Accepted Manuscript

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PII: S0378-4371(17)30442-9
DOI: http://dx.doi.org/10.1016/j.physa.2017.04.127
Reference: PHYSA 18229

To appear in: *Physica A*

Received date: 24 December 2016
Revised date: 3 March 2017

Please cite this article as: X. Sun, X. Han, J.-Z. Bao, R. Jiang, B. Jia, X. Yan, B. Zhang, W.-X. Wang, Z.-Y. Gao, Decision dynamics of departure times: Experiments and modeling, *Physica A* (2017), http://dx.doi.org/10.1016/j.physa.2017.04.127

Decision dynamics of departure times: experiments and modeling

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Abstract

A fundamental problem in traffic science is to understand user-choice behaviors that account for the emergence of complex traffic phenomena. Despite much effort devoted to theoretically exploring departure time choice behaviors, relatively large-scale and systematic experimental tests of theoretical predictions are still lacking. In this paper, we aim to offer a more comprehensive understanding of departure time choice behaviors in terms of a series of laboratory experiments under different traffic conditions and feedback information provided to commuters. In the experiment, the number of recruited players is much larger than the number of choices to better mimic the real scenario, in which a large number of commuters will depart simultaneously in a relatively small time window. Sufficient numbers of rounds are conducted to ensure the convergence of collective behavior. Experimental results demonstrate that collective behavior is close to the user equilibrium, regardless of different scales and traffic conditions. Moreover, the amount of feedback information has a negligible influence on collective behavior but has a relatively stronger effect on individual choice behaviors. Reinforcement learning and Fermi learning models are built to reproduce the experimental results and uncover the underlying mechanism. Simulation results are in good agreement with the experimentally observed collective behaviors.

Keywords: Laboratory experiments; Decision dynamics; Departure time choice; User equilibrium

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