Trail Explorer: Understanding User Experience in Webpage Flows

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ABSTRACT

Trail Explorer is a visual analytics tool for better understanding of user experiences in webpage flows. It enables exploration and discovery of user session data. This paper presents two case studies of Trail Explorer in use with real data.

Keywords: Web session data analysis, user experience research, visual exploratory data analysis, information visualization

Index Terms: H.5.m [Information Interfaces and presentation (e.g., HCI)]: Miscellaneous—;

1 INTRODUCTION

Providing frictionless user experience is the key to the success of a website, especially for E-Commerce websites like eBay. In addition, websites often have structured webpage flows that are designed to assist users to finish certain tasks. For example, a checkout flow guides users to submit payments and complete transactions. The success rate is defined as the percentage of users who reach the final completion step of the flow. It has significant impact on the revenue. Therefore, understanding user experience in such critical flows and making data-driven decisions to lift the success rates are critical to the business.

Researchers often gain insights of user experience from analyzing web session logs, which capture real user actions on the site. Traditionally, statistical analysis is used due to the large size and complexity of the session data. However, these statistical approaches tend to be hypothesis-driven and confirmatory rather than data-driven and exploratory. Thus, we created Trail Explorer for better understanding of user experience by enabling exploration and discovery of the session data. We mainly focused on understanding temporal behavior patterns. An intuitive visual representation was designed to achieve this goal. In order to handle large-scale session data, we implemented an effective clustering of sessions and used level-of-detail visualization techniques. Trail Explorer also enables correlation analysis of the elapsed time and success rate of a flow through easy interaction.

In the rest of the paper, we give a brief background of the session data and webpage flows, followed by an overview of Trail Explorer. We then present two real world use cases at eBay. They both show the usefulness of Trail Explorer for providing actionable insights to the business.

2 SESSION DATA AND WEBPAGE FLOWS

The basic unit of session data analysis is a *session*, or a timestamped sequence of events [1]. An event corresponds to a user action, such as clicking a button or filling a form. Every event has a timestamp, which records when the event happened. A webpage *flow* is defined as a sequence pattern, which contains a set of events and ordering dependencies among them. The events of a flow are also called steps. Based on the event timestamps, we can know how much time users spend on every step of the flow. One of these

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events is defined as the final completion step. A session, which contains the final step, is considered to be a successfully completed session. In the data preprocessing stage, we scan all the sessions and extract the sub-sessions that match the pattern. Therefore, the input data of Trail Explorer are flow sessions, which are defined as sub-sessions that happened within the flow. Since we want to focus on the predefined steps of the flow, the rest of the events are labeled as "others". Please note that these flow sessions can vary as long as they match the pattern of the flow.

3 TRAIL EXPLORER

The goal of Trail Explorer is to enable insights of temporal user behavior patterns and other factors of the success rate. The system contains four components, i.e., the main view, the detail information panel, the legend and the distribution chart of the elapsed time, as shown in Figure 1.
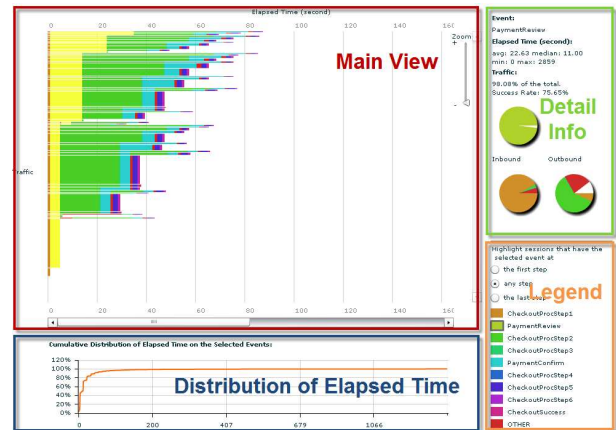

Figure 1: Trail Explorer: A visual analytics tool for understanding user experience in webpage flows.

The user sessions are visualized in the main view. Because of the sheer amount of sessions, level-of-detail visualization techniques are used. All the sessions are first clustered into groups based on their sequential patterns of events. Within each group, they are further bucketed based on the elapsed time on each step. A group of sessions is visualized as a horizontal stacked bar (See Figure 2). The height of the bar indicates the number of sessions in the group, and the width indicates the elapsed time. Different events are colored differently. This visualization allows users to see the temporal patterns of individual user sessions within the flow. In the default view, only the groups with a large number of sessions are illustrated. In order to study smaller groups, users can zoom in using the zooming slider.

Besides detail view of individual sessions, aggregated statistics are also important for understanding user behavior. Trail Explorer allows users to select an event in the legend. Based on the highlighting configuration, sessions that have the selected event as a particular step are highlighted. Statistics in the detail information panel and the distribution chart include the total count and success rate of the selected sessions, the average, median, cumulative dis-
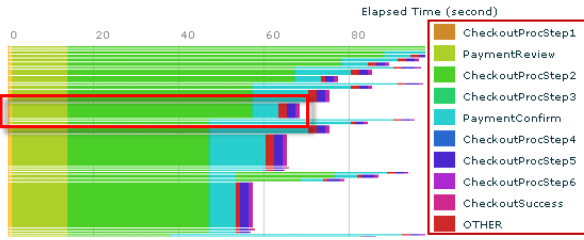
Figure 2: Visualizing a group of sessions as a horizontal stacked bar. Users in the selected session group (highlighted by the red box) spend 1 second at the CheckoutProcStep1 event and 13 seconds at the Payment Review event as the second step. In the third step, they spend 33 seconds at the CheckoutProcStep2 event.

tribution of the time spent on the selected events and etc. Users can also highlight events by selecting the stacked bars in the main view.

4 CASE STUDY: CORRELATION BETWEEN ELAPSED TIME AND SUCCESS RATE IN THE CHECKOUT FLOW

Figure 3: The checkout flow has three main steps in the flow, i.e., Payment Review, Payment Confirm and Checkout Success. There are several intermediate events between these steps.

The checkout flow is one of the most critical flows at eBay. As illustrated in Figure 3, after committing to a purchase, a user is directed to the Payment Review page, which allows him/her to revise the payment amount and method. In CheckoutProcStep 2 and 3, the user is asked to fill detail payment information of the selected payment method. Then, he/she needs to confirm the payment at the Payment Confirm step . If the user finally reaches the Checkout Success step, it is considered to be a successful checkout.

The success rate of the checkout flow directly impacts eBay's revenue. Therefore, making the checkout process as frictionless as possible for users and reducing the number of drop-offs is the top goal for the checkout production team. A lot of optimization had been done to the flow based on the insights from statistical analysis and field studies. The team was looking for opportunities for further improvement, which was not an easy task. We introduced Trail Explorer to a group of user experience designers and researchers from the checkout team. After an interactive demo session, they quickly learned the tool and started exploratory analysis right away. Trail Explorer was the perfect tool for them, because it allowed them to explore the session data and discover critical factors that they did not think of before. It also provided them very granular information visually, which was not available before. There were many interesting insights. One of the findings was the correlation between elapsed time in the flow and the success rate (See Figure 4). The longer the elapsed time at the Payment Review step is, the less likely users tend to complete the checkout process successfully. Based on this insight, the team decided to simplify the Payment Review page to reduce the elapsed time at the page.

This was the first attempt by the team to use a visual analytics tool for understanding user experience. They were very satisfied with the results and saw great potential of the tool. Therefore, they have migrated the Trail Explorer to the production environment and kept the data feed updated daily. The team has been using the tool extensively. For instance, when a new feature of checkout was launched, Trail Explorer was used to understand its impact on
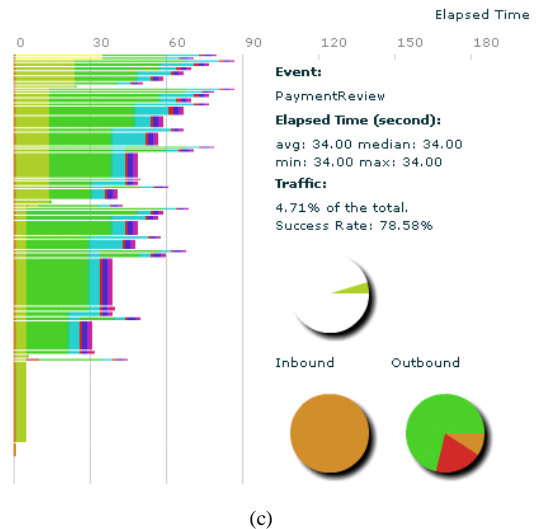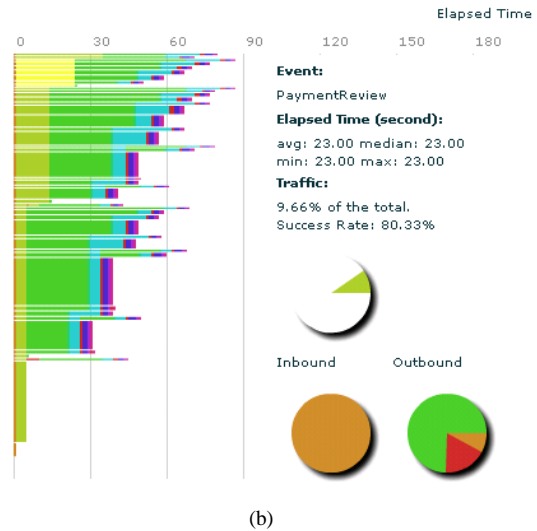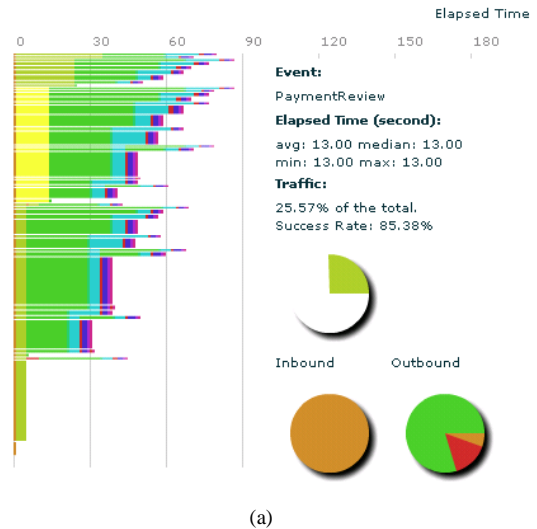

(a)

(b)

(c)

Figure 4: Correlation between elapsed time at the Payment Review step and the checkout success rate. In 4(a), the sessions, in which the average elapsed time at the Payment Review step is 13 seconds, are highlighted. The detail information panel shows that the success rate of these sessions is 85.38%. In 4(b) and 4(c), the sessions with elapsed time of 23 and 34 seconds are highlighted, and their success rates are 80.33% and 78.58%, respectively.

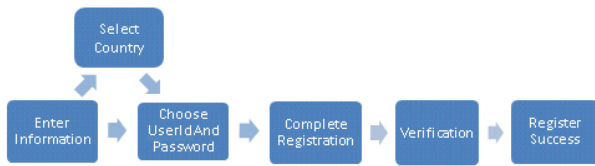user experience. The software engineers from the team even used the tool to help diagnose the issues and bugs.

Figure 5: The registration flow includes five steps and one optional step, i.e., Select Country.

5 Case Study: Finding Friction Points in the Registration Flow

When a new user comes to eBay, he/she needs to go through the registration process as illustrated in Figure 5 to create an eBay account. It is the most critical flow for user acquisition. If users feel frustrated in the registration process and leave without completion, eBay loses a valuable customer. Finding friction points in the registration flow is therefore important.

The user experience designers in the registration team had studied the friction points mainly through user studies, which were very limited. They would like to analyze real user experience extracted from the session data. Therefore, they applied Trail Explorer to their data. They tool was so intuitive to them, that they were able to identify several critical friction points without much assistant from us. The top one was related to the Select Country step. In the registration process, a user is asked to select his/her country of residence. Only several countries (e.g., United States, United Kingdom, etc) are provided as options by default. If the user does not live in these countries, he/she will be redirected to a separate page, which has a complete list of all the qualified countries. This was originally designed to speed up the registration process for major countries of eBay. In Figure 6(a), all sessions that are redirected to the Select Country step are selected. The outbound pie chart shows the distribution of the destinations users go to after this step. 33.5% of them leave the registration flow. This was a big surprise for everyone, because the drop-off rate was extremely high. It was much higher than the drop-off rate (5.1%) at the ChooseUserIdAndPassword step (See Figure6(b)), which had been thought to be the top friction point for users in registration. More surprisingly, the absolute number of users who drop off at the Select Country step was larger than that of the ChooseUserIdAndPassword step, although everyone thought that only a small number of users were directed to the Select Country page. However, as eBay expands to more countries, more and more users outside the major countries join eBay every day. The original design has become a major friction point for these users. Without exploring the session data at such a granular level using Trail Explorer, the problem of this outdated flow design would not have been identified easily. This problem has been fixed and we have seen a lift in the overall success rate of registration. Other insights were also learned using Trail Explorer, including the most time consuming steps in the registration process, behavior patterns of different user segments, etc. Many of them have led into decisions to improve the registration flow.

6 The Impact and Future of Trail Explorer

Trail Explorer enables exploration and discovery of large-scale session data. In the pilot project launched in early 2010, we worked with three production teams to apply Trail Explorer to five eBay flows, including registration, checkout, selling, bidding, and buy-it-now. It has proven useful for understanding user experience in these
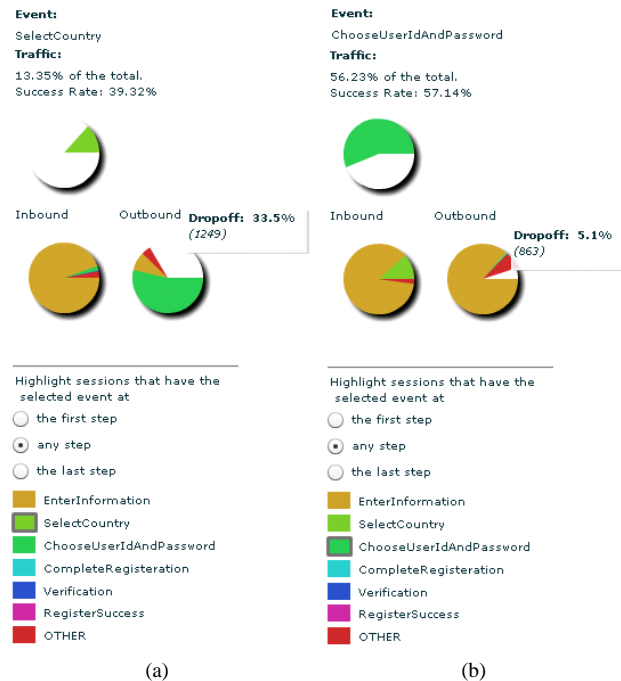

Figure 6: The Select Country step in the registration flow caused frictions with users. The drop-off rate at the step is 33.5% (See 6(a), which is much higher than other steps in the flow.

flows. The insights gained have been used in making data-drive decisions and brought positive business impact. Because of the success of the pilot project, the production development department, which owns most of the eBay flows, has initiated a project to productionize Trail Explorer and cover all the critical flows. Currently, Trail Explorer is actively used by various teams to understand and monitor how eBay users interact with their products.

We have received many valuable feedbacks and ideas from the production teams, e.g., segmenting sessions by users' levels at eBay and showing checkpoints in user sessions. We are developing Trail Explorer 2.0 with focuses on researching effective visual interfaces and integrating other data sources. The new version will provide users more analytical power and actionable insights.

References

[1] H. Lam, D. Russell, D. Tang, and T. Munzner. Session viewer: Visual exploratory analysis of web session logs. In *VAST '07: Proceedings of the 2007 IEEE Symposium on Visual Analytics Science and Technology*, pages 147–154, Washington, DC, USA, 2007. IEEE Computer Society.