PSYCHOLOGICAL THEORY
APPLIED TO MODE CHOICE PREDICTION*

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ABSTRACT

In an effort to improve transit ridership prediction, this manuscript proposes a conceptually unique mode choice model derived from the field of experimental psychology. The “psychophysical” model, as it is called, differs from earlier modal split models in its substantive use of psychological theory. The result is a modal split model with a sound behavioral foundation.

The psychophysical model is tested using data from the recent demonstration of dial-a-bus in Columbia, Maryland and found to be a marginal predictor of modal split. It is noted though that the difference between actual and predicted ridership may be accounted for in a second generation model. This will employ individual rather than aggregate data, incorporate the concept of adaptation-level, and refine the decision-making process.

Introduction

Over the past two-and-one-half decades, transit ridership in the United States has declined precipitously. Why the decline? There are many reasons, of course, but two are especially noteworthy. One is decentralization; the other is rising income. The former has reduced the market for conventional, fixed route transit. The latter has resulted in a nearly universal demand for high quality travel. Together they have assured the supremacy of the automobile. Significantly, the prospects for conventional transit are not likely to improve. As Brand (1972) notes, “Increased reliance on conventional transit technology to serve the increasing quantity and quality demands for urban travel appears to have little potential.” Tomorrow's Transportation, the summary report of the

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New Systems Study, goes a step farther than Brand (slaying the automobile as well as conventional transit). The report concludes that "present modes of urban transportation are inadequate to meet total future urban needs. The systems today — chiefly automotive, bus, and train — originated more than 50 years ago. They alone cannot provide the solution to future trip demands..." (U.S. HUD, 1968).

There is hope though. Several alternatives to conventional transportation show great promise. Dial-a-bus, for example, offers the spatial flexibility required in lower density urban areas, and personal rapid transit offers a level of service which satisfies the demand for quality travel. "Innovative" modes of transit can potentially compete with the automobile and should be considered in any analysis of future transportation.

This makes great sense, but how can it be realized? Specifically, how can new technology be evaluated without a physical demonstration of its potential? If we conclude that new technology cannot be evaluated "on paper," then we must bear the often astronomical cost of development and demonstration with uncertain results. This satisfies no one. The alternative is a mathematical simulation of new technology which cuts costs but often requires an act of faith on the part of those who apply the results. Preferable to either alternative by itself is a combination of the two. Mathematical simulation represents a small increment in cost and can be used to select an optimal site for a demonstration. The value of mathematical simulation, with or without a follow-up demonstration, should be apparent.

Accepting all this, we must develop predictive models which yield meaningful results. This has proved to be a most elusive goal. At present, neither supply nor demand modeling is truly adequate. However, it is clear that supply modeling has surpassed demand modeling in sophistication and quality of results.

In an effort to improve the quality of demand modeling, the present manuscript proposes a conceptually unique mode choice model derived from the field of experimental psychology. The model is subsequently tested using data from a recent demonstration of dial-a-bus and found to be a marginal, but promising, predictor of modal split.

Prior to introducing the "psychophysical" model of mode choice, a name derived from the parent field of psychophysics, some background information is presented. The next three sections describe (1) previous efforts to forecast ridership on new modes of transit; (2) specific problems associated with forecasting ridership on new modes; and (3) existing mode choice models and their limitations.