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Effects of Position and Time Bias on Understanding Onsite Users’ Behavior

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ABSTRACT

The existence of different biases in logged users’ behavior makes it difficult to extract realistic topical and social information from users’ interaction logs (e.g., query logs). To understand users’ behavior and their interests in the cultural heritage domain, we have logged onsite user interaction logs of visits in a museum. This prompts the question on the reliability of the social information being gathered from the onsite logs: How does the position of museum objects affect users’ behavior in the museum? How does order of visiting point of interests affect their dwell-time in front of each point of interest? How do different users’ characteristics affect their behavior in the museum? In short, what are different kinds of biases that should be considered in the onsite logs? Our main findings are the following: First, there is a considerable position bias, which is due to the design of the exhibition and should be considered during extraction of social signals from the log. Second, there is a bias in the amount of time that users spend for interacting with the point of interests and the order of picking them to visit. This shows a fatigue on users’ interactions while they are reaching to the end of the exhibition. Third, we find out some variations among the users’ visit, which shows context is an important factor to consider while using onsite logs for different purposes.

Categories and Subject Descriptors: H.3.3 [Information Storage and Retrieval]: Information Search and Retrieval—Query formulation, Search process, Selection process

Keywords: Behavioral dynamics; Bias; Internet of things; Onsite logs

1. INTRODUCTION

In modern search, interaction logs are one of the main sources of information about user behavior, form a key feature for training ranking algorithms, and are crucial for online and offline evaluation. However, due to existence of different kinds of biases in different kinds of human information interaction logs, extracting realistic behavioral information Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for components of this work owned by others than the author(s) must be honored. Abstracting with credit is permitted. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee. Request permissions from permissions@acm.org.

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1. How do position of objects and time of the visit affect on users’ behavior?

(a) How do users tend to walk through real objects in museums?

(b) How does a position rank bias affect users dwell-time in front of each point of interest?
2. EXPERIMENTAL DATA

In our archeological museum, RFID cards are provided as a key to access to some additional information about objects being shown in the museum. Visitors enter their preference at the beginning of the museum exhibition in order to personalize the content being shown in all of the point of interests. These preferences are perspectives of the narratives, language and the user's age range.

After checking in, users are free to put their keys on RFID readers of point of interests to unlock contents being shown about point of interests. They are free to interact with point of interests in any order. They can watch short movies, interacting with 3D photos of point of interests' objects, or read contents about objects being shown at POIs. At last, users might check out in a summary station, in which they might leave their name, birth date and email. In this paper, 5 months onsite logs of the museum with more than 21,000 sessions is used.

3. BIASES IN ONSITE LOGS

This section studies biases in onsite logs, aiming to answer our first research question: How do position of objects and time of the visit affect on users' behavior?

3.1 Walk Through Position Bias

The rest of the paper is organized as follows. Section 2 details the experimental data being used in this research. In Section 3, we introduce biases in the onsite logs. Section 4 is devoted to studying users' variation and the effect of biases on them. Finally, we present the conclusions and future work in Section 5.

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Figure 1: Walk through position bias: dominant transitions from check-in (C-in) to check-out (S). Numbers on the edges show count of users' movements between point of interests.

(c) How does a time rank bias affect users dwell-time in front of each point of interest?

2. What is the effect of users’ profile and their visit context on the position bias?

The users walk through bias causes two other kinds of biases, namely position rank bias and time rank bias, which will affect on understanding users’ behavior and their interests based on their dwell-time in front of POIs.
3.2 Position Rank Bias

We next look at the question: How does a position rank bias affect users dwell-time in front of each point of interest? One of the important social signals in the onsite logs is the dwell-time of each user in front of each point of interests. This information indicates the degree of interest in objects being presented at each point of interests. However, walk-through bias causes a position rank bias, in which users spending more time in front of point of interests installed in the beginning of the exhibition, and the dwell-time decreases by reaching step by step to the end of the exhibition. As it is shown in Figure 2, dwell-time is inverse-proportional to the position rank of the objects in the museum, and the highest dwell-time is for the first object after check in station. Therefore, this bias should be considered while dwell-time is being used as a social signal to understand users’ interests. According to this experiment, position of objects affects on the dwell time of users in front of them, which shows the dwell-time should be used with some care.

3.3 Time Rank Bias

As it is mentioned in previous experiments, users are free to visit any point of interest at anytime of their visits. As a result, they are free to not follow objects based on their position order. In this experiment, we analyzed dwell-time of users in each rank of point of interest based on users’ visit order. In order to do this experiment, we filter all the sessions that do not interact with all of the point of interests.

4. IMPACTS OF CONTEXTS AND PROFILES

This section answer our second research question: What is the effect of users’ profile and their visit context on the position bias?

As it is shown in the previous section, dwell-time of users in front of each object has a position and time rank bias. However, it is questionable that visits of which type of users are more affected by the position or time rank bias. To this aim, we stored gender, age, language, time and some other contexts in each session. In the following, some interesting observations based on users’ profile are detailed.

Language

We first look at differences between behaviors of users who decided to see Dutch content in comparison to users preferred English contents. According to Figure 4, we see a considerable difference in time spent by Dutch and English visitors (with identical content shown in each case) possibly due to foreign visitors spending more time with museum objects. People who preferred to see Dutch contents are less interested in POI7, which is about death. On the other hand, among sessions with English content preference, as expected by the position rank bias, people were more interested in spending time at POI7 rather than POI8. This experiment indicates that different variation of contents being prepared to be shown in deferent contexts affect differently on position rank bias.

Age

We now study contributions of age groups in position rank bias. We log 2 different values for age in this log data, namely, adult and child. Figure 5 shows that children do not like POI7 (which is about death) and spend less time in front of death point of interest. Figure 4 and 5 indicate that children and Dutch content of POI7 contribute more on the lower dwell-time of POI7 in comparison to the POI8.
Our general observation is that we cannot use dwell-time information of onsite logs without care, and we should consider position and time rank bias as two important factors for smoothing their effects on the dwell-time as a source of evidence of users’ interests.

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**References**


