Setting Up Trials for Autonomous Vehicles (AVs): Findings and Lessons

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1 Introduction

AV technology providers are investing in trials with the aim to demonstrate AV transport system benefits. Learnings are key for project development stakeholders, who must navigate a complex mix of common and local factors. Trial participant experience creates a common body of knowledge regarding institutional barriers, public perceptions and possible solutions. Despite their relevance, non-trial research such as public confidence surveys, traffic simulations, or policy reviews fail to include the 'on the ground' aspects inherent in AV trials. This extended abstract sets out one such trial and reports on the user attitudes and stated choice responses before and after making an AV trip.

2 The AV Trial

In August 2018 the University of Western Australia (UWA) sponsored an autonomous bus trial on its Crawley Campus. Partnering with Easymile, France, the project trialled a 12 passenger EZ10 shuttle on the UWA public Open Day and subsequent week.

The preparation of the trial (three weeks) was labour-intensive and required completion of diverse activities: site assessment and route evaluation, licensing application, operator training, routes mapping and testing, survey design, ethics approval and marketing. Three routes were initially proposed, with one deemed infeasible during testing, given the traffic conditions, road geometry and dense vegetation (Pedestrian slow, in yellow) - 1.2km length and with the max commercial speed of 5km/h as demanded by the university campus. Remaining routes were used for small sample testing only.

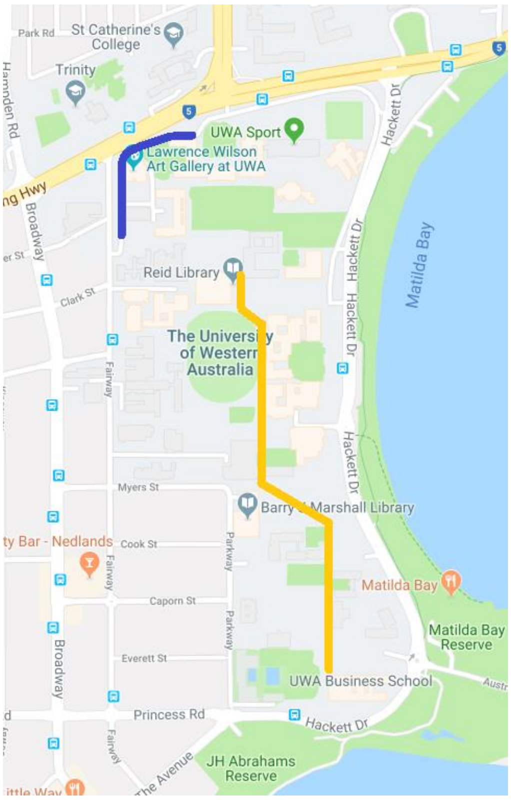

Figure 1: 'Pedestrian Slow' and 'Ring Road 2' Routes for the AV Trial

2.1 User Experience Data Collection

Over 700 visitors expressed interest in riding the AV shuttle and 300 people participated, of which 243 completed a user survey. Attitudes and concerns were taken from the scales developed in Greaves et al. (2018)[1]. Also, an extended online survey elicited responses to a stated choice experiment, in which the 139 respondents (staff and students) analysed eight scenarios (four before and four after riding an AV shuttle).

2.2 Experimental Design

The binary choice tasks considered two options (AV or walking along a campus route of up to 1.8km, Figure 2) and included three transport related attributes: a) waiting time; b) travel time; and c) cost. The attributes were presented in the context of a short (800m), mid-way (1,200m), or across campus (1,800m), with variant information regarding weather conditions. A 16-task D-efficient design using N-Gene software (Rose et al., 2014[2]) was applied.

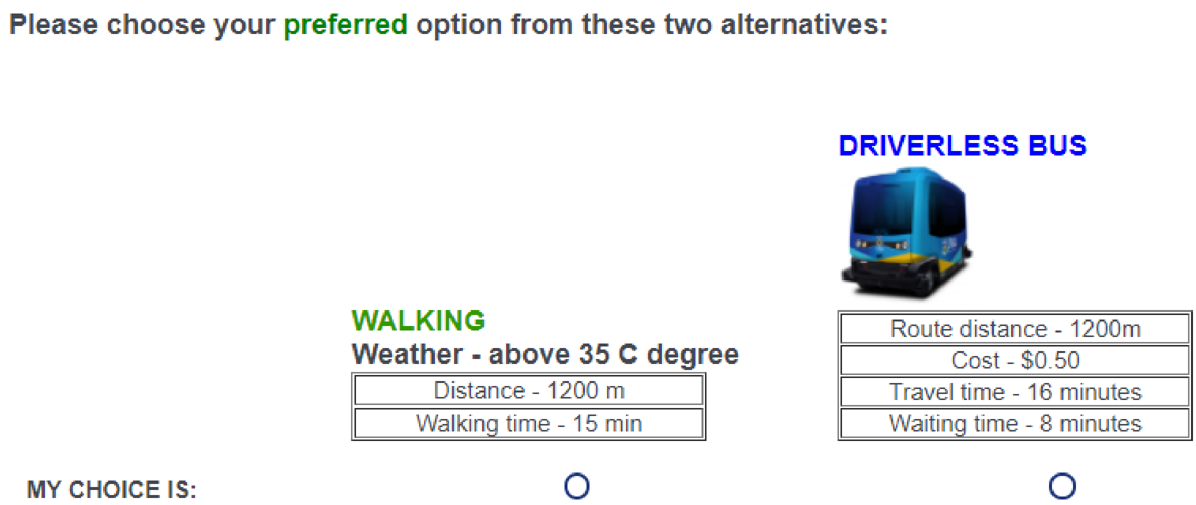

Figure 2: Example Choice Task

3 Results

3.1 Sample Statistics and User Experience

The sample was dominated by females (56.4%) and students (67%), with 56.6% aged between 18 and 24 years and 23.5% were 40 years of age. Over half of the respondents had a very positive ('thrilled') attitude towards AVs, with only 2.4% expressing a negative attitude.

The main perceived benefits referred to safer traffic and accessibility (Figure 3), with the subjects being less convinced that AVs will bring substantial travel time savings or reducing car ownership. 'Concerns' were also collected, with 'system tampering' attracting significantly higher value compared to the other four potential issues.

[1] Greaves, S., Smith, B., Arnold, T., Olaru, D. and Collins, A.T. (2018) *Autonomous Vehicles Down Under: An Empirical Investigation of Consumer Sentiment*, ATRF, 30 October-1 November, Darwin, Australia.
[2] Rose, J., Collins, A., Bliemer, M., & Hensher, D. A. (2014) NGENE software, version: 1.1. 2.

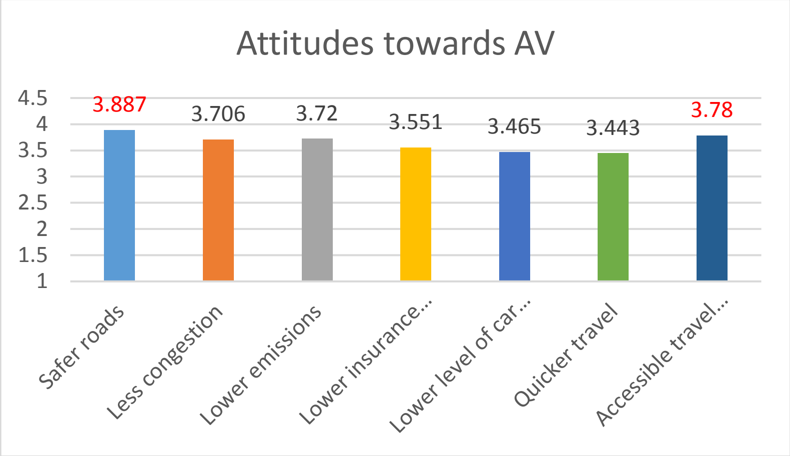

Figure 3: Degree of agreement with statements regarding AV

A confirmatory factor analysis (Greaves et al., 2018) was undertaken and the factors 'attitudes' and 'concerns' achieved good reliability (Cronbach's $\alpha_{attitude}$=0.80 and $\alpha_{concern}$=0.81). Although expected that the AV ride may shift attitudes and preferences, no significant differences were detected. The overall attitudes improved marginally (p=0.062) from an average of 4.14 (before) to 4.42 (after), but not the concerns. Data was pooled for analysis and factor scores entered the choice models as covariates.

3.2 Choice Model Results

The model presented (Table 1) is a 2-class latent class model (LCM). No dominant class was observed (44%-56% split), the main difference being that the smaller Class-1 viewed the AV shuttle as a way of saving time for getting across campus.

Table 1: LCM model results

Attribute	Class-1: "Time savers"		Class-2: "Comfort and low cost seekers"	
	Coefficient	P-Value	Coefficient	P-Value
ASC Bus	-1.326	0.311	-2.431	0.004
Weather (Hot, Patchy rain) X ASC Bus	1.880	0.010	1.785	0.000
Weather (Heavy rain) X ASC Bus	1.303	0.030	**3.262**	0.000
'Attitudes' X ASC Bus	0.195	0.409	0.343	0.026
AV shuttle fare $ (including free ride)	-0.544	0.091	**-1.365**	0.000
Travel time (min)	**-0.305**	0.002	-0.004	0.920
Class Probability Model				
Constant (Class-1)	2.564	0.0765	-	
Likely to use an AV shuttle bus if available (5 point scale)	0.597	0.110	-	
Gender (Male)	1.093	0.085	-	
Class membership probability	*0.443*		*0.557*	
Model Fit Statistics				
LL-ASC Ct. only	402.64			
LL- Model	327.56			
McFadden's psuedo-r2	0.187			
AIC/N	1.112			

4 Discussion and conclusion

Scores for 'attitudes and 'concerns' showed enthusiasm for AVs within the sample and no substantial barriers, other than system hacking and cost. Attitudes did not change significantly after the ride, perhaps because the trial conditions limited the experience of their potential.

Several LCM models estimated (not shown) also revealed no association between 'attitudes', 'concerns' or age within classes. Self-selection bias could explain this, the survey capturing mainly participants who have positive views and a desire to experience AVs; with few elderly participants, a segment deemed most likely to embrace them.

Results raise three relevant questions: 1) what is the role of 'on the ground' experience/trial to promote the AV features; 2) how can we minimise sample bias (and gauge the views of those indifferent or opposing AVs and persuade them to trial them); and 3) are the parameters of the current trials (low-speed 'fun rides') sufficient to offer insights into future AV traffic conditions? Would the experience impact the design of stated choice scenarios including AV as a viable car option, given the gap between the reality of the AV trials and their potential?