The User Experience of Freehand Gestures

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Abstract. The importance of User Experience is growing in the automotive context, which differs from other products regarding its safety-criticality. Freehand gestures might be a solution for enhancing the User Experience without endangering road users. This paper proposes some approaches on using freehand gestures to create User Experience in the automotive context and to decrease driver distraction at the same time.

Keywords: User Experience, Freehand Gestures, Psychological Motives, Psychological Needs

1 Introduction

In the last years, usability has become a standard whereas User Experience (UX) gains increasingly the position of a unique selling proposition. Psychological needs and motives have been introduced as a way of designing UX [1]. UX has also caught the attention of car manufacturers. They start to concentrate on enhancing the experience of the driver while interacting with in-car devices.

In the area of human-machine-interaction, freehand gestures have become a new input modality next to speech, touch and haptics. Especially the gaming industry showed how they can be used to create a positive UX. Nevertheless, car manufacturers have not yet added the possibility to interact with in-car devices using freehand gestures. Therefore, we want to discuss how this form of input modality can be used to enhance the interaction experience while not affecting safety and at the same time decreasing distraction. We will present three concepts, which can potentially address different psychological needs using freehand gestures in automobiles.

2 Background

Freehand gestures might be a new opportunity for UX during the in-car interaction. The next paragraphs deal with the special requirements of this context as well as UX and the contribution of psychological motives and needs.

2.1 Interaction Design in Automobiles

Interaction design is defined as “designing interactive products to support the way people communicate and interact in their everyday and working lives” [2]. Interaction design focuses in most cases on the usability of a product, which gives certain guidelines and restrictions. Usability is an established principle in interaction design. Various norms have been established (especially the 9241-series, e.g. [3]). The design of interaction as well as the usability norms evolved out of the computing industry, but the transfer towards other products of different industry domains is nowadays established. This applies also to the car industry. The interaction design in cars relies basically on the same rules as common interaction design. With one important difference: Most designed interactions in cars nowadays deal with tasks which are not involved with the primary driving task, which includes planning, maneuvering and longitudinal as well as lateral vehicle guidance [4]. These tasks involve e.g. interactions with in-vehicle information and communication systems (IVIS). Contrary to that, advanced driver assistant systems (ADAS) support the driver in his primary task, but the interaction with those systems is not the same as executing the primary task. Therefore, interaction design for IVIS in cars has to take account of the fact that in no case the primary driving is allowed to be interfered with. This led to the concept of suitability, which deals with the usability of a secondary task (e.g. navigation system programming) while driving. While suitability focuses on the four aspects interference with the driving task, learnability, ease of use and efficiency [5], usability deals with efficiency, effectiveness and acceptance of the primary task. There are certain additional standards and guidelines for the automotive context which are e.g. summarized in [6], in this case regarding IVIS. In this context, freehand gesture interaction is largely unattended and although a standard concerned with UX amongst others exists [7], it is not specifically applicable to the automotive context.

2.2 User Experience – State of the Art

UX was first defined as "all the aspects of how people use an interactive product" [8], which refers to haptic, cognitive and usability aspects. Mäkelä & Fulton Suri [9] were more abstract and claimed that UX is a “result of motivated action in a certain context”. Meanwhile the Nielsen Norman Group insists to “meet the exact needs of the customer, […] simplicity and elegance” [10]. The DIN EN ISO 9241-210 [7] additionally considers the past experience, attitudes, abilities, customs and the character of the user. This is only an excerpt of the various definitions of UX. But neither of these definitions answers the scientific problem where and when exactly UX happens. Thus, further investigation on this problem will be necessary.

2.3 Psychological Motives in Interaction

The psychological motive gives the reason for any activity [11]. “Needs” is not defined as a physical, but as a psychological need. These need concepts potentially provide genotypic explanations for the wide variety of phenotypic behaviors that individuals express [12]. The identification of psychological needs relies on the interpretation of the person collecting experiences of users. If the main interest is to investigate the true psychological motives of the users, this approach may be difficult; this is not the case with the concept of psychological needs. In contrast, psychological motives arise when a psychological need meets its object [11], whereas “object” can include human beings or animals and is not restricted to entities. Motives are therefore dependent on the context of the interaction. Positive experiences arise when psychological motives are met [11]. If an approach would be developed to measure psychological motives, either via observation or interviews, it could sharpen the understanding of what actually leads to a positive UX. If the goal is instead of user research to design and develop new interaction devices, a more conceptual approach with designing for psychological needs can be undertaken. The latter will be the approach for implementing freehand gestures as a new interaction possibility.

3 Freehand Gestures in Automobiles

McNeill [13] divides gestures into three phases. During phase one, the *preparation*, the hand moves to the starting position of the gesture. Phase two, the *stroke*, describes the execution of the actual gesture. Finally, the *retraction* is the movement of the hand back to the initial position. These phases can also be applied to interactions like pushing a button. Phases one and three are identical, phase two is different being not a gesture but another form of interaction. Former research on the use of freehand gestures in automobiles [e.g. 14] has been concentrating on the second phase. A fixed set of gestures was created which were recognized and followed by a reaction of the system. In contrast, our approach focuses on phase number one. First, we want to present three concepts for the use of freehand gestures in automobiles. Second, we want to propose how these concepts could address certain psychological needs and thus provide a possibility to create a positive UX.

3.1 Concepts for the Use of Freehand Gestures

In our first concept, we argue that it is possible to detect the intention of an interaction only by interpreting the preparation phase. One example is a driver opening the glove compartment. By detecting his gesture while he is reaching for the handle, it is possible to recognize the driver’s intent. A logical reaction would be the automated opening of the glove box. This could save time and additionally reduce the driver’s visual load, since no exact positioning of the hand is needed.

Our second concept is a further development of the first one. The idea is to interpret the preparation phase of an interaction as another stroke phase and thus as an

actual freehand gesture. An example is a driver turning on the radio while driving. Instead of actually pushing a button or turning a knob, only a gesture moving the hand towards the radio, which is usually placed in a central stack together with other devices, is needed. This again could save time and reduce the visual load.

The third concept is another advancement. It combines two types of freehand gestures: one for activation and one for manipulation. The former is the kind described in the second concept: a device can be activated by simply reaching for it. The latter is thought to be a small set of gestures, which are universal and can therefore be used across several in-car devices like radio, navigation system or air conditioning. An example is moving the hand up and down and thus controlling volume, zoom factor or temperature, depending on the device which has been activated.

In all three cases it has to be guaranteed that a device will not be activated by a gesture on accident. Such incidents would rather be a frustration for the drivers and hence not lead to a positive, but even a negative UX.

3.2 Freehand Gestures and Psychological Needs and Motives

As mentioned before, the gestures described in our concepts have the potential to let the driver benefit in terms of time advantages and reduced visual load while interacting with in-car devices. But how can this enhance the UX in automobiles? Referring to the psychological needs listed by Sheldon et al. [12] and according to the work done by Hassenzahl [1], three needs could potentially be addressed by our approach: First, the driver's motive to feel "safe from threats" while driving could be met by giving him the chance to concentrate his full visual attention on the primary task. Therefore, the psychological need for *Security* could be fulfilled. Second, with the help of the additional input modality in cars in form of freehand gestures, the driver could feel "very capable in what he did". Therefore, his need for *Competence* could be met. Third, the driver could possibly enjoy this new form of input modality and thus "experience new activities" in the car, which is a motive connected to the need for *Pleasure-Stimulation*.

4 Conclusion

In this paper, we gave a short introduction into the importance of UX and its influence on interaction design. We argued that freehand gestures have the potential to enhance interactions with in-car devices and therefore offer an opportunity to enhance the UX. To support this, we introduced three concepts for possible usage scenarios of freehand gestures in cars. We proposed that the psychological needs for security, competence and pleasure-stimulation could be addressed. Freehand gestures might also help to reduce the visual distraction of the driver. Our future work will include the construction of a prototype and the evaluation of the assumptions we made. A discussion of our concepts with experts on UX in the automotive context would be important for their further development.

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