



# Theory of routine mode choice decisions: An operational framework to increase sustainable transportation

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## ABSTRACT

A growing number of communities in the United States are seeking to improve the sustainability of their transportation systems by shifting routine automobile travel to walking and bicycling. In order to identify strategies that may be most effective at increasing pedestrian and bicycle transportation in a specific local context, practitioners need a greater understanding of the underlying thought process that people use to select travel modes. Previous research from the travel behavior and psychology fields provides the foundation for a five-step, operational Theory of Routine Mode Choice Decisions. Walking and bicycling could be promoted through each of the five steps: awareness and availability (e.g., offer individual marketing programs), basic safety and security (e.g., make pedestrian and bicycle facility improvements and increase education and enforcement efforts), convenience and cost (e.g., institute higher-density, mixed land uses, and limited, more expensive automobile parking), enjoyment (e.g., plant street trees and increase awareness of non-motorized transportation benefits), and habit (e.g., target information about sustainable transportation options to people making key life changes). The components of the theory are supported by in-depth interview responses from the San Francisco Bay Area.

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## 1. Introduction

In the last two decades since the United States Congress passed the federal Intermodal Surface Transportation Efficiency Act, there has been a surge of interest in making urban transportation systems more sustainable. Agencies at all levels of government have searched for strategies to reduce single-occupant automobile travel, including policies to shift local driving to pedestrian or bicycle modes.

At the federal level, the 1994 National Walking and Bicycling Study set a goal to double the percentage of trips made by walking and bicycling (Federal Highway Administration, 2010). More recently, the White House Task Force on Childhood Obesity (2010) established a benchmark to increase the percentage of children walking and bicycling to school from 12.7% to 19.5% by 2015. Between 2007 and 2012, the number of states with published goals to increase walking and bicycling more than doubled. Now 35 of the 50 states have goals to increase walking, and 35 have goals to increase bicycling. Of the 51 most populous cities in 2012, 36 have published goals to increase walking and 47 have published goals to increase bicycling (National Alliance for

Bicycling and Walking, 2012). For example, the Portland Bicycle Plan for 2030 envisions increasing bicycle mode share from 6% to 25% of all trips by 2030 (City of Portland Bureau of Transportation, 2010), and the Philadelphia Pedestrian and Bicycle Master Plan establishes a goal to increase bicycle commuting from 1.6% to 5% and increase pedestrian commuting from 8.6% to 12% by 2020 (City of Philadelphia, 2010). Interest in pedestrian and bicycle transportation is not limited to the largest, most metropolitan communities. More than 250 local and regional agencies throughout the United States have established “Complete Streets” policies to provide for the needs of pedestrians and bicyclists as a part of roadway improvement projects (Complete Streets Coalition, 2012).

These policies indicate that many communities seek to shift automobile travel to walking and bicycling. Strategies to increase sustainable transportation include pedestrian and bicycle infrastructure development (Pucher et al., 2011), land use planning (Ewing and Cervero, 2010), and individual and social marketing (Brög et al., 2002; Anable 2005; Rose and Marfurt, 2007). Many studies cite the need for a comprehensive set of strategies to influence travel behavior (Krzek et al., 2009; Maibach et al., 2009; Pucher et al., 2010).

However, the effectiveness of particular interventions may depend on contextual characteristics. For example, bicycle infrastructure and programs have helped increase bicycle commuting mode share in neighborhoods near the urban core of metropolitan

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regions such as Portland, OR, New York, NY, and Washington, DC, but there has been less growth in bicycling in suburban parts of these regions where activity locations are more dispersed (Pucher et al., 2011). Certain interventions may also be more effective for people in specific travel behavior segments (Anable, 2005; Steg, 2005). For example, some people may be “malcontented motorists” who are frustrated with their high level of automobile use and desire to drive less. These people may be much more receptive to interventions encouraging bicycling and walking than people who are “complacent car addicts” who think it is difficult to change their travel behavior and do not see a moral obligation to drive less (Anable, 2005). Broad mode shifts require a clearer understanding of the barriers to choosing walking and bicycling for different types of people in different communities.

The purpose of this paper is to propose an operational theory of the mode choice decision process and support it with in-depth, qualitative interviews from the San Francisco Bay Area. This information is intended for planners, designers, engineers, and other transportation professionals who are charged with the task of achieving mode shift policy goals. Many strategies have been proposed to change travel behavior, but selecting the optimal set of actions to pursue in a particular community is challenging. Practitioners can use the operational theory as a guide to understand the mode choice process and identify actions that may have the most potential to increase walking and bicycling in their local social and geographic contexts.

## 2. Proposed mode choice decision theory

This section proposes an operational theory, called the Theory of Routine Mode Choice Decisions, to describe how people choose transportation modes for routine travel purposes, such as local shopping or other errands. This theory suggests that there are five steps in the mode choice decision process (Fig. 1). The first part, (1) awareness and availability, determines which modes are viewed as possible choices for routine travel. The next three elements, (2) basic safety and security, (3) convenience and cost, and (4) enjoyment, assess situational tradeoffs between modes in the choice set. These middle three steps may be considered simultaneously or in various sequences. The final part, (5) habit, reinforces previous choices and closes the decision process loop. Socioeconomic characteristics explain differences in how individuals view each part of the process.

Operational theories like the Theory of Routine Mode Choice Decisions are useful because they can provide concise, understandable frameworks to summarize previous research for practical application. This theory draws on other studies that provide clues

to how people choose between automobile, public transit, bicycling, and walking in certain situations. It combines findings from the travel behavior and psychology fields, as suggested by Van Acker et al. (2010). The travel behavior field has traditionally focused on time, cost, and socioeconomic factors but has more recently evaluated perceptions of the local environment and attitudes towards specific modes. The psychology field has described the thought process used to select a travel mode, including intentions and habits.

### 2.1. Mode choice insights from the travel behavior field

Walking and bicycling tend to be less time-competitive with motorized modes over longer distances (Cervero and Duncan, 2003; Purvis, 2003; Kim and Ulfarsson, 2008), and these modes may have much higher travel times than automobiles for trip chains (tours) to multiple, dispersed activity locations (Bowman and Ben-Akiva, 2001). Plentiful automobile parking and low operating costs also benefit driving (Rodriguez et al., 2008; Krizek et al., 2009). Other travel barriers to walking and bicycling include traveling with other people, heavy packages, hills, and bad weather (Cervero and Duncan, 2003; Mackett, 2003; Kim and Ulfarsson, 2008). Local environment barriers to pedestrian and bicycle activity are related to a lack of facilities (e.g., sidewalks, bicycle lanes, or multi-use trails) (Dill and Carr, 2003; Clifton and Dill, 2005; Douma and Cleaveland, 2008; Handy et al., 2010), roadway characteristics (e.g., faster automobile speeds, higher automobile volumes, and difficult street crossings) (Ewing and Cervero, 2001; Gehl, 2002), and public space characteristics (e.g., sterile building facades, poor lighting, noise, and few street trees) (Appleyard, 1980; Landis et al., 2001; Gehl, 2002; Southworth, 2005; Ewing et al., 2006).

Individual and social factors are also important. Individual factors associated with driving rather than walking or bicycling include socioeconomic characteristics (e.g., greater automobile ownership, physical disabilities) (Meyer and Miller, 2001; Cervero and Duncan, 2003), concerns about traffic safety (e.g., risk of being struck by a vehicle) and personal security (e.g., risk of being a victim of crime) (Saelens et al., 2003; McMillan et al., 2006; Handy et al., 2010), lack of awareness of other travel modes (Rose and Marfurt, 2007), and habitual driving (Loukopoulos and Gärling, 2005). Some communities may perceive pedestrians and bicyclists to have lower social status than drivers (Mokhtarian and Salomon, 2001; Dugundji and Walker, 2005). Yet, there are also individual and social factors that motivate people to walk and bicycle, such as personal enjoyment (e.g., physical exercise, fresh air, time to be alone) (Handy et al., 2010) and concern for the environment (Kitamura et al., 1997; Mokhtarian and Salomon, 2001). Note that the influence of these factors on walking versus bicycling may vary greatly due to differences in travel speed, roadway positioning, and other characteristics (Krizek et al., 2009).

Although travel behavior research has identified many factors associated with walking or bicycling, it is not clear from this literature how, when, or in what order these factors are considered by individuals during the mode choice decision process. A psychological lens is needed to understand the thought process involved in choosing a particular travel mode.

### 2.2. Mode choice theories from the psychology field

Psychological theories focus on the cognitive process involved in selecting a travel mode. For example, the Theory of Interpersonal Behavior (TIB) suggests that mode choices depend on individual attitudes towards available modes and social influences (similar to enjoyment), habits, and facilitating conditions (e.g., travel time and cost; individual socioeconomic characteristics) (Galdames et al., 2011). TIB contains several components of the proposed Theory of Routine Mode Choice Decisions.

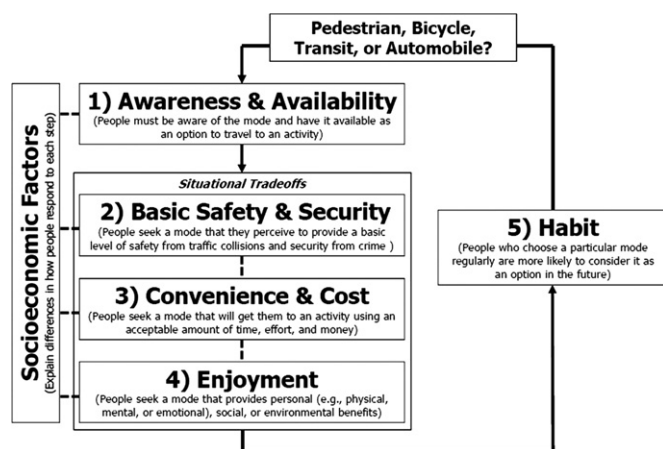


Fig. 1. Proposed Theory of Routine Mode Choice Decisions.

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