

# CARPOOLING AND THE ENVIRONMENT: DIRECTIONS FOR FUTURE RESEARCH

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**Abstract-** Carpooling brings environmental benefits in the form of carbon footprint reductions. While there is a rich literature body on the subject, efforts to encourage commuters to participate in carpools are often met with resistance. Hence in this paper, we explore directions for future research in carpooling. Our paper has implications for transportation researchers as well as policy planners working in the area of environment protection.

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## I. INTRODUCTION

From an environmental point-of-view, reduced car use is associated with a decrease in carbon emission and congestion (Greene and Wegener 1997). Yet, forecasts point towards an unsustainable increase in the number of cars on the road globally (Meyer et al. 2012); for instance current trends in the UK and US show that the majority of car journeys are still dominated by single-occupied vehicles (McKenzie and Rapino 2011; Taylor et al. 2013). In this sense, carpooling offers a possible solution: carpooling entails the sharing of the car journey among two or more participants, therefore reducing the number of single-occupied vehicles needed.

The transportation literature body is a sample with carpooling studies. However, recent developments (notwithstanding the urgent need to address environmental concerns) revive the need to re-examine this research area. Firstly, technological emergence especially in mobile phone applications and social networking has made carpool formations and partner matching much more easier (Agatz et al. 2012; Chan and Shaheen 2012). Secondly, the rise of the Sharing Economy phenomenon and the global successes of sharing initiatives such as AirBnB suggest that it is perhaps possible for an attitudinal change in commuters' acceptance to sharing their car journeys with others (Hamari et al. 2015). Thirdly, advancements in the field of driving psychology, particularly in the last decade on the non-instrumental reasons for car use, could perhaps shed some light to overcome the psychological barriers to carpool (Steg 2005). These developments could help push forward the carpool agenda. In the next section, we discuss some possible directions for future research and the challenges in this area.

## II. CARPOOLING AND DIRECTIONS FOR FUTURE RESEARCH

There are different classifications of carpools, depending on the type of trip and participants. Trip-wise, the simplest form of carpool is when the participants travel from the same origin to the same

destination; a more complex variation of this involves the driver picking up the carpool passenger from a different origin, or dropping them off at a different destination. Participant-wise, carpools are distinguished as household carpools (participants live together – for e.g., family members or housemates) or non-household carpools (participants live apart – for e.g. friends, co-workers or strangers). The latter should be the focus of researchers and transportation practitioners, as non-household carpools are harder to be formed.

Prioritising carpooling factors to be examined

In reviewing the carpooling literature, we found that there is a rich amount of empirical studies focused on examining the factors which can encourage and discourage carpooling. In Neoh (2015), our review of the literature revealed that these factors could be grouped as demographic (e.g., age, gender, income, marital status etc.), situational (e.g., travel distance, commute time, size of employer, standard of public transport links etc.), judgmental (privacy, locus of control, attitudes towards the environment, desire to socialise etc.) and interventional (e.g., parking cost incentives, high-occupancy-vehicle lanes, guaranteed-ride-home, etc.). We found that some of these factors have been 'over-studied' by the literature body, with a clear consensus reached; for example, it is widely agreed that income and commute time have no significant effects over a commuter's decision to carpool (Correia and Viegas 2011; DeLoach and Tiemann 2011; Ferguson 1997). Meanwhile, certain factors have been 'under-studied' but were found to have significant effects in encouraging carpooling; for example, employer size and parking benefits (Brownstone and Golob 1992; Su and Zhou 2012; Vanoutrive et al. 2012). Hence, our first suggestion for future research is to prioritise efforts to emphasis more investigations on the under-studied factors and less on the over-studied factors.

The role of psychology factors on carpooling

While the role of psychology barriers on carpooling such as the need for privacy and independence were examined in earlier researches (Horowitz and Sheth 1978; Ozanne and Mollenkopf 1999; Stradling et al. 2001), we found these to be

studied with less depth in newer research. In terms of psychological factors, the carpooling literature is less developed as compared to the literature on car-use motivations. From the Model of Material Possession (Dittmar 1992), researchers have found that people choose to drive or own a car not only because of functional reasons to get from one point to another (instrumental), but also because of the thrill of the drive (affective) and the perceived status of owning and driving a car (symbolic). In fact, studies have found that the affective and symbolic factors are stronger influencers as compared to the instrumental factors in determining the commuter's decision to own a car and drive (Lois and López-Sáez 2009; Steg 2005). In our empirical study, we observed similar results: instrumental reasons play only a small role in the commuter's decision to carpool (Neoh 2015). Hence, we call for future research to examine the effects of the affective and symbolic factors on carpooling behaviour.

#### Implementing and enforcing carpool interventions

As most carpooling studies often conclude with recommendations on possible intervention measures to improve carpooling uptake, this raises another question: how does one check if a carpool have actually took place? This is important to (i) measure the success of interventions, and (ii) enforce reward (or penalty) schemes for carpoolers (or solo drivers). Without a mechanism to confirm a carpool, any intervention would be susceptible to abuse. Researchers and transportation practitioners should look to creative answers; for example, a system which confirms carpool participation by comparing the speed of travel of the driver and carpool passengers (Alberth Jr and Chau 2015). However, future recommendations have to be mindful of costs, as one of the most appealing aspects of carpooling as a travel demand management solution is that it requires relatively low investment for the policy maker (Garrison 2007).

#### CONCLUSIONS

In the global fight to protect the environment and reduce carbon emissions, carpooling has been advocated as a possible answer. Recent technological, economical and research developments have improved the viability of carpooling for commuters. In this paper, we discuss areas for future research to further encourage carpooling uptake, namely in (i) prioritising the carpool factors which needs further examinations, (ii) conducting deeper studies into the effects of affective and symbolic factors on carpooling, and (iii) investigating innovative methods to enforce and implement carpooling reward (or penalty) schemes. Research within these three areas will provide insights to transportation policy planners aiming to reduce the number of single-occupied vehicles.

#### REFERENCES

- [1] LAW, D. and PEEL, D. A. (2002). Insider trading, herding behaviour and market plungers in the British horse-race betting market. *Economica*, 69, 327–38.
- [2] THALER, R. H. and ZIEMBA, W. T. (1988). Anomalies: parimutuel betting markets racetracks and lotteries. *Journal of Economic Perspectives*, 2, 161–74.
- [3] Agatz N, Erera A, Savelsbergh M, Wang X (2012) Optimization for dynamic ride-sharing: A review. *European Journal of Operational Research* 223:295-303. doi:10.1016/j.ejor.2012.05.028
- [4] Alberth Jr WP, Chau SY (2015) SYSTEM AND METHOD TO CONFIRM PARTICIPATION IN A CAR POOL. US Patent 20,150,149,086,
- [5] Brownstone D, Golob TF (1992) The effectiveness of ridesharing incentives: Discrete-choice models of commuting in Southern California. *Regional Science and Urban Economics* 22:5-24.
- [6] Chan ND, Shaheen SA (2012) Ridesharing in North America: Past, Present, and Future. *Transport Reviews* 32:93-112. doi:10.1080/01441647.2011.621557
- [7] Correia G, Viegas JM (2011) Carpooling and carpool clubs: Clarifying concepts and assessing value enhancement possibilities through a Stated Preference web survey in Lisbon, Portugal. *Transportation Research Part A: Policy and Practice* 45:81-90. doi:10.1016/j.tra.2010.11.001
- [8] DeLoach SB, Tiemann TK (2011) Not driving alone? American commuting in the twenty-first century. *Transportation* 39:521-537. doi:10.1007/s11116-011-9374-5
- [9] Dittmar H (1992) The social psychology of material possessions: to have is to be. *Harvester Wheatsheaf*,
- [10] Ferguson E (1997) The rise and fall of the American carpool: 1970-1990. *Transportation* 24:349-376.
- [11] Garrison W Increasing the Flexibility of Legacy Systems. In: *Anderson Distinguished Lecture in Applied Geography 2007*.
- [12] Greene DL, Wegener M (1997) Sustainable transport. *Journal of Transport Geography* 5:177-190.
- [13] Hamari J, Sjöklint M, Ukkonen A (2015) The Sharing Economy: Why People Participate in Collaborative Consumption. *Journal of the Association for Information Science and Technology* (Forthcoming, 2015)
- [14] Horowitz A, Sheth J (1978) Ridesharing to Work: An Attitudinal Analysis. *Transportation Research Record* 637:pp. 1-8.
- [15] Lois D, López-Sáez M (2009) The relationship between instrumental, symbolic and affective factors as predictors of car use: A structural equation modeling approach. *Transportation Research Part A: Policy and Practice* 43:790-799. doi:http://dx.doi.org/10.1016/j.tra.2009.07.008
- [16] McKenzie B, Rapino M (2011) Commuting in the United States: 2009. U.S. Census Bureau, Washington, DC
- [17] Meyer I, Kaniovski S, Scheffran J (2012) Scenarios for regional passenger car fleets and their CO<sub>2</sub> emissions. *Energy Policy* 41:66-74. doi:10.1016/j.enpol.2011.01.043
- [18] Neoh JG (2015) An Analysis of Carpool Behaviour with Statistical Methods. Unpublished Doctoral Thesis, University of Southampton
- [19] Ozanne L, Mollenkopf D (1999) Understanding consumer intentions to carpool: a test of alternative models. Research paper from New Zealand: Lincoln University
- [20] Steg L (2005) Car use: lust and must. Instrumental, symbolic and affective motives for car use. *Transportation Research Part A: Policy and Practice* 39:147-162. doi:http://dx.doi.org/10.1016/j.tra.2004.07.001
- [21] Stradling SG, Meadows ML, Beatty S Identity and independence: two dimensions of driver autonomy. In: *BEHAVIOURAL RESEARCH IN ROAD SAFETY: PROCEEDINGS OF THE 10TH SEMINAR ON BEHAVIOURAL RESEARCH IN ROAD SAFETY*, 2001.
- [22] Su Q, Zhou L (2012) Parking management, financial subsidies to alternatives to drive alone and commute mode choices in Seattle. *Regional Science and Urban Economics* 42:88-97. doi:10.1016/j.regsciurbeco.2011.07.002

- [25] Taylor E, Humphrey A, Pickering K, Tipping S (2013) National Travel Survey: 2012. Department for Transport, London, UK
- [26] Vanoutrive T, Van De Vijver E, Van Malderen L, Jourquin B, Thomas I, Verhetsel A, Witlox F (2012) What determines carpooling to workplaces in Belgium: location, organisation, or promotion? *Journal of Transport Geography* 22:77-86. doi:10.1016/j.jtrangeo.2011.11.006

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