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Interactive Interface Design for Adaptive and User Behavioural Habits

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ABSTRACT

This study aims to explore adaptive interaction design in relation to user behavior habits, optimizing the user interface (UI) of mobile applications through statistical analysis of user habits. Specifically, the research analyzes user behavior regarding landscape and portrait browsing modes when using mobile applications. The results indicate that adjusting the UI according to different browsing habits can significantly enhance user satisfaction. Therefore, adaptive interaction design strategies play a crucial role in accommodating user behavior habits, contributing to improved user experience and satisfaction.

KEYWORDS

User behavioural; Human-computer interaction; User interface; User experience

1. INTRODUCTION

Mobile phone applications have become an indispensable component of contemporary lifestyles. The average smartphone user spends approximately 30 hours per month on a variety of applications, which are widely used for communication, entertainment, and productivity. A number of studies have indicated that the typical smartphone user spends between one and ten hours per day on their mobile phone. A significant number of studies employ self-reported data, although a growing body of research has utilised actual mobile phone usage data captured through log files. This latter approach has revealed that the average daily mobile phone usage time is approximately two hours and 39 minutes [1]. By analysing the behavioural patterns of users in relation to the utilisation of mobile applications, it is possible to develop interfaces that are more aligned with the needs and habits of the user. The objective is to optimise the user experience, thereby ensuring a more seamless and enjoyable interaction.

2. STATE OF THE ART IN INTERACTIVE USER INTERFACE DESIGN

In the context of contemporary internet development, the design of user interfaces is frequently undertaken by designers and user interface developers. However, there is a paucity of interface design solutions derived from an understanding of user habits. Consequently, an investigation into the patterns of user habits could facilitate the creation of an interface that aligns with the needs of the public and offers a more personalised experience for individual users.

The user interface represents the nexus between users and the system, and the quality of UI design can have a substantial impact on user satisfaction. By analysing user behavioural patterns to inform the design of the UI, it is possible to ensure that the interface design aligns with users' expectations

and needs, minimise confusion and frustration during the user experience, and thus enhance user satisfaction.

A user interface (UI) designed based on user behaviour patterns has the potential to optimise the user's operating path, reduce unnecessary steps and clicks, and improve overall usage efficiency. To illustrate, the interface layout can be dynamically adjusted to fit the user's usage habits by predicting the user's next operation using a long short-term memory network (LSTM) [2], thus improving operation efficiency.

A user interface that aligns with user behavioural habits increases the likelihood of continued product usage. A positive user experience not only enhances the user's initial satisfaction but also fosters a greater inclination to utilize the product over time. A user-centered UI design approach can markedly enhance the user experience, with a reported satisfaction rate of 98.4% [3], hich subsequently elevates the user retention and product engagement rates.

3. INTERACTION DESIGN BASED ON USER EXPERIENCE

Firstly, from the perspective of user experience, a quality user experience is characterised by holistic, contextualised and multi-dimensional features that ensure a positive emotional response and satisfaction when interacting with a product or service. Specifically, the following five aspects can be explored:

3.1. Holistic Experience

A quality user experience is a holistic concept that covers all interactions before, during and after a user uses a product. It is important to focus not only on the usability of the product, but also on the emotional and cognitive responses of the user. In the restaurant industry, Starbucks provides a holistic user experience. From the in-store design and music selection to the mobile app's convenient booking and payment features, Starbucks ensures a consistent and high-quality experience at every touch point.

3.2. Contextual Interaction

The user experience is highly contextual, meaning that the product or service must meet the needs of the user in a variety of situations and roles. Successful UX design requires a combination of cognitive science, human-computer interaction, and ergonomics to ensure a positive experience for the user.

3.3. Positive Emotions and Satisfaction

The key to a quality user experience is the ability to promote positive emotions and satisfaction as the user interacts with the product or service. Such an experience not only increases user engagement and satisfaction, but also brings benefits to the organisation.

3.4. Multi-dimensional

A quality user experience encompasses multiple dimensions, including usability, subjective user value, emotion, and performance. These elements interact with each other to enhance overall user satisfaction and interaction.

3.5. Design Integration

Integrating the user experience into the design process is critical. Aesthetics, ease of use, and emotional response need to be considered to ensure that the product is not only functional, but also enjoyable for the user.

In the present era, there are a plethora of user interface (UI) designs that are based on user experience and interaction design. These include UI designs that are based on ergonomics, UI designs that emphasise the role of visual thinking in UI design, and UI designs that improve the user experience through visual communication technology. Additionally, there are UI designs that promote positive thinking and mental health. A further area of UI design is based on intelligence and automation, as exemplified by the BlackBox toolkit [4], which employs AI to assist in the design process, and UI design using Figma tools [4]. Another area of UI design is domain-specific, as evidenced by the development of UI design for the visually impaired domain. Research in the field of UI design covers a wide range of areas, including education, intelligence and automation, application-specific design, user experience and interaction.

4. FLAWS IN CURRENT UI DESIGN

The aforementioned UI design solution fails to account for the user's behavioural habits. By identifying these habits, a personalised UI design can be created for each user, thereby enhancing the user experience.

Although Adaptive UI (AUI) has the potential to enhance user experience, as evidenced by existing research [5], the majority of studies remain at the conceptual level and lack application in real production. Furthermore, studies have indicated that when enhancing UI design through user feedback, there is a discrepancy between the type of feedback and the improvement measures, particularly in the context of mobile applications. Additionally, research has demonstrated that existing UI design patterns lack sufficient categorisation, particularly in the application of design patterns for diverse user groups with varying behavioural habits (e.g., left-handed and right-handed individuals) [6].

In contrast to the conventional approach to user interface (UI) design, the traditional UI design methodology based on user preferences relies on the use of questionnaire surveys, which necessitate the collation of a substantial amount of user data as a benchmark, or alternatively, on the designer's own intuitive judgement in the design of the UI interface. The utilisation of user behaviour in the design of a UI interface allows for the gradual refinement and iteration of the interface into a distinctive page that aligns with the user's personal habits, thereby enhancing user satisfaction, pleasure and experience. By optimising the user experience of the UI interface, user engagement and satisfaction with the app can be elevated, which subsequently improves the user retention rate and conversion rate, thus conferring significant value to the enterprise.

Therefore, the goal of this research project is to analyse the user's behaviour habits in five dimensions through big data, and then adaptively adjust the UI interface, and finally get a UI interface that meets the user's behaviour habits.

5. DEFINING USER HABITS

The user's personalised behavioural patterns can be defined through five dimensions: frequency, duration, preference, interactivity and misuse. The remaining four behavioural patterns (tapping, swiping, preference area and focusing on content) exhibited by a user while browsing can then be determined. The mobile phone is used in both vertical and horizontal orientations. Consequently, different personalised adjustments to the UI are required for the two different screen formats, reflecting the different behavioural habits associated with landscape and portrait browsing.

The concept of user behavioural habits can be broadly defined as the manner in which users interact with digital content. These habits encompass a range of behaviours, including clicking, sliding, focusing on content, preference area behaviour and time and place influence behaviour.

Firstly, the following definition of the user's behavioural habits is proposed:

A detailed analysis of the behavioural habits of users when browsing the user interface of mobile applications is required.

5.1. Frequency

The term "frequency" is defined as the number of times a user performs a specific behavior within a given time period.

For example, one might consider the frequency with which a user opens an application on a daily basis or the number of times a user interacts with a specific button over the course of a week.

5.2. Duration

The term denotes the period of time spent by the user on each occasion that a specific behaviour is performed.

Examples of this include the average time a user spends on an interface and the time spent browsing a list.

5.3. Preferences

The term "preference" is defined as a user's inclination to select and utilise specific interfaces, features, or content.

Examples of user preferences include a preference for the night mode, a tendency to browse image content more frequently, and a greater propensity to utilise the search function.

5.4. Interactivity

The term "interactivity" refers to the degree and manner in which users interact with the app's interface elements.

Examples of user interaction include clicking on buttons, sliding the screen, filling out forms, and posting comments.

5.5. Misoperation

The term "misoperation" is defined as unexpected behaviour that is triggered unintentionally by the user during operation.

Examples of such behaviour include users inadvertently touching advertisements, users becoming disoriented when navigating, and users clicking on the incorrect links.

From these five aspects, it is possible to ascertain which mode of user behaviour is preferred.

6. GENERALISING USER BEHAVIOURAL PATTERNS.

In examining user behaviour within the context of mobile applications, the five dimensions previously outlined (frequency, duration, preference, interactivity and misuse) are employed to ascertain the potential proclivities of users. This analysis leads to the identification of several behavioural habit patterns, which can be summarised as follows:

6.1. Clicking Behaviour

A high frequency of clicking on elements of the interface, such as buttons, links, icons, etc., is indicative of a high clicking frequency.

A low frequency of clicking is also observed. It is uncommon for users to click on the elements of the interface; instead, they tend to slide to browse.

6.2. Sliding Behaviour

The act of sliding is defined as a movement of the finger or stylus across the surface of the screen in a smooth, continuous motion, without making a precise point of contact with the screen.

In the case of vertical sliding, users primarily utilise the up and down movements of the interface to navigate through the content, such as a news list or social media updates.

In terms of horizontal sliding, users tend to employ this gesture to navigate the content of the interface, including image rotation and product display.

6.3. Preferred Regional Behaviour

The manner in which the preference area is navigated can be described as follows:

The most preferred option is as follows: The majority of users employ a swiping or tapping motion on the upper portion of the interface.

In terms of the bottom preference, The bottom half of the interface is the area most frequently selected by users via swiping or tapping.

The left side of the interface is preferred. The left half of the interface is the area most frequently selected by users via a swipe or tap gesture.

The right half of the interface is the area of preference for users, who tend to swipe or tap there.

6.4. Content Focus and Behaviour

Textual content: Users demonstrate a greater interest in textual information and allocate more time to reading textual content.

Image content: Users exhibit a stronger inclination towards pictures and videos, and dedicate more time to viewing multimedia content.

6.5. Mobile Phone Holding Mode

Vertical screen mode: Users typically utilise their mobile phones in the vertical screen direction to browse apps.

Landscape mode: Users usually employ their mobile phones in landscape orientation and browse apps.

By analysing these behavioural patterns, developers and designers can optimise the user interface design in order to enhance the user experience. For example, optimising the navigation structure, adjusting the content layout, adding interactive elements, etc., can facilitate a more seamless and satisfying user experience when utilising the application.

7. DESIGNING INTERACTIVE INTERFACES BASED ON USER BEHAVIOUR

The aforementioned five behavioural patterns can be defined through the five dimensions of user habits, thus enabling the statistical inference of the most closely aligned behavioural pattern with the user's habits. To illustrate, the frequency of clicking and sliding can be counted and the total time spent on clicking can be compared with the total time spent on sliding. This allows the user's behavioural habit pattern to be inferred as either low or high clicking frequency. To illustrate, when

a user is utilising an application, the frequency of clicking and the time spent clicking are considerably higher than the frequency and time spent sliding. Therefore, it can be inferred that the user exhibits a high clicking frequency behavioural pattern.

In order to ascertain the most appropriate user interface (UI) optimisation method, the five behavioural patterns were analysed in conjunction with the user's mobile phone usage. The results indicated that the user's behaviour pattern could be categorised as one of the five behavioural patterns identified. Consequently, the corresponding UI optimisation method was proposed in order to enhance user satisfaction and experience.

By defining the user's behavioural habits, a corresponding statistical inference is made in order to arrive at the five behavioural patterns that are most consistent with the user.

In the first scenario, the user browses the app in landscape mode, which is indicative of a handheld mode behavioural pattern. The user's interaction with the app is characterised by a higher frequency of swiping (click behavioural pattern), a preference for sliding the page horizontally (sliding behavioural pattern), and an inclination to operate the sliding screen on the right side of the screen (preference area behavioural pattern). Additionally, the user demonstrates a preference for paying attention to the textual content (attention to the content behavioural pattern).

In the second scenario, when the user is browsing the app in a vertical screen orientation, the user exhibits a change in behavioural pattern from a handheld approach. This is evidenced by a change in the behavioural pattern of swiping, with the user now preferring to swipe the screen vertically. Additionally, the behavioural pattern of focusing on the content shifts, with the user now preferring to focus on the image content. The behavioural pattern of preference area also changes, with the user now operating on the lower half of the screen. Finally, the behavioural pattern of swiping remains unchanged, with the user continuing to swipe more often.

In the first scenario, the user can browse the app in landscape mode with horizontal swipes, highlighting additional textual information and positioning features that facilitate app operation, such as the navigation bar, on the right half of the screen.

In the second scenario, the user may be permitted to browse the app on a vertical screen with vertical sliding, highlighting more image information, and placing the navigation bar and other functions that facilitate app operation on the upper half of the screen.

In light of the aforementioned examples, modifications to the page can be made in accordance with the observed behavioural patterns.

7.1. Improving Interactive Interfaces Through Clicking Behaviour

In instances where the user primarily employs clicking as a means of interaction, it is advisable to facilitate the operation of the application through this modality.

For example, the return operation could be presented as a button, allowing users to navigate back to previous content by clicking.

In the event that the user's primary interaction is via sliding, it would be beneficial to facilitate this mode of operation within the application.

For example, the return operation could be presented as a slide back, allowing the user to navigate back through the content by sliding.

7.2. Improving Interactive Interfaces Through Sliding Behaviour

In instances where the user predominantly employs vertical or horizontal sliding, the operation of the app should also be predominantly vertical or horizontal, respectively.

7.3. Improving Interactive Interfaces Through Behaviour in the Preference Area

In the event that the user expresses a preference for utilising the upper, lower, left or right half of the application, the navigation bar or the functions of the application will be situated in a corresponding position within the aforementioned half.

7.4. Improving Interactive Interfaces Through Prioritise Content Behaviour

In instances where the user demonstrates a proclivity for textual content, the application in question will present a greater quantity of textual information.

In the event that the user demonstrates a greater proclivity for visual stimuli, the application will accordingly display a greater quantity of pictorial information.

7.5. Improving Interactive Interfaces Through Behaviour in Handheld Mode

A change in the user's handheld mode may result in alterations to the four corresponding behavioural patterns (clicking behaviour, swiping behaviour, preference area behaviour, content-focused behaviour). Consequently, the page design of the app may undergo corresponding modifications.

8. CONCLUSION

This project mainly studies the UI interface by analysing the user's behaviour habits and making the UI interface oriented to the user's behaviour habits, and finally makes the personalised design of the UI interface.

In this way, it can be mainly used in the mobile phone shopping app that meets the user's daily needs, and can enhance the user's stickiness to the app, thus improving the user experience. From an innovation perspective, there are four major innovations: 1. data-driven UI design, 2. rapid iteration of prototype design, 3. integration of the latest technology of user behaviour analysis, 4. personalised design based on big data. Thus, a more scientific, accurate and user-friendly UI design can be achieved.

Although this study has achieved some positive results, there are still a small number of problems, such as the imperfections in the way of analysing user behaviour habits, the dimensions of the analysis are not comprehensive enough, and the analysed user behaviour habits may not be accurate enough. Future research could consider analysing user behaviour in more dimensions and introducing intelligent UI design to help designers complete the design and application in a faster and more efficient way.

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