[EXECUTIVE SUMMARY]

WILL WE LEARN TO SHARE?

HOW CAR AND RIDE SHARING BEHAVIOURS MIGHT ADAPT WHEN AUTONOMOUS VEHICLES ARRIVE.

by

GEORGINA C L WELLS B.A.

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On UK roads the private car is still king. Most of us use them for our regular, everyday trips (NTS, 2016/17). In cities this creates a raft of issues, from poor air quality, to congestion, to reduced quality of life. This study aims to contribute to a growing research area investigating a potential solution: autonomous, connected, electric, shared vehicles (ACES).

Two UK cities are selected for this research: London and Manchester. They have similarities and differences. London is a 'global' city, with high levels of wealth, employment and public transport and is a reasonable proxy for other global cities for the purposes of this research. Manchester is a prominent city in the North of England. It has benefitted from transport investment in the form of a tram and currently enjoys a high level of private sector investment (EY, 2017). Both cities contain some of the most deprived wards in the country, though Manchester has more highly deprived wards, and less employment than London (ONS, 2016).

This research uses these two cities to study interest in vehicle and ridesharing and attitudes towards potential ACES services. Two things are fundamental to their acceptance: automaton and ridesharing. First users must accept that these services will have no driver, and they no physical control. Second for the benefits of reduced congestion, journey times and pollution, alongside increased liveability of cities, to be achieved, ridesharing is key (Fulton et al., 2017).

The research is conducted using a questionnaire survey instrument, designed to unpick the complexity of the ACES proposition. The survey was funded by the Rees Jeffreys Road Fund. Different sized vehicles are proposed, since sharing a 40-seater 'autonomous bus' is a very different proposition to sharing a 2-seater 'pod' (Figure 1). Participants are asked about vehicle and ridesharing experience, including public transport use (since riding in a train or bus could equate reasonably to ridesharing a large ACES vehicle). They are asked a set of questions about four hypothetical ACES services (Table 1). Finally, a range of demographic, behavioural, personality and attitudinal (psychosocial) questions are asked. These are used to investigate which variables have an explanatory effect on willingness-to-use each PSAV service. There is no consensus on this point in existing research, though there is a key

hypothesis to be explored, put forward by Zmud and Sener (2017), that psychosocial variables have more explanatory power than demographics on willingness-to-use PSAVs.

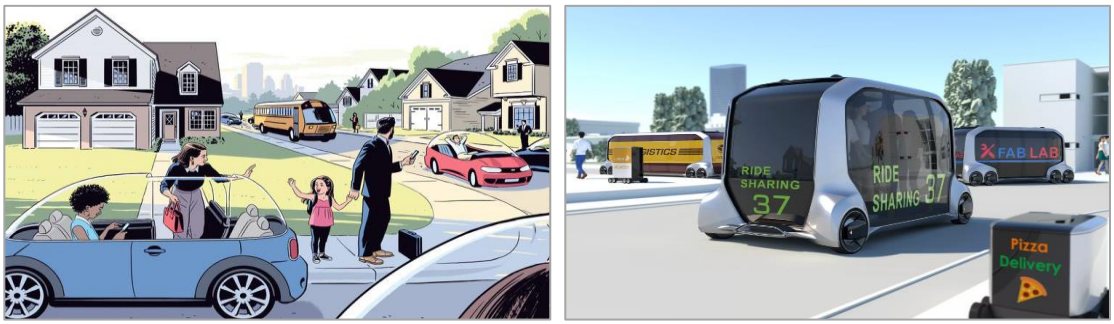

Figure 1 PSAVs could be developed in a range of sizes to suit different needs ([R] Higgins, 2017; [L] Toyota e-Palette concept, Toyota, 2018)

This methodology takes elements from previous studies (e.g. Howard and Dai, 2015; Bansal et al., 2016; Kreuger et al., 2016; Haboucha et al., 2015; Kreuger et al., 2016; and Bansal and Kockelman, 2018) who developed theories about connections between an individual's opinion of Autonomous Vehicles (AVs)/ACES and their characteristics or demographics. This study uses ordered logistic regression (OLR) models to test a range of explanatory variables for significance. Variables are selected based on new hypotheses, findings from these existing studies, and bivariate correlation testing. The dependent variables (DVs) are willingness-to-use four hypothetical ACES services (Table 1). The models produce two types of consumer demand insight; interest in using PSAVs in general and interest in using a specific service.

Table 1 Hypothetical PSAV services (dependent variables in OLR models)

2-seater (DV1)	'Pod' vehicle for short journeys in inner city areas or last-mile journeys from station to home. Cheaper per-mile cost than current taxis.
4-seater (DV2)	Vehicle providing door-to-door service (like a taxi). Costing less than a taxi because of the sharing but more than a bus.
12-seater (DV3)	Vehicle that stops to let passengers on and off, on a flexible route that changes based on passenger demand. Costs a bit more than the bus but less than a taxi.
40-seater (DV4)	Vehicle that works the same as current bus services, but costs less because there is no driver.

This study of London and Manchester has confirmed that most people in these cities use private cars for everyday journeys. Londoners rideshare more than Mancunians and own fewer cars. Nearly half the sample either didn't want to use AVs at all or weren't sure how they would use them. A low number were interested in purchase, and about 38% were interested in either ridesharing or vehicle hire. Women reported higher levels of concern around using smaller 2- and 4-seater vehicles but overall the 2-seater and 4-seater PSAV were

marginally the most popular services. The services correlate very strongly together in bivariate analysis; suggesting those who are happy to use one are happy to use all. This could suggest the barrier to use is more likely concerns around automaton than sharing. Indeed, those who already rideshare (in a taxi, bus, train or tram) appear more interested in PSAV services, as were those who used UberPOOL (Uber's ridesharing service, available in London). Having a lower income was an explanatory factor for the larger (cheaper) vehicles.

In terms of psychosocial factors, the OLR models show those who think AVs will be safer than humans, and those who are comfortable with using an AV are also more likely to be interested in PSAVs. Interestingly, those who worry about air quality in their city are too. Being a frequent taxi user was explanatory for DVs 1,2 and 3; the most taxi-like vehicles. Personality traits produced interesting findings too. Respondents were asked a set of questions, which scored them according to certain personality factors or traits. This study has found that extroverts were significantly more comfortable with the idea of sharing a 2-seater PSAV with a stranger. Neurotics were more comfortable using the two larger vehicles, 12- and 40-seater and conscientious people were generally more reticent to use PSAV services. Hypotheses to explain these and other findings are presented in chapter 4.

Perhaps the most important question (Clayton et al., 2018) is: *'How willing are people to share small vehicles – cars/taxis?'* Because it is these vehicles that will (or will not) replace the private car, and in doing so provide the benefits of reduced cost, congestion and pollution. Overall, the conclusion from this study is that people do not make serious distinctions between sharing large and small vehicles. If they are happy to accept automaton, and they have similar travelling experiences (e.g. they rideshare or use public transport already) they are likely to accept PSAV services. Other factors come into play; personality is important, as is being engaged by air quality problems. As other researchers have noted, these kinds of results are useful consumer insight for cities and planners.

On the one hand, opportunities to reduce private car use, shifting users into electric, shared AVs presents clear benefits for congestion, pollution and urban liveability. On the other, if these vehicles are as cheap as forecast, they may create mode-shift in a different direction; bringing pedestrians and cyclists *into* vehicles is to be avoided. Understanding who ACES will appeal to is a necessary step in designing the right services to fit into the existing balance of a city.