

Patterns of Motorization Development and the Next Generation Urban Mobility Systems

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1. "3-Stage Development Cycle" Hypothesis (Prof. P. Jones)
2. Patterns of Motorization Development
3. 'Auto Sapience' and the Next Generation Urban Mobility Systems



1-1 “3-Stage Development Cycle” Hypothesis : Prof. P. Jones on the evolution of urban transport policies

- Useful platform and Japanese cities:

 - Stage1 S₁: ‘Vehicle’ focus — 1960’s~

 - Stage2 S₂: ‘Personal movement’ focus — Middle of 1990’s~

 - Stage3 S₃: ‘Activity/Quality of life’ focus — 2010’s~(?)

- Relation with ‘Transport Culture’

 - Reflected in the motorization patterns, problems/issues identified and policy responses in each countries/cities

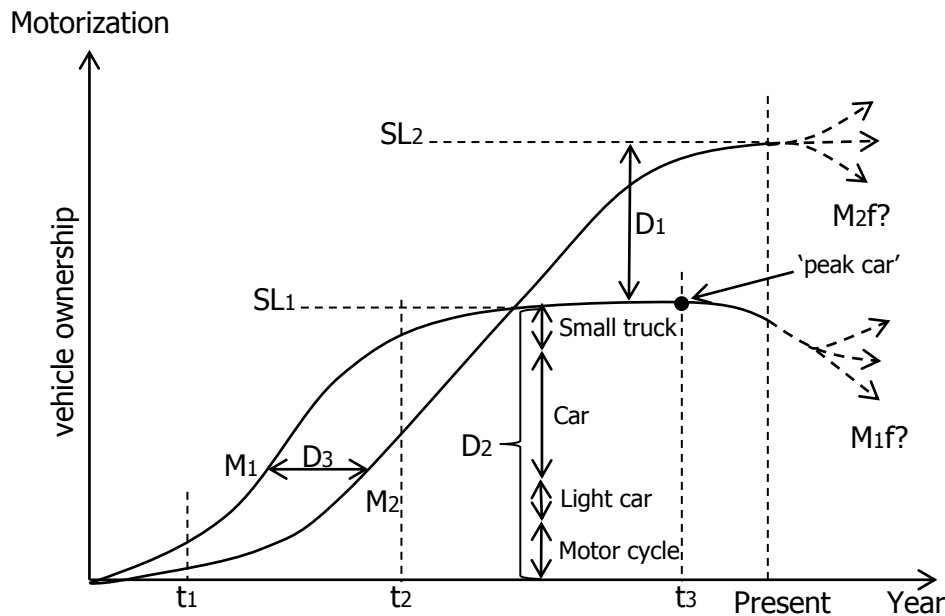
 - Turning points and the key issues:

 - S₀⇒S₁: Traffic problems(congestion, accident, air pollution)

 - S₁⇒S₂: Environment, sprawl, the mobility poor, sustainability;
TDM and MM, 1997 COP3 Kyoto Convention

 - S₂⇒S₃: Global climate, depopulation and ageing, quality-of-life, health ; 2013 Basic Act of Transport Policy

Fig. 1 Different Paths of Motorization development



Reference: M_1, M_2 —Changes of vehicle ownership of city 1 and 2 (vehicles / 1,000 persons)
 SL_1, SL_2 —'Saturation' levels of vehicle ownership
 D_1 —Difference of the saturation level
 D_2 —Share of different types of vehicles
 D_3 —Difference of the motorization timing and speed type



1-2 P. J. Hypothesis and Transport Culture

D1 Vehicle ownership: saturation level (per person or per household)

— Difference of the saturation level (vehicles /1,000 persons)

E.g. USA(800) > Europe, Japan(600) . Tokyo(300)

— Underlining factors: income, population density, road and public transport provision, life style, women's role, etc.

D2 Social meaning and use of the vehicle

— Vehicle type: car + pick up truck(USA), motorcycle (Asia)

— Function: transport or social status, recreation or work/business

— Roles of alternative modes (NMT, public transport)

D3 Contents and timing/speed of motorization:

Policy stance on motorization management

— Industrial dev. policy (truck over car)

— Restraint of ownership and use based on urban/ social/ environmental policy (e.g. Singapore, Beijing)



Major Causes of Policy Shift

— Factors in Transport demand, supply and the market —

1. Changes in demand side
 - Demography: Population, ageing, suburbanization
 - Socioeconomic development: Income growth
 - Culture and the value: Westernization, sharing economy, peak-car
2. Changes in transport supply side
 - Technological innovation: Performance, Cost, materials, energy
 - New mobility system: Virtual transport, ride-share(Uber), automated car(AV)
 - Environmental / resource constraint: environmental capacities
3. Changes in institutional framework of the market
 - Decision-making context: Political changes (leader)
 - Regulation, standards, framework for new problems and technology

Note. Policy shift is accelerated when the time is ripe w.r.t. various factors above.



1-3 P. J.Hypothesis: Policy Shifts and their Causes

- Factors behind the policy shifts: New issues or key problems identified
 - Severe traffic problem (e.g. NOx/PM air pollution, climate change)
 - Shift of political, social, economic situation
 - Paradigm shifts of the approach:
 - Ad hoc, piecemeal approach ⇒ Strategic approach
 - Demand-following approach ⇒ Integrated package approach
 - Needs of new approaches
 - New problems and issues: Climate change, natural disasters, security and technological innovations
 - Increase of uncertainty in the socioeconomic context: the need of new approach - Consensus building on visions and goals, then act / implement together
- ★ Predict and Provide ⇒ Predict and Prevent ⇒ Decide and Act together

2 Patterns of Motorization Development

Table1 City Type by Major Transport Modes (around 2000)

City type	Cities
1. <u>Car City C1</u> (S_1 -max, and $S_2, S_3 < 15\%$)	Ho Chi Minh City★, Cape Town★, Kuala Lumpur★, Athens, Bologna, Brussels, Chicago, Manchester, Melbourne, Stuttgart
2. <u>Public Transport (Transit) City C2</u> (S_2 -max, and $S_1, S_3 < 20\%$)	Dakar★, Manila★, Hong Kong, Warsaw, Tokyo
3. <u>NMT(walk/ bicycle) City C3</u> (S_3 -max, and $S_1, S_2 < 20\%$)	Mumbai★, Shanghai★, Johannesburg★, Amsterdam, Bilbao, Valencia, Osaka
4. <u>Muti-mode City C4</u>	
▪ <u>Car-base C4₁</u> (S_1 -max, and S_2 and $S_3 \geq 15\%$)	Cairo★, Bangkok★, Curitiba★, Seoul★, Barcelona, Berlin, Geneva, Hamburg, London, Madrid, Munich, Oslo, Paris, Rome, Stockholm, Vienna, Nagoya
▪ <u>Public transport-base C4₂</u> (S_2 -max, and S_1 and $S_3 \geq 20\%$)	Bogota★, Prague★, Budapest, Moscow, Prague
▪ <u>NMT (walk, bicycle)-base C4₃</u> (S_3 -max, and S_1 and $S_2 \geq 20\%$)	Harare★, Beijing★, Jakarta★, Sao Paulo, Osaka

Note1. S_1, S_2, S_3 —Modal share(%) of car, public transport and walk / bicycle.

2. Data: ★ —1995(Kenworthy, 26 cities), 3 Japanese cities (2010) and others 2000(UITP, 51 cities)

2 Patterns of Motorization Development

Table 2 Main Public Transport Modes in Major Cities

	<u>Paratransit</u>	<u>Bus</u>	<u>Mixed modes</u>	<u>Railways</u>	<u>Notes</u> <u>Motorization</u>
Japan	—	Utsunomiya [☆]	Toyama, Nagoya	Tokyo	Matured(600) (ageing, depopulation)
U.S.A.	—	Los Angeles [☆]	Portland, Boston, San Francisco	New York	Matured(800) (congestion: peak car? , car/cycle sharing)
Europe	—	Bristol, Cambridge	Munich, Zurich, Copenhagen	London, Paris	Matured(~600) (peak car? cycle revival)
Others	Hanoi [☆] , Manila	Jakarta [☆] , Curitiba, Bogota	Bangkok, Chengdu [☆] , Medellin [☆]	Beijing [☆] , Shanghai [☆]	Rapid increase (economic dev. /urbanization)

Note1. NMT(walking and bicycle) is vital in many cities as an indispensable transport mode.

Besides car, motor cycle, SUV, small truck are used as a private mode.

2. ☆: Cities where development of modern public transport systems (BRT, LRT, subway etc.) are actively proceeded.

3. Paratransit includes various NMT modes (rickshaw and horse carriages).

Also, Motorized modes include two -, three -wheel vehicle, small 4 wheel cars and light trucks.

4. Numbers in the parentheses in Notes is the total vehicles ownership level i.e. vehicles per 1,000 persons.



2-1 Patterns of Motorization Development : Japan and Asia

- Modernization and development of urban public transport means
 - Man / animal powered (NMT) ⇒ Bicycle · paratransit ⇒ Bus · tram · rails
 - Exploring more convenient, affordable, safe and speedy transport means
- Co-existence of various transport means in Asian cities
 - Besides formal modes, various informal or intermediate public transport modes (NMT plus MT) operate in the limited street space
- Different patterns of motorization (vehicle type, motorization speed and the saturation level)
 - Motorcycle or paratransit based motorization

2-3 Patterns of Motorization Development

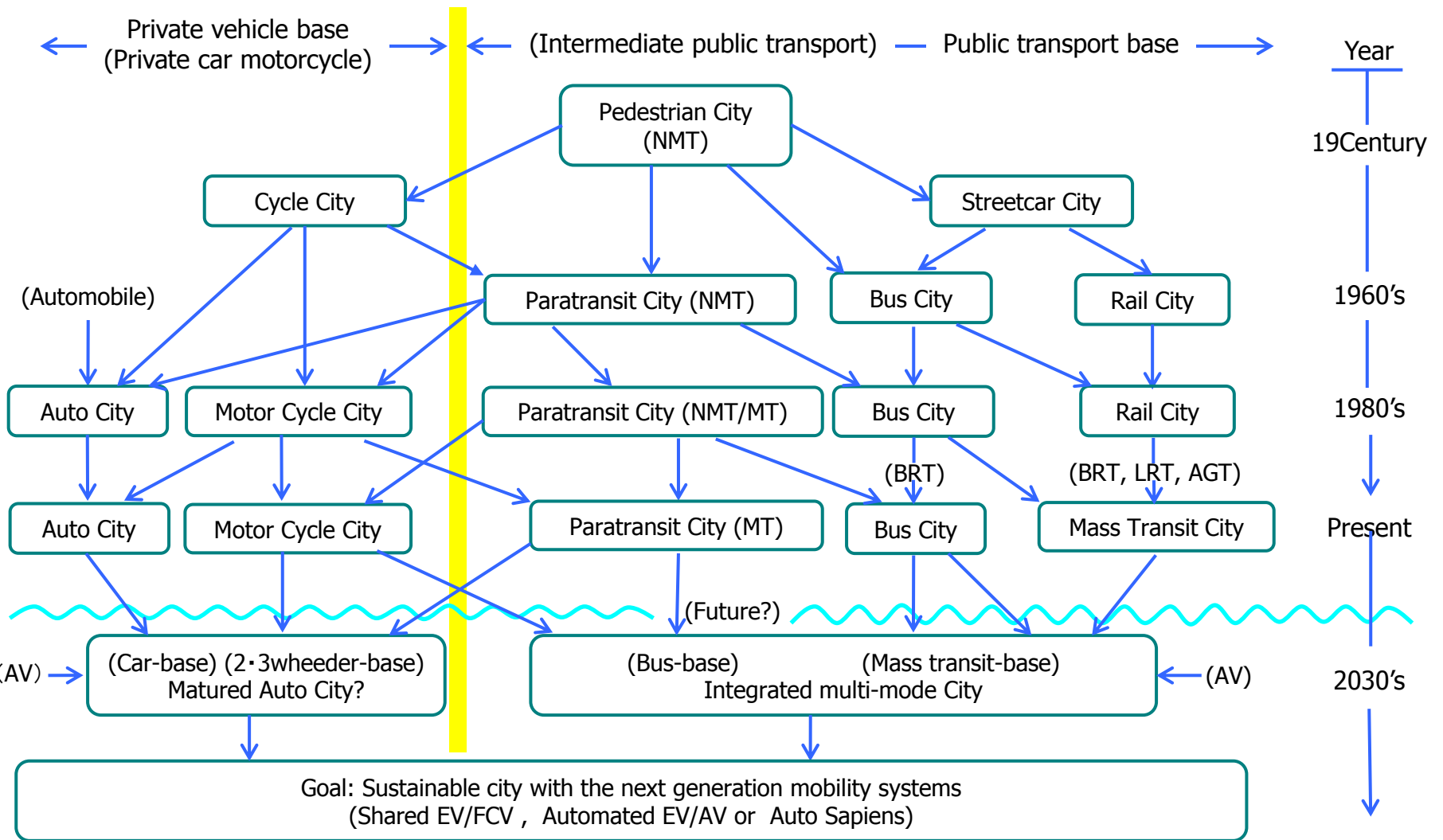
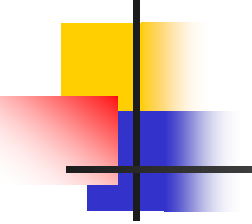


Fig.2 Developments of Urban Transport System based on main public transport modes (Image)



3 'Auto Sapiens' and the Next Generation Urban Mobility Systems –ICT technological innovation and automated vehicles

- Evolution of 'Auto Sapience' , connected and autonomous EV/AV
 - Depends of socioeconomic context of each city. The possibility of ' leap frog' propagation of the new technology.
 - Adaptation of semi-automated technologies is expected soon. Need some decades for fully automated system.
- The next generation mobility system will be a multi-mode mobility system (AV mixed with conventional vehicles; walking as the basic mode) : More choices of travel modes for all. Business models of the mobility services face major revolution with ICT.
- Goals –Healthy and Sustainable City: Accessibility and various travel options for all with sustainability subject to security and resilience, and avoiding the mobility divide

Table 2 The Next Generation Urban Transport System with AV or AS
 - An Image -

	Implications on Activity Modes and Transport Services
<p><u>General</u></p> <p>•Transport modes</p> <p>•Transport services</p>	<ul style="list-style-type: none"> –Level3: Automatic driving system with manual intervention at emergency. - Level4: Driver and the passengers can do business / study / rest / enjoy coffee and other activities during the travel. On demand , door to door service by shared AV - Automated parking with e- recharge and maintenance at remote garage. (Road/parking diet) - Automated mobility service of persons and goods available for all at all time. - Personal travel basically provided by shared AS in urban areas. No need of professional drivers in general. Conventional public mobility services or taxi-type services are also provided for non- AV and passengers with special mobility needs. - The boundary of public and private mobility service becomes ambiguous with shared AV. - Personal ownership of AV and other vehicles is limited for the specific users - Personalized vehicle serves as a private room, storage of personal items and a shelter, alternative supply source of electricity and information at emergency ☆ Possible social dispute/confusion in the transitional period. E.g. TNC and Uber vs taxi.