New Mobility: The Next Generation of Sustainable Urban Transportation

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In a classic fifties photograph, a man in a light suit stands dwarfed by the mammoth mainframe computer he's programming. It is unlikely that the idea of a "nanopod" entered his mind at the time, let alone mesh networking, G.I.S., or "Googling". He wouldn't have conceived of the connectivity that has since brought all these things together, transformed the world, and evolved into one of the world's fastest growing and most pervasive industries a mere half century later.

We are on the cusp of a parallel transformation for cities. It's called New Mobility. Accelerated by the emergence of new fuel and vehicle technologies, new information technologies, flexible and differentiated transportation modes, services and products, innovative land use and urban design, and new business models, collaborative partnerships are coming together in a variety of ways to address global urban transportation challenges and to form the basis of a vital New Mobility industry (MTE / ICF, 2004)

One example of New Mobility innovation is the Hong Kong Octopus system, which links multiple transit services, ferries, parking, service stations, access control, and retail and rewards using an affordable contactless stored-value smart card to support a seamless and sustainable door-to-door trip. Octopus has enjoyed significant business success and is now exporting its systems to the Netherlands. (Octopus, 2006)

Factors Driving New Mobility Development

New Mobility development is inspired by emerging innovations and propelled by pressing challenges, not the least of which is rapid urbanization. Though some cities are shrinking, by 2030 over 60% of the world's population and over 80% of North America's population will live in urban regions (UN 1996). With increasing motorization, the associated traffic volume and congestion is already resulting in lost productivity and competitiveness as well as health and other costs related to smog, poor air quality, traffic accidents, noise, and more recently climate change (WBCSD 2001).

At the same time sprawling, car-based urban development patterns mean either isolation or chauffeur dependence for the rapidly growing aging population as well as for children, youth, and the disabled (AARP, 2005, Hillman et al. 1995, O-Brien 2001, WBCSD 2001).

In developing nations, aspirations of progress and status translate into increasing car ownership; meanwhile the risks and costs of securing the energy to fuel these aspirations also rise. (Gakenheimer 1999, Sperling 2002, WBCSD 2001).

Frontiers of Engineering for New Mobility

The above factors combined offer not only compelling engineering challenges but also social and business innovation opportunities. New Mobility solution-building is supported by new ways of thinking about urban transportation as well as emerging tools and approaches for understanding and implementing it. This paper introduces three frontiers that underpin New Mobility thinking and practice:

- Complexity
- Accessibility
- New business models

Complexity

Tools for Understanding

Urban systems are complex. As such various tools and approaches are used to support the analysis and modeling of urban transportation complexity (2000, Sussman, 2000).

At least three different types of systems analysis can be applied to transportation and accessibility: broadly, top-down, bottom-up, and simulation. They are all useful, and they are all complementary.

In simple terms, top-down analysis generally starts with self-generated variables or hypotheses and develops a causal loop diagram (CLD) using software that highlights patterns, dynamics, and possible intervention points, after which more in-depth data gathering and modelling can take place (Gladwin, in review, Sussman, 2002, 2004)

Bottom up, or agent-based models (ABM's) are computer-based models that use empirical and theoretical data to represent the interactions among various components and environments and processes of a system, illuminating their influence on the overall behaviour of the system. (Zellner, in review, Axelrod et al, 2000, Miller et al, 2005, 2006, Zellner, 2003)

Simulation and scenario-building software can draw from and build on both approaches. It graphically depicts and manipulates transportation and other urban dynamics. (Metroquest 2006)

Sophisticated Solution Building

Complex transportation challenges call for sophisticated solutions. “Single fix” approaches (for example, alternative fuels alone, pricing mechanisms alone, or policies alone) fail to address the wider suite of urban challenges and conditions noted above.

Informed by complex systems analysis, systems-based solution building involves “connecting the dots”, enhancing or transforming existing conditions with customized and integrated product, service, technology, financing, social, marketing, or policy / regulation innovations. (ECMT 2006, MTE/ICF, 2002, Newman et al, 1999).

A good example of systems-based solution-building was initiated in Bremen, Germany and is now spreading to a number of European cities, as well as to Toronto, Canada. “New Mobility Hubs” connect a wide range of sustainable transportation modes and services at ubiquitous physical locations or “Mobile Points" throughout a city or region (MTE, 2004). They physically and electronically link the elements required for a seamless, integrated, and sustainable door-to-door urban trip.

These elements may include all the options linked by the Hong Kong Octopus card described above, and more. For example walkable, bikable, transit-oriented spatial design and development (Kelbaugh, 1997), taxis, car-sharing, slugging (Slug-Lines, 2006), free bikes, cafes, meeting places, traveler information and wi-fi amenities might be features of future hubs.

Whether in the developed or developing world, the particular combination of hub amenities is customized to local needs, resources, and aspirations.

Hub development can catalyze a range of potential engineering and business opportunities, related not only to the design and implementation of individual infrastructures and innovations, but also to engineering the physical and digital connections between them.

Accessibility

Over the past 50 years, measures of regional and economic success have become increasingly tied to (motorized) mobility and speed of travel (TTI 2005).This association originated in the West and has been widely adopted in cities of the developing world.

However transportation is a means to an end, or a derived demand. So measures and applications of accessibility do not focus instead on how fast and how far one can travel within a certain time period. They focus instead on how much can be accomplished within a given timeframe and budget, or how well we can meet our needs with available resources. For example on a typical day in Los Angeles, you may drive long distances at high speeds to fit in three meetings. In Bremen, Germany, a more accessible place, you may fit in five meetings along with a leisurely lunch having covered half the distance at half the speed and half the price. (Levine in review, Levine, 1998, Levine et al, 2002, Thomson, 1977, Zielinski1995)

Accessibility can be achieved in at least three ways:

- wise land use and design that brings needs closer together
- telecommunications technologies that eliminate the need for certain trips
- seamless multi-modal transportation (mobility is an aspect of accessibility)

Among other benefits, moving beyond mobility to provide a range of accessibility options begins to address growing demographic, equity, and affordability issues faced by seniors, children, the poor and the disabled in regions with currently low accessibility.

The University of Michigan's SMART/CARSS project (SMART / CARSS 2006) is currently developing an Accessibility Index that will compare and rate metropolitan regions based on accessibility and will serve to inform both policy and innovation directions.

<u>New Business Models</u>

A 2002 Study by Moving the Economy found that the current value of New Mobility markets can be measured in the billions of dollars (MTE / ICF 2002). Moving beyond the sectoral bounds of the traditional transportation industry, New Mobility innovations and opportunities encompass aspects of telecommunications, wireless technologies, geomatics, e-business and new media, tourism and retail, urban goods movement and supply chain management (Zielinski et al, 2004), design (products, services, technologies, community), real estate, financial services, and more.

Not only are New Mobility innovations addressing local competitiveness and quality of life goals, (Laube 2002, Newman 1999), they are also providing promising export and economic development opportunities geared at both mature and poorer or "Base of the Pyramid" markets (Hart 2005, Prahalad 2004). As urban transportation is an increasingly urgent challenge worldwide, and since urban mobility and accessibility solutions are relatively transferable, regions, nations, and enterprises that support New Mobility (supply-side) innovation, as well as industry cluster and new business model development stand to gain significantly from transportation export markets in the coming years (MTE / ICF 2002).

Into the Future – Engineering and Beyond

New Mobility transformation holds powerful potential for the vitality of cities and economies worldwide. Integrating complexity, accessibility, and new business models can support a wealth of engineering and business opportunities. But there are obstacles to overcome that are beyond engineering. The drive towards individual motorization and the status it represents in developing countries, along with the seemingly unstoppable progress of urban sprawl in the West are challenges to address on psychological and cultural as well as infrastructural and economic levels. Concerted evolution towards a positive, integrated, and sustainable future for urban transportation will mean going beyond moving people and goods (Zielinski et al. 2004) to embrace the complex task of moving hearts and minds.

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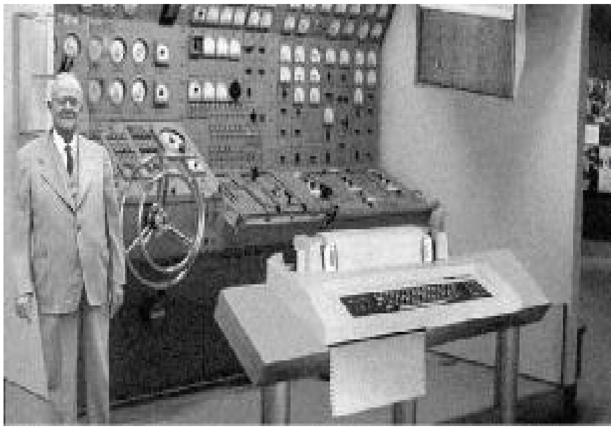
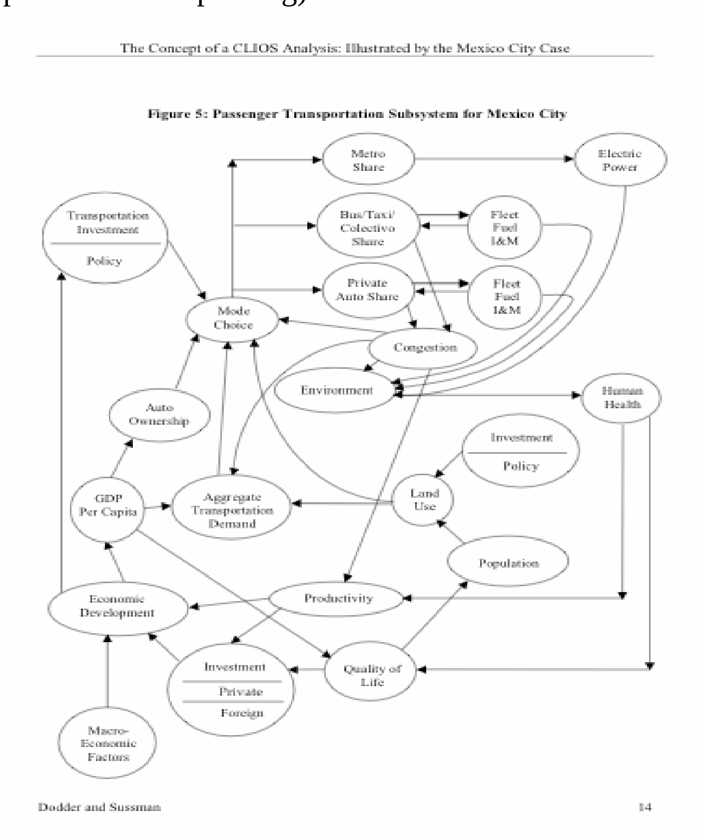
Proposed Figures

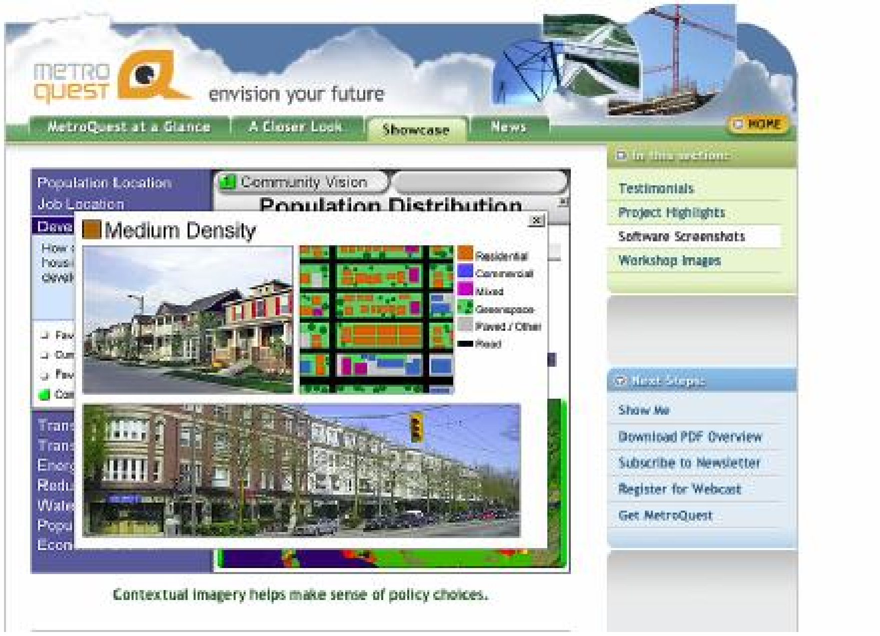
Now and Then: Mainframe and Nanopod (requires permission for printing both images)



CLIOS Transportation System Analysis – MIT, Sussman and Dodder (requires permission for printing)



MetroQuest Simulation Tool (permission required for printing)



New Mobility Hubs (Source: Moving the Economy, Toronto, Canada)