Application of User Behavior Research Method in the Vehicle Navigation Interface Design

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Abstract. The relationship between user behavior research methods and vehicle navigation interface design has been the focus of much recent research. This paper aims to improve the vehicle navigation interface use experience through user behavior and emotional, and allow user to better accept the navigation information in the vehicle. Emotional behavior analysis and multimodal interaction information integration are the key approaches which includes causal loop diagrams and information diagrams used to build the reference model of vehicle navigation interface design. The result of the measurement indicates that user behavior research can enable information interaction projects to build upon and transcend designers’ expertise and expectations during vehicle navigation interface design. The research, therefore, will highlight not only the importance of users behavior and experience in interface design, but also the necessity of taking effective measures to cater to users’ emotional needs.

1. Introduction
With the continuous reform of the function of vehicle navigation system and the increasing demand of people to use the navigation system, the interactive design of vehicle navigation faces more challenges in terms of usability, experience and safety under the special circumstances of inter-vehicle interaction. Many recent studies have focused on the general approaching of vehicle navigation function. However, not much attention has been paid to the user behavior experience and interactive design. The research of user behavior interaction design is of great significance. By reviewing the previous literature, this paper is specially aimed at investigating the user behaviors, frequently conflict characteristics and mental activities in using the vehicle navigation system.

2. User behavior conscious performance
User behavioral awareness contains two major stages: behaviour mapping and field work, while the second contains intervention development driven by iterative testing and refinement, illustrated in figure1. In navigation system, behavioral awareness is actually the physical representation of the user's information on the external environment, mainly to recognize what's happening around the user and to understand what that information means for the user's present and future [1]. The center of behavior awareness is the goal of the task, the information in the environment is only relevant to the purpose of the task is meaningful, these information is the key to assisting the user task decision. In vehicle navigation driving tasks, efficient behavior awareness can help users understand the characteristics of
navigation tasks, reduce the distractions caused by observation and thinking, and help users to make quick decisions and decisions while driving. Designing a vehicle navigation interface based on behavior awareness helps to create a high level of awareness of driving behavior.

![Figure 1. The behaviour awareness process](image)

In the interface design of vehicle navigation, through the reasonable information organization and visualization, the design of voice can improve the efficiency of user perception of information and provide the basis for the formation of user behavior awareness. The top-down awareness model requires that users be provided with information that is closely related to the task [2]. For example, if the user's task is to find a gas station, the information mainly includes information such as a gas station address and fuel consumption. The bottom-up sensing model first requires the vehicle navigation to provide key information such as steering tips when necessary. Secondly, the vehicle navigation interface should avoid excessive display of information to avoid visual and audio distractions.

3. Vehicle navigation interactive tasks analysis

3.1. Vehicle navigation mechanisms of task-oriented areas
In terms of the hierarchical characteristics of the activities, travel and its mobility are actually sub-tasks for the overall goal of completing the activity. Users from the start to the end of the process, the need to complete a number of driving tasks, which is the implementation of the route operation, the navigation system by providing instructions to support and optimize user behavior. Because vehicles are the main vehicle for activity, service information is closely related to driving, such as traffic information in the environment or prompting for lane change before turning. When you reach your destination, you are faced with the problems of parking, pickup and return. Thus, the single trip has different stages, each stage has different mission characteristics, navigation information should be based on the specific stage to provide users with the corresponding prompt information.

Vehicle navigation system can reflect the actual environment and vehicle characteristics, including dynamic and static features to provide users with relevant information to assist in the field of tasks to complete. In the activity plan, the navigation information can help users to form a better activity sequence, such as on the way to work and navigation information can also help users to determine the destination, such as in the travel to find nearby points of interest. Through the decision support of the activity plan, the user can form the itinerary planning, which can help the user to select the suitable route for the activity by providing an effective route selection set [3]. After the route selection is completed, the user can perform the route planning through the navigation information, and the completion of the driving task will also affect the environment. Thus it form the dynamic nature of navigation information and real-time, this real-time information in the course of the implementation process to help user at any time to amend the task, such as providing traffic jam information.
3.2. Vehicle navigation path planning tasks
The current guidance of the vehicle navigation route mainly adopts a steering-oriented and gradual guidance mode. Taking the key decision points in the journey as the basis for division, the whole mobile task can be composed of several sub-task units centered on the decision making points. The decision points here mainly refer to the key points where the navigation channel changes during the course of the journey, such as steering. At key decision points, the user's mission status will change significantly, the user will face the problem of whether to turn and change lanes. The process often includes both horizontal and vertical driving behaviors and is affected by other vehicle conditions on the road and traffic rules with some complexity [4].

There are two main ways to guide the route, one is to provide the entire route before the departure instructions, and the other is the form of step-by-step instructions provided in the itinerary. The current vehicle navigation is mainly used in the form of step by step instructions, step by step navigation without having to remember all the route and space structure information. If the user can not provide overall information about the itinerary and route, the user can only rely on the short-time information provided by the vehicle navigation device for driving, resulting in a certain sense of tension of the driving user [5]. In order to reduce this deficiency, detailed information on the entire route needs to be provided for the user before the trip or even any need in the itinerary.

4. Based on user behavior analysis to build vehicle navigation interface

4.1. Design process
Firstly, the user's mission objectives and decision-making analysis clear from the user behavior habits of contextual awareness and the role of the product planning belongs to the shape modification [6]. Secondly, the concept in the analysis is designed to improve the perceived efficiency, reduce the difficulty of understanding and enhance the ability to predict the performance of the principle, the detail design based on three kinds of mental models for the specific design principles, the completion of the organization and visualization of information design issues. Finally, after repeated testing of the design to complete the interface high-fidelity prototype, specific design process illustrated in figure2.

![Figure 2. Specific design process](image-url)

In the interactive interface, the expression of information is an important factor in the formation of interactive aesthetic experience, which is also the key to the realization of functionality [7]. The design of interactive interface needs to utilize the design of relevant elements to realize the reasonable unification of information function and form. In the design of information expression of vehicle
navigation, three basic principles should be considered in the design of information expression based on task while the application of basic aesthetics principle. The feature of user is to show the relationship between level and task. User get timely information related to the current main task, focusing on the distribution of attention to design, and the use of design methods to make the interface of information perception orderly sense. Secondly, the designer need the information task of the application of the characteristics to create an effective system, that focus is to enhance the understanding of information. Thirdly, positive feedback should be given to the user's task status and operation. The interface design emphasis is on enhancing the user's assessment of behavior and helping the user form a good cognitive and behavioral plan [8]. To realize the above three strategies, the two parts of the navigation information need to be specifically designed according to the hierarchical characteristics of the navigation information.

4.2. Design concept description

In order to make the user's route setting more in line with the user's activity attribute requirement, an option that can express the user's motivation requirement is added in the route setting interface, so the information searched by the user is filtered through the motivation requirement type to improve the user's route selection process. In the route setting function to increase future time settings, user can set the trip in the future one or a few weeks, and can be shared to mobile phones or wearable devices terminal, set the departure reminder, providing departure time, traffic jams and weather conditions to remind the message. According to the structure characteristics of the single-trip round-trip mission, the use of mobile phones and smart watches to extend the task of vehicle navigation, for the limited functionality of electric vehicles, parking location and destination distance and other issues.

In the design process, the purpose is to clarify the user interaction tasks, which tasks are suitable for user collaboration mode. In multichannel task sets, design the appropriate channel type for each task [9]. The purpose is to give full play to the advantages of each channel in the task and to deal with the synergies among the various channels. Through classification and concrete design, the prototype of the user's interaction structure is formed. After sorting out the structure of the interactive mode based on tasks, the task representation needs to be designed to clarify the content and specific representation of each task in the channel. It can help user to better understand the semantic content of the task and parameter.

In addition, commuter users tend to commute to more familiar routes and their route changes are more affected by traffic conditions, including traffic jams, accidents or temporary traffic control. In this kind of task situation, it is reflected in the design of human-computer interaction mainly in the following aspects: the appearance and form of status information, navigation system through the application of tasks to complete the process of providing information. But user tasks need to be aware of the information, they need to face the problem of routing, including the understanding of traffic conditions and the decision making process. Status information needs to be noticed by the user, and helps the user's awareness to reduce cognitive and decision making processes [10].

5. Conclusion

Through the analysis of user behavior, this paper systematically and structurally studies the interactive design method in vehicle navigation system. The following conclusion can be made. The user behavior method is a system and strategic approach involving spatial cognition and spatial behavior planning. The user needs to acquire the necessary task knowledge to complete the route planning. After the process of cognition, research for the user behavior in vehicle navigation interface design has a certain reference value.

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