Self-driving cars for tourists and consumers

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Submission date: 26-Aug-2022 06:21PM (UTC+0700)
Submission ID: 1887400121
File name: cers_2019_Self-driving_car.pdf (312.81K)
Word count: 5018
Character count: 27383

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Abstract

When we would like to rent a car while traveling abroad and then explore the landscape or get to the sea, we could not look around while we are driving, nor read information on the site from what we are seeing, nor perhaps take a photo and send it to our friends about what we saw on the way. And after the evening party, it would come as soon as possible to get home quickly, but it is not possible to sit behind the wheel with alcohol in the body, but taxis are expensive and come for a long time. The system of self-driving cars in the world can offer solutions to these problem sets. Self-driving cars are unlikely to replace public transport, but they can support mobility. Nowadays, more and more Artificial Intelligence Development Centers are opening up to deal with traffic-awareness applications: how will the pedestrian walk around the sidewalk, how the car going along with us, etc. These new technologies have already been researched in the literature, but there is no evidence for a consumer-oriented approach. The purpose of our research is to identify the service systems in the scientific literature where the appearance of a self-driving car would change or increase the popularity and attendance of the elements, places. It would also increase the attractiveness of a tourist destination if it could be easier to discover effectively even through self-driving cars. In this study, you can read relevant articles from high-prestige journals organized by topics that support the basics and questions of a later empirical research. We have identified different topics within tourism, where the presence of self-driving cars can be utilized. In the course of the research, we have seen that the appearance of self-driving cars in tourism could be very useful, as can be seen in the examples above.

Key words: Self-driving cars, Community, Tourism, Services, Development, Mobility

JEL Classification: L62

1. Introduction

In the last decade, Autonomous Vehicle (AV) has gained serious attention from the world over for its potential to solve various environmental as well as social problems modern societies are currently facing, from high pollution to car accidents due to stress, drunk driving and other negligence, especially in touristic places. AV is said to be a disruptive technology due to its ability to shape neighborhood and business districts as well their economy (Rosenzweig and Bartl, 2015; Crayton and Meier, 2017). Moreover, AV technology may come sooner than most people think and when the tech is available for mass consumptions it will revolutionize many business sectors, including tourism industry and increase of competitiveness (Gyulavári and Kenesei, 2012) of cities and regions.

Autonomous Vehicle (AV) can be a part of sharing economy which is increasingly popular among millennials. AV may contribute in the betterment of our environment through reduced car ownership hence reduced pollutions, traffic congestions and oil consumptions (Woldeamanuel and Nguyen, 2018). AV technology can be one of the solutions to combat our common enemy that is global warming.

Despite some potential benefits a society can reap from the emergence of AVs, some challenges still exist to make them fully operational on the road. They are mainly concerning safety and legal and ethical issues, such as consumer privacy, ownership and maintenance, insurance and accountability in the event of manslaughter (Douma and Palodichuk, 2012; Rosenzweig and Bartl, 2015). The latter which is basically a question about "who is responsible?" has been an ongoing debate within the AV literatures (Liu, 2017). Delicate issues concerning morality and technology require policy makers to have a holistic perspective and reform their current laws in order to enable the adoption of innovative technology, such as AV, in the future.

Beyond the scope of legal and ethics, potential long-term health issues derived from automation are recently raised within AV literatures. For instance, while the emergence of AV technology can potentially help in stress relief due to driving, it can also become the source of Non-Communicable Diseases (NCDs), such as inactivity and obesity (Crayton and Meier, 2017). It is then a question as to which types or what forms of car automations (semi vs full) in the future that can bring about positive social implications to our society through a well-balanced lifestyle.

Although most – if not all – studies in AV presented what-if or hypothetical scenarios, it should be clear by now that AV possesses some potential benefits as well as potential harms. We, however, are inclined to step forward and progress in this topic by framing AV technology in the scope of tourism.

The literature of autonomous vehicles is widespread, but most of the main topics related to technical and technological aspects. Only the 6% of them constitutes the social science literature (Cavoli, Phillips, Cohen, & Jones, 2017). There is no research specifically on the relationship between autonomous vehicles and tourism at international level.

The only one is the article of Tussyadiah, Zach and Wang (2017), the author wrote about the attitudes of the public to the concept of self-driving taxis. They studied 325 people in the USA in two different contexts, as residents and as tourists. Negative attitude to technology is on law level, it is because they think that the technology is dehumanizing. There is a high confidence in self-driving taxis, people have expectations for reliability, functionality and helpfulness. Travellers who often use taxi in tourism destinations and who are open to innovative technologies, they are also more likely to use self-driving taxis. So there is a potential impact of self driving taxis for the tourism industry.

The first article on tourism was written by Cohen and Hopkins (2019). In their conceptual paper, they presented some opportunities and challenges of connected and autonomous vehicles (CAVs) on urban tourism.

We will deepen our discussions in this study by examining the potential implications of anthropomorphism feature in AV towards overall touristic experience. Previous studies have linked anthropomorphism feature in AV to greater trust among passengers (Forster, Naujoks and Neukum, 2017) which may vary across cultures (Yerdon et al., 2017). This study is expected to be an insight to policy makers in tourism sector.

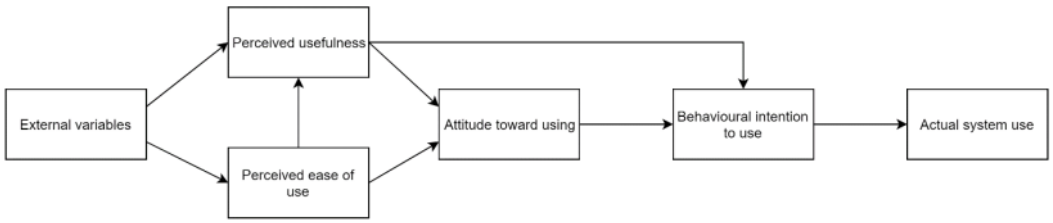
2. The theoretical background of the technology acceptance models

The Technology Acceptance Model (TAM) and its subsequent enhancements have been called upon to consider, test, and assess critical influencing factors for potential innovative technologies. Nevertheless, most studies in the literature deal with technologies that have already been introduced. Therefore, in this study, we believe that it may be worthwhile to first examine technology adoption models for social acceptance of autonomous vehicles, which, on the one hand, supports more efficient consumer satisfaction and, on the other hand, Technology Acceptance Models may be explored in new areas of research. It is worth mentioning that more or less autonomous vehicles are already on the roads today, but for example in many cases consumers may not even use the automatic parking system. This is why it is important to understand not only fully autonomous vehicles but also semi-autonomous vehicles.

Research into the acceptance of technology is largely due to breakthroughs in new IT systems (most notably personal computers). More serious research on this topic can be dated to the mid to late 1980s (Davis, 1986) and then modified and supplemented by Davis, Bagozzi and Warshaw (1989) to create the TAM 1 model (Figure 1). The model focuses on the attitude toward new technology, the behavioural intention to use, and the actual system/technology use. Among the independent variables in the model are the so-called external variables which do not directly influence consumer attitudes or behaviours; however, they directly affect perceived usefulness and perceived ease of use (Keszey and Zsukk, 2017). External variables are not explicitly listed and defined in the model (Davis et al., 1989). According to Davis et al. (1989), external variables can be, for example, technological innovations or user specificities, making TAM 1 a framework model that can be used flexibly by downstream users and researchers of the model, taking into account the characteristics of the technology being studied.

Figure 1

The first Technology Acceptance Model



Source: Keszey and Zsukk, 2017, Made by the authors

A more detailed description of previously undefined externalities was sought in the TAM 2 model (Venkatesh and Davis, 2000). At that time, these external factors were divided into two groups. One is social influence processes such as subjective norm, image and voluntariness. These elements primarily affect perceived usefulness, except for the factor of voluntariness, because moderating influence through the subjective norm on behavioural intention to use. The other group is cognitive instrumental processes such as job relevance, output quality, and result demonstrability. These elements also directly affect the perceived usefulness. In addition to these elements, the researchers also examined the experience factor in the model, which moderates the perceived usefulness and behavioural intention to use through the subjective norm. Experience is a very interesting element of the model through where we can see the differences between an introduced and an upcoming technology. Experience negatively modifies the effect of the subjective norm on perceived usefulness and behavioural intention to use. This means that if a technology system is not fully developed and users' knowledge and beliefs about the new device are still vague (i.e. they have no experience), they will be much more reliant on others' judgment of utility and intended use. After implementation, however, when much more is known about the strengths and weaknesses of the system or technology, and more experience is gained, the role of influence by others diminishes (Keszey and Zukk, 2017).

It can be seen that the TAM 2 model only addresses the factors affecting perceived usefulness, not the perceived ease of use. TAM 3, the latest TAM model extension to date, has found new variables. According to Venkatesh and Bala (2008), variables can be grouped here as well into two categories. One group is the anchor of general experience from previous experiences, which mainly helps to form opinions before gaining personal experience with technology. These include computer self-efficacy, perception of external control, computer anxiety, and computer playfulness. The other group is adjustment which modify prior perception in the light of direct experience with technology, such as perceived enjoyment and objective usability.

Along with the development of the TAM 3 model, the researchers began to investigate (Venkatesh et al., 2003) the factors that directly influence the behavioural intention to use. The Unified Theory of Acceptance and Utilization of Technology (UTAUT) was born after reviewing eight different theories. The purpose of the UTAUT model is to provide a useful tool for managers to assess the likelihood of success in introducing a new technology and to understand the additional influencing factors during adoption. The authors distinguish four direct influencing elements: expected performance, expected required effort, social impact, facilitating conditions. In addition, four other variables moderating these direct relationships were identified: gender, age, experience, voluntariness.

Extending previous facilitation conditions, they created the UTAUT 2 model (Venkatesh, Thong and Xu, 2012), which can already measure the expected adoption of technologies that are suitable for everyday use. As a result, the element of voluntariness in the UTAUT model has disappeared because, in everyday technology, the authors assume that it will not be used involuntarily. As a result, three new elements have been added: hedonic motivation, price value, and habit.

From the point of view of our research, the UTAUT models, which already take into account the social effects, can be really relevant, especially the UTAUT 2 model, where the authors have already adopted the acceptance of the technologies used in everyday life. All in all, the factors affecting the primary latent variables of TAM models (perceived usefulness, perceived ease of use, and behavioural intention to use) should not be overlooked.

3. The impact of autonomous vehicle in tourism

Autonomous vehicles will have impact on travel implications in three categories: individual travel decisions, transportation system impacts, and industrial and logistic impact (Henderson and Spencer, 2016). All of them is somehow in relation with tourism industry, but we primarily focus on how autonomous vehicles may influence individual travel decision of tourists.

There are also some examples which show that tourist might be the first to experience autonomous vehicles. Heathrow Airport tested autonomous vehicles and reduced travel time at Terminal 5 and also saved carbon. Gatwick airport also used autonomous shuttles as transfers (Cohen and Hopkins, 2019). England's Lake District national park used autonomous vehicles as a sustainable transport solution to reduce congestions and pollution (Mogg, 2018).

In this article our aim was to collect as many impacts (positive and negative) as possible of autonomous vehicles in relation to tourism industry.

3.1. Travel distance of tourists might be longer

There are also multiplication impacts of autonomous vehicles, as if the travel speed increases, travel time will reduce (Yokota et al, 1998), so tourists could travel more far in the same time period. They could reach destinations which they have not chosen because of the long travel time. So autonomous vehicles could also foster longer travel distances (ITF, 2015) The reduction in value of time could also change the preferences in travel mode, as autonomous vehicles might become more attractive than other transport options as train or flight. (IFMO, 2016)

People in autonomous vehicles favor those activities which they also can do while travelling as they could gaze out the window and talk to fellow travelers, and they mentioned only in few cases that they could work. (Cyganski et al. 2015)

All passengers could sleep in autonomous vehicle, while they travel to a destination, so they have book less accommodations. (Bainbridge, 2018)

Door to door mobility also could reduce the travel time compared to public transport and it also might give the opportunity to tourist to access such attractions which they can not reach now just on foot. (IFMO, 2016)

Autonomous vehicles could replace transfer buses and taxis, so it also could be for transferring people from airport to hotel and return as hotel pickups (Bainbridge, 2018).

Because of the constant travel speed, the planning of the route and the travel time is more reliable and predictable (Guth et al, 2012).

3.2. Travel demand might increase

There are a lot of positive factors, which could increase the travel demand. For example, in autonomous cars people with age-related or medical constraints and teenagers could increase the travel demand (Kim et al., 2015; IFMO, 2016). They do not need driving licence. They could become independent of others and flexible in their mobility, their social isolation could decrease and they could easily access every services they want (Anderson et al, 2014). This new travel demand might increase about 11 % (Sivak, Schoettle, 2015).

Tourists could share autonomous vehicles which could go with the perfect speed to use less energy, so the travel will cost less for tourists (Sivak and Schoettle, 2015), which also could increase the travel demand.

Safety is another reason for tourist to use autonomous vehicles, as they do not have to know the driving rules of the destination, it does not matter that the driving direction is left or right, unfamiliar environments and tiredness will not be problem anymore (Cohen and Hopkins, 2019).

3.3. Parking spaces might change

Parking might become easier (Pitcher, 2011). As autonomous vehicles could find the nearest free parking place and could park perfectly, so more cars could park in the garage (Mitchell et al. 2010, Kowalewski, 2014) or reduced space is enough for vehicles, so cities could improve the livability of environments and there could be more spaces for pedestrians or bicycles (Alessandrini et al., 2015). According to Wiseman's study (2017), near the airports as in Um El Hamam, not far from Tel-Aviv, large parking lot could free lands, which might be used for shopping mall, hotels or other services for tourist. All of these changes could increase the number of tourists, as they could use these new environments.

Many historical capital cities have parking difficulties. Wiseman (2017) analyzed the advantages of autonomous vehicles in parking in Israel. In Jerusalem and in Tel-Aviv, autonomous vehicles could solve the problem of parking in the city centre. Car park might be less needed near the attractions, but set down and pick up space will be necessary. Tickets also could be bought on autonomous vehicle to shorter the time of waiting, so tourists could enter the attraction straightaway (Bainbridge, 2018). Tourists do not have to take time for parking and they might have more time to spent on the destination.

Parking places near hotels located in rural locations or close to highway and major routes could be free for other usage, as building more rooms or develop it in another way for new services (Henderson and Spencer, 2016).

3.4. New tourism services could appear

Bainbridge (2018) wrote about some possibilities which autonomous vehicles could serve in tourism industry. They think that there could be created a new class of sight-seeing tour, which could be called as *auto-tour*. It could be such as a hop on hop off bus tour in cities and it also could replace guided tour on foot. They collected all the characteristics which give advantages to *auto-tours*:

- proximity does not matter anymore,
- itinerary could be easily re-configured and algorithmically generated,
- personalisation could happen in real time to anybody preferences,
- multiple topics could be organized in a single tour,
- door to door function,
- flexibility, as the tour can start and end anywhere and anytime, and it can take any duration in reliable timing,
- travel mode also could be changed.

Independent tour guides could change to vehicle based tour operator businesses, so they can wider their business.

This type of transport might give people private space, so if somebody does not like to travel with other tourists, he or she can go there alone or just with preferred people (IFMO, 2016). Autonomous vehicle could also be used as an accommodation or a small meeting room. So hotels by the hour will not be needed anymore, as tourists can book an autonomous vehicle. Small meeting could also be organized in specially designed ones, so it could have impact on not just the leisure tourism but also on MICE tourism (Bainbridge, 2018).

3.5. New opportunities for tourists

Bainbridge (2018) also highlighted the positive impact of autonomous cars, which advantages come from human delivering. As people will not drive, the driving might become an experience, a leisure activity. Evening experiences could be longer, ad people could also drink alcohol, as they could travel by autonomous vehicle, so evening tours will be more attractive.

There will be more opportunities to have dinner or book an accommodation, as tourists can go out to the suburbs of cities, so not just the centrally located restaurants and hotels could serve the tourists' preferences. Safety and reputation of the hotel might become less important, as the autonomous vehicle could pick up tourists in the pickup zone (Bainbridge, 2018).

Tourists could see other or new attractions, which were to far from the city centre, so they rather did not go there. So autonomous vehicles give opportunities and popularity to new destinations and attractions (Cohen and Hopkins, 2019).

Autonomous vehicles could also impact shopping tourism, as shopping streets and specific shops not in shipping malls could be reached easily, so the shopping areas of cities might be reconfigured (Bainbridge, 2018).

3.6. The disadvantages of autonomous vehicles

Autonomous vehicles have also negative impact on tourism industry (Cohen, Hopkins, 2019): As more tourists could reach more destinations, they can get off the car near the attractions, and it could generate over tourism. As tourists could spend their time better, and could travel to more far destinations, the public transport will be less attractive in cities, and people will less use trains, and go by autonomous cars instead. It also impacts on employment as professional human drivers could be replaced by autonomous vehicles, so a lot of people will loss their job. There are also some problems with the passenger protection as data privacy, security, and terrorism.

3.7. Anthropomorphism feature in tourist autonomous vehicles

Anthropomorphism describes the attribution of human-like characteristics, physical and emotional, to a nonhuman agent or a machine (Epley, Waytz and Cacioppo, 2007). Anthropomorphism in nonhuman agent, such as AV, is motivated by the need to create a meaningful relationship between human and robotic systems (Duffy, 2003). Previous studies have linked anthropomorphism feature in AV to greater trust among passengers (Forster, Naujoks and Neukum, 2017) which may vary across cultures (Yerdon et al., 2017). Culture, which is a set of beliefs and values embraced by a group of people, is pivotal in explaining human behavior (Chairy and Syahrivar, 2019). This is especially true in the case of driving culture. The application of anthropomorphism feature in tourist AV can potentially be the solution to the shortage of experienced and multilingual tourist guides and historians, especially in growing tourist attractions, such as Budapest. Talking or interacting Artificial Intelligence (AI) embedded in AV can potentially improve the overall tourist experience and build up positive impression to solo tourists knowing that they are taken 'accompanied' and supplied with relevant information that they need during the sightseeing. We contend that building a meaningful relationship between tourists and Tourist Autonomous Vehicles (TAV) can be one of the important research agendas in the future.

4. Conclusion

All in all, the value of the study is its special interest for the tourism industry dealing with the development and implementation of autonomous vehicles. As it was written before the literature of autonomous vehicles is widespread, but most of the main topics related to technological aspects. This is why analyzing this topic from a consumer perspective could be novel. In addition, we examined the social acceptance of autonomous vehicles in a theoretical framework that also contains new niche areas, as presented in Chapter 2. The theoretical framework mentioned is technology acceptance models, and such a niche area may be the measurement of the attitude towards technology that has not yet been introduced, and moreover, it is an everyday technology that does not necessarily have to be used. All of this is reinforced by the fact that we will be exploring the field of tourism, where the use of technology based on hedonistic approaches will appear. It is important to emphasize that autonomous vehicles technology is not an innovation in

the next 20-30 years, but today there are cars on the road or in their own ownership that already use some semi-autonomous vehicles technology (Parking Assistance, Lane Keeping Assistance, Pilot Assist etc.). In future research, it will also be important to measure the extent to which these technologies influence purchase and use intentions, and, if so, how they may provide a competitive advantage over vehicles that do not use such technologies. Tourists can plan their trips more freely thanks to the spread of autonomous vehicles. Door-to-door travel will be possible and it is a safer way than doing it with a bike or a scooter. Evening mobility can be affected by autonomous vehicles, as tourists can return to their accommodation more comfortably and relaxed from the pub or after a wine tasting. In addition, less time should be spent on scheduling or paying other travel costs.

The empirical measurement of the social acceptance of autonomous vehicles may be a critical point in our future research. For this reason, we believe that it may be worthwhile first to systematize empirical research on technology acceptance models based on research methodology and relevant topics. Thus, we first consider literature review and summary, and later focussed own empirical research and hypotheses. As we have written, this topic is under-researched in this respect, but with a few related areas, a more detailed literature analysis can be prepared.

All this can further support a deeper understanding of consumer behavior and the reasons for adopting new technologies such as autonomous vehicles.

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Acknowledgements

The work presented in this article was supported by the Topic Excellence Program 2019, Social impact of autonomous vehicles subproject.

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