IATSS Research xxx (2016) xxx–xxx

Contents lists available at ScienceDirect

IATSS Research

Patterns of motorization development and next-generation mobility systems☆,☆☆

Katsutoshi Ohta

University of Tokyo, Tokyo, Japan

ARTICLE INFO

Available online xxxx

Keywords:
Pattern of motorization
City type by transport mode
Sustainable transport
Auto Sapiens
Transport culture

ABSTRACT

This paper discusses the appropriateness of the "3-stage urban transport policy development cycle" hypothesis proposed by Professor Peter Jones and the importance of both local development context and motorization transport culture in transport policy. It then makes some observations on the future prospects for sustainable cities and transport through major technological innovations in connected and autonomous vehicles, that is, in "Auto Sapiens" as next generation vehicles.

Contents

1. "3-Stage urban transport policy development cycle" hypothesis

The hypothesis proposed by Professor Peter Jones is presented in order to discuss, through international comparisons, the evolution of urban transport policies and to learn lessons for the future. Jones identifies three stages of changing policy focus in the course of developing motorization: Stage 1 'vehicle' focus; Stage 2 'personal movement' focus; and Stage 3 'activity/quality of life' focus.

Although the appropriate policy package can be expected to differ with each city's level of motorization, for Japanese cities Stage 1 generally seems to apply to the period from the 1960s to the early 1990s, Stage 2 from the early to middle 1990s, and Stage 3 from the 2010s. The main topics and key issues in Stage 1 were road and transport infrastructure development aimed at rapid urbanization and motorization. Major transport issues were traffic accidents, road congestion, and local environmental problems like noise and air pollution. In Stage 2, with increasing recognition of the limitations of the capacity-expansion-based supply-side approach, transportation demand management (TDM) measures or soft measures were introduced to solve emerging issues of regional air pollution, urban sprawl, limited mobility, and sustainability. Major problems from previous stages still prevail in Stage 3, and further efforts to reduce over-dependence on cars have begun in many cities. Today, depopulation, the ageing of Japanese society, and gradual economic stagnation are recognized as key issues, and people increasingly value the natural environment and health in their lives. The Great East Japan Earthquake (2011) and the subsequent collapse of a nuclear power plant have also changed people's relationship with nature. In transport policy, low carbon/green transport modes, resilient systems, and inclusive services have become key and it is common now to discuss changes in life and business styles through the more intelligent use of cars.

In the context of transport culture—which refers to the general, background social and historical conditions surrounding transport in each city but excludes natural geographical conditions—the process of motorization development and the focus of related policy reflect those differences. On the former point, three basic differences reflect each city's transport culture: D1 vehicle saturation level, D2 social meaning and use of vehicles, and D3 content (vehicle type) and timing/speed of motorization. Fig. 1 illustrates different paths of motorization

☆ Peer review under responsibility of International Association of Traffic and Safety Sciences.

☆☆ This article is based on a short presentation (commentary on the leading presentation) delivered at the 1st Global Interactive Forum on Traffic and Safety (GIFTS), organized by the International Association of Traffic and Safety Sciences (IATSS) on November 28, 2015 at United Nations University in Tokyo, Japan.

http://dx.doi.org/10.1016/j.iatssr.2016.05.005

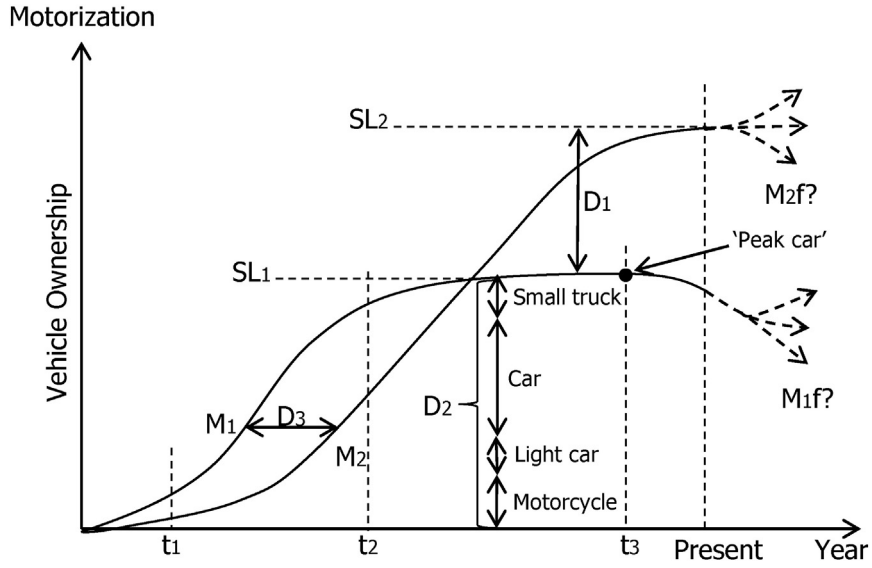

Fig. 1. Different paths of motorization development. Reference: M1, M2—change in vehicle ownership for cities 1 and 2 (vehicles/1000 persons). SL1, SL2—saturation levels of vehicle ownership. D1—difference in saturation levels. D2—share of different types of vehicles. D3—difference in motorization timing and speed.

development. Table 1 shows various situations and the possible factors underlying them.

There seem to be three major causes of shifting policy in the context of transport culture: demographic and other socioeconomic changes on the demand side, new technology and other changes on the supply side, and changes in institutional frameworks including political leadership. These causes are mutually correlated; major policy shifts occur with some trigger(s), and accelerate when the time is ripe. Table 2 illustrates these possible factors. Our experience of shifting policy has, it seems, been the result of many ad hoc short-run responses.

Table 1
Motorization development paths and transport culture.

D1 Vehicle ownership: saturation level (per person or per household)
–Difference in saturation levels (vehicles/1000 persons)
e.g. USA (800) > Europe, Japan (600), Tokyo (300)
–Underlying factors: income, population density, provision of roads and public transport, lifestyle, role of women, etc.
D2 Social meaning and use of vehicles
–Vehicle type: cars and pick-up trucks (USA), motorcycles (Asia)
–Function: transport or social status, recreation or work/business
–Roles of alternative modes (NMT, public transport)
D3 Content and timing/speed of motorization:
–Policy stance on motorization management
–Industrial development policy (trucks over cars)
–Restrictions on ownership and use based on urban/social/ environmental policy (e.g. Singapore, Beijing)

Table 2
Major causes and factors of policy shifts.

1. Changes on the demand side
–Demography: Population, ageing, suburbanization
–Socioeconomic development: Income growth
–Culture and values: Westernization, sharing economy, "peak car"
2. Changes on the transport supply side
–Technological innovation: Performance, cost, materials, energy
–New mobility system: Virtual transport, ride-share (Uber), autonomous vehicles (AV)
–Environmental/resource constraints: Environmental capacities
3. Changes in market institutional frameworks
–Decision-making context: Political changes (leaders)
–Regulations, standards, and frameworks for new problems and technology

Note. Policy shifts are accelerated when the time is ripe with respect to the various factors above.

We have seen a major shift in transport policies from an ad hoc, piecemeal approach to something more strategic, from a transport demand-following approach to an integrated package approach that considers both the demand side and the institutional side together with the supply side of urban transport. Today we face various uncertainties with new problems and issues such as climate change, natural disasters, and security even as major technological innovations in ICT open up new possibilities, so new approaches should also be explored. At the turning point from Stage 1 to Stage 2 in the UK, Professor Phil Goodwin characterized the paradigm shift from a "Predict and Provide" approach to a "Predict and Prevent" approach. Accurate prediction of the future now becomes increasingly difficult; an incremental approach that holds some basic strategic direction unchanged should be appropriate. In this way, our Stage 3 may be characterized as taking a "Decide and Act Together" approach that emphasizes the importance of sharing common goals and visions and acting together with various stakeholders in society.

2. Patterns of motorization

We observe different patterns of motorization development in terms of the main transport modes used in each city, which may be understood as a result of its transport culture. Although comparable transport data sets for international cities are limited, I tried to identify a typology of world cities that includes both mature cities and developing cities in terms of motorization. Table 3 shows the results based on major transport modes using a data set from around the year 2000.[1] This typology is based upon the modal share (%) for three basic transport modes: cars, public transport, and walk/bicycle. Since most cities used cars simultaneously with other conventional modes in 2000, I propose here a typology based upon the dominant mode with maximum share combined with the use of other modes. Since many cities are multi-mode cities using both cars and other modes, I propose three types of multi-mode city. Thresholds were subjectively selected through trial and error. Table 3 shows that the basic types that were identified: C1 Car City,

[1] Urban transport data for cities are drawn from the following sources: 1995 data from Jeffrey Kenworthy, Chapter 4 in *Urban Transport in the Developing World*, edited by H.T. Dimitrio and R. Gakenheimer (2011); 2000 data from *Mobility in Cities*, UITP 2006; and 2010 data on Japanese cities from *Transport Policy in Perspective 2015*, The Japan Research Center for Transport Policy, 2015.

Please cite this article as: K. Ohta, Patterns of motorization development and next-generation mobility systems, IATSS Research (2016), http://dx.doi.org/10.1016/j.iatssr.2016.05.005