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Intermodal strategies combining cycling and public transport to improve service and acceptability

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INTERMODAL STRATEGIES
COMBINING CYCLING AND
PUBLIC TRANSPORT TO
IMPROVE SERVICE AND
ACCEPTABILITY

Lake Sagaris

Introduction: more than incidental, strategic for public transport

A central challenge for public transport today is that while many need it, rely on it and receive crucial benefits from the better systems, it is not well loved by users, and surveys tend to reveal a preference for travel by train or private car. Planners, moreover, continue to focus on infrastructure and operations, behaving as if transport were “gender neutral” and thereby failing to respond to key social groups, particularly women. To these unsatisfied social needs, public health experts add demands that urban transport improve health, reducing impacts on the global climate crisis or noise, water and air pollution and favouring active transport to address obesity and related cardiovascular and other diseases (Mindell, 2018; Rydin et al., 2012).

In 2020, the COVID-19 pandemic raised further challenges, with public transport increasingly stigmatized as a possible source of contagion. This has reinforced the appeal of private cars in contexts where these are affordable for the general population, although this is a situation less common in countries of the Global South, particularly amidst severe economic downturns. To date, the improvements recommended for public transport involve boosting frequencies to offset reduced capacity (due to distancing) and improvements to hygiene measures, which will be credible depending on the sociopolitical context of each place. These challenges make intermodal integration even more attractive within strategies to retain existing and capture new users. Replacing some feeder services with improved bike-bus or bike-Metro combinations can reduce overcrowding and the time passengers share breathing space in enclosed buses or Metro cars, thereby reducing potential for accumulating the viral loads associated with serious contagion.

An upsurge in cycling worldwide (Buehler & Pucher, 2021) contrasts with largely ineffective efforts to position public transport, including bus rapid transit (BRT), as central to sustainable transport. Despite the early success of Curitiba, Bogotá and elsewhere, people still prefer streetcars, trains and Metros rather than buses if they can’t have their own car. Public transport alone cannot compete with the door-to-door comfort of a personal car or, increasingly, taxis or carshare. Sustainable public transport systems must overcome these limitations and thus need strategies that better integrate public transport and feeder services, particularly walking and cycling.
Since the early 1990s (Replogle, 1992a, 1992b), the advantages of integrating public transport with diverse modes of cycling have received modest attention. Asian countries, particularly India and China, where cycling, cycle rickshaws and three- and four-wheelers are an integral part of both passenger and logistics transport chains, have served as significant sources of information (Cervero, 1997, 2000; Jain & Tiwari, 2011; Mohen & Tiwari, 1999).

Transport innovations, particularly BRT in Latin America, have included modest efforts to integrate cycling by associating hubs with segregated cycle paths and cycle parking. In North America, bike-on-bus programs have become commonplace in both Canada and the United States: a recent internet search for bike-n-ride programs found over 238 million.

From a sustainable development perspective (UN, 2015), strategies that treat “sustainable” transport as an ecology of modes, centering on intermodal walk-bike-bus/Metro combinations can increase catchment areas and resolve the first/last kilometre dilemma. They can also address social aspects of sustainability, particularly road safety and urban security, health, social inclusion, gender, age and other issues (Sagaris & Arora, 2016, 2018; Tiwari et al., 2008).

This chapter reviews trends in intermodal planning for sustainable transport, considering strategies and tools that could speed transitions by improving public transport. The next section analyses the current state of intermodal transportation, defining its main components as part of an ecology of modes/users and looking at development to date. The following section considers how these measures can help public transport to respond more effectively to social justice, inclusion and other related issues. The next section presents some tools useful to implementation, particularly modal shift targets based on current origin-destination patterns, and the final section offers reflections and areas for further research.

Public transport: governance, practice and (un)sustainable transport

A major weaknesses of attempts to position public transport as central to sustainability initiatives – and people's hearts – is the lack of clear definitions and a general narrative of sustainable transport. “Sustainable” transport is often defined by a single characteristic, such as energy efficiency or emissions, rather than a clear analysis of what is essentially a sociotechnical system linked to such diverse spheres of action as politics and policy, software and social movements (see also Chapter 9).

While researchers, mainly from the social sciences, articulate and analyse “unsustainable” transport, these definitions may be unfamiliar to those working from an engineering or purely technical perspective. “Unsustainable” transport is usually defined primarily as the use of the private car as the main mode for personal mobility (Banister, 2005), influencing city form, energy consumption, pollution, noise and road safety.

“Automobility” (Beckmann, 2001; Sheller & Urry, 2000; Urry, 2004) expands this perspective, tracing the psychological, sociocultural, economic and ideological components of a complex bundle of values that drive the planning of car-centred cities. They also note, however, the relevance of movements that push back against automobility and inspire increasingly influential pro-walking advocacy.

A variety of concerns motivate efforts by public transport agencies (Sagaris, 2006) to improve bike public transport (PT) integration. Urban and social planning considerations combine health, safety, energy and equity concerns (Table 30.1), while transit-related considerations often focus on operational improvement, particularly related to access, a growing concern, given new attention being paid to transport justice (Cook & Butz, 2019; Martens, 2017).

Bike-bus integration also provides significant economic benefits (Campbell & Wittgens, 2004), as summarized in Table 30.2.
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Table 30.1 Motivations driving modal integration

Urban and social planning considerations
“Active” transport policies to counteract obesity-related illnesses and reduce the burden on health programs;
Energy efficiency programs to reduce dependency on fossil fuels;
Air quality programs to reduce the emissions associated with cars holding large modal shares;
Programs to reduce emissions that contribute to global warming;
Improvements to quality of life, social equity and public spaces;
Responses to demands from cyclists;
Concerted efforts to retain or expand transit’s modal share.

Transit-related considerations
Bicycling extends the catchment area for transit services and provides greater mobility to customers at the beginning and end of their transit trips. Bike-on-bus programs can attract new riders to the bus system, thereby boosting revenues.
Bicycle-on-transit services give cyclists backup when it gets too dark, weather changes, illness strikes or a major highway or hill blocks daily commutes, bringing them onto transit.
Bicycle and transit integration usually forms part of plans to decrease automobile traffic congestion, reduce air pollution (by reducing motor vehicle trips) and improve the public image of transit. It is particularly effective for reducing air pollution, since the worst pollution occurs during the first 11 km driven, when the motor is just warming up.
It offers more commute options for workers, giving firms more flexibility on where to locate.

Source: Sagaris, 2006, based on Transportation Research Board (TRB), 2005. © Laboratorio de Cambio Social

Table 30.2 Economic benefits of bike-bus integration

1 Reduction in road construction, repair and maintenance costs
2 Reduction in costs due to greenhouse gas emissions
3 Reduction in health care costs due to increased physical activity and reduced respiratory and cardiac disease
4 Reduction in fuel, repair and maintenance cost to user
5 Reduction of costs due to increased road safety
6 Reduction in external costs due to traffic congestion
7 Reduction in parking subsidies
8 Reduction of costs due to air pollution
9 Reduction of costs due to water pollution
10 The positive economic impact of bicycle tourism
11 The positive economic impact of bicycle sales and manufacturing
12 Increased property values along greenways and trails
13 Increased productivity and a reduction of sick days and injuries at the workplace
14 Increased retail sales in pedestrian–friendly areas

Source: Own elaboration based on Campbell and Wittgens (2004), p. 4. © Laboratorio de Cambio Social

Understanding the role of governance in transitions and transformations

From an institutional or macro perspective, Geels (2012) examines governance challenges limiting sustainability transitions using a sociotechnical approach that considers diverse disciplinary perspectives, identifying three main levels relevant to transitions. These are: niches, “the
locus for radical innovations”; sociotechnical regimes, consisting of established practices, associated rules and an exogenous sociotechnical landscape. Together these form a “nested hierarchy with regimes being embedded within landscapes and niches existing inside or outside regimes” (Geels, 2012, p. 472). Using these categories, it is possible to identify emerging niches relevant to walk-bike-PT integration (Table 30.3).

These concepts will be revisited to analyse intermodal strategies as part of more effective transitions to sustainability.

<table>
<thead>
<tr>
<th>Format</th>
<th>Where</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  Cycle parking (medium- and long-term at hubs, key stops and all stations)</td>
<td>Bogotá, Munich, Amsterdam, Santiago</td>
</tr>
<tr>
<td>2  Bike racks on buses and taxis</td>
<td>Canada, United States and elsewhere; taxis in Copenhagen are required to have racks for at least two bicycles</td>
</tr>
<tr>
<td>3  Bikes on trains, usually in special cars or times</td>
<td>Europe, Canada, United States</td>
</tr>
<tr>
<td>4  Cycle rentals</td>
<td>Netherlands, most cities associated with tourism</td>
</tr>
<tr>
<td>5  Public bikeshare</td>
<td>New York, Barcelona, Mexico, Washington, Montreal, etc.</td>
</tr>
<tr>
<td>6  Public bikeshare with fare integration</td>
<td>Montreal, Washington, New Orleans, Paris, Seville, China, elsewhere</td>
</tr>
<tr>
<td>7  Cycle routes connecting to stations</td>
<td>Netherlands, Denmark, Germany</td>
</tr>
<tr>
<td>8  Shared bike-bus lanes</td>
<td>France, Belgium, Berlin</td>
</tr>
<tr>
<td>9  Cycle taxis on fixed or flexible routes</td>
<td>India, New York, London</td>
</tr>
</tbody>
</table>

Table 30.3 Emerging “niches” of walk-bike-public transport integration around the world

Source: Own elaboration based on Godefrooij et al., 2009; Pucher & Buehler, 2012; observations in diverse cities; presentations Velo-City conferences (2012 Vancouver, 2015 Nantes). © Laboratorio de Cambio Social

From a more micro perspective, Shove et al. (2012) emphasize the “constitutive role of things and materials in everyday life”, exploring how practices emerge, exist and die; the elements on which diverse practices depend and how practices “recruit” practitioners (p. 14). Their work explores how materials, such as the objects that constitute transport modes; the competencies necessary for individuals and groups of people to use them and meanings, the way these elements are woven together as collective symbols, ideas and aspirations, generate practices that can block or open the way to sustainability.

This perspective is useful for developing actions to drive behavioural and system change through intermodal mobility strategies.

**Enriching “behavioural change” approaches with a more complete theory of daily practice**

**Ecologies of modes and users: a powerful way to understand “sustainable” transport**

The author’s own work with academics and practitioners in Europe, Chile, India and North America (ECF, 2016; Karner & Sagaris, 2016; Sagaris & Arora, 2016) started from defining
social sustainability as driven by human agency through sociopolitical structures that may favour or repress collective action and social movements, simplifying or blocking transitions.

The ability to exercise human agency depends on the right to act with relative freedom and security within a framework that guarantees human rights (social, cultural and economic) and therefore requires ongoing democratization for full development. Other aspects of social sustainability with regard to transport involve health effects and road safety, along with cultural values, norms and habits, as they influence everyday behaviour and must therefore change to improve greater sustainability.

The next sections explore “sustainable transport” as an ecology of modes and users, drawing on these three sources to consider how intermodal, walk-bike-bus/Metro combinations require shifts in governance, daily practice and urban transitions through advocacy and other catalysts and can pressure for systemic change in all three of these components. Thus, rather than treating intermodal arrangements as accidental or incidental to general strategies to position public transport within a new, sustainable transport system, they are placed at the centre of efforts to transition toward sustainable transport.

“Public” transport as an ecology of modes and users: cycling as missing link

“Public” transport has long been considered almost synonymous with bus or train passenger services. Originally, the term was associated with “ownership”, but after more than a decade of diverse public–private partnership arrangements, “public” usually refers to a system that moves “the public”, a generic term for many and diverse users, with a similarly diverse set of (dis)abilities, travel purposes and needs.

Faced with unsustainable transport, or automobility, it is tempting to assume that any mode that requires less space, generates less pollution and consumes less energy per passenger is “sustainable”. In fact, however, a bus or Metro system alone does not resolve multiple problems of specific groups of users, so while these may be sustainable from an energy or emissions standpoint, they may not be sustainable from a social perspective.

Moreover, train systems that encourage sprawl may prove unsustainable in specific contexts, just as electric vehicles are no panacea for ensuring cleaner travel, given that unsustainable fuel sources may rise substantially (Bahamonde-Birke, 2020). In contrast, focusing on walk-bike-bus/Metro combinations can reduce energy consumption and emissions and improve social sustainability aspects of mobility.

The importance of social sustainability has become particularly clear in recent years, as a plethora of studies has revealed widespread sexual harassment of women on public transport worldwide (Allen, 2016; Allen et al., 2017). Far from being “neutral”, public transport interacts with discrimination, gender and other forms of violence, social and spatial factors, worsening their impacts (Allen, 2016; Allen et al., 2017).

Thinking about public transport as a combination, or ecology, of modes rather than a single standalone mode can mobilize governance and social practice more effectively in favour of sustainability transitions. (see Table 30.4). Walking is preferable for short distances (0–2 km), while cycling is best for intermediate (2–8 km) and bus-Metro in relatively dense cities for longer distances (over 5 km; Table 4, Karner & Sagaris, 2016). These distances are relative and vary according to culture, infrastructure and other aspects of the built environment in each place, but they offer a guide to achieving public transport systems that can provide better service than cars, private or otherwise.
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Table 30.4 Walking and cycling times/distances for different kinds of users

<table>
<thead>
<tr>
<th>m (m)</th>
<th>Walk (minutes)</th>
<th>Cycle (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Easy (4.5 km/h)</td>
<td>Moderate (5 km/h)</td>
</tr>
<tr>
<td>400</td>
<td>5.3</td>
<td>4.8</td>
</tr>
<tr>
<td>800</td>
<td>11</td>
<td>9.6</td>
</tr>
<tr>
<td>1200</td>
<td>16</td>
<td>14</td>
</tr>
<tr>
<td>2000</td>
<td>27</td>
<td>24</td>
</tr>
<tr>
<td>3000</td>
<td>40</td>
<td>36</td>
</tr>
<tr>
<td>4000</td>
<td>53</td>
<td>48</td>
</tr>
<tr>
<td>5000</td>
<td>67</td>
<td>60</td>
</tr>
<tr>
<td>8000</td>
<td>107</td>
<td>96</td>
</tr>
<tr>
<td>10,000</td>
<td>133</td>
<td>120</td>
</tr>
</tbody>
</table>

Note: Dark grey = reasonable time for travel to access public transport; grey = standalone single-mode travel or cycle service trip (bike taxi, bike share, etc.); light grey = best served by combination with motorized modes

Sources: From Karner & Sagaris, 2016; moderate walking speed taken as the average in TCRP (2003, pp. 3–9) and range from (Knoblauch et al., 1996). Cycling speeds from Gould and Karner (2009). © Laboratorio de Cambio Social

From this perspective, cycling becomes a *meso* or *intermediate* mode, a missing link that can significantly increase the time/distance ratio for human-powered travel, the healthiest for human bodies and the environment. Cycling, moreover, comes in diverse formats, which can be adjusted to specific populations and local needs and are best applied together in combinations adjusted to specific contexts (Figure 30.1).

Ignoring cycling’s potential to significantly increase people’s ease of travel seriously weakens the sustainable transport ecology and significantly undermines the usefulness of public transport to most people.

Personal bicycles lend themselves to an enormous variety of vehicle designs, including cargo uses (Figure 30.1) and accessories that can serve diverse users, needs and purposes. Individual bicycles come in racing, sporting and working models, particularly the step-through frame, a central adaptation to clothing worn mainly by women (skirts and dresses but also men’s Scottish kilts, Burmese paschous, Bhutan gos and Fijian sulus). The step-through model is essential for carrying cargo and children.

Increasingly, people with mobility disabilities are also turning to variants of bicycles with hand pedals or other adaptations, which allow them to participate in city life on a more equal basis (Figure 30.2). Nongovernmental organizations, such as Cycling Without Age, bring bicycle mobility services to the elderly in cities on virtually every continent worldwide (see website, Cycling Without Age, 2021).

Cycling also offers diverse vehicles for personal and commercial transportation: tricycles and four-wheelers widely used in Asian and Latin American countries (Behrens et al., 2015; Cervero, 2000; Fernandes Ferreira et al., 2019); two-wheel cargo bikes more common in Europe, particularly Denmark and the Netherlands and increasingly the United States (Cox & Rzewnicki, 2015; Riggs, 2016; Schwartz, 2016). Thus, cycling comes in many forms: individual bikes but also bikeshare and cycle taxis, with growing interest in cargo bikes for personal use and within logistics chains.
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Figure 30.1a  Bikes on trains as part of intermodal integration, Copenhagen 2017
Source: Laboratorio de Cambio Social

Figure 30.1b  Recycler navigates a heavy cargo using her tricycle, Santiago 2017
Source: Laboratorio de Cambio Social
Bikeshare, which first appeared in the 1960s, took off in the late 1990s (Fishman, 2015). Usage varies but commonly follows peak travel times, particularly where bikeshare is co-ordinated with Metro stations and/or bus stops. Bikeshare users typically report convenience as their main reason. In cities like Montreal, where bikeshare is located in residential as well as commercial areas, having a bikeshare close to home is important (Fishman, 2015), whereas in cities such as Santiago, bikeshare is used mostly for travel from a public transport station to destination.

Fortaleza, Brazil, overcame the challenge of locating bikeshare stations in residential areas, where they may be subject to vandalism or theft, by creating four business models, one of which allows low-income users to keep the bikes overnight, then cycle back into town or to the nearest Metro station (field visit and personal communication, 2019).

Cycle taxi services have emerged, often associated with tourism (Copenhagen city centre, London’s theatre district). In developing countries, they reinforce the attraction of bus or Metro transport by filling in the first-/last-km gap. Cycle rickshaws in India have done this for over a century, providing employment while offering an essential service to women and other caregivers (Shanbaug, 2012). In Santiago, an experiment with a cycle taxi circuit in the city centre became an underground success, but was eliminated when sponsors suspended their support and neither the local government or transport authorities stepped in to maintain the system.

The usefulness of these services has become particularly relevant given new research on “care-related travel” (Sánchez de Madariaga & Zucchini, 2019), done mainly by women. Figures for Santiago, Chile, for example, indicate that women make two to three times more care-related trips, which include shopping, accompanying children, older adults or people with mobility or medical needs. Indeed, these constitute the largest category of daily trips
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Figure 30.1d  Bike messengers teach children their craft, Santiago 2017
Source: Laboratorio de Cambio Social

(47%), more than work (38%) or education (10%) (Herrmann-Lunecke et al., 2020; Sagaris & Tiznado-Aitken, 2020a).

Sexual harassment is a significant factor inhibiting women’s use of public transport, particularly when they travel alone or after dark, a reality that affects their participation in work, education, culture and recreation. The journey from home to public transport access point and from egress to destination is particularly fraught, and even very low-income women avoid public transport, combining trips so they can afford a taxi rather than taking a bus or Metro (Sagaris et al., 2018).

Having access to a bike-bus combination that eliminates a long wait at a feeder station or a lonely walk can provide vulnerable people, particularly women, with better options than relying on bus or Metro alone (Sagaris & Tiznado-Aitken, 2020b; Sagaris et al., 2017). Indeed, in the
Figure 30.1e  Carrying human cargo, bike taxis in Manhattan, 2015
Source: Laboratorio de Cambio Social

Figure 30.1f  Bikes as cargo and bikes for cargo, increasingly key to sustainable logistics chains
Source: Laboratorio de Cambio Social
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Figure 30.2a  Strollers, bike seats, protected walking spaces make life easier for caregivers, Seville, 2010
Source: Laboratorio de Cambio Social

Figure 30.2b  Tandems all decked out for a cycling parade integrate blind and seeing users seamlessly, VeloCity Taipei, 2016
Source: Laboratorio de Cambio Social
Figure 30.2c  Bike lanes provide inclusive mobility for cyclists and wheelchair users alike, Seville, 2010
Source: Laboratorio de Cambio Social

Figure 30.2d  Crowded sidewalks when facilities don’t provide sufficient space for cyclists, wheelchair
users and pedestrians, Seville, 2010
Source: Laboratorio de Cambio Social

Emerging patterns of cycle- and other forms of mobility inclusion.
Netherlands, one of the world’s most egalitarian societies, women make up half of those cycling, where cycling as part of a general bike-bus or (more commonly) bike-train commute accounts for a larger share of cycling than standalone cycle trips.

**Practical approaches to intermodal integration**

Planning for an ecology of walk-bike-bus-public transport combinations opens the way to substantial health, environmental, efficiency, social equity and other benefits but is often hampered by conflict-driven debates and siloed governance arrangements that separate planning by transport mode.

**Target modal shifts**

Innovative planning for more intermodal transport benefits from innovation in citizen participation, bringing in advocates, neighbourhood associations and other organized citizens’ groups to adequately adjust plans and systems and build a constituency of informed supporters able to communicate horizontally across diverse social groups (Sagaris, 2014, and see Chapters 9 and 36). Co-ordinating governmental, institutional and some private actors (Godefrooij et al., 2009; McClintock, 2002; Parkin, 2012; Pucher & Buehler, 2021) are also central.

To address these challenges, many cities are applying target modal shifts to establish specific objectives regarding cycling (ECF, 2016). They often simply seek to increase a current share, for example 5%, to a larger share, within a specific time framework. This perspective can be rather arbitrary and seems to depend on assumptions about promotion and infrastructure. It can be more realistic to use travel data, particularly origin-destination surveys, which include information about travel purpose and trip length, to estimate how many trips by car or other motorized mode would be better served by cycling or walking (Karner & Sagaris, 2016). This can generate a relatively simple table of current and preferable modal shares to guide planning activities seeking to build new consensuses.

Modal share targets, calculated for specific cities and contexts, should guide decisions rather than generating rigid rules. One such analysis considered car trips by length for the heavily car-dependent city of San Francisco (US) and the rapidly transitioning city of Santiago (Chile), finding that a remarkably similar number of trips by car (around 25%) were under 2 km, making them more suited to walking or a walk-bike service combination. Similarly, from half to over 60% of car trips were from 2–8 km, distances better served by cycling, bikeshare or other formats. In both cases, with some zonal exceptions, car travel for longer distances, more appropriate to public transport or private car use, accounted for just 20–30% of current trips (Karner & Sagaris, 2016). Estimating desirable modal shifts (Table 30.5) can help to visualize savings in space and resources that can be better invested in improving walkability, cycle inclusion and the general liveability of shared urban spaces, public and private.

This approach brings out the importance of land use and improving the quality of care-related trips by ensuring primary schools are within walking-cycling and secondary schools within cycling distance of residential areas. Similarly, the traditional pattern of local corner shops encourages walking for the most frequent shopping trips. From this perspective, the street fairs and vendors who circulate in many Latin American, Asian and African cities contribute to sustainability and, often, social equity, particularly if this leads to their treatment as a valuable, rather than an “illegal” or “informal”, part of urban landscapes. Similarly, moving more people by walking and cycling frees up space in residential and commercial areas for crucial eco-system services: shade trees, kitchen gardens, composting, parks and corridors for birds and other forms of life.
Using cycling to connect human and public transportation may also require additional effort, depending on the experience of specific planning departments and professionals involved. University-government-advocacy collaborations can help to develop appropriate combinations of measures for specific contexts. These need to be evaluated to ensure they are genuinely meeting their objectives and typically require institutional and governance improvements (Table 30.6).

Based on studies of innovation relating to transplants of ideas or strategies from one country to another, Table 30.7 indicates that it may be easiest to start with innovations in the field of informal practices (right-hand column), particularly daily operations activities (bottom row), before moving upward to formalize the most effective practices in regulations, laws and, where necessary, constitutional modifications.

Transitions and transformations have much to learn from the literature on institutional transplantation. From Rose’s Lesson-Drawing in Public Policy (1993), a table of key questions can be extracted to evaluate the strengths and potential barriers to measures for transitioning toward more intermodal transport (Table 30.8).

Measures to foster cycling and intermodality (Table 30.9) have been well studied and offer a broad range of possible applications, according to local context. Adjusting on-road networks to the variety of vehicles that can be mobilized for service is important and can be a challenge. Nonetheless, as this chapter indicates, the rapid advance of walkability and cycling-inclusive measures in very diverse countries and cities suggests that barriers can sometimes be overcome relatively quickly.

### Specific policies and measures

One crucial element in the success of cities as diverse as Bogotá, Portland or Seville is the development of a plan that combines a full network of cycling and walking amenities associated with transport hubs, preferably using strategies that include deliberative participation (see also Chapter 9) to build broad consensuses regarding the necessary behavioural shifts. A master
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**Table 30.6** Planning governance and institutional considerations

<table>
<thead>
<tr>
<th></th>
<th>Planning governance and institutional considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Organize roundtables, co-ordination meetings, public hearings, working groups which can bring together planners, designers, advocacy and other relevant actors, including innovations in internal and external participatory and co-ordination methods</td>
</tr>
<tr>
<td>2</td>
<td>Apply design approaches and standards that simultaneously improve “walkability” and “cycle-inclusion” in general, particularly around bus stops, Metro stations and other transport hubs</td>
</tr>
<tr>
<td>3</td>
<td>Build innovative, deliberative approaches to participation into planning, education and marketing strategies</td>
</tr>
<tr>
<td>4</td>
<td>Consider adjustments or deep innovations to current planning institutions to ensure that projects are designed in a harmonious collaborative way that gets the most out of each mode</td>
</tr>
</tbody>
</table>

*Source: Own elaboration based on field experience 2006–2019. © Laboratorio de Cambio Social*

**Table 30.7** Domains of institutional transformation

<table>
<thead>
<tr>
<th>Level of action</th>
<th>Formal relations</th>
<th>Informal practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constitutional level (ground rules)</td>
<td>Legal system</td>
<td>Value orientation</td>
</tr>
<tr>
<td>Policy area (relations between government bodies)</td>
<td>Formal regulations, programs, policies</td>
<td>Informal codes</td>
</tr>
<tr>
<td>Operation level (daily activities)</td>
<td>Procedures</td>
<td>Roles</td>
</tr>
</tbody>
</table>

*Note: Dark grey = potential for initial interventions to achieve modal integration.*


**Table 30.8** Key questions to evaluate policy transplants

<table>
<thead>
<tr>
<th>Factor</th>
<th>Relevance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Similarity of the problem</td>
<td>Is the problem addressed by the method or tool similar to the problem for which it was designed?</td>
</tr>
<tr>
<td>Institutional requirements</td>
<td>Does the method or tool require certain institutions?</td>
</tr>
<tr>
<td>Resource requirements</td>
<td>Does the method or tool assume certain resources, such as skills, knowledge, computers, software, and monitoring systems, which may or may not be available?</td>
</tr>
<tr>
<td>Complexity</td>
<td>Is the method or tool based on simple or complex cause-and-effect relationships? The more complex the relationships, the more difficult it is to implement in an organization.</td>
</tr>
<tr>
<td>Scale of change</td>
<td>Does the use of the method or tool result in small, incremental or large-scale changes? Total quality management systems, for example, usually require large-scale changes throughout the entire organization.</td>
</tr>
<tr>
<td>Interdependencies</td>
<td>Does the method or tool assume other methods and tools on which it is dependent?</td>
</tr>
<tr>
<td>Values of the managers</td>
<td>Are the methods and tools consistent with the values of the managers?</td>
</tr>
</tbody>
</table>


plan establishes a network of relevant facilities (points 1 & 6, Table 30.9), focusing on links, connections (points 2 & 3) and services (point 4), such as cycle parking, replacing the current lane-by-lane approach, which leads to many efficiency and safety deficits. It can also shed light on necessary operational innovations, which can be phased in as part of an overall program (point 5).
### Table 30.9 Key policies and measures to foster cycling for intermodality

<table>
<thead>
<tr>
<th>1</th>
<th>Extensive systems of separate cycling facilities with sufficient widths and turning ratios for cargo bikes, cycle taxis, passenger bikes, adapted bikes (people with disabilities) and others</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Well-maintained, fully integrated paths, lanes and special bicycle streets connected to key transport hubs, stops and stations</td>
</tr>
<tr>
<td>1.2</td>
<td>Adaptation of existing lanes and roads to reduce car volumes and speeds and improve safety, mobility and interconnections for diverse cycles</td>
</tr>
<tr>
<td>1.3</td>
<td>Fully co-ordinated system of colour-coded directional signs for bicyclists, with transport hubs clearly signed and adequate information on forms of cycling integration</td>
</tr>
<tr>
<td>1.4</td>
<td>Off-street short-cuts, such as mid-block connections and passages through dead-ends for cars adequately designed to avoid conflicts with pedestrians</td>
</tr>
<tr>
<td>2</td>
<td>Intersection modifications; priority traffic signals and ease of access to transport hubs, Metro stations and other relevant intermodal exchanges</td>
</tr>
<tr>
<td>2.1</td>
<td>Clear signage and clean access (no curbs) to facilitate access</td>
</tr>
<tr>
<td>2.2</td>
<td>Advance green lights for cyclists and waiting positions ahead of cars, fed by bike lanes</td>
</tr>
<tr>
<td>2.3</td>
<td>Bike paths brightly coloured when crossing intersections, accessing transport hubs, stops and stations</td>
</tr>
<tr>
<td>2.4</td>
<td>Traffic signals synchronized at cyclist speeds ensuring consecutive green lights for cyclists (green waves) and to facilitate access to hubs, stops, stations</td>
</tr>
<tr>
<td>3</td>
<td>Traffic calming</td>
</tr>
<tr>
<td>3.1</td>
<td>Traffic calming of areas around stations, stops and hubs via context-dependent speed limit (7–30 km/hr) and physical infrastructure deterrents for cars</td>
</tr>
<tr>
<td>3.2</td>
<td>Bicycle streets, narrow roads where bikes have absolute priority over cars</td>
</tr>
<tr>
<td>3.3</td>
<td>Home zones with 7 km/hr speed limit, where cars must yield to pedestrians and cyclists using the road associated with stops, stations, hubs</td>
</tr>
<tr>
<td>4</td>
<td>Cycle parking, taxis and bikeshare</td>
</tr>
<tr>
<td>4.1</td>
<td>Large supply of good bike parking throughout the city and adequately supervised (medium- and long-term parking) at hubs, stations, stops</td>
</tr>
<tr>
<td>4.2</td>
<td>Improved lighting and security of bike parking facilities often featuring guards, video surveillance and priority parking for women</td>
</tr>
<tr>
<td>4.3</td>
<td>Bikeshare, rental, repair, information and other services at major hubs, stations, stops</td>
</tr>
<tr>
<td>5</td>
<td>Co-ordination with public transport</td>
</tr>
<tr>
<td>5.1</td>
<td>Fare integration (smart card) for all bike services at stops, stations and hubs</td>
</tr>
<tr>
<td>5.2</td>
<td>Extensive bike parking at all metro, suburban and regional train stations</td>
</tr>
<tr>
<td>5.3</td>
<td>Bikes on buses (external racks or reserved spaces within) and trains (specific times, cars or other facilities), at least during non-peak hours, preferably at no extra cost</td>
</tr>
<tr>
<td>5.4</td>
<td>Bike rental or bike share at stops, stations, hubs</td>
</tr>
<tr>
<td>5.5</td>
<td>Cycle taxis available by app at major Metro, bus and train stations</td>
</tr>
<tr>
<td>5.6</td>
<td>Deluxe bike parking garages at some train stations, with video surveillance, special lighting, music, repair services and bike rentals</td>
</tr>
<tr>
<td>6</td>
<td>Road safety measures</td>
</tr>
<tr>
<td>6.1</td>
<td>Comprehensive cycling training courses for all school children with test by traffic police</td>
</tr>
<tr>
<td>6.2</td>
<td>Stringent training of motorists to respect pedestrians and cyclists</td>
</tr>
<tr>
<td>6.3</td>
<td>Special legal protection for children and elderly cyclists</td>
</tr>
<tr>
<td>6.4</td>
<td>Motorists assumed by law to be responsible for almost all crashes with cyclists</td>
</tr>
<tr>
<td>6.5</td>
<td>Strict enforcement of cyclist rights, including cargo, passenger, private, cycle taxi and bikeshare uses, by police and courts</td>
</tr>
</tbody>
</table>

**Source:** Own elaboration, based on field work and measures reported in table 1, p. 512, Pucher & Buehler, 2008. © Laboratorio de Cambio Social
Making complexity work for intermodal planning

As with all significant innovations in human activities, whether individual behavioural or governmental planning and policy, shifting from unsustainable to more sustainable transport systems presents significant challenges. This chapter has examined current knowledge about intermodal transport systems, focusing on walk-bike-public combinations with their respective ecologies of users, who are often neglected in the current fixation with new technologies, big data and “smart” cities. The news from the front of real-world planning is, notwithstanding, remarkably encouraging.

From Geels’ (2012) perspective, significant innovation niches are emerging in many cities around the world, which are experimenting with public bikeshare, cycle master plans, walkability or modal shift goals as part of their planning environment. These are successfully introducing innovations into existing sociotechnical regimes and landscapes but often in isolated ways that do not yet realize the potential of full walk-bike-PT integration. From this perspective, advanced intermodal integration as practiced in the city of Copenhagen or throughout the Netherlands can be understood as examples of how niche innovation has successfully converged to generate system-wide change in the specific social and technical components of mobility landscapes, becoming an integral part of both urban and general policies that involve health, happiness, education and land use.

These countrywide successes and the rising modal shares for cycling in many previously car-dominated cities underline the importance of combining measures in the policy sphere with strategies to influence values, norms and behaviour, often through collaborations with advocacy groups, and economic components, including products such as the step-through bikes so useful to women and care-givers or services such as cycle parking appropriate to the specific use (Spapé & Godefrooij, 2009).

Thus, intermodal strategies also foster combinations that can alter everyday practice, ensuring the availability of material goods, such as bikeshare, without requiring full commitment to purchasing, parking, maintaining and owning a bicycle or cargo bike. They require encouragement of the necessary competencies, particularly driving at safe speeds, which are common to fully developed environments (the Netherlands) and tend to emerge within school and other programs (for example, Safe Routes to School programs) in transitioning environments.

Final reflections

Intermodality also helps to generate the meanings central to shifting everyday practice, providing a rich array of highly visible symbols – cycle ways, advance lights and preference for walking and cycling at intersections, signage indicating safe routes, cycle parking and other amenities – that intrinsically encourage new meanings, ideas and aspirations. By allowing bikes on metro cars and buses, transport agencies make visible a travel option that can better serve specific groups of users (children, carers) while encouraging other passengers to “give it a try”, thereby improving their public transport experience. During COVID-19 and post-COVID-19 planning, they also offer alternatives that can reduce overcrowding, by taking passengers travelling short distances (under 5 km) off public transport vehicles through encouraging cycle taxi, public bike share and other options.

Thus, by combining often familiar objects and skills into new meanings and values, intermodal approaches to public transport show significant potential to transform daily practice, effectively mobilizing strategic factors identified by Shove et al. (2012). This is particularly
important, given that a growing body of research demonstrates that traditional social marketing and advertising campaigns, which often inform strategies to shift behaviour in the transport and other spheres, are not effective (Whitmarsh et al., 2011), at least when climate change and sustainability objectives are central.

Future research will have to consider changing knowledge regarding COVID-19 and other possible public health threats associated with the exhaustion of the earth’s natural resources. It should also focus on emerging practices in cities ranging from Fortaleza (Brazil), through New Orleans (US), to London (UK), exploring both social practice and governance requirements central to innovation and then consolidating new ways of connecting these diverse, complementary transport modes.

References


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Combining cycling and public transport


