adaptive scrolling algorithm that scrolls a text, currently read by a person, aligned to her standard reading speed. In our prototype we only consider vertical text scrolling. Our approach faced two challenges: the standard reading speed of a user and where the user is looking in the text, more precisely her reading location. Furthermore, proper scrolling of the text has to be ensured for a single user, as well as for multiple users reading the same text.

The adaptive scrolling algorithm has knowledge about the complete display layout, i.e. the number of displayed texts, the text length, as well as the width, height and position used to display the text. According to this knowledge and the input data from the eye trackers, the algorithm creates view ports (i.e. the scrolling views) for every user. The algorithm distinguishes between virtual view ports, representing the users view and defining the text area which should be displayed on the screen, and real view ports, where the scroll area is actually shown.

The number of readers able to read a text simultaneously is limited by the size of the view ports. Pilot studies have shown that it was sufficient to have a size of six text lines. However, this depends on other factors like screen size, font and use case.

In the corresponding paper, we submitted, the concept and implementation is explained in more detail. We also did a evaluation with fifeteen participants investigating the performance of the system. We reported the study setup, the analysis and the results there. The main finding was that the adaptive scrolling approach does not negatively influence peoples reading speed.

COLLABORATIVE NEWSPAPER DEMO

We will demonstarte our prototype in the following way. Using a 65 inch monitor, we are showing six news articles together with some images. A desktop computer will drive the display and receive the data input streams. Up to three persons are able to directly start using the system while standing in front od the display. We will provide three PUPIL[1] eye trackers, each connected to a laptop. After a standard nine point calibration the eye trackers are ready to use. When reading a text, the scrolling speed is adapted to the individual reading speed of the person.

CONCLUSION

The Collaborative Newspaper application can be used in various application scenarios. We see high potential in public spaces like train or bus stations. At some places big-sized screens are already available. They can be used to dispaly news articles in full length ready to be read using the adaptive scrolling technique. However , in our current prototype we are using head-mounted eye trackers. As they have to be connected to an extra computer and be calibrated, they are not suitable for a real public setting.

There is still a lot of room for improvements in our collaborative newspaper application. By demonstrating our prototype to the Perdis community, we expect discussions about improvements as well as further use cases and adaptions.

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[1] `http://pupil-labs.com/pupil`