Acharya, Sailesh, and Patrick A Singleton. 2024. "Autonomous Driving or Teleportation? Travel Time Use, Usefulness, and Other Insights from a Survey of Long-Distance Recreational Travelers." *Findings*, January. https://doi.org/10.32866/001c.92087.

TRANSPORT FINDINGS

Autonomous Driving or Teleportation? Travel Time Use, Usefulness, and Other Insights from a Survey of Long-Distance Recreational Travelers

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Keywords: in-vehicle travel time, travel-based activities, travel usefulness, autonomous driving, teleportation, national parks, autonomous vehicles

https://doi.org/10.32866/001c.92087

Findings

Based on a survey of 696 visitors to US national parks, we found higher preferences for working/studying/reading (+77%), using social media (+63%), and entertaining (+34%) activities when traveling in an autonomous vehicle (AV) compared to a human-driven vehicle (HV). A multinomial logit-based ranked-choice analysis (between HVs, AVs, and teleportation) suggests that while most travelers enjoy spending time traveling by manually driving and/or engaging in activities of interest in HVs and AVs, some would prefer teleportation instead of spending time traveling. The choice of AVs is significantly influenced by preferences for working/studying/reading and eating/caring activities.

1. Questions

In-vehicle time use behavior varies by travel mode, onboard environment, individual preferences and attitudes, and trip characteristics (Keseru and Macharis 2018). Looking towards a transportation future potentially dominated by AVs, automated driving could allow travelers to utilize and spend their travel time more efficiently. These travel time use benefits of AVs are expected to be greater for long-distance trips (Litman 2023), such as those for recreational purposes. Understanding time use preferences for AVs and their influence on mode choices could help planners forecast potential increased demand for long-distance recreational "road trips" using AVs. A simple way to assess the benefits of travel-based activities is to ask about the "usefulness" of engaging in these activities (Cornet et al. 2022; Singleton 2018). Another way that scholars have investigated whether and how much travel time uses (and other elements) are intrinsic benefits of traveling—or simply ancillary to the main activity of reaching the destination—is by offering a hypothetical option to "teleport" to one's destination (Humagain and Singleton 2020; Russell and Mokhtarian 2015).

In light of these, the present study empirically answers the following research questions:

1. How do long-distance recreational travelers want to spend travel time in AVs? How useful do they perceive HV and AV travel?
2. Would long-distance recreational travelers prefer to use an AV, an HV, or to teleport? What factors affect these preferences?

2. Methods

The researchers conducted a long-distance recreational travel survey using an online Qualtrics panel in summer 2022 (see project's repository: Acharya 2023). The target population was adult visitors to US national parks. This study collected 696 valid and complete responses. (See Supplemental Information section I for the survey and sample details.)

Subjects were asked to reveal the travel-based activities (TBAs) they conducted during their reference trip—a recent long-distance recreational trip—made with an HV. They were also asked to state the TBAs they would have conducted if the trip had been made with an AV instead of the HV. In the survey, an AV was introduced as "a vehicle having full self-driving capabilities such that no driver is needed to drive (SAE level 5)." The reported TBAs were merged into seven groups depending upon the nature of the activity and conceptual compatibility. In addition, the subjects also rated their perceived travel time usefulness (TTU) on the reference HV trip and the hypothetical AV trip, as a simple (albeit imperfect) measure of the perceived value of TBAs. To answer the first research question, the responses to these questions were visualized and compared.

To answer the second research question, subjects were asked to rank their preferences among HV, AV, and teleportation options for the reference trip. As previously mentioned, teleportation was introduced to capture if travelers do not want to spend time traveling at all, thus, to help quantify the values of TBAs and TTU for mode choices. The ranked-choice responses were analyzed by fitting a multinomial logit (MNL) model with socio-demographics, trip-related characteristics, time use variables (TBAs and TTU), and attitudinal latent variables (see Table 3 in the Supplemental Information section for their measurement structures and observed indicators) as predictors.

3. Findings

The distributions of reported TBAs (Figure 1)—and McNemar's test results—identified increases in reported engagement in working/studying/reading (+77%), using social media (+63%), entertaining (+34%), and relaxing (+7%) activities during AV travel compared to HV travel. However, the watching road (−10%) activity exhibited higher engagement in HV travel than in AV travel.

The distributions of TTU (Figure 2)—and a Wilcoxon signed-rank test between TTU in HV and AV travel—revealed that the average TTU rating decreased in AV travel compared to HV travel. This result indicates that travelers are not optimistic that their travel time can be effectively utilized in the AV environment. This is surprising at first glance but having to spend 10+ hours (mean one-way travel time in the sample is 10.89 hours) in a self-driving

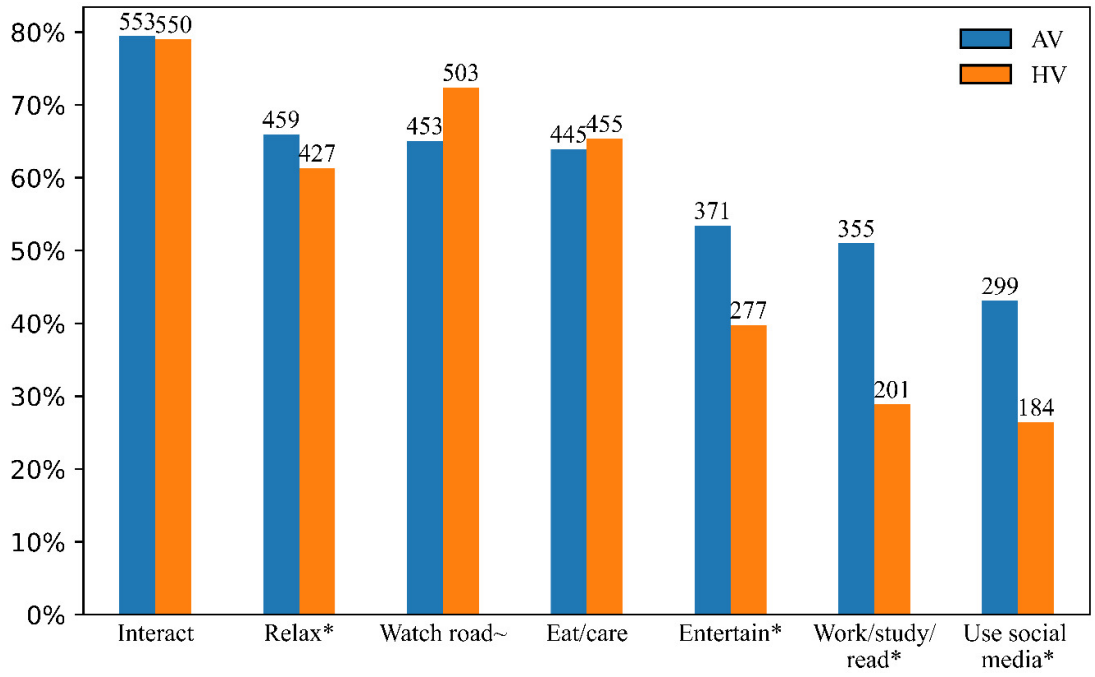

Figure 1. Sample distribution of stated engagement in travel-based activities (TBAs) for HV and AV travel.

* indicates TBAs with a significantly higher engagement for AV travel compared to HV travel, while ~ indicates lower engagement, as determined by McNemar's tests at a 95% confidence interval.

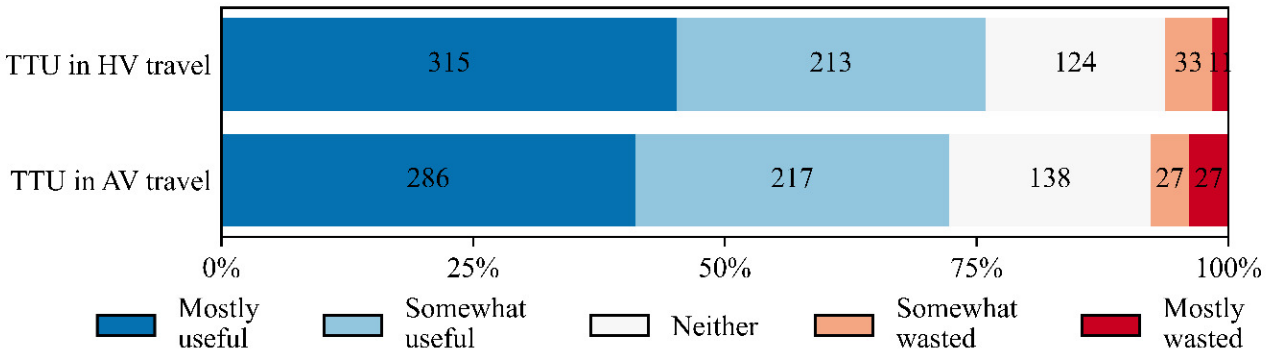

Figure 2. Sample distribution of ratings of travel time usefulness (TTU) for HV and AV travel.

Wilcoxon signed-rank test showed a significantly lower (at a 95% confidence interval) average TTU for AV travel compared to HV travel.

car without a favorable vehicle interior for the activities of interest (such as a table for work, seats designed for sleeping, etc.) could be more stressful than having to engage yourself in the driving task in an HV.

In response to the ranking questions, 41% ranked HV first, followed by 35% for AV and 25% for teleportation. For the second-place rankings, AV received 47%, while HV and teleportation were chosen by 33% and 21%, respectively. The ranked-choice MNL model (Table 1) identified several socio-demographic, trip-related, time-use-related, and attitudinal factors affecting the preferences between HV, AV, and teleportation; some key findings are discussed below.

Table 1. MNL model results of the ranked-choice between HV, AV, and teleportation.

Variables	*Modes (Base: Human-driven vehicle)*			
	Autonomous vehicle		*Teleportation*	
	Coef.	*t-stat.*	*Coef.*	*t-stat.*
ASC	0.316	0.379	2.090	2.230
Socio-demographics				
Education: undergraduate degree (ref: no college degree)			0.668	2.840
Race/ethnicity: white (ref: non-white)	-0.704	-2.640		
No traffic citations in the past	-0.380	-2.180	-0.511	-2.460
Familiarity with AV technology			-0.150	-1.960
Trip-related characteristics				
Travel cost			-0.001	-1.650
Vehicle type: Truck			-0.763	-1.810
Own vehicle			-0.537	-1.700
Vehicle feature: Adaptive cruise control			-0.335	-1.730
Vehicle feature: Parking assistance			-0.610	-2.400
Time use variables				
TBA: Use social media in AV	-0.409	-1.940		
TBA: Work/study/read in AV	0.322	1.700		
TBA: Entertain in HV			0.408	1.760
TBA: Entertain in AV			0.227	1.800
TBA: Eat/care in HV			-0.485	-2.140
TBA: Eat/care in AV	0.434	2.120	0.477	2.860
TBA: Watch the road in AV			-0.397	-1.790
TTU in HV	-0.148	-1.700	-0.347	-3.460
Attitudinal latent variables				
AV usefulness	0.873	4.730	0.717	3.300
AV concern	-0.313	-3.010		
Polychronicity			-0.334	-1.930
Goodness-of-fit statistics				
Log-likelihood (null model)		-1247.07		
Log-likelihood (final model)		-1045.10		
Rho-square		0.162		

Note: Only the significant estimates at 90% confidence interval are shown here.

Opting for AVs over HVs was associated with stated engagement in productive TBAs such as working, studying, reading, eating, and caregiving, whereas the opposite association was observed for using social media. A stronger preference for teleportation over HVs was positively linked with stated engagement in entertainment activities during both HV and AV travel, activities that are generally considered less productive. Conversely, a teleportation preference was negatively associated with watching the road while using AVs, an activity that might be enjoyable during recreational travel, due to scenic environments. Individuals who perceived their current HV travel time to be more useful were less inclined to consider switching to AVs or teleportation. These findings collectively suggest that mode choice on long-distance recreational trips is influenced by the benefits derived from utilizing travel time, as indicated by the impacts of preferences for TBAs and TTU evaluations.

Advanced vehicle features (adaptive cruise control and parking assistance) were linked to a lower preference for teleportation compared to HVs. This suggests the positive impacts of these features on driving convenience and creating an onboard environment conductive to TBAs. Also, polychronic individuals were less likely to choose teleportation over HVs, potentially because of their preferences to conduct multiple activities simultaneously (driving and conducting in-vehicle activities in HV travel).

Three study limitations are noted. First, there is potential for hypothetical bias due to the stated preference survey, particularly concerning the teleportation option, given its practical unrealism. Second, the time use analysis for the AV option is limited in scope as the study did not test different on-board environments. Third, respondents may have interpreted TTU evaluations based on travel accomplishments (e.g., successfully driving, reaching the destination), not solely on the intended assessment of the usefulness of travel time spent on TBAs.

Acknowledgements

This study was reviewed and approved by the Utah State University Institutional Review Board (IRB Protocol # 12878). Thanks to Michelle Mekker for her support in the study design and data collection. Comments from two peer reviewers significantly improved the manuscript.

Submitted: August 05, 2023 AEDT, Accepted: January 08, 2024 AEDT

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SUPPLEMENTARY MATERIALS

Supplemental Information

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