Paratransit: the need for a regulatory revolution in the light of institutional inertia[1]

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Abstract

Purpose: This chapter adopts a transport systems approach to explore why the adoption of paratransit modes is low and sporadic. Regulatory and institutional barriers are identified as a major reason for this. The chapter then reviews key trends and issues relating to the uptake of, and barriers to, paratransit modes. Based on this analysis a new regulatory structure is proposed.

Approach: Case studies and research/practice literature.

Findings: Following an exploration of the nature of paratransit system design and traditional definitions of 'paratransit', it is concluded that institutional barriers are crucial. However, current societal trends and service developments, and in particular initiatives from the technology service industry, are developing significant new paratransit models. The chapter concludes with a proposed redefinition of paratransit to facilitate a regulatory change to help overcome its institutional challenges.

Research Implications: A paratransit transformation of public transport services would produce travel behaviours different from models and perspectives built around corridor/timetabled public transport services.

Practical Implications: Technology firm invaders (e.g. Uber) are viewed as disrupters from normal transport planning to be controlled or excluded. However they may be the key to a transport system transformation.

Social Implications: Existing public transport modes are ill-suited to modern patterns of travel demand. A system involving paratransit could produce enhanced social mobility and system level improvements in CO2 emissions.

Contribution: This chapter identifies the key issues raised by the emergence of new paratransit modes and the new actors involved. A new regulatory structure is proposed that reflects this understanding.

Keywords: Paratransit; Flexible transport services; Intuitional barriers; Regulation

Introduction

This chapter adopts a transport systems approach to explore the place of paratransit relative to mainstream public transport modes. Paratransit systems have remained a relatively niche transport concern, initially due to cost and technology issues, but now regulatory and institutional barriers are the major reason for this. However, key social and economic trends are challenging these barriers. Existing public transport modes are ill-suited to the travel needs of the 21st century and the traditional approach of transport planning is ineffective. Added to this are transport service "invaders" from new technology companies such as Uber and longer term prospects of autonomous vehicles. These innovative developments are often met with strong institutional resistance. Based on this analysis a redefinition of paratransit is suggested and this is used to propose a framework for a new regulatory structure.

This chapter begins with an exploration the system design of public transport systems such as bus, tram and metro, which operate scheduled services on defined routes with large vehicles. The alternative system design for paratransit is more appropriate to the travel needs of the 21st century, but has faced barriers of cost and technology together with institutional structural inertia. The cost and technology barriers are being overcome, but the institutional barriers to paratransit remain. This leads into issues of defining paratransit modes and how they are treated in terms of regulation and institutional structures.

A reconsideration of the institutional treatment of paratransit modes is becoming more pressing as technology companies enter with new mobility products, such as personalised rapid transport, Uber cars and autonomous vehicles. Technology firm invaders are viewed as disrupters from normal transport planning to be controlled or excluded, however they may be the key to a transport system transformation. Based on this analysis a new regulatory structure is proposed to facilitate the development of paratransit systems and the evolution of a public transport system appropriate to modern travel needs.

The system design of public transport

Paratransit, or Flexible Transport Services (FTS), have a fundamentally different system design to that of conventional public transport modes, such as bus, tram and metro, which operate scheduled services on defined routes with large vehicles. Paratransit can involve a variety of service types and configurations (Cervero, 1997), commonly using small vehicles that customise routes to passenger needs and operating to demand. These can include taxis, jitneys, dial-a-ride services and various subscription buses. Paratransit modes represent a systems design that theoretically is able to dynamically match the level of supply of a service with the level of demand required, unlike conventional models of public transport.

The system design for conventional public transport is so long established that its core structure, characteristics and business model are taken for granted. This model has essentially remained unaltered since the development of the horse bus in the 1820's when it emerged as a means of providing trips at a fare significantly lower than taxi cabs, thus opening up a distinctive new market whereby capital and labour costs were spread across a large number of passengers per vehicle.

This traditional business model means that vehicles have to be large (initially the maximum size that could be hauled by two horses) and operate on corridors of high demand to set timetables, with services focused on commuting and business trips along high density corridors into and within big cities. Passengers access the service by walking to stops with interchange needed for trips off the original route. This model has essentially remained unaltered for 200 years, despite the technology of public transport vehicles, fare collection and any associated track and infrastructure, have seen considerable development over the period (Daganzo, 2010).

Professional and regulatory practices have emerged around this public transport systems model and so too has transport policy. Indeed, transport policy and debate has intuitively taken this 'big vehicle/big infrastructure/dense corridor' model as the only system choice, engrained in public transport policy thinking and culture. Even when patterns of demand do not fit the model, passengers are expected to conform to it. Hence the large vehicle operating on fixed routes is retained for peri-urban and rural services, but operates at low frequencies so as to build up user numbers.

This single model for public transport (albeit varied in scale) has led equally to a single model to make transport in cities more sustainable, with the design of transport for sustainable cities structured around concepts to ensure dense clusters that can support high-capacity, corridor-based public transport. This is seen as the ideal urban transport/land-use pattern to constrain car use –

which is intended to ensure that people arrange their habitat and lives around the service design requirements of a transport system, as depicted in figure 1. Planning controls are advocated to produce settlement patterns and conditions that will favour high-capacity, corridor-based public transport and discourage car use (Newman & Kenworthy, 1999).

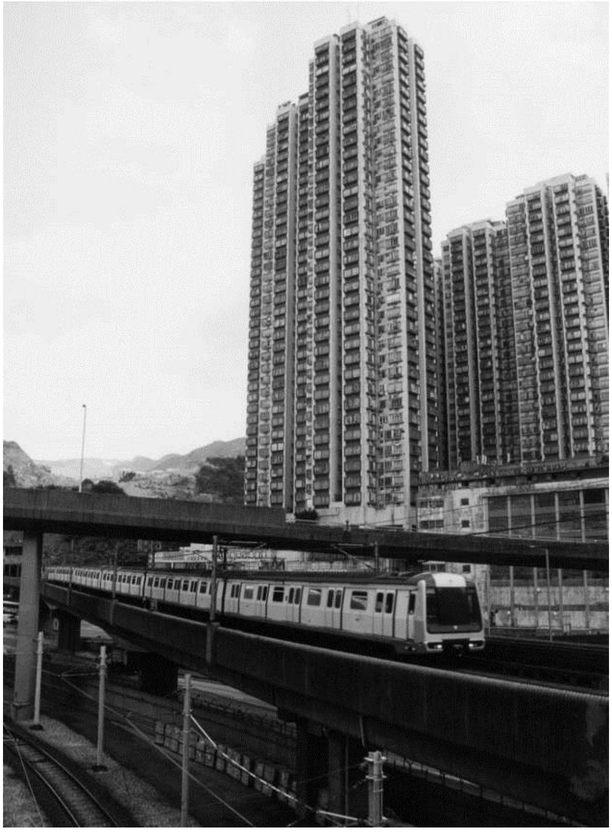

Figure 1: Hong Kong Metro and high density living
Source: Stephen Potter

In a comprehensive review of this and other approaches, Banister (2005) cites case studies of cities that have achieved a ten percent cut in car use through approaches utilising planning controls and public transport development.

But such approaches raise both ethical and practical questions of system design. First, should the sustainability imperative require people to arrange their lives around the service design requirements of any transport system? And second, even if this is accepted for the social good, is it practical to implement such a traditional public transport service design, given the preference of most people for a different type of mobility? In these regards, urban mobility is proving to be a difficult sustainability challenge. The UK's 2008 Climate Change Act, for example, seeks an 80% cut in CO2 emission by 2050 relative to the base year of 1990. This requires a three percent CO2 reduction per annum and a major reduction in CO2 from the transport sector by 2020. Between 1990 and 2012 the UK's end user greenhouse gas emissions dropped by 26%, but those from transport dropped by only four percent (DECC, 2014). As a result, transport's share of emissions rose from 18% of the total to over 23%. Rather than the required three percent CO2 reduction per annum, the transport sector has not even managed a 3% reduction *per decade*. A ten percent cut in car use from land use/transport designs that support conventional corridor public transport, as noted in Banister's study, falls considerably short of the improvement needed.

The question that is intuitively avoided is whether much of the difficulty in promoting public transport is about the suitability of the basic service design for the transport needs of people in the 21st century. Thus, while the product-level design of the service can been improved, is the key to the problem instead the service design itself? In practice, travel behaviour is driven by deep-rooted economic and social factors that have resulted in demand becoming increasingly dispersed in time, space and across functions, and patterns of travel behaviour have been moving away from high demand corridor configurations for at least the last 100 years. Yet transport planning still largely focuses upon work-related journeys, despite commuting and business travel together now constitute less than 20% of overall journeys; 16% and 3% respectively (National Travel Survey, 2014). Travel growth is now in leisure purposes (which have grown to 30% of all trips), shopping (20%) and highly dispersed personal business trips (20%). Meanwhile in terms of spatial requirements, the strongest growth is not along major city corridors, but in suburban, urban fringe and rural areas. The rise in car ownership and use has much to do with this dispersal of travel demand, but it is also a result of fundamental shifts in our economy and society and is not something that can be explained by transport factors alone. Accordingly, enhancing the quality and cutting the cost of corridor 'big vehicle' timetabled services will only have a marginal impact on car use as 80% or more of travel is no longer along high density corridors or takes place at times when corridor services are infrequent or not operating.

The fundamental problem is that travel behaviour continues to shift to a pattern of demand that is ill-suited to the longstanding system design for conventional public transport. In an article written shortly before his death, Sir Peter Hall reviewed the need for a new form of public transport to effectively serve decentralised and dispersed travel demands, seeking what he called the 'Heineken' system (a reference to the Heineken lager advertisement, with Hall seeking a public transport system that' refreshes the parts other transport cannot reach'). But Hall (2013) could not find such a system. Despite his system-level specification, Hall restricted his consideration to public transport modes conforming to the existing big vehicle/corridor system design. However, what if the answer lies in the rejection of such a rigid system configuration, which is what paratransit represents?

The potentially transformative impact of 'small vehicle/small infrastructure' paratransit public transport is that, rather than people needing to adjust their behaviour to a bus or metro, they can travel directly, whenever they want, on services that may well operate 24 hours a day, seven days a week. Crucially, the level of service can be maintained at times of low demand, thus overcoming the poor quality of infrequent evening, night and Sunday services experienced today. This is a service design that matches the socio-economic culture of the 21st century city – not one requiring 21st century society to conform to a 19th century transport system architecture. A shift to a public transport service system of this type therefore has major implications for transport and urban planning. Although conventional corridor big vehicle systems could continue to serve the market for which they are suited, a small vehicle paratransit system can provide a viable alternative to private car use in suburban, urban fringe and rural situations. It is this system level change that has the potential to deliver energy and sustainability gains together with and greater social inclusion and economic benefits.

Paratransit uptake

Despite the potential scope and appropriateness of paratransit modes for modern transport needs, in practice they have remained a niche concern. For instance, Balcombe et al., (2004) suggests that taxis (the most widely available and established form of paratransit) accounted for ten percent of all public transport trips in the UK and six percent of passenger kilometres, whilst a survey of British local authorities reveals there to be a relatively small number of Demand Responsive Transport (DRT) schemes in operation (369 from a response rate of 47% of councils, crudely suggesting a total of around 800 DRT services across the country) compared with roughly 22,000 bus services – i.e. about 4% of services (Davison, Enoch, Ryley, Quddus & Wang, 2014; Stagecoach, 2015).

Such a status has previously been ascribed to a three sets of barriers: technological, economic and institutional (Cervero, 1997; Enoch, Potter, Parkhurst & Smith, 2004; Mulley, Nelson, Teal, Wright & Daniels, 2012). In particular, technological challenges tend to relate to optimising the booking, scheduling, and routeing functions, whilst economic issues focus on the business model for paratransit. In sum, small vehicles generally are unable to generate sufficient revenue from the relatively low numbers of passengers often paying relatively low fares to cover the high costs of provision (particularly the driver costs). Meanwhile institutional barriers include navigating the diverse range of licensing regimes for operators, drivers, vehicles and routes or service areas, which in turn had major implications on insurance, subsidy, tax, VAT, safety and several other operational questions. Policies and financing mechanisms that define public transport as the existing large vehicle/corridor system generally exclude alternative system designs from a whole range of institutional and financial support.

Defining paratransit

Defining paratransit is thus of importance because definition is linked to the vital issues of regulation, policy and financing. Paratransit can be characterised as being "urban passenger transport service mostly in highway vehicles operated on public streets in mixed traffic; it is provided by private or public transport operators and is available to certain groups of users or to the general public; but it is adaptable in its routeing and scheduling to individual user's desires in varying degrees" (Vuchic, 2007, p. 501). In other words, paratransit routes may not be fixed and vehicles may not have timetables, yet are available to the general public and hence can be seen as falling into "the full spectrum of transportation options that fall between the private automobile and the conventional bus" (Cervero, 1997, p.14). Cervero continues that paratransit can "comprise a mix of service types and configurations, passenger-carrying levels, market orientations and levels of regulatory control", and states that example modes accordingly include both car rentals and carpools, in addition to taxis, DRT, jitneys, dial-a-ride services and subscription buses of various types.

This view of paratransit leads it to be viewed as a niche mode providing services in areas and/or at times where demand is not sufficient to economically justify conventional public transport modes such as a bus. Enoch et al., (2004) propose four types of paratransit service. These move from a niche role through to a systems reconfiguration. These are:

- Interchange services have evolved to act as feeder services to enable people living in relatively low density areas to access higher frequency bus and rail-based services. One example here is the Lincolnshire InterConnect scheme in the UK, which sees a whole number of DRT minibus services being timetabled to meet a network of interurban bus services connecting the larger settlements in what is by UK standards, a very rural county (Wang et al., 2015).
- Network services differ in that they enhance public transport either by providing additional services, or by replacing uneconomic services in a particular place or at certain times. One such example occurs on the Indian Ocean island of Mauritius. Here, so-called 'taxi train' services supplement inadequate bus services throughout the day, whereby taxis not on other duties and which are registered on a specific route corridor provide travellers with a shared taxi ride for a fare slightly higher than for an equivalent bus fare. These typically run from a main terminus point only when the vehicle is full, but otherwise cruise the route in order to solicit custom (Enoch, 2003). Similar paratransit services of relatively high capacity operated by taxis and/or minibuses also operate in countries as diverse as (limited areas in) the USA (jitneys); Russia (marshrutka), Kenya (matatu), Turkey (dolmus), Northern Ireland (black taxibuses), Hong Kong (public light buses, as shown in figure 2), Philippines (jeepneys) and Tunisia (louage). Slightly different, the Helsinki 'Kutsuplus' uses a nine seater minibus that can be ordered to a pickup point at a certain time. Other passengers will be already on board, picked up and dropped en-route. An algorithm calculates the most efficient route for drop off for everyone but each passenger only pays for their trip via the shortest route.
- Destination-specific services have been developed to serve special destinations such as employment locations or airports. Well known examples here include the airport shuttles that operate to most major USA airports, the Allobus, a DRT service which provides employees with a means of accessing Paris Charles de Gaulle Airport; and the Deeside Shuttle, which began operating in 2003 to transport employees from Merseyside to an industrial park in north Wales, but which at the time of writing was due to close down due to local authority funding cuts (Enoch et al., 2004; Porter, 2015).
- Substitute paratransit effectively reinvents public transport by replacing conventional public transport rather than complementing it. One of the best known examples of this type is the Taxibus scheme in Rimouski, Quebec, which saw the city authorities replace a stage bus network with a shared taxi operation for services to suburban areas in 1993 (Trudel, 1998).

Figure 2: A public light bus in Hong Kong
Source: Stephen Potter

Institutional inertia and new technology developments

Public policy-led paratransit systems have been developed within the culture, structures and governance systems of the existing public transport regime. This has resulted in them tending to have high operating costs and low revenue leading to them having only a marginal role within the existing institutional frameworks. Recent advances in big data systems could substantially benefit paratransit and potentially move from specialist applications into mainstream public transport operations. But existing paratransit schemes, operating within structures for stage carriage services, have only gradually responded to this opportunity. By way of contrast, the minicab/private hire sector has rapidly adopted the digital world of booking apps and the internet, using this to significantly improve customer service and to automate and improve the efficiency of driver scheduling. This has both provided increased value to users and reduced costs to the operators.

This process is being accelerated by, often controversial, entrants from the world of the digital economy, where a variety of so-called New Mobility Services are emerging. New technologies and social media tools allow passengers and service providers to communicate directly with each other thanks to a 'marketplace of travel marketplaces' where trip demand needs and available transport supply alternatives can be matched or brokered almost instantaneously. This does not require bespoke information technology (IT) infrastructure, but an adaptation of products provided by digital economy companies. For example, even individual citizens can now accept fares paid by smart card, on a phone or contactless credit cards thanks to the availability of inexpensive fund transfer equipment. It is these sorts of developments and their associated business models that are now set to drive the paratransit agenda and which have the potential to redefine what constitutes public / collective transport systems. Such New Mobility Services are perhaps epitomised by the technology company Uber and its new model of dynamic liftsharing on-demand car service (Boeckel, Sprunger, Smith & Work, 2012). This new business model is strongly commercially driven and is far from the cumbersome structures used by niche paratransit operators to date. Uber's model involves a user-oriented booking and payment app, crowdsourced drivers, highly efficient scheduling and back-office software, which together outperform incumbent minicab operators and has invoked a backlash from the hackney carriage taxi industry in cities around the world.

A further influence is the emergence of autonomous or driverless vehicle technologies. To date these have seen very restricted applications, such the Heathrow Airport Personalised Rapid Transit (PRT) 'pods' introduced in 2011 to replace a bus service, as shown in figure 3. Here, instead of a bus linking a number of stops along a fixed route before arriving at the one nearest the users' car, the four-seat pod travels non-stop to the nearest station.

Figure 3 A Heathrow Pod at a car park stop
Source: Stephen Potter

The service design for PRT places it in the 'substitute' paratransit category and represents the full paratransit system design. PRT operates individual journeys across a network of narrow tracks. It is effectively a driverless taxi. The battery-electric 'pods' wait for customers at local stops, and when one pod is occupied another automatically replaces it to await the next customer.

PRT systems are only being applied gradually, but the prospect of autonomous PRT systems that do not require segregated tracks is now beginning to be realised. In 2011, Nevada became the first USA state to permit autonomous cars on public roads, with other states soon following. The UK made them street legal from 2015. With the elimination of the cost of both driver and special infrastructure, the economics of small vehicle PRT systems are transformed as nearly half the operational costs for bus and taxi services are the driver (Enoch, 2015). Autonomous vehicles therefore likely represent the next development for the emerging Uber-style service model, potentially offering a door-to-door '24/7' taxi level of service for about the same fare as for a bus journey.

Autonomous tourist passenger shuttle vehicle trials were due to commence in 2016 in the London Borough of Greenwich, together with autonomous valet parking for adapted cars. The Milton Keynes element of the *Autodrive* programme, which also involves a related project in Coventry, is led by the UK Transport Catapult and linked to the MK:Smart programme; 'Pathfinder' autonomous pods running in trials began in late 2015 on short-distance links from the station to destinations in Central Milton Keynes. These two-seat pods (Figure 4) run on cycleways and footpaths, mixing with cyclists and pedestrians. Lastly, Bristol's *Venture Consortium* will investigate whether autonomous vehicles might improve or worsen congestion, together with the safety aspects. The latter aspects have already stimulated much research interest (for example Rodoulis, 2014; Burns, 2013).

All these developments mean that, through improved and more affordable technologies, many of the economic barriers for paratransit modes, particularly for car-based and small vehicle services, have been, or are in the process of being, reduced or eliminated. Thus it is the industry structure and other institutional barriers that provide the last obstacles preventing the rapid up take of paratransit systems. The new business models emerging behind new technology-led services are essentially commercial ones and they frequently clash not only with incumbent commercial providers, but with the regulations and institutional structures that have been built up around the existing business models that the new entrants are so strongly challenging.

Figure 4: The prototype Milton Keynes two-seater 'pod'
Source: Stephen Potter

In characterising these institutional issues, perhaps the most challenging to address relate to the fact that the regulatory environment for the local passenger sector has been built incrementally over many years and effectively around two, or possibly three, very separate institutional frameworks, namely:

1. Stage carriage services (i.e. buses). Buses tend to operate fixed routes and timetables and operate using larger vehicles. Bus companies are often eligible for various forms of subsidy payment, can bid for contracts to run various services and, in the UK and several other countries, there is no VAT on bus fares. However, they do face stringent rules on financial probity, and on vehicle and driver standards. In the UK context, bus service standards are

monitored and enforced by a national agency known as the Traffic Commissioners, which is an agency of the national Government.

2. Public hire and private hire vehicles (i.e. taxis). Operators of taxis and minicabs are licensed to operate in specific areas, generally operate vehicles of less than nine seats, and can and do bid for some public transport contracts. While they pay VAT on fares and do not usually qualify for subsidy payments, the operator, vehicle and driver standards are probably less onerous than for bus companies. Taxis and minicabs are monitored and licensed by local district councils or unitary authorities.
3. Private vehicles (i.e. cars). Owners of private vehicles are not really supposed to provide transport for strangers for the purpose of financial gain, and so there are no systems in place to ensure that vehicles and/or drivers are of a suitable standard to transport passengers beyond the basic annual vehicle safety check and driving tests, which are administered by agencies of national Government. Increasingly services in the UK are also being operated by community transport or social enterprise organisations, which are 'not for profit' organisations and therefore conform to yet another set of institutional rules

The problem is that, almost by definition, paratransit alternatives do not comfortably fit under any of these categorisations with the result that they have no institutional home and either upset the status quo (as with Uber currently) or else are still born. Such challenges are not new in the paratransit sector. Indeed the story of the jitney in Los Angeles 100 years or so ago echoes the regulatory struggles of DRT operators around the turn of the Millennium in the UK to register new service types, and perhaps more closely the battles facing Uber currently throughout the world (Nilsson, 2015). The issue of regulation is not just an operational one. User confidence concerns, particularly around personal security, affect confidence in Uber and other New Mobility Services.

Future developments

Looking to the future, Enoch (2015) suggests that there are several factors pushing away from the traditional modes of car, bus and taxi and towards increased role for paratransit-type modes. These include:

- More elderly people who will no longer be able to drive but who need access to places buses serve poorly; more younger people excluded from car ownership by high insurance costs and competing demands on their incomes;
- A growing culture of 'collaborative consumption';
- Increasing pressures on the global economy and the impact of the austerity agenda in many countries on revenue budgets. Expensive public transport infrastructure projects will be difficult to fund and bus subsidies hard to justify compared to commercial paratransit;
- The political desires to deregulate policy sectors and promote 'choice' as a means of improving service quality;
- The increasingly blurred boundaries within the intermediate transport mode supplier sector and the increasing range of 'new mobility solutions';
- The increasing desire to better integrate transport options to create a more user friendly transport system, through spatial, temporal, ticketing, information and seat brokerage mechanisms; and

- The widespread adoption of big data technologies such as the internet, smartphone and GPS tracking technology.

To these factors needs to be added the structural factors mentioned at the beginning of this chapter – that of deep-rooted economic and social factors lead to travel demand becoming increasingly dispersed in time, space and across functions.

In recognising these broader ‘market pull’ and ‘technology push’ trends, one future for the current local passenger transport market could see the traditional landscape of bus, car and taxi being replaced, first by a range of paratransit modes, and ultimately, once driverless technology becomes mainstream, by convergence on autonomous taxi systems (Enoch, 2015). Yet even if this full transition were not to take place, the current direction is towards a transport system where paratransit modes play a far more important role than currently. Accordingly, there is a need for the present institutional structures to be revisited, and most likely rebuilt in a way that can be open to a new means of delivering transport services.

Redefining paratransit: Suggestions for institutional change

The approach proposed here is that the current modal-based institutional structures (bus, taxi, car) be realigned into a format based on the degree of operator specialism (occasional, regular, specialist), but that the day to day operation of the various regulatory functions (driver licensing, subsidy allocation, etc.), would essentially remain unchanged and would in most cases only subject to refinements. Underlying this, are two core principles:

1. That ‘new’ modes would no longer be forced into operating pre-conceived service patterns (constrained, for example, by limitations on number of seats, timetable schedules, route/area restrictions); and
2. That the more specialist the operator, the tighter the regulations but the greater the operational benefits and opportunities.

The concept behind this is that such a system would be flexible enough to enable operators to design the transport operations that they deem to appropriate for the anticipated demand, and to select the minimum performance criteria against which they would be judged. Moreover, operators could potentially move up or down the continuum as the market or their circumstances changed, simply by deciding which criteria to meet. Under the proposed new system, operators would be classed as being specialist, regular or occasional.

Typically, specialist operators would operate much like bus companies do currently, with regular stringent checks on financial, maintenance, drivers and service levels, coupled with the opportunity to bid for the full range of contracted transport services, eligibility for subsidy schemes, and exemption from VAT on fares.

Regular operators (including some minicab operators, subscription bus providers, or vanpool operations) would submit to slightly less onerous licensing arrangements across the board, but as a consequence would be restricted to bidding for a limited range of contracted services and subsidy sources, and would not be VAT exempt.

Finally, all other vehicle owners would be classified as being occasional operators. Under this designation, it is perceived that car drivers that offered lifts to people would be able to be reimbursed and would not be subject to any additional administrative burdens to what they face currently in terms of driver and vehicle licensing requirements, insurance and so on. However, neither would they be eligible for VAT reimbursement, or subsidy payments for example.

Figure 5 illustrates how this concept may look in practice.

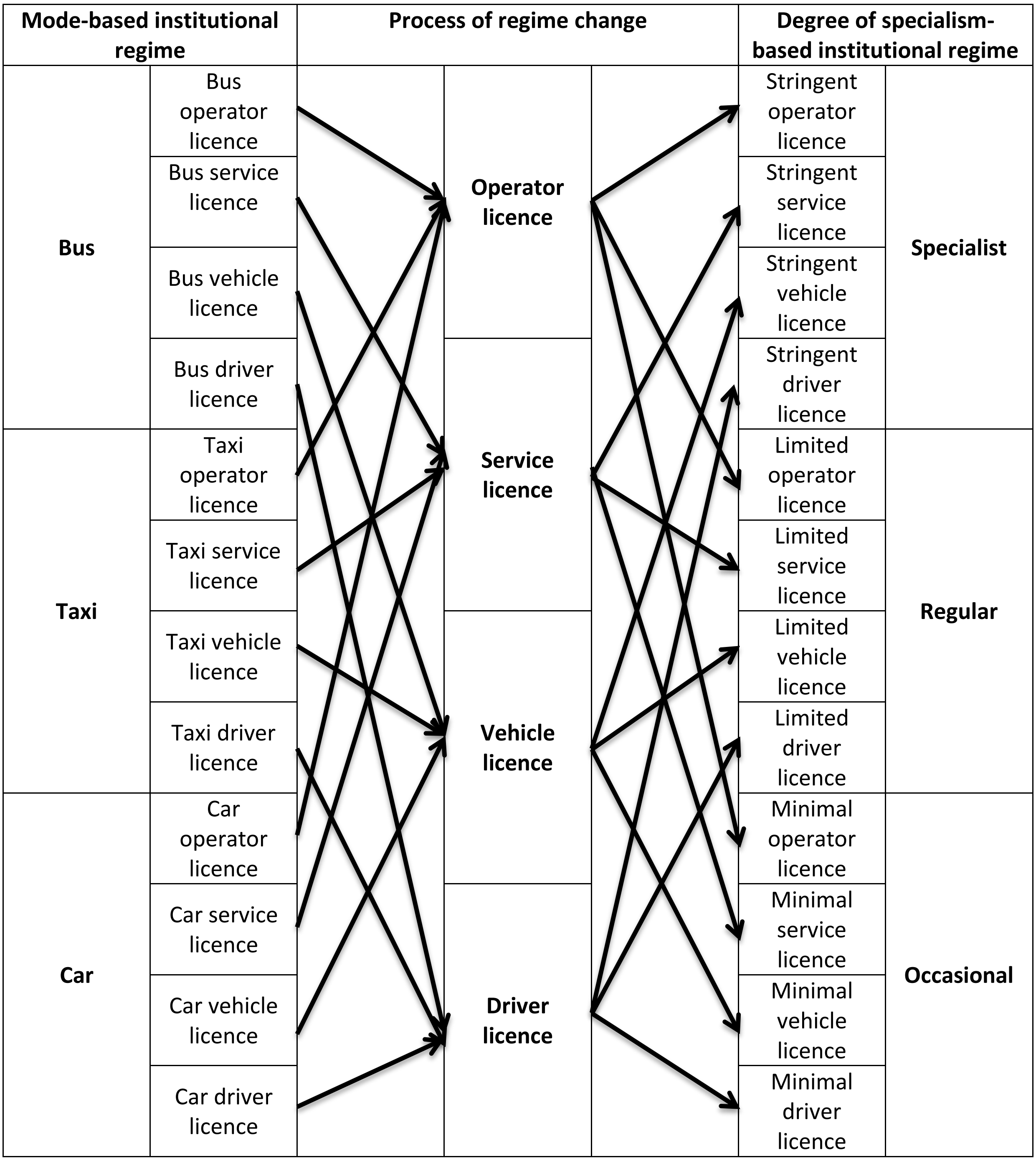

Figure 5: From a modal-based institutional structure to one based on operational specialism
Source: Marcus Enoch

Interestingly, although the strategic institutional set up would clearly look very different, it is not expected that the day to day functions of the various licensing authorities would change very much beyond their being re-organised and some minor refinements to allow for a broader interpretation of the service configurations that may be allowed. As already alluded to, it is recognised that such a major regulatory redesign would require deft political handling to ensure that those who stand to lose out from such reforms are adequately supported through the process. Yet such challenges are already having to be addressed even without such a change – one only need acknowledge the riots of taxi drivers in Paris in June 2015 protesting against the rise of Uber whilst this chapter is being written to illustrate this point (Arthur, 2015). Indeed, it could be argued that proactive change could actually serve to mitigate the situation before such disturbances against innovative services become an even more common occurrence than at the moment.

In practice however, such a radical approach is contrary to that currently being applied in many jurisdictions around the world, where policy makers appear to responding to new forms of market entry either by simply preventing them from legally operating, or else on a reactive and ad hoc basis. Such approaches however, could be viewed as being short sighted and risk further complicating institutional structures that have already been progressively tweaked and increasingly unfit for purpose. Crucially, retaining the present type of regulatory regime risks suppressing new forms of transport that have potential significant benefits to the travelling public, society and the environment. Instead, the proposal here is an approach that seeks to provide sufficient flexibility of response whilst maintaining standards within a relatively simple and structured framework thus pre-empting future developments. In a sense, this represents a third stage in how authorities respond to new disruptive technologies – from simply blocking them, to reacting to them in an ad hoc fashion, to pre-empting such new challenges in a structured way.

Conclusions

Society is potentially seeing a redefinition of public/collective transport systems and, as in any system transformation, actors and businesses will be replaced and new ones created. Small vehicle flexible paratransit services represent a design that could yield substantial system-level energy, environmental and social benefits. But with entrenched actors within the structure of the existing system architecture, the politics and conflicts are only just starting. This needs to be recognised now, and understanding and partnerships need to be built so that both new and existing actors can have a stake in shaping our transport future.

If the emergence of new service configurations more appropriate to 21st Century society is to be encouraged and not hindered, a new regulatory structure is needed. The challenge is framing what this might look like such that it would maintain the various minimum standards required for a transport system to function safely, efficiently and effectively, whilst allowing for new and more customer-appropriate models to develop, so overcoming the current institutional inertia that has hamstrung the transport sector in a rapidly changing world. As a final note, whilst these recommendations have been made in the context of passenger transport, there is no reason why a parallel development could not take place for freight given that similarly transformative processes are also occurring in that sector.

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