

# Acceptance of autonomous vehicles using a combination of UTAUT and DOI

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## ABSTRACT

The advent of Autonomous Vehicles (AVs) revolutionized the future transportation system. Along with the potential benefits of this technology, new and unknown challenges in the field of transportation are emerging. One of the first steps in examining the impact of these devices is to identify latent variables that affect their acceptance. Most researchers have used Unified Theory of Acceptance and Use of Technology (UTAUT) to examine the latent variables influencing the acceptance of AVs, which is a combination of the previous eight theories of acceptance models but ignores some variables affecting acceptance. This paper uses a combination of UTAUT and Diffusion of Innovations (DOI) Theory, and the latent variables of Performance Expectancy (PE), Effort Expectancy (EE) and Social Influence (SI) (in UTAUT) and Observability (OB) and Trialability (TR) (in DOI) are examined. The results of the calibrated proposed model for 338 samples obtained from the design and distributed questionnaire for this purpose in 2019 among the residents of Tehran indicate that the PE and OB have the highest and least impact on the acceptance of AVs, respectively. The results of this study can be used by policymakers to address the barriers and challenges facing individuals in order to adopt this technology and thus benefit from its potential benefits.

## KEYWORDS

Autonomous Vehicles, Unified Theory of Acceptance and Use of Technology, and Diffusion of Innovations Theory, Structural Equation Modeling

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## 1- Introduction

The advent of new technology, such as Autonomous Vehicles (AVs), is shaping the future of mobility. Reducing fatal crashes caused by reducing or eliminating human error [1], increasing network capacity, increasing traffic flow efficiency, enabling people with low ability to create independent travel [2], reducing driving costs, and improving the land use pattern [3] are just some of the benefits of this technology.

The purpose of this study is to identify latent variables affecting the acceptance of AVs, which has used the Unified Theory of Acceptance and Use of Technology (UTAUT) and Diffusion of Innovations (DOI) theory. The variables used in this study include Performance Expectancy (PE), Effort Expectancy (EE) and Social Influence (SI), Observability (OB), and Trialability (TR). The contribution of this research is that in order to further explain the acceptance of AV, the combination of the two theories of UTAUT and DOI has been used.

## 2- Methodology

Structural Equation Modeling (SEM) among researchers has become a popular way to study causal hypotheses. In general, the criteria used for the overall fit of the SEM are divided into three categories: absolute fit, comparative fit, and parsimonious fit. Absolute fit indicators show how much the proposed model is similar to the observational model. Comparative fit indicators indicate the relative position of the model between the worst fit (zero) and the best fit (one). Parsimonious fit indicators are used to compare different models with different parameters.

In general, when at least three indicators have values in the acceptable range, it can be claimed that the fit of the model is good and acceptable [4].

## 3- Research data

In order to find the latent variables affecting the acceptance of AVs in the present study, a random sample of residents of Tehran was selected. For this purpose, 338 questionnaires were distributed in Tehran from September to December 2019.

According to the purpose of this paper, which is to evaluate the acceptance of AVs using UTAUT, and DOI, in the conceptual model of this research (Figure 1), three latent variables of PE, EE, and SI in UTAUT and two variables of OB and TR in DOI are used.

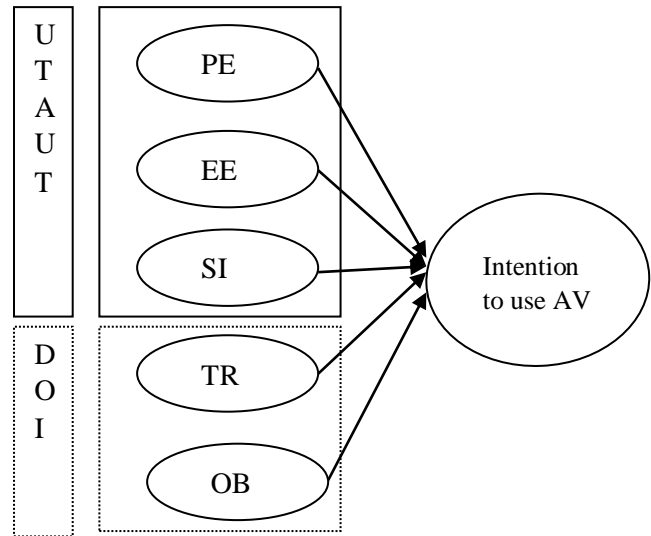


Figure 1. Conceptual model of current research

## 4- Discussion and Results

In this study a SEM is done using AMOS software. Based on the results shown in Table (1), the effect of all variables on the intention to use AVs at the level of 5% has been significant.

Table 1. The results of modeling the acceptance of AVs

Row	Latent Variable	Coefficient	P- Value
1	PE	0.3857	0.0000
2	EE	0.1632	0.0313
3	SI	0.2038	0.0105
4	OB	0.1313	0.0975
5	TR	0.1224	0.0455

According to the results, by increasing the amount of latent variable of PE, the person's intention to use AVs increases. This is reasonable; because this latent variable reflects a person's view of increasing their efficiency when using an AV. This result is consistent with other previous studies [5, 6]. If one finds it easy to use AVs, one will be more inclined to accept it. In line with the results of this study, some researchers have acknowledged the direct effect of this latent variable on the intention to use AV [5-7]. The SI variable indicates the impact of society on individuals and the influence of individuals from the surrounding groups. As can be seen from the results of the model, if a person thinks that people who influence his behavior encourage him/ her

to use an AV, he/ she will be more inclined to use it [5, 6, 8]. With an increase in the OB, the intention to use AVs increases. This variable indicates that technology is not accepted in the early stages of market introduction. It can be argued that people prefer to use self-driving car technology in society and see the benefits of using it, then they will be interested in using it [9]. The variable of TR has a positive sign. This means that if people can use this technology for a limited time and understand its benefits, they will be more inclined to it.

According to the evaluation criteria (Table 2) SEM in this study has a good fit.

**Table 2 SEM Assessment**

Index	Category	The value in this study	Acceptable range
Root Mean Square Error of Approximation (RMSEA)	Absolute fit	0.0624	<0.08
Comparative Fit Index (CFI)	Comparative fit	0.9085	>0.9
Incremental Fit Index (IFI)		0.9091	>0.9
Parsimony Normed Fit Index (PNFI)	Parsimonious fit	0.7706	0.5-0.9

## 5- Conclusions

Before the widespread use of Autonomous Vehicle (AV), it is necessary to study the factors affecting acceptance. Most researchers have used Unified Theory of Acceptance and Use of Technology (UTAUT) to examine the latent variables influencing the acceptance of AV. Some variables such as observability (OB) and trialability (TR) have not been considered in UTAUT. In order to further integrate this study uses a combination of the above theory with and Diffusion of Innovations (DOI) theory.

A questionnaire was designed and it was randomly distributed among 338 residents of Tehran. The results of the SEM of this study indicate the significance of the effect of all latent variables (Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI) (in UTAUT) and Observability (OB) and Trialability (TR) (in DOI) on the acceptance of AV. Among the variables used, PE has the highest and the TR has the least effect on the acceptance of AV. It can be argued that in order

to attract more and more people, manufacturing companies can become more aware of the benefits of AVs by using advertising to reinforce PE. So, developers, designers, and marketers are increasingly taking advantage of this technology (such as flexibility, convenience, faster and easier access to transportation and so on).

For further studies, it is recommended to investigate the acceptance of AV using discrete choice models. Using these models can help analyze the heterogeneity between individuals and alternatives.

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