The concept of Acceptance

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Abstract

Over the recent years there has been a large development of various driver support systems with the intention to improve traffic safety. For these systems to be successful in reducing fatalities and trauma it is decisive that they are used by the drivers. Hence, the driver’s acceptance of the systems is vital. How acceptance can be measured depends on how it is defined. Unfortunately, there is no prevailing definition which has resulted in a number of different measurement methods, often with disparate outcomes.

This paper discusses the definition of acceptance and how acceptance is measured. The Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al, 2003), used in the area of information technology, is analysed and put forward as a promising alternative to study the acceptance of driver support systems.

Introduction

Over the recent years there has been a large development of various driver support systems with the intention to improve traffic safety, e.g. Intelligent Speed Adaptation (ISA), Forward Collision Warning (FCW), Lane Departure Warning (LDW), etc. For these systems to be successful in reducing fatalities and trauma it is decisive that they are used by the drivers. Hence, the driver’s acceptance of the system is vital. This is recognised by many, e.g. NHTSA (2006) who stated that “driver acceptance is the precondition that will permit new automotive technologies to achieve their forecasted benefit levels”. Also, van der Laan et al (1997) concluded that “it is unproductive to invest effort in designing and building an intelligent co-driver if the system is never switched on, or even disabled”. Over the years, acceptance has been measured in a number of ways, which often resulted in different outcomes. How acceptance can, and should, be measured depends, of course, on how it is defined. Unfortunately there is no prevailing definition.

This paper discusses the definition of acceptance and how acceptance is measured. The Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al, 2003), used in the area of information technology, is analysed and put forward as a promising alternative to study the acceptance of driver support systems.

What is “Acceptance”?

Despite the recognized importance of acceptance, there is no clear definition of what acceptance is and how to measure it. Only little work regarding acceptance theory has been carried out within the driver support area. Many studies have claimed to measure acceptance although few of them have defined what it is. As Regan et al (2002) put it “While everyone seems to know what acceptability is, and all agree that acceptability is important, there is no consistency across studies as to what ‘acceptability’ is and how to measure it”.


Although there is no prevailing definition of acceptance, there is some work done. Nielsen (1993) for example described acceptance as “basically the question of whether the system is good enough to satisfy all the needs and requirements of the users and other potential stakeholder”. This definition is both very general and broad. According to this definition a system must satisfy all needs in order for it to be acceptable. Far less perfect systems than so are well accepted and used by car drivers today. Chismar and Wiley-Patton (2002) defines acceptance as “the intention to adopt an application”. This definition is very concrete but it could be argued that it is too short to define the nature of acceptance. Ausserer and Risser (2005) defined acceptance as “a phenomenon that reflects, to what extent potential users are willing to use a certain system”. Both Chismar and Wiley-Patton (2002) and Ausserer and Risser (2005) talks about the adoption/use of the system but neither of them require a manifestation with actual behaviour, without no traffic safety effects can be expected.

There are also suggestions that there is more than one type of acceptance. Goldenbeld (2002) made a differentiation between acceptance and support, where acceptance denoted the willingness to subject to something (e.g. pay taxes) while support denoted the liking of doing so. Similarly to this, Franken and Lenz (2004) differentiated between attitudinal acceptance and behavioural acceptance where the attitudinal acceptance denoted that the system was accepted in a cognitive way (e.g. “ISA is a good way to reduce traffic speeds”) and the behavioural acceptance is expressed by actual behaviour (e.g. to buy an ISA-equipped car). One could argue that the behavioural acceptance could be large without a large attitudinal acceptance if there are either carrots and/or sticks important enough to make the driver decide to subject to using a support system even though he/she might not approve it (e.g. use of a speed assistance system to avoid being fined for speeding). The opposite also yields, attitudinal acceptance can occur without the behavioural acceptance (“ISA is a good way to reduce traffic speeds, but I do not need it”).

Neither the definitions suggested by Nielsen (1993), Chismar and Wiley-Patton (2002), Ausserer and Risser (2005), the attitudinal acceptance (Franken and Lenz, 2004) nor support (Goldenbeld, 2002) require any impact on the actual use of a system. If it does not affect the actual use of a support system it does not affect traffic safety. Hence, from a traffic safety point of view, the main focus should be the behavioural acceptance (Franken and Lenz, 2004).

How acceptance is measured

The lack of theory and definition regarding acceptance has resulted in a large number of different attempts to measure acceptance, often with quite different results. One example of such an attempt is the assessment of acceptance of the Active Accelerator Pedal, in the large scale field trial held in Lund, Sweden in 2001. In this case, the questions “the idea of the system” and “willingness to pay” were used as two indicators of acceptance (Adell and Várhelyi, 2008), see figure 1.

![Figure 1: What is the acceptance of the Active Accelerator Pedal? Responses from the large scale field trial in Lund (Adell & Várhelyi, 2008).](image-url)
Other examples of how acceptance has been measured are reported and logged 'voluntary use', 'willingness to keep the system after the trial period ended' (Vlassenroot et al, 2007), 'willingness to have the system' (e.g. Várhelyi and Mäkinen, 2001), 'the liking of the system', 'willingness to pay' and 'on what roads the drivers like to use the system' (Piao et al 2005), 'ease of use', 'perceived value', 'ease of learning', 'advocacy' and 'driving performance' (NHTSA, 2006), 'usefulness', 'ease of use', 'effectiveness', 'affordability', and 'socially acceptability' (Regan et al 2002).

A major step in measuring acceptance was done in 1997 by van der Laan et al who suggested a standardised procedure to measure two dimensions of acceptance of advanced transport telematics: 'usefulness' and 'satisfaction'. This method makes it possible to quickly estimate the usefulness and satisfaction of the system and to compare different systems. However, it has not been shown that the constructs ‘usefulness’ and ‘satisfaction’ influences the acceptance and use of a system. Further, the method is limited to two dimensions of the acceptance construct. Literature, both within the traffic safety area and in other areas, such as information technology, suggests that acceptance is of a more complex nature and could also contain dimensions such as social influence, effectiveness and perceived value (see for example Regan et al 2002, NHTSA 2006, Venkatesh et al 2003).

The present situation, without both a definition of acceptance and a framework in which the acceptance could be viewed, makes it difficult to understand the level of acceptance, and to learn how to improve the acceptance. To make comparisons between systems and studies are almost impossible. A definition and a model in which to view acceptance would facilitate an up-build of the knowledge base of the concept of acceptance and the drives behind it. This could give valuable information in development, design, deployment and implementation of new driver support systems.

**The Unified Theory of Acceptance and Use of Technology (UTAUT)**

Following the rapid development of new technologies and software within computer science the interest in acceptance and use of these technologies has increased significantly. Today this area includes one of the most comprehensive research bodies on acceptance and use on new technology. Venkatesh et al (2003) performed a review of the user acceptance literature as well as empirically comparison of the eight most significant models, including their extensions, and proposed the Unified Theory of Acceptance and Use of Technology (UTAUT). The models investigated were the Theory of Reasoned Action, the Technology Acceptance Model, the Motivational Model, the Theory of Planned Behaviour, a model combining the technology acceptance model and the theory of planned behaviour, the Model of PC Utilization, the Innovation Diffusion Theory and the Social Cognitive Theory (for references see Venkatesh et al 2003). Within all these models the key element is the behaviour, i.e. use, of the new technology indicating a focus on behavioural acceptance.

Venkatesh et al (2003) postulates two direct determinants of usage behaviour, 'intention to use' and 'facilitating conditions': 'Intention to use' is in turn influenced by 'performance expectancy', 'effort expectancy' and 'social influence'. Gender, age, experience and voluntariness of use act as moderators, see figure 2.
The model was validated on acceptance and use of computer software by workers in the USA. The results showed that the UTAUT model outperformed the eight individual models named above, accounting for 70 percent of the variance (adjusted R²) in the use (Venkatesh et al 2003). The ‘performance expectancy’ was a determinant of intention to use in most situations: the strength of the relationship however, was moderated by age and gender, being more significant for men and younger workers. The effect of ‘effort expectancy’ was also moderated by gender and age, being more significant for women and older workers. This effect decreased with experience. The effect of ‘social influence’ on intention was conditioned by age, gender, experience and voluntaries such that the authors found it to be non-significant when the data were analyzed without the inclusion of moderators. The effect of ‘facilitating conditions’ was only significant when examined in combination with the moderating effects of age and experience – i.e. they only matter for older workers in later stages of experience (Venkatesh et al 2003).

The authors concluded that the promising results indicated that the UTAUT provides a useful tool for assessing the likelihood of success for new technology introductions and provides knowledge of what stimulates acceptance, that could be used to proactively design interventions (including training, marketing, etc) targeted at populations of users that may be less inclined to adopt and use new systems (Venkatesh et al 2003).

In the last years the model has also begun to be used in a other contexts, such as adoption of mobile services among consumers (Carlsson et al 2006, Bouwman et al 2007) and in the health sector. Within the health sector it has e.g. been used to examine the viability of motes (tiny, wireless sensor devices) as reliable and efficient health monitoring tool (Lubrin et al 2006), health professionals’ reluctance in accepting and utilise information and communication technologies (Schaper and Pervan, 2007), and physicians’ acceptance of a pharmacokinetics-based clinical decision support system (Chang et al, 2007).
Discussion and conclusion

The lack of definition of acceptance as well as a model or framework in which to understand acceptance, and the drives behind it, present a significant barrier both for understanding and working with acceptance.

To define acceptance in the area of driver support systems, the focus should be on behavioural acceptance. Without behavioural change the systems will not have any affects on traffic safety. Nevertheless, it is also desirable to accurately predict the user acceptance as early as possible in the design process to be able to evaluate different alternatives and to examine obstacles to overcome. In these early stages it is often not possible to measure the behavioural acceptance but indirect measures such as intention have to be used. The question then is, to what extent the intention to adopt a future application (asked for in its design phase) reflects the behavioural acceptance of the developed system. The difficulty in establishing the relationship between intention and actual use seems to be a fundamental question in acceptance research to which there is no easy answer (Regan et al 2002). However, it is very important to establish this relationship and it should not be overlooked.

Further, it is important to focus on the individual who makes the decision to use or not to use a system. Since acceptance is developed by the individual it can only be based on the individual’s perception of the system. Expected objective effects (e.g. reduction in accident risk) can only influence the acceptance if they are understood and believed in by the driver. A misunderstanding of a system will influence the acceptance as much as a correct conception.

The focus should neither be on the innovation per se nor on political/policy goals. It has been recognized that to achieve acceptance and use of new systems the personal importance for the users has to be higher valued than the degree of innovation (see for example Ausserer and Risser (2005)). However, policies and political goals are often confused with the driver’s personal goals. The goals for society and the individuals do not necessarily coincide. They don’t have to. For example, the policy goal behind ISA could be to increase traffic safety or to increase the speed limit compliance. Since some drivers might have the feeling that safety measures are redundant because of their own personal driving skills (Brookhuis and Brown, 1992) or that speeding is not seen as a “real” crime (Corbett, 2001) these policy goals are unlikely to appeal to those drivers. Nevertheless, it is possible that these drivers show an interest to use a system like the ISA to avoid speeding tickets or because they have an interest in innovative systems.

To start a discussion on the definition of acceptance the following definition of acceptance is proposed: The degree to which an individual in his/her behaviour manifests the intention to use a system. This definition has the advantages of considering both the intention to use (which could be assessed early in the development phase) but also emphasises the importance of manifesting the intention in actual behaviour. Further, the definition clearly states that the level of acceptance is not believed to be limited to acceptance/no acceptance, but to be of a continuous nature. This is in line with the Transtheoretical Model of Change, which describes how people modify problem behaviour or acquire a positive behaviour (e.g. Prochaska and DiClemente (1983) and Prochaska and Velicer (1997)). The definition also stresses the importance of focusing on the individual who makes the decision to use or not to use a system and his/her understanding of the system that influence the acceptance.

The Unified Theory of Acceptance and Use of Technology has provided assistance in understanding what factors either enable or hinder technology adaptation and use. Although the model was developed within the area of information technology, it has been used successfully within other areas. As such it is possible that the UTAUT model also would provide a useful lens through which to view acceptance and use of new driver support systems. Further work is necessary to adapt this model to driver support systems and develop a measuring tool.
If this model could help us to come closer to accurately assess the likelihood of success for new technology introductions, as well as provide knowledge of what stimulates acceptance and proactively design interventions targeted at populations of users - as it has done within the information technology area - we could take a significant step forward in our knowledge in how to measure acceptance of driver support systems.

References

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